NetIQ® Identity Manager

Administrator's Guide to the Identity Applications

February 2017

Contents

About this Book and the Library

The *Setup Guide* provides instructions for installing the NetIQ Identity Manager (Identity Manager) product. This guide describes the process for installing individual components in a distributed environment.

Intended Audience

This book provides information for identity architects and identity administrators responsible for installing the components necessary for building an identity management solution for their organization.

Other Information in the Library

For more information about the library for Identity Manager, see the Identity Manager documentation website.

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Overview

This section introduces you to the Identity Manager identity applications, and helps you plan for using the applications in your organization.

- Chapter 1, “Introduction to the Individual Identity Applications,” on page 21
- Chapter 2, “Understanding the Functionality of the Identity Applications,” on page 25
- Chapter 3, “Understanding the Back-end Functions for the Identity Applications,” on page 35

1 Introduction to the Individual Identity Applications

The Identity Manager identity applications are an interconnected set of browser-based Web applications. They enable your organization to manage the user accounts and permissions associated with the wide variety of roles and resources available to users. You can configure the identity applications to provide self-service support for your users, such as requesting roles or changing their passwords. You can also set up workflows to improve the efficiency in managing and assigning roles and resources.

The following components comprise the identity applications:

- "Identity Manager Dashboard" on page 21
- "Catalog Administrator" on page 22
- "User Application" on page 23
- "Identity Reporting" on page 23

Identity Manager Dashboard

Identity Manager Dashboard serves as the primary entry portal to the identity applications. From here, **users** can perform the following activities:

- Manage their profile settings and password
- Review and complete their tasks, such as approving user requests for access
- Request permissions for roles, resources, or processes
- Review the status and history of their requests for permissions
- Find other users in your organization

Users with an appropriate **administrator** role can perform the following tasks:

- Create and modify user profiles.
- Create and modify teams that represent sets of users and groups that can perform provisioning requests and approval tasks associated with the teams.
- Add items and links that your users need to see or access, such as links to your company intranet.
- Add links to Catalog Administrator, the User Application, and Identity Reporting so your identity administrators can easily perform their tasks.

  Both Catalog Administrator and the User Application provide a **Home** button that returns users to the Dashboard.
- Organize the items and links into categories that make sense for your enterprise
- Manage user access to the various pages in the Dashboard.
- Configure the ability for users to approve permission requests through email.
- Change the look and feel of the site, such as the header, footer, and localization.

NOTE: This Dashboard replaces the previously released Identity Manager Home and Provisioning Dashboard. For example, if you attempt to edit **Featured Items** in Home, you will be directed to the new Dashboard. The older interface will be deprecated in a future release.

Although the installation program for the identity applications includes the Home and Provisioning Dashboard, this guide does not provide information for setting up or configuring that interface. For more information about that interface, see the *NetIQ Identity Manager Home and Provisioning Dashboard User Guide*.

Catalog Administrator

Catalog Administrator serves as the primary method for managing roles and resources associated with the various connected systems in organizations managed by Identity Manager. Although the catalog is not a unique database or a set of files, it encompasses all information about roles, resources, and the relationship between them.

Role Administration

Users with the Role Administrator entitlement can perform the following tasks:

- Create, remove, and modify roles.
- Establish the process for the approving and revoking the role.
- Create roles and role relationships within the roles hierarchy.
- Create, remove, and modify separation of duty (SoD) constraints to manage potential conflicts among roles.
- Browse the list of roles created.
- Find out which role is associated with which container.

Resources Administration

Users with the Resource Administrator entitlement can perform the following tasks:

- Create new resources, either from an entitlement or without an entitlement.
- Remove and modify resources.
- Establish the process for the approving and revoking resource.
- Associate resources to roles or a role that is part of other role, group, or a container in your organization.
- Browse the list of resources.
- Find out which resource is associated with which container.

Catalog Administrator provides a more up-to-date method for managing roles and resources than the User Application’s role and resource functionality. However, it does not support assigning permissions or ownership for the roles and resources.

All role and resource information comes from the User Application driver.

User Application

Originally, the User Application was part of the Roles Based Provisioning Module (RBPM). Some of the RBPM functions have been moved to the Dashboad and Catalog Administrator. The User Application continues to provide the following functions that does not yet exist in the other two components:

- Create groups of users, usually associated with their position in your organization, such as the Finance Department.
- Map role and resources assignments to resources within your organization, such as user accounts, computers, and databases. For more information, see Chapter 12, "Creating and Managing Resources," on page 139.
- Assign ownership to and configure the methods for approving roles and resources.
- Configure password management settings so users can reset their own passwords. For more information, see Section , "Password Management Configuration," on page 170.
- Ensure that your organization has a method for verifying that personnel are fully aware of organizational policies and are taking steps to comply with these policies.
- Ensure that access to corporate resources complies with organizational policies and that provisioning occurs within the context of the corporate security policy. You can grant users access to identity data within the guidelines of corporate security policies. For more information, see Section 5, "Configuring Security in the Identity Applications," on page 47.
- Create workflows to reduce the administrative burden of entering, updating, and deleting user information across all systems in the enterprise. These workflows provide a Web-based interface for users to manipulate distributed identity data that triggers workflows as necessary. For more information, see Part V, "Configuring and Managing Provisioning Workflows," on page 217.
- Support complex workflows and manage manual and automated provisioning of identities, services, resources, and assets.

  You can establish a manual provisioning process by creating workflows that route provisioning requests to one or more authorities. For automated provisioning, you can configure the User Application to start workflows automatically in response to events occurring in the Identity Vault. The Dashboard can trigger a workflow when users request permission.

  For more information, see Part V, "Configuring and Managing Provisioning Workflows," on page 217.

Identity Reporting

As a complement to the identity applications, Identity Manager includes Identity Reporting. While Identity Reporting is not installed with the identity applications, it does give you a 360-degree view of your users' entitlements, providing the knowledge you need to see the past and present state of authorizations and permissions granted to identities in your organization.

For more information about reporting, see the *Administrator Guide to NetIQ Identity Reporting*.

2 Understanding the Functionality of the Identity Applications

Identity is the foundation of the identity applications. The applications use identity as the basis for authorizing users' access to systems, applications, and databases. Each user's unique identifier—and each user's roles—have specific access rights to identity data. For example, users who are identified as managers can access salary information about their direct reports, but not about other employees in their organization.

NOTE: The identity applications comprise an application and not a framework. The Identity Manager documentation provide instructions for modifying the applications. Modifications to areas not outlined within the product documentation are not supported.

Enabling Self-Service Activities for Users

The identity applications can provide users a convenient way to view and work with their identity information.

- Manage their own user accounts directly
- Change their password
- List applications with which they are associated
- View their permissions
- Request permissions
- View the status of their permissions requests
- Look up other users and groups in the organization
- Visualize how those users and groups are related
- (Conditional) View and complete tasks, such as approving permission requests

Providing Permissions to Users

Permissions represent the accounts, roles, and resources that apply to users. Your organization might automatically assign permissions or users might need to requeste them. For example, a user might receive a computer as part of the job, but then need to request access to a specific software application. Users request permssions through the Dashboard. Some requests require approval from a single individual; others require approval from several individuals. In some instances, a request can be fulfilled without any approvals.

Provisioning users encompasses the following elements:

Resources

A resource is any digital entity such as a user account, computer, or database that a business user needs to be able to access.

Each resource is mapped to an entitlement. A resource definition can have no more than one entitlement bound to it. A resource definition can be bound to the same entitlement more than once, with different entitlement parameters for each resource.

For more information, see Chapter 12, "Creating and Managing Resources," on page 139.

Roles

A role represents a hierarchy of permissions. For example, a corporate role called Sales Employee might consist of various child permissions that apply to all employees, such as Garage Access, Building Access, and Read Access to Company Intranet. The role might also have permissions specifically for sales employees, such as access to sales software applications and financial data.

You can map role assignments to resources within a company, such as user accounts, computers, and databases.

For more information, see Chapter 11, "Creating and Managing Roles," on page 133.

Separation of duties policies

Separation of duties (SoD) policies help you manage potential conflicts between role assignments. For example, your organization might have two or more roles that could create security problems when assigned to the same individual. When a user requests one of these roles while already having a conflicting role or requests two or more conflicting roles, the identity applications respond according to the SoD policies.

For more information, see Section , "Understanding Separation of Duties Constraints," on page 26.

Workflows

A process that coordinates the approval or revocation of a request for permissions. Each workflow can have automatic or manual triggers and can include email notifications.

Workflows take into account the methods required for approving and revoking a role or resource. For example, the SAP software application might require two levels of approval: first from the user's manager and second from the resource manager for the application.

For more information, see Section , "Understanding Workflow-Based Provisioning," on page 27.

Understanding Separation of Duties Constraints

A key feature of the Role and Resource Subsystem is the ability to define separation of duties (SoD) constraints. A separation of duties (SoD) constraint is a rule that defines two roles that are considered to be in conflict. The Role Administrator/Role Manager creates the separation of duties constraints for an organization. By defining SoD constraints, they can prevent users from being assigned to conflicting roles, or maintain an audit trail to keep track of situations where violations have been allowed. In a separation of duties constraint, the conflicting roles must be at the same level in the roles hierarchy.

Some separation of duties constraints can be overridden without approval, whereas others require approval. Conflicts that are permitted without approval are referred to as separation of duties violations. Conflicts that have been approved are referred to as separation of duties approved exceptions. The Role and Resource Subsystem does not require approvals for SoD violations that result from indirect assignments, such as membership in a group or container, or role relationships.

If a separation of duties conflict requires approval, the constraint definition specifies details about the workflow process used to coordinate approvals, as well as the list of approvers. The approvers are those individuals that can approve or deny an SoD exception. A default list is defined as part of the Role and Resource Subsystem configuration. However, this list can be overridden in the definition of an SoD constraint.

Understanding Workflow-Based Provisioning

Workflow-based provisioning allows you to initiate workflow processes to manage the approval and revocation of user access to your organization’s secure systems.

The **Work Dashboard** tab in the User Application allows users to make workflow provisioning requests. A **provisioning request** is a user or system action intended to initiate a process, and can be in the following ways:

- Directly by the user through the **Work Dashboard** tab
- Indirectly in response to events occurring in the Identity Vault

When a provisioning request requires permission from one or more individuals in an organization, the request starts one or more workflows. The workflows coordinate the approvals needed to fulfill the request. Some provisioning requests require approval from a single individual; others require approval from several individuals. In some instances, a request can be fulfilled without any approvals.

By default, the **Work Dashboard** tab does not display any provisioning requests. To configure a provisioning request, a designer familiar with your business needs creates a *provisioning request definition*, which binds the resource to a workflow.

The designer can configure workflows that proceed in one of the following ways:

- *Sequential* fashion, with each approval step being performed in order
- *Parallel* fashion, which allows more than one user to act on a workflow task concurrently

Identity Manager provides a set of Eclipse-based tools for designing the data and the flow of control within the workflows. In addition, Identity Manager provides a set of Web-based tools that allow users to view existing provisioning requests and manage workflows that are in process. For more information, see Section , “Design and Configuration Tools,” on page 32.

The Provisioning Administrator is responsible for managing the workflow-based provisioning features of the User Application. For more information, see Section , “Understanding the Types of Users for the Identity Applications,” on page 29.

Understanding Email-based Approvals

The Dashboard includes an email-based approvals feature that enables the identity applications to send an email notifying users that they need to review a permission request. The notification can include action links that correspond to Approve and Reject so users can more easily respond to the request. Email-based approvals also supports digital signatures to ensure authentication of the message content.

You enable email-based approvals in the Dashboard and configure your Provisioning Request Definitions to support the feature. For more information, see the following sources:

- Help in the Identity Manager Dashboard.
- "Email Based Approval" in the *NetIQ Identity Manager - Administrator's Guide to Designing the Identity Applications*

Ensuring Permission Assignments Comply with Your Standards

Compliance is the process of ensuring that an organization conforms to relevant business laws and regulations. One of the key elements of compliance is attestation, which provides a method for organizations to verify that personnel are fully aware of organizational policies and are taking steps to comply with these policies. By requesting that employees or administrators regularly attest to the accuracy of data, management ensures that personnel information such as user profiles, role assignments, and approved SoD exceptions are up-to-date and in compliance.

To allow individuals within an organization to verify the accuracy of corporate data, a user makes an *attestation request*, which initiates one or more workflow processes. The *workflow processes* give the *attesters* an opportunity to attest to the correctness of the data. A separate workflow process is initiated for each attester. An attester is assigned a workflow task in the **My Tasks** list on the **Requests & Approvals** tab. To complete the workflow process, the attester opens the task, reviews the data, and attests that it is correct or incorrect.

The identity applications support four types of attestation:

- User profile
- SoD violations
- Role assignment
- User assignment

When an attestation process is initiated, each attester receives an email message indicating that they must complete a compliance task. The message provides a link to the workflow activity that has been assigned to the attester. This behavior is enabled by default, but can be disabled in Designer.

The **Compliance Task** (Attestation Notification) template determines the content and format of email messages sent to attesters. For more information on this template, see "Working with Email Templates" on page 243.

You must have the Compliance Administrator role to modify compliance settings. For more information, see the description of the **Compliance** tab in the *Identity Manager User Application: User Guide* (http://www.netiq.com/documentation/idm45/pdfdoc/ugpro/ugpro.pdf).

NOTE: For compliance and attestation processes, we recommend using **NetIQ Identity Governance** (formerly Access Review) instead of the identity applications. Identity Governance enables administrators and managers to easily collect all user and access information in one central location and certify that each user has only the level of access that they need to do their job. Following the principle of least privilege, Access Review helps you ensure that your users have focused access to those applications and resources that they use and cannot access resources that they do not need to access. You can review all permissions assigned to your employees, either individually or as a group, and decide whether those permission assignments are appropriate. For more information, see the NetIQ Identity Access Governance documentation.

Understanding the Types of Users for the Identity Applications

Users of the identity applications generally fall into the following categories:

- Administrative Users
- Administrator and Manager Categories
- Designers
- Business Users

Administrative Users

The identity applications have several types of administrative users. During installation, you establish the following administrators:

Identity Vault Administrator

A user who has rights to configure the Identity Vault. This is a logical role that can be shared with other administrative user types.

The Identity Vault Administrator needs the following rights:

- Supervisor rights to the User Application driver and all the objects it contains. You can accomplish this by setting the rights at the driver container level and making them inheritable.
- Supervisor Entry rights to any of the users that are defined through the directory abstraction layer user entity definition. This should include Write attribute rights to objectClass and any of the attributes associated with the `DirXML-EntitlementRecipient`, `srvprvEntityAux` and `srvprvUserAux` auxiliary classes.
- Supervisor rights to the container object `cn=DefaultNotificationCollection, cn=Security`. This object persists email server settings used for automated provisioning emails. It can contain SecretStore credentials for authenticating to the email server itself.
- Supervisor rights to the container object `cn=Authorized Login Methods`, `cn=Security`. During the User Application installation the SAML Assertion object is created in this container.
- Ensure that you have supervisor rights to the `cn=Security` container before you install User Application. During the User Application installation, the container `cn=RBPMTrustedRootContainer` is created under the `cn=Security` container.

  Alternatively, manually create the `cn=RBPMTrustedRootContainer,cn=Security` container (create an object called `Trusted Root Container` with object class `NDSPKI:Trusted Root` inside the `Security` container), and then assign supervisor rights to the container.

User Application Administrator

A user who has the rights to perform administrative tasks for the identity applications. This user has the following attributes:

- Can manage the Dashboard, Catalog Administrator, and User Application.
- Can use iManager to administer workflow tasks, such as enabling, disabling, or terminating in-process workflows.
- Does not have any special privileges within the identity applications.
- Does not need any special directory rights because it controls application-level access to the identity applications from the Dashboard and User Application. Although a User Application Administrator has the ability to customize the look and feel of the applications, the identity applications use the LDAP administrator credentials to modify the selections in the Identity Vault.
- Can manage the password for this account.

  A feature of password self-service is password synchronization status. To enable the User Application Administrator to view the password synchronization status for other users (for troubleshooting or other reasons), you should create a PasswordManagement group and assign one or more users to this group. The members of this group are allowed to view the password synchronization status of other users. If you choose to create this group, it must:

  - Be named `PasswordManagement`.
  - Be given the privileges to the Identity Vault. The group must have rights to read the user's eDirectory object attribute for users whose password synchronization status they need to view.

  IMPORTANT: NetIQ Self Service Password Reset (SSPR) is the default password management program for Identity Manager. For more information, see "Managing Your Password" in the *NetIQ Identity Manager - User's Guide to the Identity Applications*.

Administrator and Manager Categories

The identity applications use a security model that recognizes three general categories of administrators and managers:

Domain Administrator

An administrator who has the full range of capabilities within a particular domain, and is able to perform all operations on all objects within the domain for all users

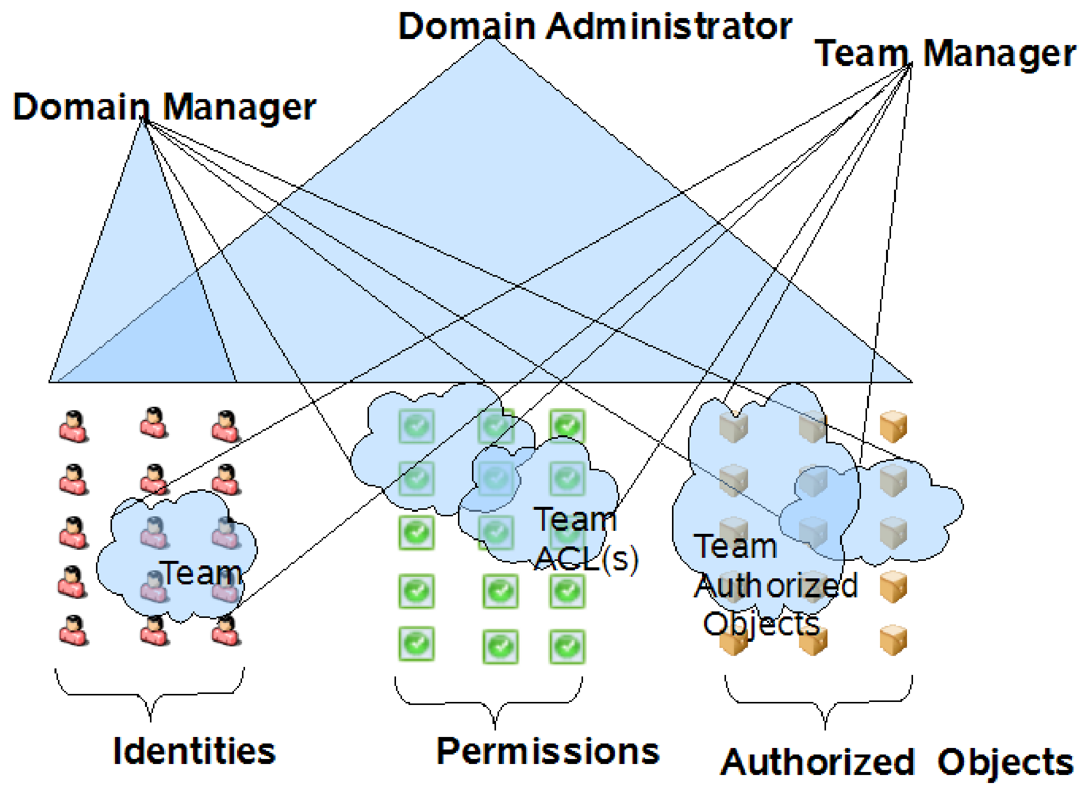
Domain Manager

A delegated administrator who has the ability to perform selected operations for a subset of authorized objects within the domain for all users

Team Manager

A business line manager who can perform selected operations for a subset of authorized objects within the domain, but only for a designated set of users (team members)

The following diagram illustrates the security model:



Team Managers

A Team Manager is a user designated as a manager of a **team**, which represents a set of users, groups, or users and groups that can perform provisioning requests and approval tasks associated with the team. Although a team might match a group that exists in the user directory, teams are not the same thing as groups. That is, a group or a member of a group cannot perform team capabilities except when assigned to a team.

You can assign Team Managers either in the **Teams** page in the Dashboard or the **Administration > Team Configuration** tab in the User Application. You can allow Team Managers to make requests on behalf of and act as a proxy for team members. For more information on configuring teams, see the following sources:

- *Help in the Identity Manager Dashboard.*
- Section , "Team Configuration," on page 210

Designers

Designers use the Designer for Identity Manager to customize the User Application for your enterprise. Designer is a tool aimed at information technology professionals such as enterprise IT developers, consultants, sales engineers, architects or system designers, and system administrators who have a strong understanding of directories, databases, and their information environment and who act in the role of a designer or architect of identity-based solutions.

To create or edit workflow objects in Designer, the user needs the following rights on the RequestDefs.AppConfig container for the specific User Application driver.

- [Entry Rights] Supervisor or Create
- [All Attribute Rights] Supervisor or Write

To initiate a workflow, the user must have Browse [Entry Rights] on the RequestDefs.AppConfig container for the specific User Application driver or individually per request definition object if you are using a delegated model.

Business Users

Business users interact with the User Application's **Identity Self-Service**, **Work Dashboard**, and **Roles and Resources** tabs. A business user is an *authenticated user*, such as an employee, a manager, or a delegate or proxy for an employee or manager. A *delegate user* is a user to whom one or more specific tasks appropriate to that user's rights can be delegated, so that the delegate can work on those specific tasks on behalf of someone else. A *proxy user* is user who acts in the role of another user by temporarily assuming that user's identity. All of the rights of the original user apply to the proxy. Work owned by the original user continues to be owned by that user.

The user's capabilities within the User Application depend on what features of the User Application Administrator has enabled for them. They can be allowed to:

- View and edit user information, with appropriate rights
- Search for users or resources using advanced search criteria, which can be saved for later reuse
- Recover forgotten passwords

The User Application can be configured so that users can:

- Request a resource (start one of potentially many predefined workflows)
- View the status of previous requests
- Claim tasks and view tasklists (by resource, recipient, or other characteristics)
- View proxy assignments
- View delegate assignments
- Specify one's availability
- Enter proxy mode to claim tasks on behalf of another
- View team tasks and request team resources

Design and Configuration Tools

The various administrators can use the following tools to design and configure the Identity Manager User Application.

Table 2-1 Tools for Designing and Configuring the User Application

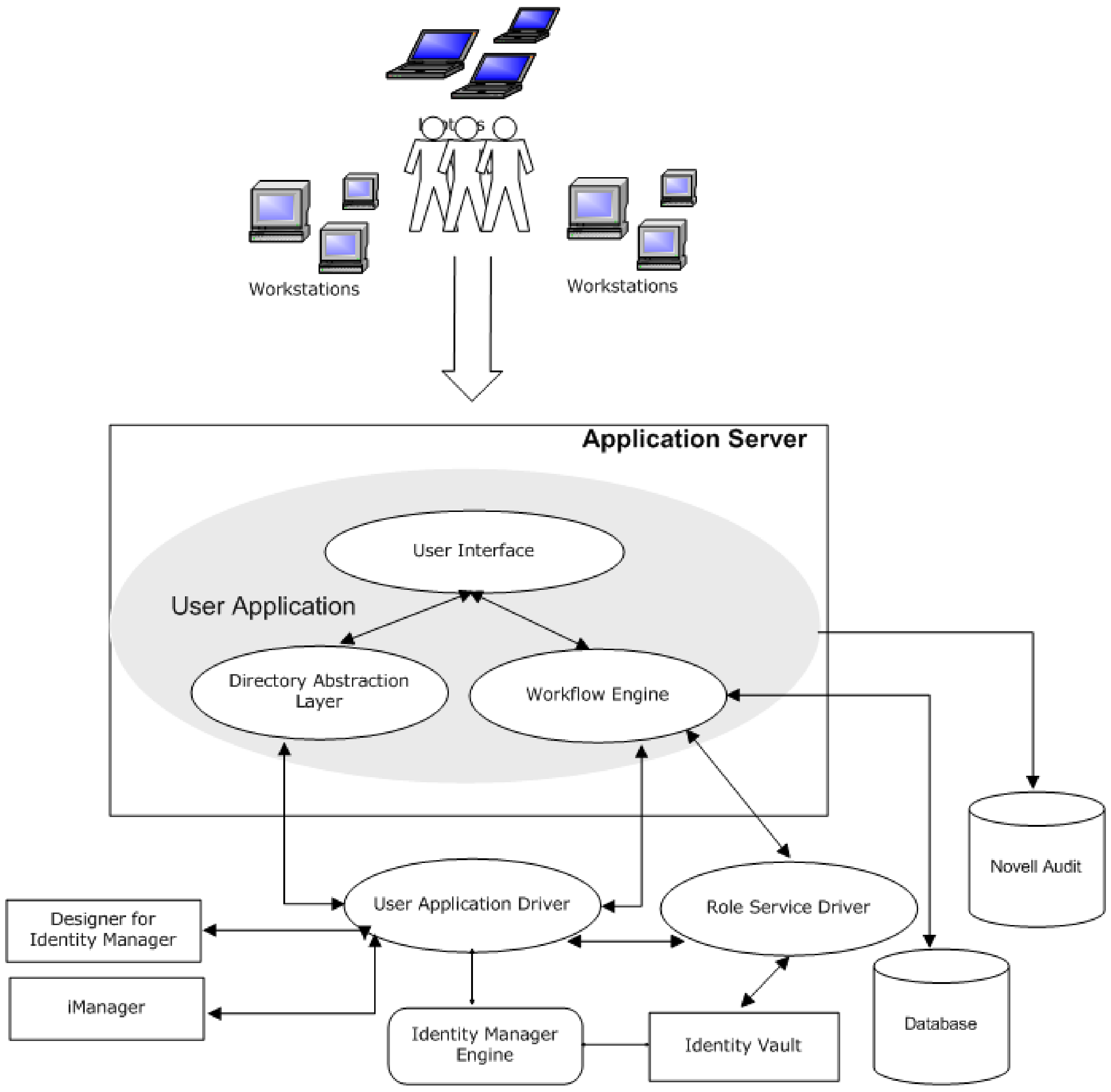
Tool	Purpose
Designer for Identity Manager	A powerful, graphical toolset for configuring and deploying Identity Manager. The following plug-ins are designed to help you configure the User Application: ◆ Directory Abstraction Layer editor: Lets you define the Identity Vault objects for your User Application. ◆ Provisioning Request Definition editor: Lets you create workflows for provisioning request definitions. Also allows you to customize the forms by which users make and approve requests and email templates. ◆ Provisioning view: Lets you import, export, deploy, and migrate directory abstraction layer and provisioning requests to the User Application driver. ◆ Role editor: Lets you create and configure roles for use within the User Application. ◆ Resource editor: Lets you create and configure resources for use within the User Application. For more information, see the *Identity Manager User Application: Design Guide.*
iManager	A Web-based administration console. The following plug-ins are designed to help you configure and administer the User Application: ◆ Provisioning Request Configuration plug-in: Provides a read-only view of provisioning request definitions d through Designer and allows you to mark them active or inactive. ◆ Workflow Administration plug-in: Provides a browser-based interface that lets you view the status of workflow processes, reassign activities within a workflow, or terminate a workflow in the event that it is stopped and cannot be restarted. ◆ Provisioning Team plug-in: Not supported with this release of the Roles Based Provisioning Module. The **Team Configuration** user interface on the **Administration** of the User Application replaces this iManager tool. ◆ Provisioning Team Request plug-in: Not supported with this release of the Roles Based Provisioning Module. The **Team Configuration** user interface on the **Administration** of the User Application replaces this iManager tool. For more information, see Part V, "Configuring and Managing Provisioning Workflows," on page 217
User Application Administration tab	A Web-based administration console that allows you to configure, manage, and customize the User Application. For more information, see Part IV, "Administering the User Application," on page 147.

3 Understanding the Back-end Functions for the Identity Applications

The identity applications rely on a number of components acting together:

- "User Interfaces" on page 36
- "Directory Abstraction Layer" on page 37
- "Workflow Engine" on page 37
- "SOAP Endpoints" on page 37
- "Application Server (J2EE-Compliant)" on page 38
- "Database" on page 38
- "User Application Driver" on page 39
- "Role and Resource Service Driver" on page 40
- "Designer for Identity Manager" on page 41
- "iManager" on page 41
- "Identity Manager Engine" on page 41
- "Identity Vault" on page 41
- "Authentication Service for Single Sign-on Access" on page 42

The following figure shows how these components fit into the overall architecture of the identity applications.



User Interfaces

Users interact with the identity applications through a Web browser, based on Java appliations and a Tomcat application server. The underlying framework for the identity applications provide container services, such as managing window state, persistence, caching, theming, logging, and acts as a security gatekeeper. The application server on which the applications run provides various services to the application as a whole, such as scalability through clustering, database access via JDBC, and support for certificate-based security.

NOTE: Support for the portal functionality in the User Application was removed in Identity Manager 4.5.

Directory Abstraction Layer

The directory abstraction layer provides a logical view of the Identity Vault data. You define a set of entities and their related attributes based on the Identity Vault objects that you want users to view, modify, or delete in the identity applications. The Directory Abstraction layer:

- Performs all of the LDAP queries against the Identity Vault. This isolates presentation-layer logic from the Identity Vault, so that all requests for identity data go through the directory abstraction layer.
- Checks constraints and access control on data requests made with the identity applications.
- Caches runtime configuration and entity-definition data obtained from the Identity Vault. See Section , “Caching Management,” on page 151

You use the directory abstraction layer editor plug-in (available in Designer for Identity Manager) to define the structure of the directory abstraction layer data definitions. To learn more, see the section on the directory abstraction layer editor in the Configuring the Directory Abstraction Layer in the *NetIQ Identity Manager - Administrator’s Guide to Designing the Identity Applications*.

Workflow Engine

The Workflow Engine is a set of Java executables responsible for managing and executing steps in an administrator-defined workflow and keeping track of state information (which is persisted in a database). When the necessary approvals have been given, the Provisioning System provisions the resource as requested.

During the course of workflow execution, the Workflow Engine can send one or more email messages to notify users of changes in the state of the workflow. In addition, it can send email messages to notify users when updates have been made to proxy, delegate, and availability settings.

You can edit an email template in the Designer for Identity Manager or in iManager and then use this template for email notifications. At runtime, the Workflow Engine retrieves the template from the directory and replaces tags with dynamic text suitable for the notification.

Additional details about the Workflow Engine, including how to configure and manage provisioning workflows, are in Part V, “Configuring and Managing Provisioning Workflows,” on page 217.

SOAP Endpoints

The identity applications provide the following SOAP endpoints to allow third-party software applications to take advantage of identity applications services:

SOAP Endpoint	Description
Provisioning Web Service	To support third-party access, the provisioning Workflow Engine includes a Web service endpoint. The endpoint offers all provisioning functionality (for example, allowing SOAP clients to start a new approval flow, or list currently executing flows).
Metrics Web Service	The workflow engine also includes a Web Service for gathering workflow metrics. The addition of the Metrics Web Service to the Workflow Engine lets you monitor an approval flow process. In addition, it provides indicators the business manager can use to modify the process for optimal performance.

SOAP Endpoint	Description
Notification Web Service	The Provisioning System includes an email notification facility that lets you send email messages to notify users of changes in the state of the provisioning system, as well as tasks that they need to perform. To support third-party access, the notification facility includes a Web service endpoint that lets you send an email message to one or more users.
Directory Abstraction Layer (VDX) Web Service	The directory abstraction layer provides a logical view of the Identity Vault data. To support access by third-party software applications, the directory abstraction layer includes a Web service endpoint called the VDX Web Service. This endpoint lets you access the attributes associated with entities defined in the directory abstraction layer. It also lets you perform ad hoc searches for entities and execute predefined searches called global queries.
Role Web Service	To support access by third-party software applications, the Role subsystem includes a Web service endpoint called the Role Web Service. It supports a wide range of role management and SoD management functions.

Application Server (J2EE-Compliant)

The application server provides the runtime framework in which the identity applications, directory abstraction layer, and Workflow Engine execute. The identity applications are packaged as a Java Web Application Archives, or WAR files.The installation process enables you deploy the WAR files to the application server.

The following WAR files apply to the URL for a component of the identity applications:

- **IDMProv** for the User Application
- **rra** for Catalog Administrator
- **idmdash** for the Dashboard
- **dash** for the Home and Provisioning Dashboard (to be deprecated in a coming release)

The identity applications run on an Apache Tomcat application server, included in the installation kit. You can also use your own installation of Tomcat. For more information about the application server requirements, see “Planning to Install the Identity Applications” in the *NetIQ Identity Manager Setup Guide*.

Database

Most user information is stored in the Identity Vault. However, the identity applications rely on a separate database to store the following information:

- Configuration data for the identity applications, such as Web page definitions and preference values
- State of a workflow

NOTE: The actual workflow definitions are stored in the User Application driver in the Identity Vault.

For more information about installing and configuring database, see "Installing the Identity Applications " in the *NetIQ Identity Manager Setup Guide*.

User Application Driver

The User Application driver is responsible for:

- Storing application-specific environment configuration data.
- Notifying the directory abstraction layer when important data values change in the Identity Vault. This causes the directory abstraction layer to update its cache.

You can configure the User Application driver to:

- Allow events in the Identity Vault to trigger workflows.
- Communicate the success or failure of a workflow's provisioning activity back to the identity applications database, which allows users to view the final status of their requests.
- Start workflows automatically in response to changes of attribute values in the Identity Vault.

The User Application driver is both a runtime component and a storage wrapper for directory objects (comprising the runtime artifacts of the identity applications).

Artifacts	**Description**
Driver Set Object	Every Identity Manager installation requires that drivers be grouped into driver sets. Only one driver set can be active at a time (on a given directory server). The drivers within that set can be toggled on or off individually without affecting the driver set as a whole. The User Application driver like any other Identity Manager driver, must exist inside a driver set. The driver set is not automatically created by the User Application; you must create one, then create the User Application driver within it.
User Application	The User Application driver object is the container for a variety of artifacts. The User Application driver implements Publisher and Subscriber channel objects and policies. The Publisher channel is not used by the User Application but is available for custom use cases.

Artifacts	Description
App Config Object	The AppConfig object is a container for the following User Application configuration objects. • **RequestDefs:** Container for Provisioning Request Definitions. The definitions stored here (as XML) represent the classes of requests that end users with appropriate rights can instantiate via the User Application. • **WorkflowDefs:** Container for Workflow objects, including design-time descriptions plus any template or unused flows. • **ResourceDefs:** Container for Provisioned Resource definitions, including design-time descriptions plus any templates or unused targets. • **ServiceDefs:** Container for Service Definition objects, which wrap Web Services called by workflows. • **DirectoryModel:** Directory abstraction layer objects that represent different types of content of the Identity Vault that can be exposed in the User Application. • **AppDefs:** Container for configuration objects that initialize the runtime environment, such as cache configuration information and email notification properties. • **ProxyDefs:** Container for proxy definitions. • **DelegateeDefs:** Container for delegate definitions.

Role and Resource Service Driver

The identity applications use the Role and Resource Service Driver to manage back-end processing of resources:

- Starts an SoD workflow and waits for approvals in situations where a role request requires an SoD workflow.
- Starts a role assignment workflow and waits for approvals in situations where a role request requires a workflow.
- Adds users to and remove users from roles. To do this, the Role and Resource Service driver:
  - Waits for a start date before making assignments
  - Terminates a role assignment when the end date is reached
- Adds and removes higher-level and lower-level role relationships.
- Adds and removes role assignments for groups.
- Adds and removes role assignments for containers.
- Maintains all role membership information for indirect role assignments, including:
  - Role assignments acquired through role relationships
  - Role assignments that result from membership in groups
  - Role assignments that result from membership in containers
- Grants and revokes entitlements to and from users according to their role memberships.
- Maintains additional reporting information that is associated with each role assignment.
- Maintains additional reporting information on objects in eDirectory, such as:
  - Approval information

    - Where indirect assignments come from
    - Where entitlements come from
- Logs events to an auditing service.
- Cleans up processed requests after a user-specified amount of time.
- Recalculates role assignments based on dynamic and nested groups on a polled basis.

Designer for Identity Manager

Designer for Identity Manager provides a set of plug-ins that you can use to define the directory abstraction layer objects and provisioning requests and their associated workflows. For more information, see Section , “Design and Configuration Tools,” on page 32

iManager

iManager provides a set of plug-ins you can use to view provisioning requests and manage their associated workflows. For more information, see Section , “Design and Configuration Tools,” on page 32.

Identity Manager Engine

The Identity Manager engine provides the runtime framework that monitors events in the Identity Vault and connected systems. It enforces policies and routes data to and from the Identity Vault. The Identity Manager User Application is a connected system. Communication between the Identity Vault, the directory abstraction layer, and the Workflow Engine occurs through the User Application driver.

Identity Vault

The Identity Vault is the repository for:

- User data
- Other identity data
- Identity Manager driver set
- User Application driver

The User Application relies on various Identity Vault objects, so it is necessary to extend the eDirectory schema to accommodate the custom LDAP objects and attributes required by the User Application.

The identity applications schema extension occurs automatically as part of the install. The custom objects and attributes are populated with default values after the User Application driver is installed and activated.

Authentication Service for Single Sign-on Access

Identity Manager uses NetIQ One SSO Provider (OSP) as the authentication service to provide single sign-on access (SSO) for the following components:

- Catalog Administrator
- Identity Manager Dashboard
- Identity Reporting
- Self-Service Password Reset
- User Application

For information about installing OSP, see “Installing the Single Sign-on Component” in the *NetIQ Identity Manager Setup Guide*. For more information about how OSP works, see Chapter 33, “How OSP Works with Identity Manager,” on page 623.

II

Preparing the Identity Applications for Use

This section helps you set up your production environment for the identity applications.

For more information about installing the identity applications, see “Planning to Install the Identity Applications” in the *NetIQ Identity Manager Setup Guide* .

4 Understanding the Design Needs

Each major subsystem can have many instances and many ways of connecting. Not every possible layout is supported. This section provides information about design constraints and using a high-availability environment.

- "Design Constraints" on page 45
- "High Availability Design" on page 46

Design Constraints

In general, you install the Identity Manager components on specific servers, as described in the *NetIQ Identity Manager Setup Guide*. When configuring the identity applications, you also need to consider the following architectural constraints:

One user container per identity applications instance

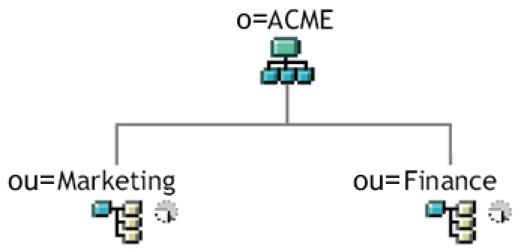
No instance of the identity applications can service, such as search, query, or add users to, more than one user container. Also, a user container association with the applications is meant to be permanent.

One User Application driver per identity applications instance

No User Application driver can be associated with more than one instance of the identity applications, except when the applications are installed on sister nodes of the same cluster. In other words, Identity Manager does not support a one-to-many mapping of drivers to identity applications instances.

The first constraint enforces a high degree of encapsulation in User Application design. Suppose you have the following organizational structure:

Figure 4-1 *Sample Organizational Structure*



During installation of the identity applications, you are asked to specify the top-level user container that your installation looks for in the Identity Vault. In this case, you could specify `ou=Marketing,o=ACME` or (alternatively) `ou=Finance,o=ACME`. You cannot specify both. All searches and queries (and administrator logins) for the are connected to whichever container you specify.

NOTE: In theory, you could specify a scope of `o=ACME` in order to encompass Marketing and Finance. But in a large organization, with potentially many `ou` containers (rather than just two relating to Marketing and Finance), this is not likely to be practical.

It is possible to create two independent installations of the identity applications that share no resources in common: one for Marketing and another for Finance. Each installation would have its own database and its own appropriately configured User Application driver. Also, each would be administered separately, possibly having unique User Application drivers.

If you truly need to place Marketing and Finance within the same scope for one installation, you can consider one of the following tactics:

- Insert a new container object (for example, `ou=MarketingAndFinance`) in the hierarchy, above the two sibling nodes; then point to the new container as the scope root.
- Create a filtered replica (a special type of eDirectory tree) that combines the needed parts of the original ACME tree, and point the identity applications at the replica's `root` container. For more information about filtered replicas, see the *eDirectory Administration Guide*.

If you have questions about a particular system layout, contact your NetIQ representative for assistance or advice. For more information about design constraints, see "Recommended Installation Scenarios and Server Setup" and "Planning to Install the Identity Applications" in the *NetIQ Identity Manager Setup Guide*.

High Availability Design

You can provide high availability of the identity applications by installing in a cluster. Set up a cluster so that each node runs one instance of the identity applications. The instances are all coequals (peers). The support automatic failover, where an interrupted workflow can resume after the loss of a cluster node.

For more information about using a clustered environment, see the following sections:

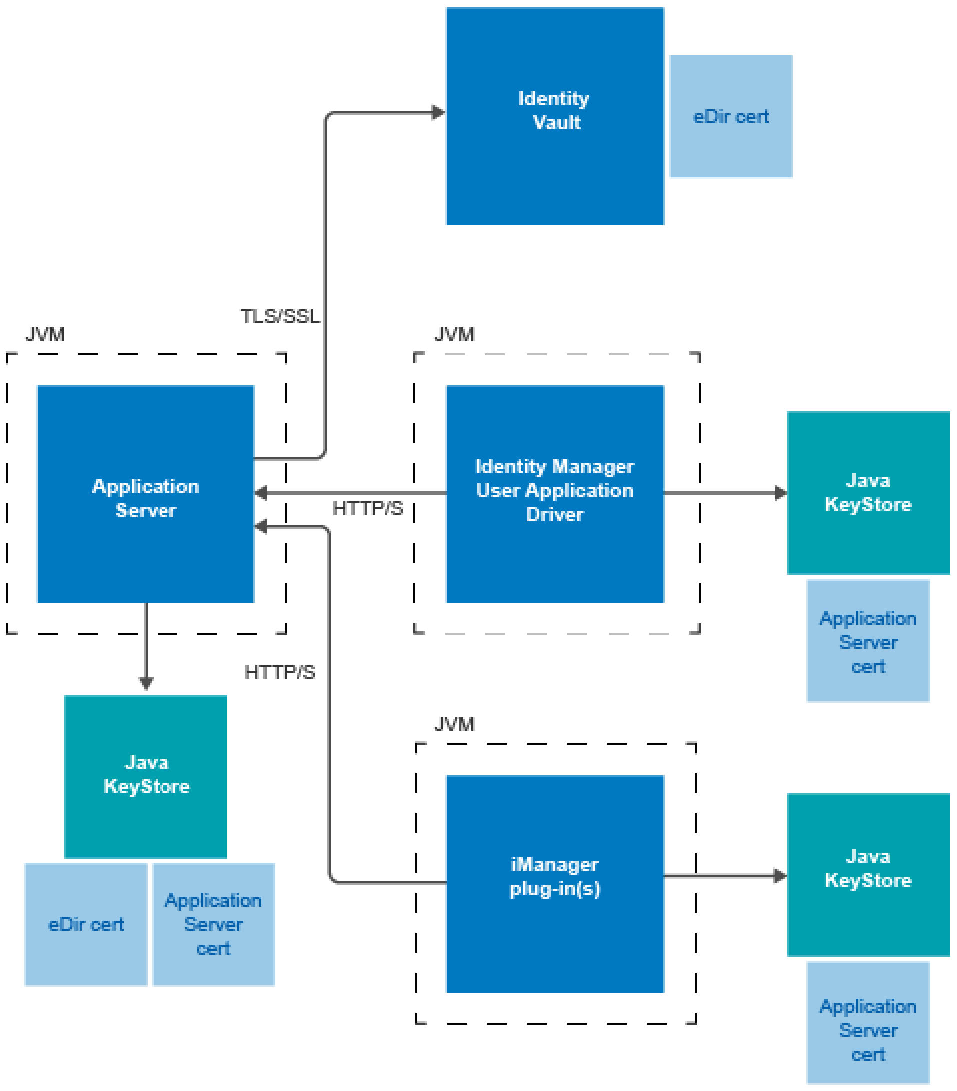
- "Ensuring High Availability for Identity Manager" in the *NetIQ Identity Manager Setup Guide*
- "High Availability Design" on page 46
- "Configuring the Workflow Engine and Cluster Settings" on page 207

5 Configuring Security in the Identity Applications

Moving from pre-production to production usually involves hardening the security aspects of the system. In sandbox testing, you might use regular HTTP to connect the User Application driver to the application server, or you might use a self-signed certificate (as a temporary measure) for driver/app-server communication. In production, on the other hand, you probably use secure connections, with server authentication based on your company's Verisign* (or other trusted provider) certificate.

Understanding Security in the Identity Applications Environment

It is typical for X.509 certificates to be used in a variety of places in the identity applications environment, as shown in the following diagram.



All communication between the identity applications and the Identity Vault is secure, using Transport Layer Security, by default. The installation of the Identity Vault (eDirectory) certificate into the Tomcat application server keystore is done automatically during installation time. Unless you specify otherwise, the installer places a copy of the eDirectory certificate in the JRE's default *cacerts* store. For more information, see the *NetIQ Identity Manager Setup Guide*.

The server certificate needs to be in several places, if communications are to be secure, as shown in the diagram. Different setup steps might be needed depending on whether you intend to use a self-signed certificate in the various places in the diagram shown with a *Application Server cert* box, or you intend to use a certificate issued by a trusted certificate authority (CA) such as Verisign.

Using Secure Sockets for User Application Connections to the Identity Vault

By default, secure sockets are used for communication between the User Application server and the Identity Vault. However, in some environments, not all communication needs to be secured. For example, if the User Application and Identity Vault servers are on an isolated network, and the only ports available to the outside are the HTTP ports, it might be acceptable for some communication between the two servers to be accomplished using non-secure sockets. Some aspects of the application will *always* use a secure connection (for example, a user changing a password) even though the setting might indicate that secure connections are not required. Turning off secure connections, especially for user connections, can greatly increase performance and scalability. If, in a particular environment, there are many concurrent logins, and communication between the User Application server and the Identity Vault server have been secured using the network setup, then turning off the secure connection for user connections greatly increase the number of concurrent logins that can be processed. We recommend that this option be used only when there is actual evidence of scaling or performance problems in the environment, and adding additional eDirectory servers is not an option.

Additionally, secure connections can be turned off for administrative connections. These connections are used for general queries on the Identity Vault server that do not require user credentials. These connections are pooled and used round-robin. The bind over a secure connection is only done once at application startup (or possibly again later on if the connection becomes unresponsive) and so does not represent the scalability issues that can arise with the user connections. However, the time it takes to encrypt and decrypt the data at both ends does add overhead. We recommend that the default setting be used, unless there is a need to gain extra performance.

Secure communications for administrative and user connections must be disabled in both the User Application and in iManager.

Disabling Secure Communications Using the User Application Configuration Tool

To disable the secure administrative and user connections in the User Application:

1. Run the configupdate script, located in the User Application directory, as follows:
   - Linux: Type the following to run `configupdate.sh`:

     ```
     ./configupdate.sh
     ```

   - Windows: Run `configupdate.bat`

   The User Application configuration utility starts.
2. Deselect **Secure Admin Connection** and **Secure User Connection**.
3. Click **OK**.

Disabling Secure Communications Using iManager

To disable the requirement for secure LDAP (LDAPS) connections for administrative and user connections to eDirectory using iManager:

1. Log into your eDirectory tree.
2. Navigate to the **LDAP** group object and display its properties.
3. Click **General**.
4. Deselect **Require TLS for Simple Binds with Password**.

NOTE: In a multi-server eDirectory tree, disabling TLS on the LDAP group removes the TLS requirement from all servers. If you want mixed TLS requirements for each individual server in your tree, you must enable the TLS requirement on each server.

Enabling SSL for User Access

The identity applications use HTML forms for authentication. As a result, user credentials are exposed during log in. We strongly recommend that you enable SSL to protect sensitive information.

NOTE: When enabling SSL between Identity Manager engine and Remote Loader, only java keystore method is supported on the Remote Loader.

The procedure for enabling SSL varies depending on whether on you are working in a test or production environment, as in the following sections:

- "Enabling SSL in a Test Environment" on page 50
- "Enabling SSL in a Production Environment" on page 51

Enabling SSL in a Test Environment

If you are in a test environment, you might want to use a self-signed certificate. The procedure below explains how to do this.

To enable SSL in a test environment:

1 Export the Certificate Authority from your eDirectory server using iManager:

1a Go to iManager.

1b Login with the eDirectory administrator's username and password.

1c Go to **Administration** > **Modify Object**.

1d Browse to the CA object in the Security container called `*TreeName*` `CA.Security`. For example, `IDMTESTTREE CA.Security`.

1e Click **OK**.

1f Click **Certificates** > **Self Signed Certificate**.

1g Select the self-signed certificate you want to use.

1h Click the **Export** button.

1i Clear **Export private key**.

1j Click **Export format** and select **DER**.

1k Click **Next**.

1l Click **Save the exported certificate**.

1m Click **Save File**. iManager saves the file as `cert.der`.

1n Click **Close**.

1o Move the saved file to a location where you want to store the exported certificate.

2 Create a keystore:

In a command prompt, cd to your `.../tomcat/conf` directory and the keystore.

NOTE: The `tomcat/conf` path is the default path for a User Application installed on Tomcat. The path can vary, depending on how you installed the User Application and Tomcat.

To the keystore, use the following command:

```
keytool -genkey -alias [keystore name] -keyalg RSA -keystore [your keystore
name.keystore] -validity 3650
```

You will be prompted for your password, first and last name, and possibly other pieces of information.

Here are a few important points to keep in mind as you answer the prompts:

- When asked for your first and last name, you should supply the fully qualified name of the server. For example:

  ```
  MyTomcatServer.NetIQ.com
  ```

- Be sure your spelling is correct. If you spell any words incorrectly, you will see errors when you generate your signed certificate from the signing authority.
- Save a copy of the information you provided in a simple text file. This will help to ensure that you supply the same information when you apply to the signing authority and when you import your certificate.

3 In your Tomcat `conf` directory, create a simple text file to store your keystore .csr file. Once this file is created, return to a command prompt and create the .csr with the following command:

```
keytool -certreq -v -alias [Keystore name you used when you created your
keystore] -file [your.csr] -keypass [password you created in keystore] -
keystore [your.keystore] -storepass [your password]
```

4 Issue a certificate using iManager:

4a Go to **Certificate Server** > **Issue Certificate**.

4b Browse to the .csr file created earlier.

Click **Next**. Then click **Next** again.

4c Select Unspecified as the certificate type.

Click **Next**. Then click **Next** again.

Enabling SSL in a Production Environment

To install a signed certificate into the Tomcat application server with the identity applications :

1 Create a keystore using the keytool utility included in the JRE.

In a command prompt, cd to your `.../tomcat/conf` directory and create the keystore.

NOTE: The `tomcat/conf` path is the default path for a User Application installed on Tomcat. The path can vary, depending on how you installed the User Application and Tomcat.

```
keytool -genkey -alias [keystore name] -keyalg RSA -keystore [your keystore
name.keystore] -validity 3650
```

You will be prompted for your password, first and last name, and possibly other pieces of information.

Here are a few important points to keep in mind as you answer the prompts:

- When asked for your first and last name, you should supply the fully qualified name of the server (for example, MyTomcatServer.NetIQ.com).
- Be sure your spelling is correct. If you spell any words incorrectly, you will see errors when you generate your signed certificate from the signing authority.
- Save a copy of the information you provided in a simple text file. This will help to ensure that you supply the same information when you apply to the signing authority and when you import your certificate.

2 In your Tomcat `conf` directory, create a simple text file to store your keystore .csr file. Once this file is created, return to a command prompt and create the .csr with the following command:

```
keytool -certreq -v -alias [Keystore name you used when you created your
keystore] -file [your.csr] -keypass [password you created in keystore] -
keystore [your.keystore] -storepass [your password]
```

3 Submit your .csr file to your Certificate Authority (CA), such as VeriSign or Entrust.

Once you have received your signed certificate from your CA, you need to import it into your Tomcat Server.

To import your signed certificate:

1 Place a copy of your certificate in your Tomcat `conf` directory.

Be sure to create a backup copy of this certificate and store it in a safe location.

2 Convert the root CA to DER format:

2a Double-click on your certificate stored in the Tomcat `conf` directory.

This will open a pop-up Certificate dialog screen.

2b Click on the **Certificate Path** tab.

2c Highlight the root certificate (the certificated issue by the signing authority, such as Entrust or Verisign).

2d Click on **View Certificate**. This will open a new Certificate dialog for the root certificate.

2e Click on the **Details** tab.

2f Click **copy to file**. This will open the Export Certificate Wizard.

2g Click **next** when the Export Certificate Wizard opens.

2h Select **DER encoded binary for X.509 (.CER)** and click **next**.

2i Create a new file to store the newly formatted certificate and store it in your Tomcat `conf` directory.

Then click **Finish**.

3 Convert the signed certificate into DER format:

3a Double click on your certificate, which should be stored in the Tomcat `conf` directory.

This will open a pop-up Certificate dialog screen.

3b Click on the **Details** tab.

3c Click **copy to file**. This will open the Export Certificate Wizard.

3d Click **next** when the Export Certificate Wizard opens.

3e Select **DER encoded binary for X.509 (.CER)** and click **next**.

3f Create a new file to store the newly formatted certificate and store it in your Tomcat `conf` directory.

Then click **Finish**.

4 Open a command prompt and cd to your Tomcat `conf` directory.

5 Import your Root CA:

```
keytool -import -trustcacerts -alias root -keystore your.keystore -file
yourRootCA.cer
```

Be sure to specify **root** as your alias in this step.

If all goes well, you should see a **Certificate was added to keystore** message.

6 Import your signed certificate.

```
keytool -import -alias [alias you used when creating the .csr] -keystore
[your.keystore] -file [your DER converted Signed Cert.cer]
```

If all goes well, you should see a **Certificate reply was installed in keystore** message.

7 To verify that the signed certificate was imported correctly, you can run the following command in a command prompt from your Tomcat `conf` directory.

```
keytool -list -v -alias idm -keystore idm.keystore
```

You should see your self signed and signed certificates listed in the output.

8 Enable SSL in Tomcat.

Locate `server.xml` under `.../tomcat/conf` directory and open that file in a text editor. Enable SSL by uncommenting or adding the following section:

```
maxThreads="150" strategy="ms" maxHttpHeaderSize="8192"
emptySessionPath="true"
scheme="https" secure="true" clientAuth="false"
keystoreFile="${tomcat.server.home.dir}/conf/tomcat.jks"
keystorePass="changeit" sslProtocol ="TLS" />
```

NOTE: Remember to point `keystoreFile` to the keystore you created. For example: `${tomcat.server.home.dir}/conf/server.keystore`. Also, remember to change the `keystorePass="changeit"` to your keystore password.

You may also need to add SSLEnabled="true" protocol="HTTP/1.1", as shown below:

```
  <Connector port="8443" protocol="HTTP/1.1" SSLEnabled="true"
       maxThreads="150" scheme="https" secure="true"
       clientAuth="false" sslProtocol="TLS"
       keystoreFile="/opt/certs/chap8.keystore"
       keystorePass="changeit" />
```

9 Restart your Tomcat server and test.

Enabling SOAP Security

1 In `IDMProv.war`, find the `web.xml` file and open it in a text editor.

2 At the bottom of the file, uncomment the following section:

```
<security-constraint>
        <web-resource-collection>
                <web-resource-name>IDMProv</web-resource-name>
                <description>IDM Provisioning Edition</description>
                <url-pattern>/*</url-pattern>
                <http-method>POST</http-method>
                <http-method>GET</http-method>
                </web-resource-collection>
        <user-data-constraint>
                <transport-guarantee>CONFIDENTIAL</transport-guarantee>
        </user-data-constraint>
</security-constraint>
```

3 Save the file and archive, then restart Tomcat.

Enabling Authentication

Enabling Mutual Authentication

The Identity Manager User Application does not support client certificate-based authentication out of the box. That functionality can be obtained, however, by using NetIQ Access Manager. See your NetIQ representative for more information. See also "Enabling Third-Party Authentication and Single Sign-On" on page 54.

Enabling Third-Party Authentication and Single Sign-On

You can configure Identity Manager to work with NetIQ Access Manager using SAML 2.0 authentication. This capability enables using a non-password-based technology to log in to the identity applications through Access Manager. For example, users can log in through a user (client) certificate, such as from a smart card.

Access Manager interacts with One SSO Provider (OSP) in Identity Manager to map the user to a DN in the Identity Vault. When a user logs in to the identity applications through Access Manager, Access Manager can inject a SAML assertion (with the user's DN as the identifier) into an HTTP header and forwards the request to the identity applications. The identity applications uses the SAML assertion to establish the LDAP connection with the Identity Vault. For information on configuring Access Manager to support this capability, refer to the Access Manager documentation.

Accessory portlets that allow single sign-on authentication based on passwords do not support single sign-on when SAML assertions are used for identity application authentication.

For more information about configuring Identity Manager to work with Access Manager, see "Using SAML Authentication with NetIQ Access Manager for Single Sign-on" in the *NetIQ Identity Manager Setup Guide*.

Encrypting Sensitive Identity Applications Data

Any sensitive information associated with the User Application that is stored persistently is encrypted by using the symmetric algorithm AES-128. The master key itself is protected by password-based cryptography using PBEWithSHA1AndDESede. The password is never persisted or stored out of memory.

Information that is encrypted includes (but is not limited to):

- LDAP administrator user password
- LDAP guest user password
- DSS trusted CA keystore password
- DSS signature key keystore password
- DSS signature key entry password

However, in a cluster environment, if session failover is enabled, some sensitive data (for example, a login-password for single sign-on) in the user session can be transferred on the network during session replication. This can expose sensitive data to network sniffers. To protect this sensitive data, do one of the following:

- Enable encryption for JGroups. For information about enabling JGroups encryption, see JGroups Encrypt (http://wiki.jboss.org/wiki/Wiki.jsp?page=JGroupsENCRYPT).
- Make sure that the cluster is behind a firewall.

Preventing XSS Attacks

The User Application supports the concept of XSS (Cross-Site Scripting) blacklists to allow you to prevent scripting attacks. The XSS blacklists prevent XSS injection in the free text input fields within the Detail portlet, approval flow, and role assignments pages within the application.

The User Application provides default values for two blacklists, one for the Detail Portlet, and one for the workflow system (which handles the approval flow and role assignments pages). However, you can customize the blacklists to suit the requirements of your environment.

To customize the either of the blacklists, you need to enter the words or characters you want to block in the sys-configuration-xmldata.xml file. In Tomcat, you can find this file in the `<`*`tomcat_home`*`>/conf` folder. Open the file with a UTF-8 friendly editor.

To modify the blacklist for the Detail portlet, open `<`*`tomcat_home`*`>/conf/ism-configuration.properties` in a UTF-8 editor, and find the `com.netiq.xss.blacklist.detailportlet` property:

```
<property>
  <key>com.netiq.xss.blacklist.detailportlet</key>
  <value>...</value>
</property>
```

The text node of `<value>` is the blacklist for Detail portlet. The blocked words are separated by comma (for example, `blocked_word1,blocked_word2,...`). The default setting is:

```
",&lt;
```

This means that double quote and < are disallowed.

To modify the blacklist for the approval flow and role assignments pages, locate the `com.netiq.xss.blacklist.workflow` property.

```
<property>
  <key>com.netiq.xss.blacklist.workflow</key>
  <value>...</value>
</property>
```

The syntax is the same. The default value is:

```
&lt;
```

which means that < is disallowed.

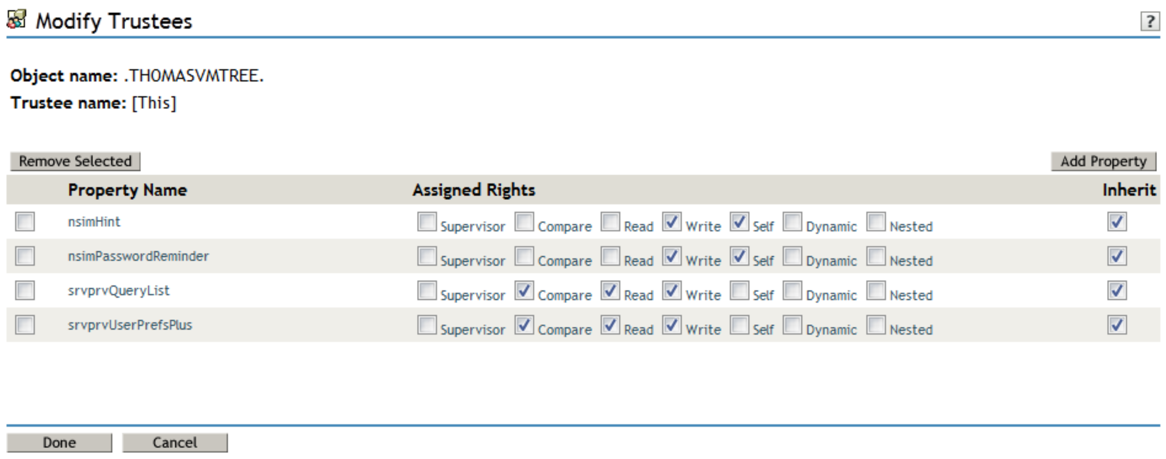
If you decide to customize the blacklists, be careful not to remove the default values. If you remove these values, you will make the lists less restricted, and therefore increase the risk of XSS attacks.

Modifying Trustee Rights

To perform tasks within the identity applications, users must have specific trustee rights.

Modifying the Trustee Rights for User Preferences

To allow user preferences to be saved, the administrator must ensure that the permissions on the srvprvUserPrefsPlus and srvprvQueryList attributes are set so that the user is able to write to these attributes. The necessary rights should be set for [This] at the tree root level, since [This] is a special alias to the object itself, causing only the user to have rights to modify its own preferences. To set the proper permissions, the administrator needs to modify the trustees for these attributes in iManager, as shown below:



Object name: .THOMASVMTREE.
Trustee name: [This]

	Property Name	Supervisor	Compare	Read	Write	Self	Dynamic	Nested	Inherit
☐	nsimHint	☐	☐	☐	✓	✓	☐	☐	✓
☐	nsimPasswordReminder	☐	☐	☐	✓	✓	☐	☐	✓
☐	srvprvQueryList	☐	✓	✓	✓	☐	☐	☐	✓
☐	srvprvUserPrefsPlus	☐	✓	✓	✓	☐	☐	☐	✓

The srvprvUserPrefsPlus property has no space limitations, so it can save a large amount of user preference information. If you have used the srvprfUserPrefs property in a previous release, this property will be migrated to srvprvUserPrefsPlus the first time a user saves new preferences in the User Application.

Modifying the Trustee Rights for a Provisioning Request Definition

To view the details and comments associated with a task in the **Task Notifications** section of the Work Dashboard tab, the Domain Administrator or Delegated Administrator must have the proper rights to the provisioning request definition. In particular, the user must have the nrfAccessMgrTaskAddressee right to the provisioning request definition, with write access enabled. To set the proper permissions, the administrator needs to modify the trustees for the provisioning request definition, as described below:

1. Log into iManager as an administrator.
2. Select **Modify Trustee** from the **Rights** left-navigation menu.
3. Browse to the provisioning request definition.
4. If necessary, click **Add Trustee** to add the user.
5. Click on the **Assign rights** link.

   Notice that nrfAccessMgrTaskAddressee is not listed with the write permission checked, which means that the user does not have the proper rights for the provisioning request definitiion.

6. Click the **Add Property** button.
7. Check the check box for **Show all properties in schema**.
8. Select nrfAccessMgrTaskAddresss.
9. Check the **write** checkbox for **Assigned Rights**.
10. Click **Done**.
11. Click **OK**.

Updating a Password for a Database User on Tomcat

Perform the following actions to update the database user's password in the database server.

1. Stop Tomcat.
2. Update the password in the database server.
3. With Java in your path, enter the following command:

   ```
   java -jar idm/apps/tomcat/lib/idm-datasource-factory-1.2.0-uber.jar
   %newpassword%
   ```

4. Copy the encrypted output of the password to the server.xml file.
5. Save and close the file.
6. Start Tomcat.

6 Assigning the Identity Applications Administrators

The identity applications support several types of users. To make administrative-type changes to the applications, you must be assigned to at least one of the administrator or manager roles.

Understanding the Administrators of the Identity Applications

The installation process initializes the Domain Administrators and Domain Managers system roles for the identity applications. However, during installation, you can specify only the User Application Administrator and allow all other assignments to default to this user. After installation, you can assign accounts to the roles.

You must assign an account to the roles that have an Administrator title.

Compliance Administrator

Required

A Domain Administrator who can perform all possible actions for all objects within the Compliance domain.

Configuration Administrator

Required

A Domain Administrator who can perform all possible actions on all objects within the Configuration domain. The Configuration Administrator controls access to navigation items with the User Application.

In addition, the Configuration Administrator configures the delegation and proxy service, the digital signature service, the provisioning user interface, and the workflow engine.

Provisioning Administrator

Required

A Domain Administrator who can perform all possible actions for all objects within the Provisioning domain.

Provisioning Manager

A Domain Manager who can perform only allowed actions for a subset of objects within the Provisioning domain.

Report Administrator

Required

A Domain Administrator who can define report permissions, which include the ability to use Identity Manager Reporting.

Resource Administrator

Required

A Domain Administrator who can perform all possible actions for all objects within the Resource domain.

Resource Manager

A Domain Manager who can perform only allowed actions for a subset of objects within the Resource domain.

Role Administrator

Required

A Domain Administrator who can perform all possible actions for all objects (except for the System Roles) within the Role domain.

Role Manager

A Domain Manager who can perform only allowed actions for a subset of objects within the Role domain.

Security Administrator

Required

A Domain Administrator who can perform all possible actions for all objects within the Security domain. The Security domain allows the Security Administrator to configure access permissions for all objects in all domains within the Roles Based Provisioning Module.

The Security Administrator can configure s, and also assign domain administrators, delegated administrators, and other Security Administrators.

NOTE: For testing purposes, NetIQ does not lock down the security model in Standard Edition. Therefore, the Security Administrator is able to assign all domain administrators, delegated administrators, and also other Security Administrators. However, the use of these advanced features is not supported in production. In production environments, all administrator assignments are restricted by licensing. NetIQ collects monitoring data in the audit database to ensure that production environments comply. Furthermore, NetIQ recommends that only one user be given the permissions of the Security Administrator.

The User Application Administrator is not a system role. For more information, see "User Application Administrator" on page 30.

Assigning the User Application Administrator

The User Application Administrator performs administrative tasks for the identity applications, using the **Administration** page of the User Application. The User Application Administrator does not have provisioning administration rights, and is considered an ordinary user while using the **Work Dashboard** panel. There can be more than one User Application Administrator.

One user *must* be assigned to the User Application Administrator role at installation. The User Application Administrator created during installation can administer everything in the User Application including the Provisioning system and can designate other users as User Application Administrators.

You can assign the User Application Administrator during installation and on the Application Configuration page on the Administration tab of the Identity Manager User Application. When you assign the administrator at installation, Identity Manager writes the assignment to the identity applications configuration file, which is editable with the configupdate utility. But, at deployment of the WAR, the assignment is written to the User Application database. Thus, after you start the Tomcat Application Server the first time after installation, you cannot change the assignment with the configupdate utility. It must be changed from the Application Configuration page.

A user who is to be a User Application Administrator should typically be located under the user root container specified in the User Application's LDAP configuration. This enables the user to log in simply by username (instead of requiring the fully distinguished name each time).

The user who is a User Application Administrator does not need special directory rights because this role controls application-level access.

When assigning User Application Administrators, you can specify users, groups, or containers.

1. Go to the **Application Configuration** page.
2. Under **Portal Configuration**, select **User App Administrator Assignment**.
3. Specify values for the following search settings:

Setting	What to Do
Search for	Select one of the following from the drop-down menu: ◆ Users ◆ Groups ◆ Containers
Starts with	If you want to: ◆ Find all available objects of your specified type (user), then make this setting blank. ◆ Find a subset of those objects, then enter the starting characters of the CN values you want. (Case is not considered. Wildcards are not supported.)

4. Click **Go**.

   The results of your search appear in the Results list.
5. Select the users, group, or container you want to assign as User Application Administrators, then click **Add** (>).

   Hold down the Ctrl key to make multiple selections.
6. Click **Save**.

To unassign User Application Administrators:

1. In the Current Assignments list, select the users, group, or container you want to unassign as User Application Administrators, then click **Remove** (<).

   Hold down the Control key to make multiple selections.
2. Click **Save**.

You cannot delete yourself as User Application Administrator. This is a safeguard to ensure that the User Application always has at least one User Application Administrator.

Changing the Default Administrator Assignments after Installation

The following administrative accounts are assigned during the initialization of the User Application:

- Compliance Administrator
- Provisioning Administrator
- RBPM Configuration Administrator
- Resource Administrator
- Roles Administrator
- Security Administrator

Modifying the mappings for these administrative accounts in the configupdate utility after the installation and initialization process will not work in this release. The check for assigning the administrative roles happens only once. At this time, a property is set that keeps track of when these roles were assigned.

NOTE: To modify the default administrator assignments for the User Application, you must first edit the `configupdate.sh` or `configupdate.bat` file and change the `-edit_admin` property to `true`. You can then use configupdate to modify the default assignments.

If you want to modify the default assignments for the administrative roles without deleting the Driver (which would cause all role assignments to be removed), you need to perform one of the following actions:

- "Granting or Removing Assignments in the User Application" on page 62
- "Changing the Assignments in Configupdate Utility" on page 63
- "Changing the Default Administrator Assignments without an Administrator Account" on page 63

Granting or Removing Assignments in the User Application

To grant or remove the role assignment through the User Application:

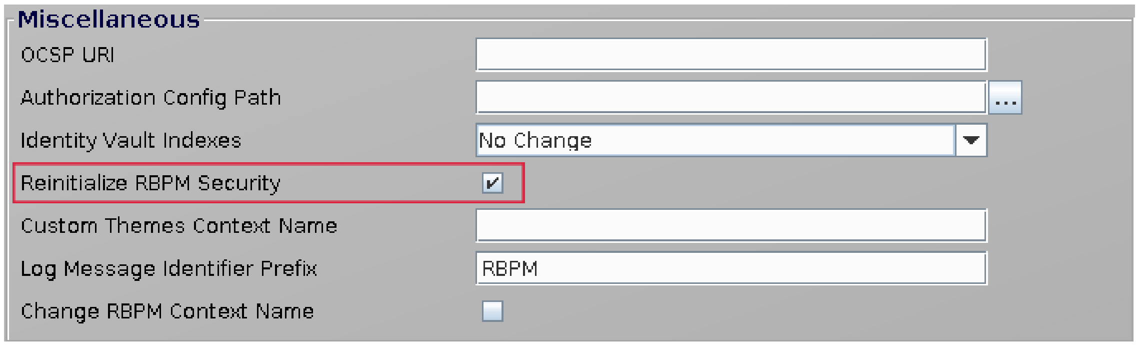
1. Log in to the User Application as the Security Administrator.
2. Go to the **Roles Catalog** on the **Roles and Resources** tab.
3. Select the administrative role you want to change (for example, the Provisioning Administrator).
4. Select **Edit**.
5. Select the **Assignments** tab.

6. If you want to remove the current assigned user, then select the user and press the **Remove** link.
7. To add a user, press the assign button where you will need to provide a description and the user to assign the role to and the press the **Assign** button.

Changing the Assignments in Configupdate Utility

To change any or all of the administrative assignments using Configupdate utility:

1. Stop the Application Server that the User Application WAR is deployed on.
2. Stop the User Application driver.
3. Stop the Roles and Resource Service Driver.
4. Launch the configupdate utility.
5. Change the mappings for the administrative roles outlined above as required.
6. Click **Show Advanced Options**.
7. In **Miscellaneous**, check **Reinitialize RBPM Security** and click **OK**.



Miscellaneous

OCSP URI	
Authorization Config Path	
Identity Vault Indexes	No Change
Reinitialize RBPM Security	✓
Custom Themes Context Name	
Log Message Identifier Prefix	RBPM
Change RBPM Context Name	☐

8. (Conditional) To remove the existing (default) users that have been granted the role assignment. Log in to iManager and remove the user from the role, then the role from the user.
9. Restart the User Application.
10. Restart the User Application driver.
11. Restart the Roles and Resource Service Driver.
12. Access the User Application and in the logs you will see the administrative roles will be issued.

Changing the Default Administrator Assignments without an Administrator Account

The default administrator assignment settings are established at the time you initialize the User Application driver. After the driver has been initialized, you can change the default settings on the Administrator Assignments page, as long as your “admin” user account still exists. If the account has been deleted, deactivated, or moved to a different location, you will not be able to log in to make the new assignments. In this case, you need to reset the values in the configupdate utility and delete the initialization property in the User Application driver.

1. Change the administrator assignment values in the configupdate utility.
2. Delete the initialization parameter in the User Application driver.
3. Restart the User Application driver and the Roles and Resources Driver.
4. Restart the User Application.

Assigning Administrators in the Identity Applications

An administrator assignment specifies a domain type (Security, Provisioning, Role, Resource, Configuration, and Compliance), as well as a set of permissions for the assignment. To assign administrative roles, you must either be a Security Administrator or have a Domain Administrator-type of role, such as Provisioning Administrator. Delegated administrators of a domain have no access to this page.

The permissions for an administrator assignment define the actions that administrators can take on a particular scope of object instances within the domain type selected. For example, if you select the Role domain as the domain type for an assignment, the permissions determine what actions the administrators can take on the set of role instances selected as the scope for the assignment. These permissions might specify, for the selected scope of roles, that administrators can perform actions such as assigning roles to users, viewing role assignments, and reporting on role assignments.

- “Viewing Current Administrator Assignments” on page 64
- “Creating New Administrator Assignments” on page 64
- “Editing an Existing Assignment” on page 70
- “Deleting Assignments” on page 70

Viewing Current Administrator Assignments

To view the current administrator assignments, navigate to **Administration > RBPM Provisioning & Security > Administrator Assignments** in the User Application.

Creating New Administrator Assignments

1 In the User Application, navigate to **Administration > RBPM Provisioning & Security > Administrator Assignments**.

2 Click **Assign**.

3 Select one of the following domains:

- The **Compliance** domain defines rights to launch attestation requests and view the status of attestation requests.
- The **Configuration** domain defines rights to configure access to User Application header tabs and navigation items.
- The **Provisioning** domain defines rights to launch and retract process requests, manage addressee tasks, and configure delegate, proxy, and availability settings.
- The **Reports** domain defines report permissions, which include the ability to use the Identity Manager Reporting tool.

  NOTE: To access the existing role and resource reports, a user who is a Report Administrator must be assigned as Role or Resource Manager, and be given the **Report on Role** or **Report on Resource** permission for a specific role or resource, or for all roles or resources.

- The **Resource** domain defines rights to manage resources, assign, revoke, and report on resources, as well as rights to configure resource settings and bind entitlements.

- The **Role** domain defines rights to manage roles and SoDs, assign, revoke, and report on roles, as well as rights to configure role settings.
- The **Security** domain defines rights to manage User Application security, such as assign and revoke domain administrators, domain managers, and s.

The domain determines what types of objects the administrator can act on. An administrator assignment can only be associated with a single domain.

NOTE: If a particular user has been designated as a manager of a , NetIQ recommends that this user should not also be designated as a domain administrator for the domain associated with the .

To see a description of a particular domain, click the Info icon to the right of the **Domain** list.

4. Specify one of the following choices for the **Type of Assignment**:
   - **User**
   - **Group**
   - **Container**
   - **Role**
5. Select the users (or groups, containers, or roles) in the **Select Users** field.

   The label for the control, and the objects available for selection, vary according to the type of assignment you have specified.
6. Select an **Effective Date** for the assignment. This date (and time) determines when the permissions are enabled for the assignment.
7. Select an **Expiration Date** for the assignment. This date (and time) determines when the permissions are disabled for the assignment.
8. (Optional) To give the administrator full permissions for the selected domain, click the **All Permissions** checkbox.

   When the **All Permissions** checkbox is checked, the assignment creates a Domain Administrator. When it is unchecked, the assignment creates a Delegated Administrator.

   When the domain selected is **Security**, **Configuration**, **Compliance**, or **Reports**, the assignment automatically gives full permissions for the selected domain, and the **All Permissions** checkbox is not displayed.

   NOTE: When a user is assigned a Compliance Administrator role, the user interface shows two rows in the Administrator Assignments page, one for the Compliance Administrator role, and one for a Provisioning Manager role with no permissions visible. Note that this latter row should not be removed. If the row is removed, the user assigned to be Compliance Administrator will not be able to launch attestation requests successfully. The Compliance Administrator role is automatically given rights to initiate and retract attestation provisioning requests. For this reason, the Provisioning Manager role is required.

   ---
9. Click **Save** to preserve your administrator assignment settings.

   If the domain for the assignment is **Provisioning**, **Role**, or **Resource** domain, and you've unchecked the **All Permissions** checkbox, the **Permissions** section is added to the page.
10. To define the permissions, click **New**.

    This interface shows controls that apply to the domain selected for the assignment. These controls allow you to specify which objects are within the scope of the assignment and which permissions administrators have with respect to these objects.

11 To define permissions for an assignment that uses the **Provisioning** domain, complete the following steps:

11a To include all provisioning request definitions, click the **All Provisioning Request Definition** button.

11b To select provisioning request definitions individually, choose the **Select Provisioning Request Definition** radio button, and use the Object Selector to pick one provisioning request definition at a time.

NOTE: If you select All Provisioning Request Definitions, and define a permission at this level, and then try to define the same permission for a particular provisioning request definition, the Administration Assignment page will not create the permission for the provisioning request definition, since it has already been defined at a higher level. In general, a permission will not be set on a lower level object if it has been already defined for a higher level object. However, if it is defined on a lower level object first, the same permission can be set on a higher level set of objects as well.

11c Once you've defined the scope, choose the permissions you want to allow for each object by selecting the object and picking the desired permissions in the list on the right side of the dialog.

Permission	Description
Initiate PRD	Allows the user to initiate the selected provisioning requests. **NOTE:** The Initiate PRD permission has no effect on the behavior of the NetIQ-installed PRDs for resources, roles, and attestation within the User Application, since these PRDs cannot be initiated directly from the User Application. However, this permission does control whether these PRDs can be initiated from a SOAP call.
Retract PRD	Allows the user to retract the selected provisioning requests when they are in progress.
View Running PRD	Allows the user to view the selected provisioning requests when they are in progress.
Configure Delegate	Allows the user to configure delegate assignments for the selected provisioning requests.
Manage Addressee Task	Allows the user to manage tasks associated with the selected provisiong requests that have been addressed to other users. When this permission is enabled, Domain and Delegated Administrators can manage tasks for all users, including addresses and recipients. Managers are able to manage tasks for addressees, but not for recipients.
Configure Availability	Allows the user to configure availability for tasks associated with the selected provisioning requests.

11d In the **Add User Application Driver Permissions** section of the page, optionally select the **Configure Proxy** permission to allow the selected user(s) to configure proxy assignments. This setting applies to the driver as a whole.

11e Click **Save** to save the permissions for the selected objects or containers.

To delete a permission, select the permission and click **Delete**.

To refresh the list of permissions, click **Refresh**.

12 Follow these steps to define permissions for an assignment that uses the **Role** domain:

12a To include all roles in all levels in the roles hierarchy, choose **All Role Levels** in the **Role Level** control.

To include all roles at a particular level in the role hierarchy, choose one of the following levels:

- **Business Role**
- **IT Role**
- **Permission Role**

To include all roles in a particular sub container under the selected role level, use the Object Selector to select the sub container.

12b To select roles individually, choose **Select Roles** radio button, and use the Object Selector to pick one or more roles.

12c Once you've defined the role scope, choose the permissions you want to allow for each object by selecting the object and picking the desired permissions in the list on the right side of the dialog.

Permission	Description
Create Role	Allows the user to create roles. This permission is hidden when a particular role is selected.
Delete Role	Allows the user to delete the selected roles. This setting applies only at the container level. At installation time, no user has the ability to delete system roles. However, the administrator may grant user access to the system roles. The permission to delete roles should not be given for the RoleConfig, Level20, and System roles containers. Also, in general, you should not set permissions on those containers, because permissions on these containers will be propagated to the system roles. Instead, you should create role subcontainers under the role level container and set permissions on each subcontainer.
Update Role and Role Relationship	Allows the user to update the selected roles and modify role relationships. This setting applies only at the container level.
View Role	Allows the user to view the selected roles. This setting applies only at the container level.

Permission	Description
Assign Role To User	Allows the user to assign users to the selected roles. **IMPORTANT:** Only the Security Administrator can assign system roles on the Work Dashboard tab and the Roles and Resources tab.
Revoke Role From User	Allows the user to revoke user assignments for the selected roles.
Assign Role To Group And Container	Allows user to assign groups and containers to the selected roles.
Revoke Role From Group And Container	Allows the user to revoke group and container assignments for the selected roles.
Report On Role	Allows the user to generate reports that provide information about the selected roles.

12d To include all separation of duties constraints, choose **All Separation of Duties Constraints** radio button.

12e To select separation of duties constraints individually, choose **Select Separation of Duties Constraint** radio button, and use the Object Selector to pick one or more constraints.

12f Once you've defined the separation of duties scope, choose the permissions you want to allow for each object by selecting the object and picking the desired permissions in the list on the right side of the dialog.

Permission	Description
Create SoD	Allows the user to create separation of duties constraints. This permission is hidden when a particular SoD constraint is selected.
Update SoD	Allows the user to update the selected separation of duties constraints.
Delete SoD	Allows the user to delete the selected separation of duties constraints.
View SoD	Allows the user to look at the selected separation of duties constraints.
Report On SoD	Allows the user to generate reports that provide information about the selected separation of duties constraints.

12g In the **Add Role Configuration Permissions** section of the page, optionally select the **Configure Roles Settings** permission for the configuration object.

This setting controls access to the **Configure Role and Resource Settings** page on the **Roles and Resources** tab. To access this page, the user must have the **Configure Roles Settings** permission as well as the **Configure Resource Settings** permission, which is given through a Resource Manager (or Resource Administrator) assignment. If a user does not have both of these permissions, the **Configure Roles and Resource Settings** page displays read-only information, and cannot be edited.

- **12h** Click **Save** to save the permissions for the selected objects or containers.

  To delete a permission, select the permission and click **Delete**.

  To refresh the list of permissions, click **Refresh**.

13 Follow these steps to define permissions for an assignment that uses the **Resource** domain:

- **13a** To include all resources, click the **All Resources** button.
- **13b** To select resources individually, choose the **Select Resources** radio button, and use the Object Selector to pick one or more resources.
- **13c** Once you've defined the resource scope, choose the permissions you want to allow for each object by selecting the object and picking the desired permissions in the list on the right side of the dialog.

Permission	Description
Create Resource	Allows the user to create resources. This permission is hidden when a particular resource is selected.
Delete Resource	Allows the user to delete the selected resources.
Update Resource	Allows the user to update the selected resources.
View Resource	Allows the user to view the selected resources.
Assign Resource	Allows the user to assign users to the selected resources.
Revoke Resource	Allows the user to revoke user assignments for the selected resources.
Report On Resource	Allows the user to generate reports that provide information about the selected resources.

- **13d** To include all drivers for entitlements, click the **All Drivers** radio button.
- **13e** To select drivers individually, choose the **Select Driver** radio button, and use the Object Selector to pick a resource.
- **13f** Once you've defined the driver scope, optionally select the **Bind Entitlement** permission to allow the selected user(s) to bind resources to entitlements. To allow the user to generate reports on entitlements, optionally select the **Report On Entitlement** permission.
- **13g** In the **Add Resource Configuration Permissions** section of the page, optionally select the **Configure Resources Settings** permission for the configuration object.

  This setting controls access to the **Configure Role and Resource Settings** page on the **Roles and Resources** tab. To access this page, the user must have the **Configure Resources Settings** permission as well as the **Configure Roles Settings** permission, which is given through a Role Manager (or Role Administrator) assignment. If a user does not have both of these permissions, the **Configure Roles and Resource Settings** page displays read-only information, and cannot be edited.
- **13h** Click **Save** to save the permissions for the assignment.

  To delete a permission, select the permission and click **Delete**.

  To refresh the list of permissions for the assignment, click **Refresh**.

14 Click **Save** to save the assignment and permissions.

Editing an Existing Assignment

To edit an existing administrator assignment:

1. Select a previously defined assignment and click **Edit**.
2. Make your changes to the administrator settings and click **Save**.

Deleting Assignments

Select a previously defined assignment and click **Edit**.

7 Setting Up Logging in the Identity Applications

Logging is the main tool you use for debugging the identity applications configuration. The logging service provides facilities for writing, viewing, filtering, and listening for log messages. The Tomcat application server instances and subsystems, and applications that run on Tomcat or in client JVMs generate these log messages.

This sections discusses the following topics:

How Logging Services Help

A Tomcat server instance uses logging services to communicate its status and respond to specific events, including server startup and shutdown information, failures of one or more subsystems, errors, warning messages, access information on HTTP requests, and additional information. For example, you can use Tomcat's logging services to report error conditions or listen for log messages from a specific subsystem.

All administrative and end-user actions and events are logged to the server console and to Tomcat server's log file. This allows easy access to this information for security and operational purposes. Additionally, the audit log system provides the ability to monitor ongoing activities such as authentication activity, up time of the system, and so on. File logging is enabled by default.

The identity applications features are implemented in a layered architecture. Each feature uses one or more packages. Each package handles a specific area of a feature and has its own independent log level that obtains event messages from different parts of the application. The logs contain information about processing and interactions among identity applications components that occur while satisfying users and administrative requests and during general system processing. By enabling the correct log levels for various packages, an administrator can monitor how identity applications processes users and administrative requests. The package names are based on log4j conventions. The event messages include these package names indicating the context of the message output. The logs include tags and values that allow the administrator to identify and correlate which package log entries pertain to a given transaction and user. Table 7-1 describes some of the features and the packages they use.

Table 7-1 Identity Manager User Application Packages

Feature	Description	Packages	Notes
Roles	Roles are permanently stored in the Identity Vault. For fast access to roles information, Identity Manager stores roles in a local cache called permission index. When a role is requested, the User Application queries the permission index for that role. When a role is modified through the User Application driver, the change is reflected in the permission index. For more information about roles, see "Understanding Role Assignments" on page 134.	◆ com.novell.idm.nrf.service ◆ com.novell.idm.nrf.persist ◆ com.novell.srvprv.impl.vdata.model ◆ com.netiq.idm.rest.catalog	For troubleshooting any issues when a role is assigned, revoked, or expired, monitor the Roles and Resource driver log. `com.novell.srvprv.impl.vdata.model` is a verbose package when set to `Debug` log level. It generates messages for each object class and attributes present in Virtual Data Access (DAL). For example, it shows all DAL lookups. This can result in a large amount of logs. To limit the number of messages, you can set the log level to `Warn`. For more information about the messages generated by `com.novell.srvprv.impl.vdata.model`, see "Virtual Data Access Logging" on page 636. For troubleshooting issues related to managing roles, see "When a Role Is Requested" on page 641.

Feature	Description	Packages	Notes
Resources	Resources are permanently stored in the Identity Vault. For fast access to resources information, Identity Manager stores resources in a local cache called permission index. When a resource is requested, the User Application queries the permission index for that resource. When a resource is modified, the change is reflected in the permission index is updated. For more information about resources, see Section , "Understanding Resource Assignments," on page 141.	◆ com.novell.idm.nrf.service ◆ com.novell.idm.nrf.persist ◆ com.novell.srvprv.impl.vdata.model	For troubleshooting any issues when a resource is assigned or revoked, monitor the Roles and Resource driver log.
Code Map Refresh	Code map is a local cache used by the User Application to store entitlements values for all connected systems from the Identity Vault. The User Application queries the Identity Vault for the drivers that are in running state and have entitlements. The User Application updates the User Application database at configurable intervals with entitlement changes.	◆ com.novell.idm.nrf.service ◆ com.novell.idm.nrf.persist ◆ com.novell.srvprv.impl.vdata.model	For troubleshooting any connected system issue, enable DSTrace on the driver. For viewing sample log messages related to code map refresh, see "When a Code Map Refresh Is Triggered" on page 639.
Proxy	Enables you to manage proxy configuration. Identity Manager stores proxy definition in the ProxyDefs container in the User Application driver. For more information about configuring proxy, see Section , "Configuring Delegation and Proxy Settings," on page 201.	◆ com.novell.srvprv.impl.security.service ◆ com.netiq.idm.rest.access ◆ com.novell.soa.af.impl.persist ◆ com.novell.srvprv.apwa.actions	When a user is designated as a proxy, check the audit events for any suspicious activity.

Feature	Description	Packages	Notes
Delegation	Enables you to manage delegation configuration based on a user`s availability. A delegate is another user that you can temporarily grant permission to view and resolve your workflow work items. A delegate can view his delegator tasks in the task page and act on them. Identity Manager stores delegate definitions in the DelegateeDefs container in the User Application driver. For more information about configuring delegation, see Section , “Configuring Delegation and Proxy Settings,” on page 201.	◆ com.novell.srvprv.impl.security.se rvice ◆ com.novell.srvprv.apwa.actions	When a user is made a delegate for another user, check the audit events for any suspicious activity that can occur through delegation.
Outgoing e-mails	E-mail notifications inform Identity Manager users of tasks and events in the system. For example, Identity Manager can send an e-mail to approvers when an event or task requires an approval. For more information, see “Working with Email Templates” on page 243.	com.novell.soa.notification.impl	For troubleshooting e-mail approval issues, see “Troubleshooting E-Mail Based Approval Issues” on page 650. For viewing sample log messages related to E-Mail notifications, see “Virtual Data Access Logging” on page 636.
Database connectivity/ updates	Any schema changes made in the User Application are updated in the database when the User Application server is started and `com.netiq.idm.create-db-on-startup` flag is set to true in the `ism-configuration` properties file. When this flag is set, the database compares the existing schema with target schema and then updates the database schema. To update the database with any application configuration changes, you must set `com.netiq.idm.rbpm.updateConfig-On-StartUp` flag to true in the `ism-configuration` properties file.	com.novell.soa.persist	

Feature	Description	Packages	Notes
Configuration Item (Landing page)	Allows you to manage application items on the landing page. You can quickly navigate to internal and external pages of the application. For more information, see Configuring Identity Manager Home Items in the *NetIQ Identity Manager Home and Provisioning Dashboard User Guide*.	com.netiq.idm.icfg	
Client Settings	Allows you to manage client settings to control the behavior of the application. You can also modify the access rights and branding of the application for different set of users. For more information, see Chapter 8, "Customizing the Identity Applications for Your Enterprise," on page 99.	◆ com.netiq.idm.rest.access ◆ com.netiq.idm.settings	
Workflow Tasks	A task can be controlled by a workflow process. A workflow process can include one or more steps that must be performed before Identity Manager can complete a task that is under workflow control. A job is a runtime instance of a workflow process. The Workflow Engine is responsible for managing and executing steps in a workflow and for keeping track of state information which is persisted in a database. For more information, see Part V, "Configuring and Managing Provisioning Workflows," on page 217.	◆ com.novell.soa.af.impl.core ◆ com.novell.soa.af.impl.activity ◆ com.netiq.idm.rest.access	
Separation of Duties	Allows you to prevent users from being assigned to conflicting roles unless someone in your organization makes an exception for the conflict. To eliminate conflicts in role assignments, you perform certain management tasks such modify role definition and set up a proper approval process. For more information, see "Understanding Role Assignments" on page 134.	◆ com.novell.idm.nrf.service ◆ com.novell.idm.nrf.persist ◆ com.novell.srvprv.impl.vdata.model	

Feature	Description	Packages	Notes
My Permission	A user can view a list of role and resource permissions assigned to him or for other users. For more information, see Viewing Your Permissions in the *NetIQ Identity Manager Home and Provisioning Dashboard User Guide*.	◆ com.netiq.idm.rest.access ◆ com.netiq.idm.rest.access.util	
History	A user can review the status and history of the permission requests (role, resource, PRD) for himself or for other users. For more information, see Viewing Your History in the *NetIQ Identity Manager Home and Provisioning Dashboard User Guide*.	◆ com.netiq.idm.rest.access ◆ com.novell.idm.nrf.persist ◆ com.netiq.idm.rest.access.util	
Teams	You can perform team management tasks such as create, modify, and delete a team based on access privileges. Identity Manager stores team configuration in the TeamDefs container in the User Application driver. For more information about configuring Teams, see Section , "Team Configuration," on page 210.	◆ com.netiq.idm.rest.access ◆ com.novell.idm.security.authorization.ldap ◆ com.novell.srvprv.spi.vdata.model ◆ com.netiq.idm.rest.access.util ◆ com.novell.idm.security.authorization.service	
Group	Allows you to manage groups. For example, you can create, modify and delete a group based on access privileges. For more information, see Managing Users and Groups in the *NetIQ Identity Manager - User's Guide to the Identity Applications*.	◆ com.netiq.idm.rest.catalog ◆ com.novell.srvprv.spi.vdata.model	
Organization Chart	The Organization Chart page shows the hierarchy of users in your organization. A user can view the organization chart and quick information about the users based on the access rights set by the administrator. For more information, see Viewing Other Users in Your Organization in the *NetIQ Identity Manager - User's Guide to the Identity Applications*.	◆ com.netiq.idm.rest.access ◆ com.novell.srvprv.impl.portlet.orgchart ◆ com.novell.srvprv.impl.servlet.service ◆ com.novell.soa.portlet ◆ com.netiq.idm.rest.access.util	

Feature	Description	Packages	Notes
User Catalog	You can create, modify, and delete users. A new user is created under the base container configured for the user. Based on the access control list rights, the user information can be edited. The user attributes can be configured to view, edit, and search by using the client settings. For more information, see Managing Users and Groups in the *NetIQ Identity Manager - User's Guide to the Identity Applications*.	◆ com.netiq.idm.rest.access ◆ com.netiq.idm.infosrv ◆ com.novell.srvprv.impl.vdata.model ◆ com.netiq.idm.settings ◆ com.novell.idm.nrf.service ◆ com.novell.idm.security.authorization.service ◆ com.novell.idm.nrf.persist ◆ com.novell.idm.security.authorization.ldap ◆ com.netiq.idm.rest.access.util	
Make a request	A user can request a permission for himself or for another user. The Request page directly fetches the permission from the Permission index. The requested permission is directly assigned or through an approval process. For more information, see Requesting Permissions in the *NetIQ Identity Manager Home and Provisioning Dashboard User Guide*.	◆ com.netiq.idm.rest.access ◆ com.netiq.idm.infosrv ◆ com.novell.srvprv.spi.vdata.model ◆ com.novell.idm.nrf.ajaxservice ◆ com.novell.idm.nrf.service ◆ com.novell.idm.nrf.persist ◆ com.novell.idm.security.authorization ◆ com.novell.soa.af.impl.core ◆ com.novell.soa.af ◆ com.novell.idm.nrf.assignment	
Permission Index	Roles, resources, and PRDs are permanently stored in the Identity Vault. For fast access, Identity Manager stores this information on the User Application server in a set of cache files called Permission Index. When you install the identity applications, the process creates a permission index for the application server hosting the identity applications. For more information, see Preparing Your Environment for the Identity Applications in the *NetIQ Identity Manager Setup Guide*. When a request is issued, the identity applications query the permission index for the requested information.	◆ com.netiq.idm.cis ◆ com.netiq.cis.permindex ◆ com.netiq.idm.cis.permfilter ◆ com.sssw.fw.core ◆ com.netiq.uaconfig	Only applicable to NetIQ Identity Manager Dashboard and the new Dashboard.

Feature	Description	Packages	Notes
Directory Abstraction Layer	The directory abstraction layer provides a virtual access to the Identity Vault data. You define a set of entities and their related attributes (virtual data) based on the Identity Vault objects that you want users to view, modify, or delete in the User Application. For more information, see Preparing Your Environment for the Identity Applications in the *NetIQ Identity Manager Setup Guide*.	◆ com.novell.srvprv.impl.vdata.model	For viewing sample log messages related to Virtual Data Access, see "Virtual Data Access Logging" on page 636.

The logs generated by the packages are primarily intended for debugging the software, although they can be used to detect any other software that is not behaving properly. System administrators and support personnel can identify and isolate problems caused by configuration errors, invalid user data, or network problems such as broken connections. However, component file logging is typically the first step in identifying software bugs.

Package logging is more verbose than audit logging. It increases the processing load. On a day-to-day basis, you are recommended to enable only log levels of error conditions and system warnings. If a specific problem occurs, logging can be set to **Info** or **Debug** to gather extra information needed to isolate and resolve the detected problem. When the problem is resolved, logging should be reconfigured to log only error conditions and system warnings.

What Can Be Logged

The identity applications functionality that deals with workflows (PRDs) and actions such as granting and managing of roles, resources, and entitlements can be logged. The log level for these features is controlled by configuring logging for the packages used by them. You can change log levels from the Logging page. For more information, see "Changing Log Levels" on page 166.

The identity applications functionality that executes on a client and does not directly execute in context of the User Application web server cannot be logged in the same way. For example, most of the form processing that occurs in the client. The action scripts defined on the form control's onLoad, onChange, or custom events execute in the browser of the user's client computer and not in the User Application web server. Therefore, if an error occurs while rendering the form or processing an action script, it cannot be directly logged. However, Identity Vault queries issued from a form or Start Activity can be logged for troubleshooting the identity applications features. To view the identity applications client errors and informational messages, click the Console tab or the Network tab under Developer Tools section in the client browser. It contains HTTP response codes for both success and failed requests. The identity applications allow you to record the outcome of a user's request and response.

Identity Applications allow you to log what happens with a user's request and response during certain times:

- Between the browser and the application server
- Between the application server and the User Application database
- Between the application server and the Identity Vault

You can configure the log files to include entries for the following events:

- Configuration
- Events processed by the identity applications components, such as authentication, role assignment, and resource access
- Error conditions

The log files help you determine which of the following reasons is responsible for a request failure:

- The browser did not send the required information
- Directory Access Layer or the Identity Vault did not send the web client browser the required information

To view Identity Manager processing events in Identity Manager drivers, use Trace. Specify appropriate trace values to the driver set and the drivers in Designer or iManager. For more information, see Viewing Identity Manager Processes in the NetIQ Identity Manager Driver Administration Guide.

How Logging Works

The following sections describe the identity applications logging environment and provide an overview of the logging process.

Terminology

Log4j has three main components: loggers, appenders, and layouts. These components work together to accomplish the following tasks:

- Record messages based on message type and level.
- Control how log messages are formatted and where they are reported at runtime.

Logger: In Log4j terminology, a logger is a named entity. Log4j defines a Logger class. A Logger object records messages for a specific subsystem or application component. An application can create multiple loggers, each with a unique name. In a typical usage of Log4j, an application creates a Logger instance for each application class that will emit log messages. Logger names are case-sensitive and they follow the Java package dot notation naming convention.

All loggers specific to the identity applications are defined in the `idmuserapp_logging.xml` file. You can set the severity level for each logger at any level in the hierarchy from the Logging Administration page or by editing the log4j file. For more information, see Section , "Specifying the Severity Level for Commons Logging API Loggers," on page 87.

Appender: In Log4j terminology, an output destination is called an appender. Log4j defines appenders to represent destinations for logging output. You can define multiple appenders. For example, an application might define an appender that sends log messages to standard out, and another appender that writes log messages to a file. Additionally, you can configure individual loggers to write to zero or more appenders. For example, you can configure the loggers to send all logging messages (all levels) to a log file, but only Error level messages to standard out. To change the destination of the log files, stop the identity applications and then change the settings in the Logging Location and Appender section of the `log4j.properties` file. Identity Applications provide a full suite of appenders offered by Log4j. For more information about appenders, see Log4j documentation.

The Console and File appenders are defined in the `tomcat-log4j.xml` file. The NAudit appender that is specific to the identity applications is defined in the `idmuserapp_logging.xml` file.

Layout: Log4j defines layouts to control the format of log messages. Each layout specifies a particular message format. A specific layout is associated with each appender. This lets you specify a different log message format for standard out than for file output if required.

Components for Logging

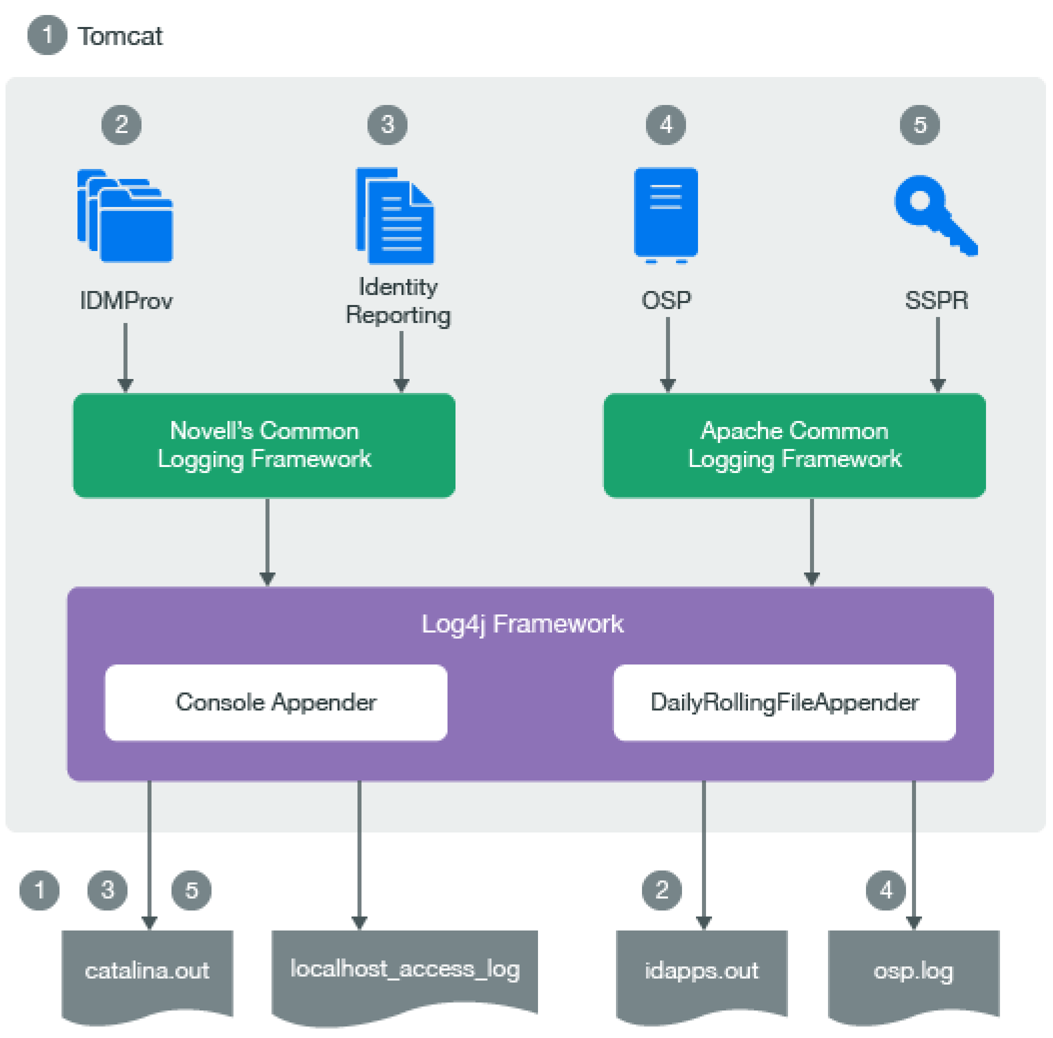
A logging system includes the following basic components:

- A component that produces log messages
- A component that distributes (publish) log messages

The Tomcat subsystems use log4j to produce messages. By default, Tomcat supports Java based logging to distribute messages. The LoggingHelper class provides access to the java.util.logging.Logger object used for server logging. The Java Logging APIs can be used to add custom handlers, filters, and formatters. Alternatively, you can configure Tomcat to use Log4j APIs to distribute log messages.

How Logging Works

The identity applications support logging by using a custom-developed logging framework that integrates with log4j, an open-source logging package distributed by The Apache Software Foundation. In identity applications environment, Tomcat subsystems and identity applications components send log requests to the Logger objects. The Logger objects then assign LogRecord objects, which are passed to Appender objects for publication. By default, the logger objects log messages to the system console and to the Tomcat server's log file at `Info` logging level and above. Events are logged to all activated loggers.



* The Tomcat server's log messages are directed to `catalina.out and idapps.out`.
* User Application's log messages are directed to `idapps.out`.
* Identity Reporting's log messages are directed to `catalina.out`.
* OSP's log messages are directed to `osp.out`.
* SSPR's log messages are directed to `catalina.out`.

Custom appenders like NAuditAppender are created to handle log messages in order to convert the messages to a specific format and send them to the configured auditing service. To configure event message output to an auditing service, see "Sending Log Messages to an Auditing Service" on page 166.

To configure logging, see Section , "Configuring Logging," on page 86.

Types of Log Files

An identity applications framework uses several components such as OSP, SSPR, Dashboard, User Application driver, and Role and Resource driver. Each component has its own logging configuration that defines the default log levels and appender configuration for that component. Logs for all identity applications components including OSP and Identity Reporting are logged to the `catalina.out` file while the Localhost log records the interactions between the Tomcat server and the client. Some components such as OSP maintain additional log files that help in auditing their individual interactions. This section discusses different log files that are generated in an identity applications environment and what each of them contains.

Difference Among Catalina, Application, and Localhost Log Files

Catalina Log: This is the global log. It records information about events such as the startup and shutdown of the Tomcat application server, the deployment of new applications, or the failure of one or more subsystems. The messages include information about the time and date of the event and the ID of the user who initiated the event.

The `catalina.log` file contains all log messages that are written to Tomcat's system.out and system.err streams. Tomcat's internal log statements use the `java.util.logging` package (`juli`) to log. The default destination for that log is `standard.out`.

The catalina.out file can include:

- Uncaught exceptions printed by java.lang.ThreadGroup.uncaughtException(..)
- Thread dumps, if you requested them via a system signal

Each Tomcat server instance prints a subset of its messages to `standard.out` or `idapps.out` file. The `idapps.out` log file is specific to User Application. The `Userapp-log4j.xml` file stores the logging configuration for User Application, which directs all log messages to `idapps.out`.

The `catalina.out` file is located on the computer that hosts the Tomcat server instance. Each server instance has its own `catalina.out` file. By default, the `catalina.out` file is located in the logs directory under Tomcat's root directory. For example, `/opt/netiq/idm/apps/tomcat/logs/catalina.out`. To view messages in the `catalina.out` file, log in to the computer hosting Tomcat and use a standard text editor.

NetIQ recommends that you do not modify the log files by manually editing them. Modifying a file changes the timestamp and can confuse log file rotation. In addition, editing a file might lock it and prevent it from recording information from the Tomcat server.

Some operating systems enable you to redirect standard out to some other location. By default, a server instance prints only messages of `Info` severity level or higher to standard out. You can modify the severity threshold as a logging configuration so that the server prints more or fewer messages to respective log files.

Localhost Log : This is the log for all HTTP transactions between the client and the application server. The log file is named as, `localhost_access_log.<date of log generation>.txt` file. The default location and rotation policy for this log is the same as catalina.out file.

Application Log: Each identity application component is responsible for its own logging. Tomcat provides no support for application logs. Each component will have its own logging configuration where default log levels and appender configurations are defined. These logging configuration files are placed under `\conf` directory of Tomcat server.

Additional Log Files

The `catalina.out` log messages and log files communicate events and conditions that affect Tomcat server's operations. Logs for all identity applications components including OSP and Identity Reporting are also logged to the `catalina.out` file. This file also records the interactions between the Tomcat server and the client.

Some subsystems and components also maintain additional log files that help in auditing their individual interactions. The following list describes some of the additional log files:

- Logging information from the User Application is also logged into the `idapps.out` file. However, this file does not contain Tomcat server specific information.
- OSP logs are additionally stored in a separate file, `osp-idm-<date of log generation>.log` file located in `/opt/netiq/idm/apps/tomcat/logs/` directory. Logging is turned off by default and must be enabled in the `setenv.sh` file in the `/TOMCAT_INSTALLED_HOME/bin/` directory.
- Identity Reporting logs are additionally stored in `/var/opt/netiq/idm/log/`.
- SSPR logs are stored in `/opt/netiq/idm/apps/sspr/sspr_data/logs/SSPR.log`.
- The HTTP subsystem keeps a log of all HTTP transactions between the client and the application server in a text file, `localhost_access_log.<date of log generation>.txt` file. The default location and rotation policy for this log is the same as the catalina.out file. You can set the attributes that define the behavior of HTTP access logs for your server.
- By default, logs for User Application driver and Role and Resource Service driver are added to DSTrace. The trace is turned off by default and must be enabled in the driver configuration by using Designer or iManager or console. When enabled, DSTrace displays messages related to operations that the driver performed or tried to perform, at the level of detail specified by the driver trace level, as the engine processes the events. The driver trace level affects only the driver or driver set where it is set. You can also specify to write the trace information for a driver to a separate file. For more information, see Viewing Identity Manager Processes in the *NetIQ Identity Manager Driver Administration Guide*.
- Each server has a transaction log which stores information about committed transactions coordinated by the server that may not have been completed. Tomcat uses the transaction log when recovering from a system crash or a network failure. You cannot directly view the transaction log. The file is in a binary format.
- The auditing service records information from a number of security requests, which are determined internally by the security framework. The service also records the event data associated with these security requests and the outcome of the requests. Each server writes auditing data to its own log file in the server directory.
- The JDBC subsystem records various events related to JDBC connections, including registering JDBC drivers and SQL exceptions. The events related to JDBC are written to the server log, such as when connections are created or refreshed or when configuration changes are made to the JDBC objects.
- The JMS logging is enabled by default when you create a JMS server. The identity applications use Apache ActiveMQ as a JMS provider. Logs can be found in the ActiveMQ installed path at data/activemq.log. The identity applications rely on a Java Message Service (JMS) persistent store to persist e-mail messages. If JMS is not properly configured, any e-mail messages in the memory queue will be lost if the application server is shut down.
- The Hibernate framework writes log messages in different categories and log levels. For example, it logs messages for establishing connections with the database, executed SQL statements, or cache interactions. Hibernate logging is enabled by default at Info level. The events related to JDBC subsystem are written to the server log. All Hibernate related information is logged when the data is persisted in the application.

Understanding the Log Format

The identity applications have a specific format for file log entries. To improve log entry readability, the log entries in the `catalina.out` files use standard elements. This facilitates the use of non-interactive stream-oriented editors such as sgrep, sed, awk, and grep. The first part of each message begins with locale-formatted timestamp followed by a data portion that contains information specific to the log entry. The data portion is the most flexible part of a log entry.

A log entry has the following fields:

```
time-date-stamp [Severity] [Subsystem] [Message Text]
```

The following entry is an example entry that is logged when a user has requested for a role:

```
2017-03-08 08:43:10,660 INFO com.novell.idm.nrf.service.RoleManagerService- [RBPM]
[Role_Request] Requested by cn=David.Scully,ou=Active,ou=People,o=acme, Target DN:
CN=Kaitlin.Demore,OU=active,OU=People,O=acme, Source
DN:cn=PennDOT_Vehicle_Certification,cn=Application
Access,cn=Level10,cn=RoleDefs,cn=RoleConfig,cn=AppConfig,cn=UserApplication,cn=idm
46,ou=services,o=acme, Request DN:cn=20160308084310-
15da49b28ddf4ee1b7d71b4ce220c080-
0,cn=Requests,cn=RoleConfig,cn=AppConfig,cn=UserApplication,cn=idm46,ou=services,o
=acme, Request Category: 10, Request Status: 0, Original Request Status: 0,
Correlation ID: UserApp#UserStartWorkflow#082080ec-5b10-498f-b87d-28825ab63278
```

Most log entries do not use the optional line breaks ([\n]). Notice that the time-date-stamp, the severity, subsystem, and message text are on the same line so that stream-oriented editors that use only one line (such as grep) can be used to locate related log entries.

If a message is logged within the context of a transaction, the message text contains the Correlation ID assigned to the transaction.

The Tomcat server uses the host computer's default character encoding for the messages it writes.

Message Fields

A Tomcat server message contains a consistent set of fields as described in the following table. In addition, if your applications use Tomcat logging services to generate messages, those messages will contain these fields.

Table 7-2 *Fields in a Log Entry*

Field	Description
Time-date-stamp	Time and date when the message originated in a format that is specific to the locale. The JVM that runs a Tomcat server instance refers to the host computer operating system for information about the local time zone and format. The date and time is specified in the W3C profile format of ISO 8061. It has the following fields: year-month-day-T-hour-minutes-seconds-time zone. The Z value for the time zone indicates that the time is specified in UTC.
Severity	Indicates the degree of impact of the event reported by the message such as warning, informational, or debug. In the example log entry, the level of severity is Info.

Field	Description
Subsystem	Indicates Tomcat's subsystem or the type of the module that was the source of the message. For example, RBPM or Java Messaging Service (JMS). In the example log entry, this field contains the following string: `com.novell.idm.nrf.service.RoleManagerService- [RBPM] [Role_Request]`

Message text	A description of the event or condition specific to the log entry. It can be as simple as an informational string, such as the string in the example log entry:
	
	`Requested by cn=David.Scully,ou=Active,ou=People,o=acme, Target DN: CN=Kaitlin.Demore,OU=active,OU=People,O=acme, Source DN:cn=PennDOT_Vehicle_Certification,cn=Application Access,cn=Level10,cn=RoleDefs,cn=RoleConfig,cn=AppConfig,cn=UserApplication,cn=idm46,ou=services,o=acme, Request DN:cn=20160308084310-15da49b28ddf4ee1b7d71b4ce220c080-0,cn=Requests,cn=RoleConfig,cn=AppConfig,cn=UserApplication,cn=idm46,ou=services,o=acme, Request Category: 10, Request Status: 0, Original Request Status: 0,`
	
	If a message is logged within the context of a transaction, the message text contains an identifier assigned to the identity applications transaction. Identity applications transactions are actions such as authenticating a user, processing a request for a role, and request for access to a resource.
	
	An identifier is assigned to each identity applications transaction.
	
	If a user requests access to multiple resources, multiple request objects are created and each request is given a separate Correlation ID. Each request is processed separately and status of each can be seen in the user request history.
	
	The example log entry contains the following Correlation ID:
	
	`UserApp#UserStartWorkflow#082080ec-5b10-498f-b87d-28825ab63278`

Message Severity

The severity attribute of a log message indicates the potential impact of the event or condition that the message reports. The following table lists the severity levels of log messages from the identity applications subsystems, starting from the lowest to the highest level of impact.

Level	Description
Fatal	The least detail. Writes fatal errors to the log.
Error	Writes errors (plus all of the above) to the log.
Warn	A suspicious operation or configuration has occurred but it might not affect normal operation. Writes warnings (plus all of the above) to the log.
Info	Used for reporting normal operations; a low-level informational message. Writes informational messages (plus all of the above) to the log.
Debug	Writes debugging information (plus all of the above) to the log.
Trace	Used for most detailed messages. You can configure this level to report the request path of a method. Writes tracing information (plus all of the above) to the log.

You can set a log severity level on loggers and appenders. When set on a logger, none of the appenders receives any events that are rejected by that logger. For example, if you set the log level to `Info` on a logger, none of the appenders will receive `Warn` level events. When you set a log level on the appender, the restriction only applies to that appender and not to other appenders. For example, if you turn `Error` off for the File appender, no `Error` messages are written to the log file. However, `Error` messages are written to the `standard.out` file.

```
<logger name="com.sssw" level="INFO" additivity="true">
             <appender-ref ref="NAUDIT"/>
        </logger>
<logger name="com.netiq" level="DEBUG" additivity="true">
            <appender-ref ref="NAUDIT"/>
        </logger>
```

You set log levels for loggers using the Logging Administration page or the log4j file. For more information, see Section , "Configuring Logging in User Application Administration Tab," on page 88. Loggers can also be configured through APIs. You can only enable or disable an appender.

The identity applications modules generate many messages of lower severity and fewer messages of higher severity. For example, under normal circumstances, they generate many `Info` or `Trace` messages. If your application uses Tomcat logging services, it can use an additional severity level of `Debug`.

Configuring Logging

You can configure logging to troubleshoot errors or to receive notification for specific events. For example, configure logging to perform the following activities:

- Stop recording of Debug and Info messages in the log file.
- Allow recording of Info level messages from the HTTP subsystem in the log file.
- Configure an appender to publish messages only whose severity level is Warning or higher.
- Track log information for individual servers in a cluster.

You can change the log settings in two ways:

- **Configure logging in User Application Administration Page:** Your changes will be in effect only until you restart the identity applications.
- **Edit the properties file:** Your changes will take effect next time you start the identity applications. These changes are permanently stored for future sessions.

You may need to configure the logging.properties file in some cases.

The following sections describe basic configuration tasks:

- "Understanding Logging Configuration" on page 87
- "Understanding the Log Level Settings" on page 87
- "Specifying the Severity Level for Commons Logging API Loggers" on page 87
- "Configuring Logging in User Application Administration Tab" on page 88
- "Editing the log4j Files" on page 89
- "Managing Log File Size" on page 90

Understanding Logging Configuration

When you enable logging, a logging request is sent to subscribed appenders. Tomcat provides appenders for sending log messages to the `standard.out` file and the server log (`catalina.out`) file. You can control logging for each type of handler by filtering log messages based on severity level and other criteria. For example, the Stdout Handler has a Notice threshold severity level by default. Therefore, Info and Debug level messages are not sent to the `standard.out` file.

By default, event messages are logged to the system console and to the Tomcat server's log file at `Info` logging level and above. Events are logged to all activated loggers.

The default behavior of the Tomcat server is to limit the console log4j appender to display log messages with a verbosity of Info or less. To see log messages for more verbose levels (for example, Debug), you need to examine the server log file. Notice that the low threshold settings, such as Debug are extremely verbose and will increase Tomcat's startup time.

The following sections discuss different ways of configuring the logging behavior.

Understanding the Log Level Settings

Console logging involves synchronized writes. Therefore, logging can become a processor usage issue and concurrency impedance. You can change the priority value default setting to Error, on a Tomcat server, by modifying the setting in the `<`*`installdir`*`>/Tomcat/server/`*`IDMProv`*`/conf/tomcat-log4j.xml` file. Locate the root node that looks similar to this:

```
   <root>

      <priority value="INFO"/>

      <appender-ref ref="CONSOLE"/>
      <appender-ref ref="FILE"/>
   </root>
```

Change the priority value to:

```
<root>
      <priority value="ERROR"/>

      <appender-ref ref="CONSOLE"/>
      <appender-ref ref="FILE"/>
</root>
```

Assigning a value to the root ensures that any appenders do not have a level assigned inherit the root's level.

Specifying the Severity Level for Commons Logging API Loggers

If you are using the Commons Logging API, logger names follow the Java package dot notation naming convention. For example, a logger name can be `com.acme.Barlogger`, corresponding to the name of the classes in which it is used. Each dot-separated identifier appears as a node in the Logger tree. In this case, the logger named com.acme is a parent of the logger named `com.acme.Barlogger`.

You can configure the severity for a package or for any logger at any level in the tree. For example, if you specify the severity level for package `com.acme=Warn`, then `Fatal` and `Error` messages from the child nodes of this package will be blocked. You can override the severity level of a parent node by explicitly setting a value for a child node. For example, if you specify the severity level for `com.acme.Barlogger=Debug`, all log messages from `Barlogger` will be allowed, while `Fatal` and `Error` messages will be filtered for other child nodes under `com.acme`.

You can specify the severity level for a package or a logger in the following ways:

- Change the log level settings in the Logging page of the User Application. The changes will be immediately applied. When you restart User Application, the changes are not preserved. To persist the changes for subsequent sessions, select **Persist the logging changes**. Alternatively, modify the `log4j.properties` file.
- Edit the `log4j.properties` file. Your changes will take effect when you restart the User Application. Identity Applications preserves this configuration for subsequent sessions.

If you change, enable, or disable logging, you need not restart the identity applications to apply the changes.

Configuring Logging in User Application Administration Tab

You can change the logging behavior of the individual packages (loggers) via the Administration tab of the User Application while the application is running. Any changes made in this way will apply only to the currently running application session and are not written to the `log4j.properties` file.

The Logging page shows a list of all currently defined loggers. On this page, you can:

- Add a new logger for a class or package name.
- Remove a logger for a class or package name.
- Set the logging level (Fatal, Error, Warn, Info, Debug, Trace) for each class or package name.
- Reset all logging levels.

All logging configuration cannot be changed in the Logging administration page, such as Tomcat server specific configuration and appender configuration. For making such changes, stop the identity applications and then edit the `log4j.properties` file.

Perform the following actions to change the logging configuration:

1. Log in to the User Application as the User Application Administrator.
2. Select **Administration**.
3. Click **Logging**.
4. Change the **Log Level** of any package. Higher logging levels include the lower levels in the log.

Level	Description
Fatal	The least detail. Writes fatal errors to the log.
Error	Writes errors that can cause system processing to not proceed.
Warn	Logs potential failures, but the impact on execution is minimal. Warnings indicate that you should be aware that this event is happening and might want to make a configuration change to avoid it.
Info	Logs informational messages. No execution or data impact occurred.
Debug	Includes debugging information.
Trace	The most detail. Writes tracing information (plus all of the above) to the log.

5 To save the changes for application server restarts, select **Persist the logging changes**.

6 Click **Submit**.

Identity Manager saves the logging configuration in `idmuserapp_logging.xml` file, located by default in the `<installdir>/tomcat/server/IDMProv/conf/` directory.

Editing the log4j Files

The configuration settings for the identity applications logging are stored in the `idmuserapp_logging.xml` in the install directory on the Tomcat server. The log4j configuration settings are contained in `tomcat-log4j.xml` in the install directory. To configure the logging levels and other settings permanently, stop the Tomcat server and change the settings in these files.

NOTE: The Console and File appenders are defined in `tomcat-log4j.xml`. The NAudit appender that is specific to the identity applications is defined in `idmuserapp_logging.xml`. All loggers specific to the identity applications are defined in `idmuserapp_logging.xml`.

To change the log level in the `tomcat-log4j.xml` file, open the file in a text editor and locate the following entry at the end of the file:

```
<root>
    <priority value="INFO" />
      <appender-ref ref="CONSOLE" />
      <appender-ref ref="FILE" />
  </root>
```

Assigning a value to root ensures that any log appenders that do not have a level explicitly assigned inherit the root level (in this case, Info). For example, the File appender does not have a default threshold level assigned. It assumes the root's threshold level.

The possible log levels used by log4j are Debug, Info, Warn, Error, and Fatal, as defined in the `org.apache.log4j.Level` class. Inattention to the proper use of these settings can be costly in terms of performance.

A good rule of thumb is to use Info or Debug only when debugging a particular problem.

Any appender included in the root that does have a level threshold set, should set that threshold to Error, Warn, or Fatal unless you are debugging something.

The performance hit with high log levels has less to do with verbosity of messages than with the simple fact that console and file logging, in log4j, involve synchronous writes. An AsyncAppender class is available, but its use does not guarantee better performance. These are known issues of Apache log4j.

The default log level of Info in the log configuration file for the identity applications is suitable for many environments. However, for a performance intensive environment, you can change the entry as follows:

```
<root>
      <priority value="ERROR"/>
      <appender-ref ref="FILE"/>
</root>
```

For a fully tested and debugged production setup, enabling Info and Console logging are not needed. For more information about log4j, see Apache Logging Services.

Managing Log File Size

By default, event messages are logged to both of the following:

- The system console of the application server where the identity applications components are deployed
- A log file on that Tomcat server. For example: `/opt/netiq/idm/apps/tomcat/logs/catalina.out`

  This is a rolling log file. By default, the server rotates the file based on a time interval of 24 hours. However, you can instruct the server to rotate the file over to another file after it reaches a certain size by specifying the size in the `log4j.appender.R.MaxFileSize` property in the `$TOMCAT_HOME/lib/log4j.properties` file. It does not rotate the local server log file when you start the server.

To cause the immediate rotation of the log file, change the appender configuration in the `log4j.properties` file.

By default, the rotated files are stored in the same directory where the log file is stored. You can specify a different directory location for the archived log files in the `log4j.properties` file.

Configuring Logging in a Cluster

This section includes tips for configuring logging in a Tomcat cluster.

- "Tomcat Logging" on page 90
- "User Application Logging" on page 91

Tomcat Logging

You can configure Tomcat for logging in a cluster. To enable logging for clusters, you need to edit the `tomcat-log4j.xml` configuration file, located in the `\conf` directory for the Tomcat server configuration (for example, `\server\IDM\conf`), and uncomment the following section at the end of the file:

```
<!--  Clustering logging
  -->
- <!--
 Uncomment the following to redirect the org.jgroups and
      org.tomcat.ha categories to a cluster.log file.
   <appender name="CLUSTER"
class="org.tomcat.logging.appender.RollingFileAppender">
     <errorHandler class="org.tomcat.logging.util.OnlyOnceErrorHandler"/>
     <param name="File" value="${tomcat.server.home.dir}/log cluster.log"/>
     <param name="Append" value="false"/>
     <param name="MaxFileSize" value="500KB"/>
     <param name="MaxBackupIndex" value="1"/>
     <layout class="org.apache.log4j.PatternLayout">
       <param name="ConversionPattern" value="%d %-5p [%c] %m%n"/>
     </layout>
   </appender>
   <category name="org.jgroups">
     <priority value="DEBUG" />
     <appender-ref ref="CLUSTER"/>
   </category>
   <category name="org.tomcat.ha">
     <priority value="DEBUG" />
     <appender-ref ref="CLUSTER"/>
   </category>
  -->
```

You can find the `cluster.log` file in the `log` directory for the Tomcat server configuration (for example, `\server\IDM\log`).

User Application Logging

The logging configuration is not propagated to all servers in cluster. For example, if you use the Logging administration page on a server in a cluster to set the logging level for `com.netiq.afw.portal.aggregation` to Trace, this setting is not propagated to the other servers in the cluster. You must individually configure the level of logging messages for each server in the cluster.

For more information, see Section , “Logging Configuration,” on page 165.

Logging to a Sentinel Server

To enable NetIQ Sentinel logging in your Identity Manager environment, you need to configure the Platform Agent on your application server and then enable Sentinel logging.

Configuring the Platform Agent

The Platform Agent is required on any client that reports events to Sentinel. You configure the Platform Agent through the `logevent` configuration file. This file provides the configuration information that the Platform Agent needs to communicate with the Sentinel server. The default location for this file, on the application server, is:

- Linux: `/etc/logevent.conf`
- Windows: `/<WindowsDir>/logevent.cfg` (Usually `c:\windows`)

To configure the Platform Agent:

1. Configure the Platform Agent on your application server.

   Specify the following properties:

   Loghost: The IP address or DNS name of your Sentinel server. For example:

   ```
   LogHost=xxx.xxx.xxx.xxx
   ```

   LogJavaClassPath: The location of the lcache jar file `NauditPA.jar`. For example:

   ```
   LogJavaClassPath=/opt/netiq/idm/NAuditPA.jar
   ```

   LogCacheDir: Specifies where lcache stores cache files. For example:

   ```
   LogCacheDir=/opt/netiq/idm/naudit/cache
   ```

   LogCachePort: Specifies on which port lcache listens for connections. The default is 288, but in a Linux server, set the port number greater than 1000. For example:

   ```
   LogCachePort=1233
   ```

   BigData Specifies the maximum number of bytes that the client will allow. Larger amounts of logging data will be truncated. The default value is 3072 bytes, but you should change this to at least 8192 bytes to handle a typical form that has approximately 15 fields on a half page.

   ```
   LogMaxBigData=8192
   ```

   IMPORTANT: If your data is very large, you might want to increase this value. If you are logging events that include digital signatures, it is critical that the value of LogMaxBigData be large enough to handle the data being logged.

   Specify any other settings needed for your environment.

   NOTE: You must restart the Platform Agent any time you change the configuration.

2. Restart the Platform Agent for the changes to take effect.

Enabling Sentinel Logging

1. Log in to the User Application as the User Application Administrator.
2. Select **Administration**.
3. Click **Logging**.
4. Select **Also send logging messages to audit service**.
5. To save the changes for subsequent restart of the Tomcat server, make sure **Persist the logging changes** is selected.
6. Click **Submit**.

NOTE: To enable logging for Role events, you must select the **Generate audit events** property for the Role and Resource Service driver. For more information on this property, see "Configuring the Role and Resource Service Driver Settings" on page 136.

Using Log Files for Troubleshooting

The following example has trace messages logged to the `catalina.out` file when a code map refresh cycle is triggered.

```
2017-08-29 16:05:05,500 [INFO] CodeMapEngine [RBPM] Refreshing the Entitlement CODE
MAP tables...
2017-08-29 16:05:05,499 [TRACE] BestLocaleServletFilter [RBPM] Using Resource-
Group[common-resgrp] with bestLocale[en] for /IDMProv/GwtServiceRouter
2017-08-29 16:05:05,510 [DEBUG] DirXMLDriverDAO [RBPM] Entering
getDriversEnabledForMappings() mappingType=2
2017-08-29 16:05:05,600 [DEBUG] DirXMLDriverDAO [RBPM] Exiting
getDriversEnabledForMappings()
2017-08-29 16:05:05,600 [INFO] CodeMapEngine [RBPM] Done refreshing the Entitlement
CODE MAP tables
```

The descriptions of the log messages are sequentially listed below:

- The first message indicates that a code map refresh is in process. This is the first entry when a code map refresh is triggered.
- The second message specifies the entitlement values are persisted to the best suited locale.
- The third message provides information about the drivers enabled with entitlements.
- The fourth message indicates that the process is exiting after obtaining the information about the drivers enabled with entitlements.
- The fifth message indicates that the code map is updated with the entitlements values from the drivers and the process is completed.

Log Events

The identity applications log a set of events automatically from workflow, search, detail, and password requests. By default, the following events are automatically logged to all active logging channels:

Table 7-3 *Logged Events*

Event ID	Process	XDAS Event	Severity
31400	Detail portlet		Info
31401			Info
31410	Change Password portlet		Error
31411			Info
31420	Forgot Password portlet		Error
31421			Info
31430	Search portlet		Info
31431			Info
31440	Create portlet		Info

Event ID	Process	XDAS Event	Severity
31520	Workflow		Error
31521			Info
31522			Info
31523			Info
31524			Info
31525			Info
31526			Info
31527			Info
31528			Info
31529			Info
31534			Info
31535			Info
31537			Info
3152A			Info
3152B			Info
3152C			Info
31533			Info
31538			Info
31539			Info
3153A			Info
3153B			Info
3153C		XDAS_AE_CREATE_DATA_ITEM	info
3153D		XDAS_AE_CREATE_ROLE	Info
3152D	Provisioning		Error
3152E			Info
3152F			Info
31530			Error
31531			Info
31532			Info
31550		XDAS_AE_CREATE_SESSION	Info
31551		XDAS_AE_CREATE_SESSION	Info

Event ID	Process	XDAS Event	Severity
31450	Security Context		Info
31451			Error
31452			Info
31453			Error
31454			Info
31455			Error
31456			Info
31457			Error
31458			Info
31459			Error
3145A			Info
3145B			Error
3145C			Info
3145D			Error
3145E			Info
3145F			Error
31600	Role Provisioning	XDAS_AE_APPROVAL_ REQUESTED	Info
31601		XDAS_AE_APPROVAL_ REQUESTED	Error
31610	Role Assignment Request		Info
31611			Error
31612			Info
31613		XDAS_AE_CREATE_DAT A_ITEM_ASSOC	Info
31614		XDAS_AE_TERMINATE_ PEER_ASSOC	Info
31615		XDAS_AE_TERMINATE_ PEER_ASSOC	Error
31620	User Entitlement	XDAS_AE_CREATE_DAT A_ITEM_ASSOC	Info
31621		XDAS_AE_CREATE_DAT A_ITEM_ASSOC	Error
31622		XDAS_AE_TERMINATE_ DATA_ITEM_ASSOC	Info
31623		XDAS_AE_TERMINATE_ DATA_ITEM_ASSOC	Error

Event ID	Process	XDAS Event	Severity
31624			Error
31630	Role Management		Info
31631			Error
31632			Info
31633			Error
31634			Info
31635			Error
31640			Info
31641			Error
31642			Info
31643			Error
31644			Info
31645			Error
31646		XDAS_AE_MODIFY_DATA_ITEM_ATT	Info
31647		XDAS_AE_MODIFY_DATA_ITEM_ATT	Error

```
00031665,Resource Provisioning
00031666,Resource Provisioning Failure

00031600,Role Provisioning
00031601,Role Provisioning Failure

00031677,Create Resource Association Failure
00031678,Delete Resource Association
00031679,Delete Resource Association Failure
0003167A,Modify Resource Association
0003167B,Modify Resource Association Failure

#^GROUP^Engine events logged from vrdim^00030001-00030032
00030001,Status Success
00030002,Status Retry
00030003,Status Warning
00030004,Status Error,Channel
00030005,Status Fatal
00030006,Status Other
00030007,Search
00030008,Add Entry
00030009,Delete Entry,Channel
0003000A,Modify Entry
0003000B,Rename Entry
0003000C,Move Entry
0003000D,Add Association
0003000E,Remove Association
0003000F,Query Schema
00030010,Check Password
```

```
00030011,Check Object Password
00030012,Change Password
00030013,Sync,Channel
00030014,Input XML Document
00030015,Input Transformation Document
00030016,Output Transformation Document
00030017,Event Transformation Document
00030018,Placement Rule Transformation Document
00030019,Create Rule Transformation Document
0003001A,Input Mapping Rule Transformation Document
0003001B,Output Mapping Rule Transformation Document
0003001C,Matching Rule Transformation Document
0003001D,Command Transformation Document
0003001E,Publisher Filter Transformation Document
0003001F,User Agent Request
00030020,Resync Driver
00030021,Migrate
00030022,Driver Start
00030023,Driver Stop
00030024,Password Sync
00030025,Password Reset
00030026,DirXML Error
00030027,DirXML Warning
00030028,Custom Operation
00030029,Clear Attribute
0003002A,Add Value - Modify Entry
0003002B,Remove Value
0003002C,Merge Entries
0003002D,Get Named Password
0003002E,Reset Attributes
0003002F,Add Value - Add Entry

#^GROUP^Job events logged from vrdim^000303E4-000303E7
000303E4,Job Result Aborted
000303E5,Job Result Error
000303E6,Job Result Warning
000303E7,Job Result Success

#
#^GROUP^Server events Logged from DXevent^000307D0-000307E2
000307D0,Config:Log Events
000307D1,Config:Driver Cache Limit
000307D2,Config:Driver Set
000307D3,Config:Driver Start Option
000307D4,Driver Resync
000307D5,Migrate Application
000307D6,Shim Password Set
000307D7,Keyed Password Set
000307D8,Remote Loader Password Set
000307D9,Regenerate Key Pair
000307DA,Get Server Certificate
```

```
000307DB,Cache Utility
000307DC,Check Object Password
000307DD,Initialize Driver Object
000307DE,Notify Job Update
000307DF,Open Driver Action
000307E0,Queue Driver Event
000307E1,Start Job
000307E2,Abort Job

#^GROUP^Remote Loader^00030BB8-00030BBB
00030BB8,Remote Loader Start
00030BB9,Remote Loader Stop
00030BBA,Remote Loader Connection Established
00030BBB,Remote Loader Connection Dropped
```

8 Customizing the Identity Applications for Your Enterprise

Identity Manager provides several tools for localizing or customizing the content in the identity applications user interface. This section helps you perform the following activities:

- "Linking the Dashboard to Catalog Administrator and the User Application" on page 100
- "Customizing the Look of the User Interfaces" on page 100
- "Localizing the Text in the Interfaces" on page 106
- "Adding a Language to the Identity Applications" on page 112
- "Configuring User Names" on page 117
- "Configuring Email Notification Templates for the Dashboard" on page 118
- "Configuring Forgot Password? Functionality" on page 119
- "Ensuring that Characters Display Properly in Role Report PDF Files" on page 120
- "Ensuring that Dates Display Correctly in Norwegian" on page 121
- "Configuring Client Settings Mode" on page 121

For more information about...	See...
Setting the preferred locale	"Specifying Locales and Localization Resource Groups" in the *NetIQ Identity Manager - Administrator's Guide to Designing the Identity Applications*
Localizing email templates	"Adding Localized Email Templates" on page 255
Localizing challenge questions	"Security Best Practices" in the *NetIQ Identity Manager Security Guide*
Localizing the password sync status application name	Table 14-10, "Password Sync Status Application Settings," on page 178
Localizing the names of container or shared pages	**Page Name** property in Section , "Creating Container Pages," on page 188
	Section , "Creating Shared Pages," on page 193.
Localizing provisioning objects or customizing their display text, such as: ◆ Directory abstraction layer objects ◆ Provisioning request definitions ◆ Workflow activity display names	"Localizing Provisioning Objects," in the *NetIQ Identity Manager - Administrator's Guide to Designing the Identity Applications*

Linking the Dashboard to Catalog Administrator and the User Application

You can modify the **Applications** page in the Dashboard to display all the applications, activities, and permissions that you want users to access. To ensure that users can access Catalog Administrator, the User Application, and Identity Reporting, add the following types of links to the **Applications** page:

Activity	Link to...
Assign roles and resources	User Application > Roles and Resources
Create and map resources	Catalog Administrator > Resources
Create and map roles	Catalog Administrator > Roles
Create a group	User Application > Identity Self-Service > Create User or Group
Manage the organization chart	User Application > Identity Self-Service > Organization Chart
Run identity reports	Identity Reporting
Manage password	Self-service Password Reset

For more information about customizing the **Applications** page, see “Configure the Applications Page ” Help for the Dashboard.

NOTE: The **Home** icon in Catalog Administrator and User Application should always link users to the Dashboard. You configure that setting in the RBPM Configuration Utility. For more information, see “SSO Clients Parameters” in the *NetIQ Identity Manager Setup Guide*.

Customizing the Look of the User Interfaces

The Dashboard allows you to modify the product title, logo, and colors in the header to meet your organization’s branding requirements. In the footer you can customize with copyright/Trademark and contact information. The User Application provides a set of built-in themes that you can apply to the look and feel of the user interface. You can also customize one of these themes or create your own for branding purposes.

- “Applying Your Organization’s Brand to the Dashboard” on page 100
- “Applying a Cascading Style Sheet to the Dashboard” on page 101
- “Using the Built-in Themes for the User Application” on page 101
- “Applying Your Brand to a User Application Theme” on page 102
- “Creating a Custom Theme for Your Brand” on page 103
- “Customizing the Theme for External Password Management” on page 105

Applying Your Organization’s Brand to the Dashboard

You can use your organization’s logo and name in the header and footer of the Dashboard. You also can specify your brand colors and localize the content in the header. For more information about applying your brand to the Dashboard, see *Customize the Branding* in the Dashboard *Help for the Identity Applications Dashboard*.

Applying a Cascading Style Sheet to the Dashboard

You can change the appearance of the Dashboard user interface by using your own cascading style sheet (css). The `idmdash.war` supports customization through a file called `idmdashcustom.css`. It looks for this file in a directory called `netiq_custom_css` within the home directory of the user that started Tomcat on the server where the application server is running.

By default, this user is `novlua`, so the home directory is `/opt/netiq/idm/apps/novlua`. If a `idmdashcustom.css` file exists, it overrides the default style sheet file provided with the Dashboard.

1 Create a new directory in the home directory of the Tomcat user running the server.

2 Add your `idmdashcustom.css` file to the `netiq_custom_css` folder created in Step 1.

3 If Tomcat is already running, refresh your browser to see the changes. Otherwise, restart Tomcat and clear the cache from your browser.

Using the Built-in Themes for the User Application

You can use the **Themes** page to control the visual characteristics that apply to the User Application interface. The theme applies to the guest and login pages, the **Identity Self-Service** tab, the **Work Dashboard** tab, and the **Administration** tab.

- “Understanding the Built-in Themes” on page 101
- “Previewing a Theme” on page 101
- “Choosing a Theme” on page 102
- “Migrating from a Deprecated Theme” on page 102

Understanding the Built-in Themes

Identity Manager currently includes the themes **BlueGloss** and **Neptune** for the User Application. The following themes have been deprecated:

- IDMStandard
- Linen
- Manilla
- Medico

If you use a deprecated theme, you should change to a supported theme. If you use a custom theme that is based on one of the deprecated themes, complete the steps in “Migrating from a Deprecated Theme” on page 102.

Previewing a Theme

Before choosing a theme, you can preview how it will change the look of the User Application.

1 In the User Application, select **Administration > Themes**.

2 Select the theme that you might want to use.

3 Select the corresponding **Preview** button.

The preview for that theme displays in a new browser window.

4 Review the preview to see the characteristics of this theme.

5 Click **Close Preview Page** (in the top left corner) or close the preview window manually.

Choosing a Theme

When you find a theme that you like, you can choose to make it the current theme for the User Application user interface.

1. In the User Application, select **Administration > Themes.**
2. Select the theme that you want to use.
3. Click **Save**.

   The look of the user interface changes to reflect your chosen theme.

Migrating from a Deprecated Theme

If you use a custom theme that is based on one of the deprecated themes, complete the following steps.

1. Open the `.css` file for your custom theme.
2. Copy any custom selectors (new or edited) from this theme into either the BlueGloss or Neptune theme.
3. Save a new custom theme, which now includes your customizations as well as selectors from the BlueGloss or Neptune theme.

Applying Your Brand to a User Application Theme

You can tailor any User Application theme by substituting your own images and changing some color settings. This enables you to give the Identity Manager user interface a custom look to meet the branding requirements of your company or organization.

1. In the User Application, select **Administration > Themes.**
2. Find a theme that you want to customize, then click the corresponding **Customize** button.

   s displays the **Customize Branding** settings for that theme.
3. Change the settings in one or more tabs (as needed). Each contains the settings for different parts of the User Application interface. They include the following areas:

   General

   Specifies general theming properties such as a favorites icon, background, link and hover color, and the left navigation area properties.

   Header

   Specifies the header color, texture, logo and username properties.

   NOTE: The Left Background image needs to be the size indicated on the Header page (which defaults to 272 x 79 pixels) in order to display properly. The user interface does not attempt to resize the image automatically. For example, it will not stretch the image if it is too small.

   Header tabs

   Specifies the properties for the header tabs.

   Admin subnavigation

   Specifies the properties for the **Admin** tab.

   Login

   Specifies the properties for the login screen.

Follow the on-screen instructions for specifying each setting. The changes are not reflected in the User Application until you save them. If you have made unsaved changes, the **Save** button displays an asterisk * to indicate that the changes are pending a save.

4 Click **Save**.

   If you're editing the current theme, the look of the user interface changes to reflect your customizations.

5 (Optional) To cancel all of your customizations to the theme, click **Reset**.

6 When you're done working on this theme, click **Back to Theme Selector**.

Creating a Custom Theme for Your Brand

You can create and deploy your own custom themes for the User Application and deploy them in their own WAR files. When they are deployed, the custom s are available at **Administration > Themes** in the User Application. Before attempting to create a custom theme, ensure you have a working knowledge of the following technologies:

- The structure of J2EE WAR files, how to modify the contents of a WAR file, and how to deploy one to your application server.
- How to modify CSS and XML files
- How to create the graphic elements for your theme

To create a custom theme:

1 Back up the deployed User Application WAR file (`IDMProv.WAR`) to the installation directory . For example, the `/opt/netiq/idm` subdirectory.

2 In a test environment, extract the contents of the WAR file.

   The files that comprise the User Application's themes are located in the `resource\s` subdirectory. Each theme resides in its own directory with an appropriate name.

3 In the test environment, create a directory for the custom theme.

   The directory name can be any valid directory name, but it should reflect the name of the theme, and it should not contain spaces.

4 Copy the contents of the theme from the extracted WAR file to the new subdirectory. For example, **BlueGloss)**.

   You will be working with the following files associated with the theme:

File Name	Description
`.xml`	The theme descriptor file. It includes entries for display name and description. They are used in the **s** page of the **Administration** tab. The remaining entries correspond to the brandable selectors. The width and height attributes on these entries are used in the branding page to reference the exact dimensions needed when a user uploads a customized version of these images. These entries must match their respective images, width and height as found in the `s.css`.
`.css`	Contains the CSS selectors used to style the look and feel of the user interface.
`print.css`	Contains the CSS selectors used to style a print friendly version of the user interface.
`dojo.css`	Contains a pointer to additional CSS files used by RBPM.
An images subdirectory	Contains the images used by the .

Rules for working with these files:

- Do not change the names of the `.xml`, `.css`, `print.css` and `dojo.css` files.
- The CSS Selector names must remain the same, but you can change the properties of the selectors to establish the look and feel.
- The images subdirectory can have any name, but you must reference it correctly in the CSS and XML files.

5 Make your changes to the images, CSS style sheets and other theme elements as needed. The following changes are recommended:

- In the `.xml` file:
  - **display-name:** Change this to a value that represents your . It displays as the -name in the Themes page of the User Application’s **Administration** tab.
  - **description:** Change this to a value that describes your . It displays as the Description in the Themes page of the User Application’s **Administration** tab.
  - Consider whether to localize the **display-name** and **Description** fields.
  - Remove the following:

    ```
    <resource-bundle>com.novell.afw.portal.artifacts..BlueGloss</resource-
    bundle>
    <resource-group>admin-resgrp</resource-group>
    ```

  - In the dojo.css file, change the `@import` line to the following value:

    ```
    @import url("../../../../IDMProv/javascript/dijit/themes/idmua/
    idmua.css");
    ```

    where `IDMProv` is the name of your WAR context.
  - If you wish to change the appearance of some Dojo elements, such as the menu buttons within the profile section on the Work Dashboard, you should take the following steps, instead of performing the steps above:
    1. Copy the following from your extracted WAR in this location: `/javascript/dijit/themes`:

```
dijit.css
dijit_rtl.css
idmua (folder)
```

Paste these items into your new theme folder.

2. Change the `@import` line in the dojo.css file, as follows:

```
@import url("idmua/idmua.css");
```

- In the graphics directory:
  - **thumbnails.gif:** Replace the copy with your own image. This image displays along with the -name and Description of the theme (described above) that is shown in the Themes page of the **Administration** tab. It typically illustrates what the User Application landing page looks like when the associated theme is applied
  - **Renaming graphics files:** If you change the names of graphics files (rather than just substituting a different image of the same name), make sure to change the reference to the image in both the `.xml` and the `.css` file. If the image is not used in the branding interface (for example, if it is not listed as one of the subset of brandable images in the .xml file), then you will only need to change the reference to the image in the `.css` file. Suppose you want to rename `images/header_left.gif` to `images/my_company_name.gif`. Edit the `.css` file to reflect the new image name.

6 After you make all of the desired changes to the theme files, add your customized theme directory to a new WAR file that contains one or more custom themes. Deploy the new WAR to your test application server. Testing tip: Open the Themes page (available under the **Administration** tab). Your theme should display along with the prepackaged themes. Use the Theme Preview action to see how the customized changes to your new theme will render. This is a useful way to preview many of your intended changes to your theme. Running through commonly used features of the application is also a recommended testing step.

7 After your changes are fully tested, you can deploy the WAR containing the custom theme to your production application server.

Any number of custom themes can reside in a single WAR. Any number of custom WARs containing custom themes can be deployed.

To undeploy the theme, remove the WAR that contains the theme from the application server's deploy directory. Before undeploying, make sure that any themes it contains are not defined as the User Application's default . If you remove the WAR and it does contain the default theme, the Theme Administration page displays an error message and reverts the User Application theme to the original default theme defined at installation time.

Customizing the Theme for External Password Management

If you configured Password Management to use an **External Password WAR**, the theme for the Forgot Password page is defined in that external password WAR. The default name for the external password WAR is `IDMPwdMgt.WAR`. The `IDMPwdMgt.WAR` contains one ; by default, it is **BlueGloss**. It does not include a user interface for modifying or branding this theme.

You can define a custom theme for the external Forgot Password page. The procedure for defining a custom theme is described in "Creating a Custom Theme for Your Brand" on page 103. However, the deployment procedure for the external Forgot Password page is different and the rules about the custom theme WAR are more restrictive. After you define the custom :

- Package the theme in a WAR named `IDMPwdMgt.WAR`.

- The IDMPwdMgt.WAR can contain a single theme, and the theme must be located in the resource/s/ directory within the WAR.
- Deploy the IDMPwdMgt.WAR on the application server where the external WAR is located. Only one custom theme can be deployed at a time.

Localizing the Text in the Interfaces

The text displayed in the identity applications is stored in either a set of language-based JSON files, language-based JAR files, or properties files located in the User Application WAR and User Application driver. In general, the file name includes a reference to the language. For example, the English language strings for the User Application are stored in the UserAppStrings_en.JAR.

NOTE: The labels and string text typically change between versions. This means that you have to apply your string changes or customizations to each new release.

- "Considerations for Modifying Text and Strings" on page 106
- "Localizing the Labels in the Dashboard" on page 108
- "Localizing Text Stored in the JAR Files" on page 108
- "Localizing the Text Stored in JSON Files" on page 111

You can also translate or localize the names and descriptions of provisioning objects in the Directory Abstraction Layer, Provisioning Request Definition, and Role Catalog. For more information, see Localizing Provisioning Objects.

Considerations for Modifying Text and Strings

To determine which text you want to modify, review the following considerations:

- Which identity application do you want to modify: Dashboard, Catalog Administrator or User Application? If the text comes from a WAR file, you must select the WAR for the appropriate application.
- Make a list that includes each string you want to change and where the string is located in the user interface. You can use this list when testing your changes to ensure that you made the text changes in the appropriate places.
- Determine whether the strings are stored in the User Application driver or in the language-based JAR. The following guidelines help you determine where the strings are stored:
  - **Navigation, headers, names, and instructions:** This content is stored in language-based .jar files.
  - **Dashboard:** Some content is stored in language-based .jar files. However, other content derives from .properties files that you can download from the Dashboard.
  - **Identity Self-Service tab:** This content is stored in language-based JARs, unless it is related to directory abstraction layer entities (such as display name, lists, and categories). Content related to directory abstraction layer entities is stored in the User Application driver.
  - **Work Dashboard tab:** This content is stored in language-based .jar files, unless it is in the Form Details section. The content in the Form Details section is stored in the User Application driver, which you update in iManager.
  - **Administration tab:** This content is stored in language-based .jar files.

   - **Roles and Resources tab:** This content is stored in language-based `.jar` files unless it is related to role or SoD names or descriptions. Role or SoD names and descriptions are stored in the User Application driver.
   - **Compliance tab:** This content is stored in the language-based `.jar` files unless it is related to the provisioning request definition. Content related to the provisioning request definition is stored in the User Application driver.
- The following table provides the designation for each supported language:

Language	Locale Designation
Chinese (China)	zh_CN
Chinese (Taiwan)	zh_TW
Danish	da
Dutch	nl
English	en
French	fr
German	de
Italian	it
Japanese	ja
Portuguese	pt
Russian	ru
Spanish	es
Swedish	sv

- Modify only the value, and not the key. The strings in the files are in the properties file format of key=value. Modifying the key can cause run-time errors.
- Use an editor that formats properties files for improved readability, when possible.
- Use an editor that displays characters rather than unicode encoding for improved readability. Some of the properties files contain unicode-encoding.
- In the editor, turn off wrapping to improve readability. It helps identity each property on a separate line.
- In some files, the key value might be difficult to identify, especially if your editor does not provide automatic property file formatting. In these cases, search for the equals sign, and find the first occurrence of the equals sign that does not have a backslash preceding it (\=). The key precedes the equals sign (=), and the value follows it.
- Maintain the proper properties file format. For more information, see Java Properties Object (http://www.java.sun.com/j2se/1.5.0/docs/api/java/util/Properties.html#load)

Localizing the Labels in the Dashboard

Some organizations might want to customize the default names for the fields and navigation items in the Dashboard. This procedure describes the process for updating the downloadable `.properties` files.

To customize Dashboard content derived from the User Application WAR file, see Section , “Localizing the Text Stored in JSON Files,” on page 111.

WARNING: Do not modify any text in the code string before the = sign. For example, `category-featured-47-name =`. The Dashboard might not function appropriately if you change the code string incorrectly.

---

1 Log in to the Dashboard using an domain administrator account that is assigned the Role Administrator, Resource Administrator, Provisioning Administrator, and Security Administrator roles.

2 Select **Applications >** ⚙.

3 On the **Manage Applications** page, select the **Localize** icon.

   The Dashboard lists the `.properties` files by language

4 In the **Languages** window, download the `.properties` file for each language that you want to localize.

   Depending on your browser settings, you might be prompted for the download path.

   NOTE: If prompted, do not rename the `.properties` file. The Dashboard cannot upload a file that does not match the expected name.

   ---

5 In a text editor, customize the displayed text for the attributes that you want to change.

   For example, if you download the `pt.properties` file to localize the Dashboard in Swedish, modify the properties file as follows:

```
# English value: My Category
category-featured-47-name = Min kategori
```

   NOTE: If you want to use double-byte or extended characters in the properties file, ensure that you save the file using the correct encoding.

   ---

6 Save and close the file.

7 In the **Languages** window, upload the modified file to the appropriate language.

8 Close the **Languages** window, then select **Edit Done**.

9 Refresh the browser window to view the changes.

   NOTE: Depending on the browser settings, you might need to log out of the Dashboard, clear the cache in the browser, then log in again.

Localizing Text Stored in the JAR Files

The text strings stored in the WAR files are found in a language-based `.jar` file. These `.jar` files include various `.properties` files, which you can customize for the RBPM Configuration Utility as well as most of the Dashboard, Catalog Administrator, and User Application interfaces. You can also customize the labels for One SSO Provider (OSP).

WARNING: Do not modify any text in the code string before the = sign. For example, `category-featured-47-name =`. The identity applications might not function appropriately if you change the code string incorrectly.

The `.jar` files are located by default in the following directories.

- **Identity applications**: `/opt/netiq/idm/apps/UserApplication/l10n-resources/userapp`

  For example, `UserAppStrings_<`*`locale`*`>.jar`.
- **OSP**: `/opt/netiq/idm/apps/osp/osp-extras/l10n-resources`

  For example, `osp-custom-resource.jar`.

Customizing Strings for Identity Applications

To customize strings for identity applications:

1. Log in to the server where you installed the identity applications.
2. Identify the WAR file for the identity application that you want to modify:
   - `IDMProv.war` for the User Application and Dashboard
   - `rra.war` for Catalog Administrator
3. In the WAR file, locate the `.jar` file(s) that you want to update.

   For example, the `UserAppStrings.JAR` file contains displayed text for the User Application.
4. Copy the `.jar` files that you want to update to a temporary directory.

   WARNING: Do not change the file names or directory structure of the `.jar` files.

   ---
5. To access the `.properties` files in each `.jar` file in the temporary directory, complete one of the following actions:
   - Extract the `.properties` files
   - Use WinRAR to open each `.properties` file

   For example, access the `OAuthManagerRsrc_en.properties` file in the `UserAppStrings_en.JAR`.
6. Browse the file directory to the `.properties` file that you want to edit.

   For example, `UserAppStrings_fr.properties`.
7. In a text editor, customize the displayed text for the content that you want to change.

   WARNING: Do not modify any text in the code string before the = sign. For example, `ADMIN_PASSWORD=`. The identity applications might not function appropriately if you change the code string incorrectly.

   ---
8. Save and close the editor.
9. To apply your changes to the application, complete the following steps:

   WARNING: Do not change the file names or directory structure of the `.jar` and WAR files.

   9a Using the Java JDK jar program, add the properties files back to the `.jar` file.

   9b Add the modified `.jar` to the appropriate WAR file, maintaining the folder location within the WAR.

   You can use the Java JDK Jar program. For example:

```
jar -uvf IDMPRov.WAR WEB-INF/lib/UserAppStrings_fr.jar
```

9c Redeploy the WAR file to your application server.

10 Stop Tomcat.

For example:

```
/etc/init.d/idmapps_tomcat_init stop
```

11 Delete all files and folders in the following directories:

- Tomcat temporary directory, located by default in `/opt/netiq/idm/apps/tomcat/temp`
- Catalina directory, located by default in `/opt/netiq/idm/apps/tomcat/work/Catalina`

12 Delete all log files from the `tomcat/logs` directory, located by default in `/opt/netiq/idm/apps/tomcat/logs`.

13 Start Tomcat.

For example:

```
/etc/init.d/idmapps_tomcat_init start
```

14 Before logging in to the identity applications, clear the browser cache to ensure that the browser displays your changes.

15 To test your changes, complete the following steps:

15a Access the identity application that you modified.

15b Using your list of changes, review each occurrence of the string you changed to determine if you made the change appropriately.

Customizing Strings for OSP

To customize the strings on the OSP login page:

1 Log in to the server where OSP is installed.

2 Navigate to `osp-extras/l10n-resources`.

By default, it is located in`/opt/netiq/idm/apps/osp/osp-extras/l10n-resources`.

3 Back up `osp-custom-resources.jar` file.

4 Copy the backed up `osp-custom-resources.jar` to a temporary directory.

5 Extract the `osp-custom-resources.jar` file in the temporary directory.

For example: `jar xf osp-custom-resources.jar`

NOTE: Make sure that you have maintained the existing directory structure during extraction.

6 Navigate to `resources` folder and open `oidp_enduser_custom_resources_en_US.properties` file and uncomment the following properties:

WARNING: Do not modify any text in the code string before the = sign. For example, `ADMIN_PASSWORD=`. The identity applications might not function appropriately if you change the code string incorrectly.

```
## Organization name [nbsp], [reg], [tm], [amp], [br], [plus], [apos] are
pseudo-tags
## that are converted at runtime into appropriate HTML.
OIDPENDUSER.LoginProductName=Company[nbsp]Name[reg]
```

```
## Whether the company or product name should be displayed in the login pages:
"true" or "false"
OIDPENDUSER.LoginProductNameDisplay=true
```

These properties modify the banner name on the login page. You can uncomment other properties and change them to localize different texts on the login page.

7 Save and close the editor.

8 Stop Tomcat.

For example:

```
/etc/init.d/idmapps_tomcat_init stop
```

9 To apply your changes to the application, complete the following steps:

WARNING: Do not change the file names or directory structure of `.jar` and WAR files.

9a Using the Java JDK jar program, add the properties files back to the `.jar` file.

9b Update the `osp-custom-resources.jar` with the customized properties files in the temporary directory.

You can use the Java JDK Jar program. For example:

```
jar -uf osp-custom-resources.jar resources/
oidp_enduser_custom_resources_en_US.properties
```

9c Copy the updated `osp-custom-resources.jar` to the `tomcat/lib` directory.

10 Delete all files and folders in the following directories:

- Tomcat temporary directory, located by default in `/opt/netiq/idm/apps/tomcat/temp`
- Catalina directory, located by default in `/opt/netiq/idm/apps/tomcat/work/Catalina`

11 Start Tomcat.

For example:

```
/etc/init.d/idmapps_tomcat_init start
```

12 Before logging in to the identity applications, clear the browser cache to ensure that the browser displays your changes.

Localizing the Text Stored in JSON Files

Some text in the Dashboard derives from a `.json` file in the User Application WAR.

1 Log in to the server where you installed the identity applications.

2 Identify the WAR file for the identity application that you want to modify.

3 In the WAR, locate the `.json` file that you want to localize.

For example, to change the English content, locate `DashStringsRsrc_en.json`, by default in the `tomcat/webapps/idmdash/i18n/json` directory.

4 In a text editor, customize the displayed text for the content that you want to change.

WARNING: Do not modify any text in the code string before the = sign. For example, `ADMIN_PASSWORD=`. The identity applications might not function appropriately if you change the code string incorrectly.

---

5 Save and close the editor.

6 Upload the file to `/opt/netiq/idm/apps/novlua/netiq_custom_css`.

7 Delete all log files from the `tomcat/logs` directory, located by default in `/opt/netiq/idm/apps/tomcat/logs`.

8 Retart Tomcat.

For example:

```
/etc/init.d/idmapps_tomcat_init start
```

9 Before logging in to the identity applications, clear the browser cache to ensure that the browser displays your changes.

Adding a Language to the Identity Applications

If the default languages for Identity Manager do not meet your organization's needs, you can translate the strings and user interface content to a different language. For example, you might want to interact with the identity applications in Norwegian (language code=`nb`). To translate content to a non-default language, you can copy the `.properties` files of an existing language.

To complete this process, we recommend perform the following steps in the listed order.

	Checklist Items
❑	1. Configure the identity applications to support the new language. For more information, see Section , "Adding the New Language to the Identity Applications," on page 112.
❑	2. Copy an existing set of files that you can use as a template for translating to the new language. For more information, see Section , "Preparing Files for Translation," on page 113.
❑	3. Translate the files.
❑	4. Change the default language to the new language. For more information, see Section , "Changing the Default Language," on page 115.
❑	5. Add the translated files to the appropriate locations, such as WAR files or upload to the user interface. For more information, see Section , "Add the Translated Files to the Proper Locations," on page 116.
❑	6. Update notification templates using designer. For more information, see Section , "Updating an Email Notification Template," on page 116.
❑	7. Verify that the identity applications display the appropriate content. For more information, see Section , "Verifying the New Translations," on page 117.

For more information about customizing the content for a existing language, see Section , "Localizing the Text in the Interfaces," on page 106.

Adding the New Language to the Identity Applications

You must configure the identity applications to support the new language. You can perform this action in iManager.

1 Log in to iManager as an Administrator.

2 Click icon for **View Objects**.

3 In the tree, navigate to ***Context*** **>** ***Driver Set*** **>** ***Driver*** **> AppConfig > AppDefs**.

For example, **netiq > TestDrivers > UserAppDriver > AppConfig > AppDefs**.

4 Click **local-configuration**.

5 In the **Valued Attributes** list, select **XmlData**, then click **Edit**.

6 In the **Edit Attribute** window, search for `<locale code"=xx> </locale>` and create similar tags with the values for the language that you want to support.

Ensure that you verify the language code.

7 Search `<supported-locale>xx</supported-locale>` and add a new tag with the newly created language code. For example:

```
<supported-locale>en</supported-locale>
```

8 Click **OK**, then **OK** again.

9 Restart the application server.

10 To verify that the identity applications can display the new language, complete the following steps:

10a Log in to the Dashboard as an administrator.

10b Select **Applications >** ⚙.

10c On the **Manage Applications** page, select the **Localize** icon.

The Dashboard lists the `.properties` files by language.

10d Verify that the language you added to iManager appears in the list of Languages.

Although the Dashboard displays a Download option for the new language, there is not content to download. To create that content, continue to Section , "Preparing Files for Translation," on page 113.

Preparing Files for Translation

The identity applications display content from several types of language-based `.properties` files from the following sources:

- `.json` files, such as `DashStringsRsrc_en.json`
- `.jar` files, such as `UserAppStrings_en.jar`

WARNING: Do not change the directory structure of the `.jar` files or modify any text in the code strings before the = sign. The identity applications might not function if you make inappropriate alterations.

- Downloadable files, such as `localizedLabels_en.properties`

  To make it easy to modify the content that the identity applications source from the WAR files, we enable you to download the `.properties` files directly from the Dashboard. You do not need to edit the WAR files.

You use different tools to customize the text depending on where the text is stored. To ensure that all content appears in your preferred language, you must translate all of the files. This procedure assumes that you will translate English `.properties` files to the new language, rather than starting from another language such as French.

For more information about customizing the interface content, see Section , "Localizing the Text in the Interfaces," on page 106.

To prepare files for translation:

1 Complete the steps in Section , "Adding the New Language to the Identity Applications," on page 112.

2 To prepare the file that the Dashboard uses for labels in the user interface, complete the following steps:

  2a To download a file to use as the template for translation, complete the procedure in Section , "Localizing the Labels in the Dashboard," on page 108.

  2b Change the locale code in the file name to represent the language that you want to add.

  For example, to add Norwegian, change

  ```
  localizedLabels_en.properties
  ```

  to

  ```
  localizedLabels_nb.properties
  ```

3 To prepare the content in the `.jar` files, complete the following steps:

  3a Create backup copies of the `.jar` files that you want to translate. Store the backups in a safe location.

  For more information about updating `.jar` files, see Section , "Localizing Text Stored in the JAR Files," on page 108.

  3b Copy the `.jar` files that you want to translate to a temporary directory.

  You will need these files again after the translations are complete.

  3c To access the `.properties` files in each `.jar` file in the temporary directory, complete one of the following actions:

  - Extract the English `.properties` files
  - Open the properties file in WinRAR

  For example, access the `OAuthManagerRsrc_en.properties` file in the `UserAppStrings_en.JAR`.

  3d For each `.properties` file, change the locale code in the file name to represent the language that you want to add.

  For example, to add Norwegian, change

  ```
  OAuthManagerRsrc_en.properties
  ```

  to

  ```
  OAuthManagerRsrc_nb.properties
  ```

  3e Within each `.properties` file, change the language code in the key `BUNDLE_LOCALE` to represent the language that you want to add.

  For example, to add Norwegian, change

  ```
  BUNDLE_LOCALE=en
  ```

  to

  ```
  BUNDLE_LOCALE=nb
  ```

  3f (Conditional) If a string that you want to translate and use in the `.properties` file has a comment, you must un-comment it.

  For example, change

`#OIDPENDUSER.50048=Next`

to

`OIDPENDUSER.50048=Next`

3g Create `.jar` files to contain the `.properties` files that you want to translate.

For example, for the Norwegian translator, you might create `UserAppStrings_nb.jar`.

The new `.jar` files must mimic the directory structure of the original files.

3h Add the `.properties` files that are ready for translation to the new, appropriate `.jar` files.

For example, add the `OAuthManagerRsrc_nb.properties` file to the `UserAppStrings_nb.jar` file.

4 To prepare the content in the .json files, complete the following steps:

4a Locate the files as described in Section , "Localizing the Text Stored in JSON Files," on page 111.

5 Provide the `.jar` files, `localizedLabels_`*`xx`*`.properties` files, and `.json` files to your translator.

WARNING: Ensure that the translator maintains the file names and directory structure of the `.jar` files. Also, do not modify any text in the code string before the = sign. For example, `com.netiq.UA.persistence.ops.AttributeDefinition.USER.guid=`. The identity applications might not function if you make inappropriate alterations.

Changing the Default Language

The RBPM Configuration Utility controls which languages appear in the identity applications and sets the default language. Perform this procedure when you are ready to add new translations to the identity applications.

1. Complete the steps in Section , "Preparing Files for Translation," on page 113.
2. In a terminal, navigate to the `/bin` directory, located by default in `/opt/netiq/idm/apps/UserApplication`.
3. At the command prompt, use one of the following methods to run the configuration utility:
   - **Linux:** `./bin/configupdate.sh`
   - **Windows:** `./bin/configupdate.bat`

NOTE: You might need to wait a few minutes for the utility to start up.

---

4. Select **Miscellaneous**.
5. For **Supported Locales**, add the locale code that represents the language(s) that you want to include. Use a pipe sign to separate entries.

   For example, enter `|nb` for Norwegian.
6. For Default Locale, specify the language that you want to use.

   For example, enter `nb` for Norwegian.
7. Save your changes and close the utility.

Add the Translated Files to the Proper Locations

After translations are completed, you can add the translated files to their appropriate WAR and uploaded locations.

1. Log in to the server where you installed the identity applications.
2. Copy the `.jar` file(s) to `WEB-INF/lib/`, by default in the `/opt/netiq/idm/apps/tomcat/webapps/IDMProv/` directory.
3. Upload the `.json` file to `/opt/netiq/idm/apps/novlua/netiq_custom_css`.
4. Stop Tomcat.

   For example:

   ```
   /etc/init.d/idmapps_tomcat_init stop
   ```
5. Delete all files and folders in the following Tomcat directories:
   - `temp`, located by default in `/opt/netiq/idm/apps/tomcat`
   - `Catalina`, located by default in `/opt/netiq/idm/apps/tomcat/work`
6. Delete all log files from the Tomcat `logs` directory, located by default in `/opt/netiq/idm/apps/tomcat`.
7. Start Tomcat.

   For example:

   ```
   /etc/init.d/idmapps_tomcat_init start
   ```
8. To upload the label files, complete the following steps:

   8a Log in to the Dashboard as an administrator.

   8b Select **Applications >** ⚙.

   8c On the **Manage Applications** page, select the **Localize** icon.

   8d For the language that you added to the identity applications, select **Upload**.

   For example, if you added the locale code for Norwegian, upload the `localizedLabels_nb.properties` file.

   8e Refresh the browser window to view the changes.

   NOTE: Depending on the browser settings, you might need to log out, clear the cache in the browser, then log in again.

Updating an Email Notification Template

After adding a language to the identity applications, add the notification templates for the newly added language using Designer.

1. Export the templates to a file using Designer.

   The exported file will contain all the templates. Each template will have an appropriate language code. For example, if you are updating the `Attestation Completed Notification` template for Norwegian language, the template name will be `Attestation Completed Notification_nb`.

2 Import the modified notification template into **Default Notification Collection**.

   2a Right-click **Default Notification Collection** and select **Import Templates from File**.

   2b Browse to and select the notification template.

3 Right-click **Default Notification Template** and select **Live > Deploy**.

Verifying the New Translations

1 In a browser, clear the browser cache.

2 Change the browser language to the language that you added.

3 Enter the URL for the identity applications.

   If you did not translate the content in the OSP `.jar` files, the login page continues to appear in the default language.

4 Log in.

5 Observe the translated content.

Configuring User Names

The Dashboard and the User Application allow you to configure the format of displayed user names in your environment based on the user's current locale. To simply name entry, the identity applications attempt to complete the names as you type them based on the information in the database.

- "Configuring the Format of Displayed User Names" on page 117
- "Enabling Localized User Names in Typeahead Fields" on page 118

Configuring the Format of Displayed User Names

The Dashboard and the User Application allow you to configure the format of displayed user names in your environment based on the user's current locale.

You can then use localized user names in Approval forms, using the literal `%LocaleFormattedFullName%` for forms with the `User` entity definition key. For more information about creating or configuring forms in Designer, see "Creating Forms for a Provisioning Request Definition", in the *NetIQ Identity Manager - Administrator's Guide to Designing the Identity Applications*.

1 Start Designer.

2 Open your current project and click the project name in the Outline view.

3 In the Provisioning view, right-click **Full Name** and select **Edit**.

4 In the Directory Abstraction Layer editor, expand **Entities > Full Name**.

5 Select the locale name pattern that you want to modify.

6 Modify the **Calculated Attribute** expression to specify the format you want to use for the locale. For example, if you want to display the user's surname first and given name second, modify the expression as follows:

```
attr.getValue("Surname") + " " + attr.getValue("Given Name")
```

You can either modify the expression manually in the Expression field or click the **Build ECMAScript Expression** icon and use the ECMA Expression Builder to modify the expression. For more information about modifying ECMAScript expressions, see "Working with ECMA Expressions" in the *NetIQ Identity Manager - Administrator's Guide to Designing the Identity Applications*.

7. Save your changes to the locale name pattern.
8. Repeat Step 5 through Step 7 for each name pattern you want to configure.
9. When finished, close the Directory Abstraction Layer editor.
10. In the Modeler, right-click the User Application driver and select **Driver > Deploy**.
11. Click **Deploy**, then click **Yes** to restart the driver.
12. Click **OK**.

Enabling Localized User Names in Typeahead Fields

After you configure the `Full Name` entity in the Directory Abstraction Layer, the identity applications automatically display user names formatted by locale.

However, to use user names with localized name formatting in typeahead fields within the identity applications, you must create one or more custom registry entries. The identity applications use typeahead controls when a supervisor wants to manage a specific or team, and the typeahead controls do not use the `%LocaleFormattedFullName%` literal.

1. In the `conf` directory of your application server installation, create an empty file with the file name `UIControlRegistry_CustomProps.xml`.
2. Open the User Application WAR, `IDMProv.war` by default, and extract the contents.
3. Locate the `UIControlRegistry.xml` file in the WAR's `WEB-INF` directory.
4. In the `UIControlRegistry.xml` file, locate the entries for the `UserDNLookup` and `UserInTeamDNLookup` keys.
5. Copy the `<registry>` element, `<ctrls>` element, and both keys to the `UIControlRegistry_CustomProps.xml` file.
6. Modify the `display-exp` property of each of the copied keys as follows:

```
<prop name="display-exp" type="string">
    <value>FirstName LastName</value>
    <value xml:lang="en">LastName FirstName</value>
</prop>
```

7. Create an `xml:lang` value for each localized name format you want to use. You can include a value for each language supported by the User Application.
8. Save and close the `UIControlRegistry_CustomProps.xml` file.
9. Restart Tomcat.

Configuring Email Notification Templates for the Dashboard

By default, email notification templates in Identity Manager direct recipients to the User Application. To direct recipients to the Dashboard, you must modify the default email notification templates in Designer.

NOTE

* Not all notification templates include links to the User Application.
* Modifying an existing notification template marks that template as customized in Designer.

To direct recipients to the Dashboard:

1. Start Designer.
2. Make sure you have imported email notification templates into your Designer project.
3. In the **Outline** view, right-click the notification template you want to modify and select **Copy**.

   NOTE: We recommend you create and modify a copy of the original notification template you want to configure, rather than modifying the original. You can then specify the “Identity Manager Dashboard” version of the template in any workflows where you want users to use the Dashboard, and not modify the workflows where you want users to use the User Application.

4. Specify a name for the copied template and click **OK**.
5. Right-click the copied template and select **Edit**, then click **Yes** to confirm.
6. (Optional)To remove all links to the User Application, change all instances of the following text:

   ```
   $PROTOCOL$://$HOST$:$PORT$/$TASKLIST_CONTEXT$
   ```

   to:

   ```
   $PROTOCOL$://$HOST$:$PORT$/idmdash/#tasks
   ```

7. (Optional) To retain the existing User Application links, add text similar to the following line to the notification template message:

   ```
   You can review your tasks list using the Dashboard at
   $PROTOCOL$://$HOST$:$PORT$/idmdash/#tasks.
   ```

8. When finished, save and close the notification template.
9. Repeat Step 3 through Step 8 for each notification template you want to modify, including any localized templates.
10. Deploy the new templates to the Identity Vault.
11. Modify any workflows where the approver should use the Dashboard so the workflow uses the new notification templates.

Configuring Forgot Password? Functionality

If you want the Dashboard login page to display the **Forgot password?** link, you must configure the Password Management Settings in the **Authentication** tab of the ConfigUpdate Section and then restart the Tomcat application server.

1. Launch the ConfigUpdate utility from the command line: `configupdate.sh` or `configupdate.bat`
2. Navigate to **Authentication > Password Management**, then select **Forgot Password**.
3. Click **OK**.
4. Click **Logout**.
5. To start Tomcat, enter the following command in a command prompt:

```
/etc/init.d/idmapps_tomcat_init restart
```

6. After Tomcat finishes restarting, go to the Dashboard login page to verify the page displays the **Forgot password?** link.

Ensuring that Characters Display Properly in Role Report PDF Files

By default, the role report feature of the identity applications uses “UniGB-UCS2-H” for the PDF encoding and “STSong-Light” for the PDF font for Chinese simplified, Chinese traditional, Russian and Japanese locales. For the other locales, “Cp1252” is used for PDF encoding and “Helvetica” or “Helvetica-Bold” is used for the PDF font.

If the user's browser locale or preferred locale is set to one of the above four locales, the report will be able to display most of characters from these locales. However, some extended characters found in ISO-8859 may not be displayed properly in the report.

Conversely, if the browser locale or preferred locale is not set to one of these four locales then some Asian characters will not display properly.

To allow all characters to display properly in generated PDF files, you need to:

- Edit the Configuration XML Data in iManager
- Configure the identity applications

NOTE: You may also notice problems displaying some characters in role reports for languages that are not in the standard set of supported languages. If you add a new language (such as Polish), you may also need to perform the steps provided in this section to ensure that all characters display properly for that language as well.

- “Editing the Configuration XML Data in iManager” on page 120
- “Configuring the User Application” on page 121

Editing the Configuration XML Data in iManager

1. Login to iManager as your Administrator.
2. Click the View Objects icon.
3. In the Tree, navigate to the following location:

   Context > *Driver Set* > *Driver* > `AppConfig` > `AppDefs`

   For example:

   `netiq > TestDrivers > UserAppDriver > AppConfig > AppDefs`
4. Click **configuration**.
5. In the Valued Attributes list, select `XmlData` and click **Edit**.
6. In the Edit Attribute window, search for `PREF_FONT` and replace the corresponding `<value></value>` with `<value>Arialuni.ttf</value>`.
7. Search for `PREF_ENCODING` and replace the corresponding `<value></value>` with `<value>Identity-H</value>`.

8 Click **OK**, the click **OK** again.

9 Restart the User Application driver.

Configuring the User Application

1 If you edited the `</property>` tag (in Step 6 and Step 7 on page 120) to add support for the four locales by specifying `Arialuni.ttf` as the preferred font, the directory that contains the file `Arialuni.ttf` (the name of the file must match the entry specified for PREF_FONT above) has to be added to the Application Server's classpath.

   For example, if the file `Arialuni.ttf` was saved to the directory `/home/lab/font`, the start script could be modified with the following entry:

   ```
   TOMCAT_CLASSPATH="$TOMCAT_CLASSPATH:/home/user/font"
   ```

2 Restart Tomcat.

NOTE: Arialuni.ttf is the Arial Unicode MS distributed by Microsoft. If you do not have permission to use it, then try to find and use another unicode font that supports as many characters as possible. Then update the font and encoding in Step 6 and Step 7 on page 120 and Step 1 on page 121 with this information.

Ensuring that Dates Display Correctly in Norwegian

For language codes `no` and `nb`, you need to perform a workaround to ensure that dates display correctly in Norwegian. The `Date.js` file contains `no` but not `nb`, however, the dmask value (`dd/MM/yyyy`) is not correct. For both `no` and `nb`, the format should be `dd.MM.yyyy`.

To ensure that dates display correctly in Norwegian:

1 Copy the file `com/netiq/common/i18n/I18nDateTimeRsrc_en.properties`, modifying the locale portion of the file name to match the desired locale (for example, `I18nDateTimeRsrc_nb.properties`).

2 Modify the format(s) in the file to match the desired format. There are four format types: short, medium, long and full. These formats correspond to the java.text.DateFormat.SHORT, .MEDIUM, .LONG and .FULL constants.

3 Add the file to the `IDMProv.war` under `WEB-INF/classes/com/netiq/common/i18n` using the `jar` utility (file must be placed in a directory tree corresponding to the above path).

   ```
   jar uvf IDMProv.war
   WEB-INF/classes/com/netiq/common/i18n/I18nDateTimeRsrc_nb.properties
   ```

Configuring Client Settings Mode

Administrator with the settings page navigation rights can configure multiple clients with different settings using the Identity Manager dashboard. Administrator can decide to save these configurations using the following modes as part of application configuration:

Using File System

The client settings directory is stored in the **<tomcat base folder>/conf** folder, by default the directory is not configured. The clients settings configuration can also be stored in a clients settings directory under the **User Home** folder. The administrator needs to add the `com.netiq.idmdash.client.settings.directory` in the `ism-configuration property` file with the appropriate value.

NOTE: You can set client settings directory as `%user.home%` to create the client settings directory under the **User Home** folder. You can also set the client setting directory as `%catalina.base%` to create the client setting folder under **<tomcat base folder>/conf**. If you do not set the client settings directory to any of the above mentioned values, the directory will be created under the **User Home** folder.

Using Database

Administrator can also store the configuration in the `CLIENT_SETTINGS` table in the Identity User Application database.

By default the client settings configuration is stored in File System mode. The administrator can specify the mode of saving the configuration in the `ism-configuration properties` file. You can add the `com.netiq.idmdash.client.settings.store.preference` in the `ism-configuration properties` file with the appropriate value. If you want to change the mode, the property value should be set to `database`.

IMPORTANT

- Always select the `database` mode for saving the client settings configuration on each node of the cluster environment.
- If you want to migrate from file system to database mode or vice versa, client settings do not get migrated. Identity Manager Dashboard reflects the settings which is already configured in the selected mode.

Modifying the Client Settings on Identity Manager Dashboard

Identity Manager Dashboard allows you to modify the settings for every client configured.

- "General Settings" on page 122
- "Control User Access" on page 123
- "Customization" on page 123

General Settings

LDAP attribute to match

Represents the condition that helps to determine the client settings to be applied for the logged in user. If no condition is matching then it applies the default client settings.

Control User Access

Access

This allows you to specify which user accounts are trustees for the user- and configuration-based functions within the client. When a trustee logs in, the application displays the navigation item. Otherwise, the navigation item is hidden. You can add users, groups, roles, and containers as trustees.

For any client, if you have not provided the access to default navigation, the identity applications redirects to the **Identity Manager Dashboard** and shows an error message. By default, all users can access **Identity Manager Dashboard** and **Applications** page. Therefore, the option to modify trustees, **Password Sync Status**, **Edit user**, and **Area default** options are disabled. You can modify these options to provide access to the required users. For more information about configuring user access, see *Identity Manager Dashboard Help*.

Customization

You can modify the following attributes for the required clients:

Card View

Represents the attributes that you want the application to display by default when the user selects **Card View** in the **Users** page.

Other Attributes

Represents additional attributes that provide details about a selected user.

Editable Attributes

Represents the attributes that can be modified for a user’s details. For most attributes, you can also enter text to serve as default values or examples to aid in new user creation, as desired.

User Search Lookup Attributes

Represents the attributes that users can define when searching for a user or filtering search results in the **Users** page.

User General Settings

Represents the default container for storing users and how the application responds when displaying search results.

- **Base Container**

  Specifies the container in the Identity Vault that stores a newly created user.

  When creating a user, you can see this value but cannot modify it. This limitation ensures that all users are stored in the same container for that client.

- **User Search Limit**

  Specifies the maximum number of users that the application can list as a result of a user search.

User Search Lookup Attributes

Represents the attributes that users can define when searching for a user or filtering search results in the **Users** page.

Feedback Message Span

Set the required time in milliseconds (ms) to display the feedback message.

Uploading CSS files to the Cluster Node

You must import the customized CSS file on each node of the cluster environment.

To modify the customized CSS files, perform the following:

1. Download the CSS file.
2. Modify the contents of the downloaded file.

   IMPORTANT: You must include only style information in the CSS file. NetIQ recommends that you refrain from adding comments or entries other than the style information in the file.

To upload the customized CSS files, perform the following:

1. Log in to **Identity Manager Dashboard**.
2. In top right corner, select **Settings > Branding > Advanced Settings**.
3. Click **Upload CSS**.
4. Ensure that each node has the same copy of CSS in the following location:

   ```
   <user home directory>/netiq_custom_css
   ```

9 Tuning the Performance of the Applications

Performance tuning is a complex subject. The identity applications rely on diverse technologies with many interactions. It is not possible to anticipate every single configuration scenario or user interaction scenario that could result in poor performance. Nevertheless, some subsystems are subject to best practices that can boost performance.

Indexing Attributes in the Identity Vault

LDAP queries can be a bottleneck in a heavily utilized directory-server environment. To maintain a high level of performance with large numbers of objects, eDirectory (which is the basis of the Identity Vault in Identity Manager) records frequently requested information and stores it in indexes. When a complex query is run against objects with indexed attributes, the query returns much faster.

Out of the box, eDirectory comes with the following attributes already indexed:

```
Aliased Object Name
cn
dc
Equivalent to Me
extensionInfo
Given Name
GUID
ldapAttributeList
ldapClassList
Member
NLS: Common Certificate
Obituary
Reference
Revision
Surname
uniqueID
uniqueID_SS
```

When you install Identity Manager, the default directory schema is extended with new object class types and new attributes pertaining to the User Application. User-application-specific attributes are by default not indexed. For better performance, you might find it useful to index some of those attributes (and perhaps a few traditional LDAP attributes as well), particularly if your user container contains over 5,000 objects.

The general idea is to index only those attributes that you know are regularly queried, which could be different attributes in different production environments. The only way to know which attributes are heavily used is to collect predicate statistics at runtime. The collection process itself degrades performance, however.

The process for collecting predicate statistics is discussed in detail in the *eDirectory Administration Guide*. Indexing is also discussed in more detail there. In general, you need to do the following:

- Use iManager to turn on predicate-statistics collection for attributes of interest
- Put the system under load
- Disable statistics collection and analyze the results
- Create an index for each type of attribute that might benefit from having one

If you already know which attributes you want to index, there is no need to use ConsoleOne. You can create and manage indexes in iManager with eDirectory **Maintenance > Indexes**. For example, if you know that users of your org chart are likely to perform searches based on the isManager attribute, you can try indexing that attribute to see if performance is enhanced.

NOTE: As a best practice, it is recommended that you index, at a minimum, the manager and isManager attributes.

For an in-depth discussion of attribute indexing and performance, see “Tuning eDirectory” in *Guide to Troubleshooting eDirectory* by Peter Kuo and Jim Henderson (QUE Books, ISBN 0-7897-3146-0).

For more information about performance tuning, see “Maintaining eDirectory” in the *eDirectory Administration Guide*.

Increasing the Stack Size

The amount of heap memory allocated to the Java virtual machine can impact performance. If you specify minimum or maximum memory values that are either too low or too high (too high meaning more than the physical memory of the machine), you could experience excessive pagefile swapping.

Increasing the stack size for recursive workflows If you have workflows that are recursive in nature (that execute loops), you might see a StackOverflowError at execution time. Java does not handle the stack space for recursive type functions effectively. Therefore, for recursive workflows, you need to increase the stack size for the JVM. The JVM defaults to 512K. You might want to increase the stack size to 1M.

To increase the stack size, you can include the -Xss1M setting with the JAVA_OPTS in your start Tomcat script file.

```
JAVA_OPTS="-server -Xss1M -Xms512M -Xmx512M -XX:MaxPermSize=512m"
```

Ensuring Concurrent Access from Multiple Clients

In a medium to large environment, you might have 50 or more clients accessing the server concurrently. To prevent operational failures, you should configure the session time-out and maximum number of open files to support your environment.

- “Decreasing the Session Time-out” on page 127
- “Increasing the Number of Maximum Open Files” on page 127

Decreasing the Session Time-out

The **session time out** represents the amount of time a user can leave a page unattended in his or her Web browser before the server causes a session-time-out warning dialog box to appear. This value should be tuned to match the server and usage environment in which the application runs. In general, the session time out should be as short as practicable. If business requirements can tolerate a 5-minute session time out, this would allow the server to release unused resources twice as early as it would if the time-out value were 10 minutes. This improves performance and scalability of the Web application.

Consider the following when adjusting the session time out:

- Long session time-outs can cause the Tomcat server to run out of memory if many users log in over a short period of time. This is true of any application server that has too many open sessions.

  We recommend a timeout of three to five minutes for best performance.
- When a user logs in to the identity applications, an LDAP connection is created for the user and bound to the session.Thus, the more sessions that are open, the greater the number of LDAP connections that are held. The longer the session time out, the longer these connections are held open. Too many open connections to the LDAP server (even if they are idle) can cause system performance degradation.

  In addition to a short time-out interval, we recommend that you increase the number of
- If the server starts experiencing out-of-memory errors, and the JVM heap and garbage collection tuning parameters have already been optimally tuned for the server and usage environments, consider lowering the session time out.

You can modify the session time out after installation by changing this value in the `web.xml` file in the `IDMProv.war` archive followed by a configuration update.

Increasing the Number of Maximum Open Files

Lowering the session time-out decreases the number of LDAP connection threads, which improves performance. You can further improve performance by increasing the maximum number for open files on the Linux server. For example, increase the maximum number of open files on the server to 35,000.

View Request Status Search Limit

By default, the **View Request Status** action retrieves up to 10,000 request objects. If a user attempts to retrieve a larger result set, the user will see a message indicating that the limit has been reached. In this case, the user should narrow the search (by specifying a particular user or status, for example) to limit the number of objects returned in the result set. Note that when a user applies a filter to a role name, the filter limits what the user sees and its order, not the number of objects returned.

To change the maximum number of request objects retrieved:

1. Log in to iManager.
2. Navigate to the User Application driver.
3. Under **EntityDefs.DirectoryModel.AppConfig**, locate the `sys-nrf-request` object.
4. Modify the **XmlData** attribute for the object to the following value:

```
<search-max>10000</search-max>
```

5 Save your changes.

10 Setting Up the Dashboard for Identity Applications

This section helps you to set up the Identity Manager Dashboard.

Checklist for Setting Up the Dashboard for Identity Applications

NetIQ recommends that you review the following checklist for setting up the enhanced Identity Manager Dashboard:

	Checklist Items
❑	1. Create compound indexes for all the basic attributes. To use any other attributes, you must create compound index for those attributes. For more information about creating compound indexes, see Creating Compound Indexes in the NetIQ Identity Manager Setup Guide. **NOTE:** If you create a compound index for a multivalued attribute and this attribute has multiple values, the identity applications return duplicate records in user catalog when you sort using that attribute. For example, if you created a compound index for multivalued attribute named as First Name, and it holds multiple values, you will see duplicate records for each values when this attribute is used for sorting.
❑	2. Add a new language that is not a default language, see Section , “Adding a Language to the Identity Applications,” on page 112.
❑	3. Modify the administration configuration settings for the Dashboard. You can customize the following settings: ◆ User access to pages ◆ Attributes displayed in user profiles ◆ Logo, stylesheet, and other brand settings For more information, see “Customize the User Interface” in the Help for the Dashboard.
❑	4. Add links to the **Applications** page to provide your users easy access to common permissions and activities. For example, you might want to provide links for administrators to access Catalog Administrator and the User Application. For more information about providing links for your users, see Section , “Linking the Dashboard to Catalog Administrator and the User Application,” on page 100 and “Configure the Applications Page” in the Help for the Dashboard. **NOTE:** With Identity Manager 4.6, the Dashboard replaces Identity Manager Home and Provisioning Dashboard. The Dashboard’s **Applications** page should replicate **Featured Items** that had been in Identity Manager Home.

III Role and Resource Administration

This section provides information about managing the roles and resources that you intend to grant to users in your organization.

11 Creating and Managing Roles

A **role** defines a set of permissions related to one or more target systems or applications. For example, a user administrator role might be authorized to reset a user's password, while a system administrator role might have the ability to assign a user to a specific server.

Both the Catalog Administrator and User Application allow you to create roles, establish a roles hierarchy, define role relationships, and perform administrative actions on the roles. When creating a role, you must not include the following characters in the **Name** and **Description** of the role: `< > , ; \ " +  # = / | & *`

In Catalog Administrator you can modify all role parameters except **Role Level** and **Subcontainers**. Once you have defined a role, you cannot change the level of the role. To change the level of the role, you must delete the role and create it again. With Catalog Administrator, you can select multiple roles for modify and delete operations.

Users can access the role administration activities from the Dashboard, if the identity applications administrator created links on the Applications page. To change information associated with a role, you can either select it from the default list of roles or filter the list.

The **Configure Roles and Resources Settings** action on the **Roles and Resources** tab of the User Application allows you to specify administrative settings for the Role Subsystem. These settings control the behavior of the role management components of the identity applications. For example, you can define a removal grace period for the time between removal of a role assignment and the initiation of related entitlement removal processes. You can also set the display strings for business levels. For more information, see the section on configuring the role subsystem in the *Identity Manager User Application: User Guide* (http://www.netiq.com/documentation/idm402/pdfdoc/ugpro/ugpro.pdf).

To create and manage roles, you must have one of the following identity applications role:

- Role Administrator
- Role Manager

The following sections contain information about operations that you can perform as a role administrator:

Understanding Role Assignments

When a user requests a role that results in a potential SoD conflict, the initiator has the option to override the SoD constraint and provide a justification for making an exception. In some cases, a SoD conflict can cause a workflow to start. The workflow coordinates the approvals needed to allow the SoD exception to take effect.

Your workflow designer and system administrator are responsible for setting up the contents of the **Roles and Resources** tab for you and the others in your organization. The flow of control for a roles-based workflow or SoD workflow, as well as the appearance of forms, can vary depending on how the workflow designer defined the workflow's approval definition in the Designer for Identity Manager. In addition, your job requirements and level of authority determine what you can see and do.

For more information, see "Creating New Roles" in the *NetIQ Identity Manager - User's Guide to the Identity Applications*.

NOTE: The ability to define custom roles is available only with Identity Manager 4.5 and later.

Searching for Roles

Click **Filter** icon in the Role Administration page. The **Filter** dialog displays **Role Categories** and **Role Level** fields that you can use to filter the roles.When you are doing a simple search for a role, you can type in part of a role name or a description to display a list of roles that meet the criteria. When you enter some characters strings, called "stop words", the search does not display the associated item. Also, the browser's built-in search mechanism cannot search through the generated list of items. The filter is a more robust search feature that you should use to find all items that meet your search criteria.

Role Ownership

When you define a role, you have the option to designate one or more owners for that role. A role owner is the person who is designated as the owner of the role definition. The role owner can be a user, a group, or a container. The role owner does not automatically have the authorization to administer changes to a role definition. In some cases, the owner must ask a Role Administrator to perform any administration actions on the role.

Role Approval and Revocation

After you create a role, you can modify it to define the approval process for that role. An approver can be a user, a group, a container, or a specific role.

To change the approval process for a role, select it from the list of roles or search for it using **Filter**. The page displays information for the role. You can define the approval process for a role using one of the following options:

- **Serial Approval:** Specify multiple approvers, and define the order by selecting an approver and moving that approver earlier or later in the order by clicking the arrows at the right of the approval list.
- **Quorum Approval:** Specify the approvers, then use the slide bar to specify the percent of those approvers that are required to grant access.

- **Other Available Processes:** Specify the other approval process that you want to use. This approval process must be available for use in Catalog Administrator.

  NOTE: You must set up this approval process in Identity Manager Designer. For more information, see User Application: Design Guide.

If you choose **None**, no approvers are required for the role.

You can choose to have a revoke process or not. If **Revoke Process Required** is enabled, the revocation process follows the same process that is defined for role approval.

Role Hierarchy

Role levels define role hierarchy. The roles hierarchy supports three levels. Roles defined at the highest level (called Business Roles) define operations that have business meaning within the organization. Mid-level roles (called IT Roles) supports technology functions. Roles defined at the lowest level of the hierarchy (called Permission Roles) define lower-level privileges.

A higher-level role automatically includes privileges from the lower-level roles that it contains. For example, a Business Role automatically includes privileges from the IT Roles that it contains. Similarly, an IT Role automatically includes privileges from the Permission Roles that it contains.

Role relationships are not permitted between peer roles within the hierarchy. In addition, lower-level roles cannot contain higher-level roles.

You can modify the label used for each role level in the User Application by defining localized strings for the level's **Name** and **Description** in the role configuration editor.

To associate a role with another role, select it from the list of roles or search for it using **Filter**. The page displays information about the role. A child role must have a lower role level than the parent role, and the parent role is automatically assigned the privileges assigned to the lower-level roles.

Associating a Resource to a Role

A role is only useful when it is defined to have access to a resource, and a resource is only useful as an entity that a user has access to. Therefore, you must associate roles and resources to make them useful. A user assigned to a role has access to all resources that are associated with that role.

To associate a resource with a role,

1. Go to the Roles Administration page.
2. Select the role you want to map from the list of roles.
3. Click **Resource Associations**, then click **Manage Associations**.
4. Select **Resources** or **Entitlements** to associate to a role.

   You are presented with two options: **Resources** and **Entitlements**. You can bind entitlements with a role. If a role has an entitlement bound to it, it allows you to see the entitlement mapping.

   or

   Search for a resource by drivers installed in your Identity Manager environment. You can type in part of a driver name to display a list of resources that meet the criteria.
5. (Conditional) If you select **Resources**, you can either search for a resource or select it from the list of available resources.

6 (Conditional) If you select **Entitlements**, select the driver for granting entitlements to this role from the list of available drivers. Based on the type of the role, the list of entitlements is displayed in the page. Select an entitlement to grant for this role. Also, you can search for values associated with an entitlement. To do this, you can either enter text in the **Entitlements Values** search field for the entitlement you are searching for.
7 Click **Add Association.**
8 Enter a mapping description for the resource or entitlement you selected.
9 Click **Apply** and **Close** to return to the Roles Administration page.

Separation of Duties Constraints

Separation of duties is an important aspect of an organization's security controls because it helps prevent fraud and user error related to user access. In a separation of duties constraint, the conflicting roles must be at the same level in the roles hierarchy.

An SoD constraint represents a rule that makes two roles mutually exclusive, unless there is an exception allowed for that constraint. You can define whether exceptions to the constraint are always allowed or are only allowed through an approval flow. When a role assignment results in a potential separation of duties conflict, the initiator has the option to override the separation of duties constraint, and provide a justification for making an exception to the constraint.

You can add or delete separation of duties constraints.

To add separation of duties constraints, do the following:

1 Go to the Role Administration page.
2 Click **Manage Constraints**.
3 In the Add Separation of Duties page, fill in the mandatory fields.
4 Click **Apply** and **Close** to return to the Roles Administration page.

Editing Multiple Roles at Once

Catalog Administrator provides you the ability to perform actions on multiple roles as a group instead of requiring you to repeat those actions on each role individually. Select the roles you want to manage from the list of roles. You can change **Categories, Owners, and Approval Details** for the roles you selected. Also, you can append or overwrite values for **Categories** and **Owners** for the selected role.

Managing the Role Service Driver

On occasion, you might want to change the settings for the Role Service driver or update the indexes that it uses to display roles in the identity applications.

Configuring the Role and Resource Service Driver Settings

After creating the Role and Resource Service driver at installation time, you can optionally modify some of the driver configuration settings in iManager.

1 In iManager, click **Identity Manager>Identity Manager Overview**.
2 Browse to the driver set where the driver exists, then click **Search**.

3 Click the upper-right corner of the Role Service driver icon, then click **Edit Properties**.
4 Click on the **Driver Configuration** tab.
5 Scroll down to the **Driver Settings** section of the page.
6 Make any changes you would like to the settings, and click **OK** to commit your changes.

You can modify the following standard driver settings (listed under **User Application/Workflow Connection** on the Driver Configuration page), which get their initial values at installation time:

Table 11-1 *Standard Driver Settings*

Option	Description
User Application Driver DN	The distinguished name of the User Application driver object that is hosting the role system. Use the eDirectory format, such as UserApplication.driverset.org, or browse to find the driver object. This is a required field.
User Application URL	The URL used to connect to the User Application in order to start Approval Workflows. This is a required field.
User Application Identity	The distinguished name of the object used to authenticate to the User Application in order to start Approval Workflows. This needs to a user who has been assigned as a Provisioning Administrator for the User Application. Use the eDirectory format, such as admin.department.org, or browse to find the user. The identity needs to be entered in LDAP format (for example, cn=admin,ou=department,o=org), rather than dot format. Note that this is different from the format required at driver install time, where dot notation is expected. This is a required field.
User Application Password	Password of the account specified in the User Application Identity field. The password is used to authenticate to the User Application in order to start approval workflows. This is a required field.
Reenter User Application Password	Re-enter the password of the account specified in the User Application Identity field.

In addition, you can modify the following additional settings (listed under **Miscellaneous** on the Driver Configuration page) to customize the behavior of the Role Service driver:

Table 11-2 Additional Settings for Customizing the Role Service Driver

Option	Description
Number of days before processing removed request objects	Specifies the number of days the driver should wait before cleaning up request objects that have finished processing. This value determines how long you are able to track the status of requests that have been fulfilled.
Frequency of reevaluation of dynamic and nested groups (in minutes)	Specifies the number of minutes the driver should wait before reevaluating dynamic and nested groups. This value determines the timeliness of updates to dynamic and nested groups used by the User Application. In addition, this value can have an impact on performance. Therefore, before specifying a value for this option, you need to weigh the performance cost against the benefit of having up-to-date information in the User Application.
Generate audit events	Determines whether audit events are generated by the driver. For details on audit configuration, see Chapter 7, "Setting Up Logging in the Identity Applications," on page 71.

Indexing for the Role Service Driver

The Role Service driver s relevant indexes in eDirectory for roles definitions. If you upload a large number of roles, the indexing of these values may take some time. You can monitor these indexes under Index Management in iManager.

Here is the list of Index Names for the indexes d for the Role Service driver:

```
nrf(Object Class)
nrf(nrfMemberOf)
nrf(nrfStatus)
nrf(nrfStartDate)
nrf(nrfNextExpiration)
nrf(nrfParentRoles)
nrf(nrfChildRoles)
nrf(nrfCategory)
nrf(nrfRoleCategoryKey)
nrf(nrfLocalizedNames)
nrf(nrfLocalizedDescrs)
nrf(nrfRoles)
```

12 Creating and Managing Resources

A resource is any digital entity such as a user account, computer, or database that a business user needs to be able to access. Each resource is mapped to an entitlement. For more information, see Section , "Providing Permissions to Users," on page 25.

Catalog Administrator allows you to create entitlement-based dynamic resources and non-valued resources (without entitlements). It also allows you to create static resources. You can modify **Categories, Owners**, and **Approval Process** for a resource. With Catalog Administrator, you can select multiple resources for modify and delete operations.

You can access the Resource Administrator page from the Identity Manager Home and Provisioning Dashboard page. The Resource Administrator page displays a list of currently defined resources in your organization.

To change information associated with a resource, you can either select it from the list of resources or search for it using **Filter**. The Resources page displays information about that resource.

The following sections contain information about operations that you can perform in the Resource Administration page.

Searching for Resources

Click **Filter** icon in the Resource Administration page. The **Filter** dialog displays **Resource Categories** field that you can use to filter the resources.When you are doing a simple search for a resource, you can type in part of a resource name or a description to display a list of resources that meet the criteria. When you enter some characters strings, called "stop words", the search does not display the associated item. Also, the browser's built-in search mechanism cannot search through the generated list of items. The filter is a more robust search feature that you should use to find all items that meet your search criteria.

Creating Resources

You can create a non-valued resource (without entitlements) and entitlement based static or dynamic resource. If you choose to create a resource with entitlements, you have the following choices:

- Select the driver from the list of available drivers installed in your Identity Manager environment. When you click the tree view of the driver you selected, the entitlements associated with the driver are displayed. Select an entitlement and specify a value for it. If you select **Entitlement Association**, Catalog Administrator creates a dynamic resource. You must enter a description for the entitlement for the resource to be created. Ensure that you do not include the following characters in the **Name** and **Description** of the resource: `< > , ; \ " +  # = / | & *`

  After creating a dynamic resource, you can specify the entitlement value when the resource is requested using the Dashboard or when you are associating the resource with a role using Catalog Administrator.

  To allow users to select entitlement values at the time of request for the logical systems within the connected system, you must create a separate resource for each logical systems.

  NOTE: Select **Allow this resource and entitlement to be assigned multiple times with different values** only if this resource will be requested by business users multiple times with different values.

  This option is displayed for User Account entitlement though it should not be because User Account entitlement is a single-valued entitlement.

- Select the driver from the list of available drivers installed in your Identity Manager environment and select an entitlement value from the list. The new static resource is associated with this entitlement value. If you select multiple entitlement values for creating a resource, Catalog Administrator automatically creates only one resource for each entitlement value.

To create a resource without entitlements, you must specify the mandatory fields to create it. The newly added resources are added to the organizational resources and available for business managers.

Modifying Resources

You can modify several parameters of a resource. You can select a resource whose parameters you want to change from the list of available resources or search for it in the filter dialog. The tool allows you to modify all parameters that are displayed in the page.

You can modify more than one resources at one time. For more information, see Section , “Editing Multiple Resources at Once,” on page 141.

Resource Approval and Revocation

After you create a resource, you can modify the resource information and define the approval process for it. You can choose the role approval process to override the resource approval process.

To change the approval process for a resource, select it from the list of resources or search for it using **Filter**. The page displays information for the resource. A resource approver can be a user, a group, a container, or a specific role. You can define the approval process for a resource using one of the following options:

- **Serial Approval:** Specify multiple approvers, and define the order by selecting an approver and moving that approver earlier or later in the order by clicking the arrows at the right of the approval list.
- **Quorum Approval:** Specify the approvers, then use the slide bar to specify the percent of those approvers that are required to grant access.
- **Other Available Processes:** Specify the other approval process that you want to use. This approval process must be available for use in Catalog Administrator.

  NOTE: You must set up this approval process in Identity Manager Designer. For more information, see User Application: Design Guide.

If you choose **None**, no approvers are required for assigning the resource.

You can revoke the resource assignment by choosing one of the available options. The resource revocation process can match the resource approval process, or you can define a different process. Select the **Same as Grant Approval** option if you want the revocation process to match the approval process. If you define a different process, you are presented with same options that you have for defining the approval process.

Editing Multiple Resources at Once

Catalog Administrator provides you the ability to perform actions on multiple resources as a group instead of requiring you to repeat those actions on each resource individually. You need to select the resources you want to manage. You have the option to change **Owners, Categories, Grant Approval Process**, and **Revoke Process** for the resources you selected. Also, you can append or overwrite values for **Categories** and **Owners** for the selected resource.

Understanding Resource Assignments

Resources can be assigned to users only. They cannot be assigned to groups or containers. However, if a role is assigned to a group or container, the users in that group or container might automatically be granted access to the resources associated with the role.

A Resource Administrator can configure the approval process for resources. The approval process for a resource might be handled by one of the following:

- a provisioning request definition
- an external system, by setting the status code on the resource request

If a role assignment initiates a request for a resource, it is possible that the request will not be granted, even though the role is provisioned. The most likely reason for this would be that the necessary approvals were not provided.

When a user requests a resource, the request starts a workflow. The workflow coordinates the approvals needed to fulfill the request. Some requests require approval from a single individual; others require approval from several individuals. In some instances, a request can be fulfilled without any approvals.

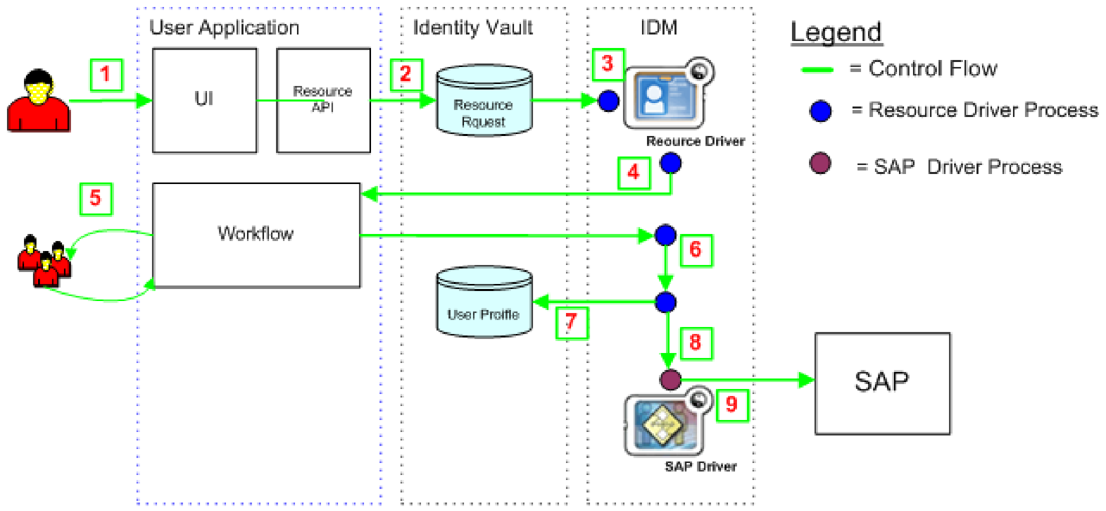
The following business rules govern the behavior of resources within the User Application:

- Resources can only be assigned to a user. The resource can be granted to users in a container or group based on implicit role assignment. But the resource assignment will only be associated with a user.
- Resources can be assigned in any of the following ways:
  - Directly by a user through UI mechanisms
  - Through a provisioning request
  - Through a role request assignment
  - Through a Rest or SOAP interface
- The same resource can be granted to a user multiple times (if this capability has been enabled in the resource definition).
- A resource definition can have no more than one entitlement bound to it.
- A resource definition can have one or more same-entitlement references bound to it. This capability provides support for entitlements where the entitlement parameters represent provisionable accounts or permissions on the connected system.
- Entitlement and decision support parameters can be specified at design time (static) or at request time (dynamic).

Your workflow designer and system administrator are responsible for setting up the User Application for you and the others in your organization. The flow of control for a resource-based workflow, as well as the appearance of forms, can vary depending on how the workflow designer defined the workflow's approval definition in the Designer for Identity Manager. In addition, your job requirements and level of authority determine what you can see and do.

Resource Request Process Flow

The following example shows the process flow for a resource assignment request. In this example, a user requests a resource that grants access to an SAP profile:



1. In the Dashboard, a user requests access to SAP.
2. The Identity Vault creates a User Request object.
3. The Role and Resource Service Driver processes the new request.
4. The Role and Resource Service Driver starts a workflow, and changes the request status.
5. The identity applications perform the approval process. Upon completion of the approval process, the workflow activity changes the request status.
6. The Role and Resource Driver picks up the change in the status and begins to provision the resource if all of the necessary approvals have been provided.
7. The User Object attributes are updated to include the resource binding and approval information.
8. An entitlement request is made for the SAP Profile.
9. The SAP Driver processes the entitlement and creates the user's profile in SAP.

Enabling Drivers for Resource Mappings

The identity applications includes updated configuration files for the following drivers:

- Active Directory
- GroupWise
- LDAP
- Notes
- eDirectory
- SAP User Management
- SAP GRC Access Control

All of these updated driver configuration files contain a new section on the driver's Global Configuration Values (GCV) page labeled **Role and Resource Mapping**.

To display the configuration options available in the new section, select **show** for the **Show role and resource mapping configuration** GCV.

To enable resource mapping for the driver, select **Yes** for the **Enable resource mapping** GCV.

Depending on the driver's capabilities, one or more lower-level options are displayed once resource mapping is turned on. The Active Directory driver, for example, has three lower-level options:

- **Allow mapping of user accounts**
- **Allow mapping of groups**
- **Allow mapping of Exchange mailboxes**

Each option can be turned on or off individually by selecting **Yes** or **No**.

After saving the changes and restarting the driver, RBPM will detect the driver as enabled for resource mapping.

NOTE: Before RBPM can detect the driver, RBPM must query the entitlement system. RBPM sends the query to the entitlement system every 1440 minutes by default, but you can force the application to send the query immediately using the User Application.

To force the query to run immediately, log into the User Application using a User Application administrator account. Click **Roles and Resources > Configure Roles and Resources Settings**, then click the **Refresh** button under **Entitlement Query Status > Refresh Status**.

Creating a List to Improve Resource Request Forms

You can use lists in request forms to display various options for specifying a resource assignment. This section provides instructions for adding lists to the database by executing a few SQL statements. Once these lists have been created, they can be displayed on a request form on the Roles and Resources tab.

The following example shows how you would create a simple set of values for a list:

```
INSERT INTO PROVISIONING_CODE_MAP SET VIEWID='Factory-Locations', VERSIONNO=1,
DESCRIPTION='Factory Locations', NAME='Factory
Locations',ENTITYKEY='Factory-Locations', ENTITYTYPE=1,
LASTREFRESHED=UNIX_TIMESTAMP();

INSERT INTO PROVISIONING_VIEW_VALUE SET VALUEID='Factory-Locations-1',
VERSIONNO=1, VIEWID='Factory-Locations', PARAMVALUE='Cambridge, MA 02440';

INSERT INTO PROVISIONING_VIEW_VALUE SET VALUEID='Factory-Locations-2',
VERSIONNO=1, VIEWID='Factory-Locations', PARAMVALUE='Provo, UT 97288';
```

The following example uses SQL statements that work with PostgreSQL:

```
INSERT INTO PROVISIONING_CODE_MAP
(VIEWID,VERSIONNO,DESCRIPTION,NAME,ENTITYKEY,ENTITYTYPE,LASTREFRESHED)
VALUES ('Factory-Locations',1,'Factory Locations','Factory-Locations','Factory-
Locations',1,extract(epoch FROM now()));

INSERT INTO PROVISIONING_VIEW_VALUE (VALUEID,VERSIONNO,VIEWID,PARAMVALUE)
VALUES ('Factory-Locations-1','1','Factory-Locations','Cambridge, MA 02440');

INSERT INTO PROVISIONING_VIEW_VALUE (VALUEID,VERSIONNO,VIEWID,PARAMVALUE)
VALUES ('Factory-Locations-2','1','Factory-Locations','Waltham, MA 02451');

INSERT INTO PROVISIONING_VIEW_VALUE (VALUEID,VERSIONNO,VIEWID,PARAMVALUE)
VALUES ('Factory-Locations-3','1','Factory-Locations','Provo, UT 97288');
```

The VIEWID is the primary key for the PROVISIONING_CODE_MAP. The ENTITYTYPE value 1 identifies the map type as a list. The VIEWID is the foreign key for the PROVISIONING_VIEW_VALUE relationship to the PROVISIONING_CODE_MAP table. The VALUEID is the primary key for the PROVISIONING_VIEW_VALUE table.

After the Company Location field has been added to the form, you can specify that the company location value should come from the Company Locations list at request time.

After the Factory Location field has been added, you can specify that the factory location value must come from the Factory Locations list at request time.

At request time, the user can then select the company location and factory location values when assigning the resource.

After the resource has been assigned, the Request Status tab for the resource displays the parameter values chosen from the lists for the request form fields.

IV Administering the User Application

These sections describe how to configure and manage the Identity Manager User Application by using the **Administration** tab of the user interface.

13 Using the Administration Tab

This section introduces you to the **Administration** tab of the Identity Manager user interface. You'll learn how to use the **Administration** tab to configure and manage the Identity Manager User Application.

About the Administration Tab

The Identity Manager user interface is primarily accessed by end users, who work with the tabs and pages it provides for identity self-service and workflow-based provisioning. However, this browser-based user interface also provides an **Administration** and page, which administrators can use to access a page and configure various characteristics of the underlying Identity Manager User Application.

For example, choose the **Administration** to:

- Change the used for the look and feel of the user interface
- Customize the identity self-service features available to end users
- Specify who is allowed to perform administration actions
- Manage other details about the User Application and how it runs

Who Can Use the Administration Tab

The **Administration** tab is not visible to typical end users of the Identity Manager user interface. There are three kinds of users who can see and access this tab:

User Application Administrators: A User Application Administrator is authorized to perform all management functions related to the Identity Manager User Application. This includes accessing the **Administration** tab of the Identity Manager user interface to perform any administration actions that it supports. During installation, a user is specified as User Application Administrator. After installation, that user can use the Security page on the **Administration** tab to specify other User Application administrators, as needed.

Domain Administrators and Domain Managers: Domain Administrators and Domain Managers are authorized to perform provisioning and security tasks for the Identity Manager User Application. For details, see Chapter 16, "RBPM Provisioning and Security Configuration," on page 201.

Accessing the Administration Tab

When you are a User Application Administrator (or other permitted user), you can use any supported Web browser to access the **Administration** tab of the Identity Manager user interface to manage the Identity Manager User Application.

For a list of supported Web browsers, see the "System Requirements for the Identity Applications" in the *NetIQ Identity Manager Setup Guide*.

NOTE: To use the Identity Manager user interface, make sure your Web browser has JavaScript* and cookies enabled.

To access the Administration functionality using the Identity Manager Home page:

1 Log in to the Identity Manager Home page using the OSP login as a User Application Administrator.

  After you log in, the Identity Manager Home page displays. This page provides default links to the basic tasks an administrators can perform in Identity Manager. For more information, see "Accessing Identity Manager Home" in the *NetIQ Identity Manager Home and Provisioning Dashboard User Guide*.

2 Under the Administration section, click the appropriate link.

To access the Administration functionality directly with a URL:

1 In your Web browser, go to the URL for the Identity Manager user interface as configured in your environment, with the context you used when you installed the User Application.

  For example:

```
http://myappserver:8080/IDMProv
```

2 Specify the username and password of a User Application Administrator (or a user with some Administration permissions), then click **Login**.

3 Click the **Administration** tab.

  For more general information about accessing and working in the Identity Manager user interface, see the *Identity Manager User Application: User Guide*.

Administration Tab Actions You Can Perform

After you're on the **Administration** tab, you can use any available actions to configure and manage the Identity Manager User Application. Table 13-1 contains a summary.

***Table 13-1** Administration Tab Actions Summary*

Action	Description
Application Configuration	Controls User Application configuration of caching, logging, password management, and LDAP connection parameters. Provides read-only information about the driver status and the portal. Provides access to tools that allow you to export or import portal content (pages and portlets used in the Identity Manager User Application. For details, see Chapter 14, "Application Configuration," on page 151.
Page Admin	Controls the pages displayed in the Identity Manager user interface and who has permission to access them For details, see Chapter 15, "Page Administration," on page 185.
RBPM Provisioning & Security	Controls the provisioning configuration, as well as security permissions and navigation access. For details, see Chapter 16, "RBPM Provisioning and Security Configuration," on page 201.

14 Application Configuration

This section describes the tasks that you can perform from the Application Configuration page.

Portal Configuration Tasks

NOTE: The portal functionality within the User Application has been deprecated in Identity Manager 4.0.2.

Caching Management

You can use the Caching page to manage various caches maintained by the Identity Manager User Application. The User Application employs these caches to store reusable, temporary data on the application server so it can optimize performance.

You have the ability to control these caches when necessary by flushing their contents and changing their configuration settings.

Flushing caches

The caches are named according to the subsystems that use them in the Identity Manager User Application. Normally, you don't need to flush them yourself, because the User Application does that automatically based on how frequently their data is used or when the source data changes. However, if you have a specific need, you can manually flush selected caches or all caches.

1. Go to the Caching page.
2. In the **Flush Cache** section of the page, use the drop-down list to select a particular cache to flush (or select **Flush all**).

   The list of available caches is dynamic; it changes depending on what data is cached at the moment.
3. Click **Flush Cache**.

Flushing the Directory Abstraction Layer Cache

The User Application's directory abstraction layer also has a cache. The DirectoryAbstractLayerDefinitions cache stores abstraction layer definitions on the application server to optimize performance for all data model operations.

In a typical situation, the User Application automatically keeps the DirectoryAbstractLayerDefinitions cache synchronized with the abstraction layer definitions stored in the Identity Vault. But, if necessary, you can manually flush the DirectoryAbstractLayerDefinitions cache as described in "Flushing caches" on page 151 to force the latest definitions to be loaded from the Identity Vault.

For more information on the User Application's directory abstraction layer, see the *Identity Manager User Application: Design Guide*.

Flushing Caches in a Cluster

Cache flushing is supported in both clustered and non-clustered application server environments. If your application server is part of a cluster and you manually flush a cache, that cache is automatically flushed on every server in the cluster.

Configuring Cache Settings

You can use the Caching page to display and change cache configuration settings for a clustered or non-clustered application server environment. Your changes are saved immediately, but they don't take effect until the next User Application restart.

TIP: To restart the User Application, you can reboot the application server; redeploy the application (if the WAR has been changed in some way); or force the application to restart (as described in your application server's documentation).

How Caching Is Implemented

In the Identity Manager User Application, caching is implemented via JBoss Cache. JBoss Cache is an open source caching architecture that can run on the Tomcat application server.

How Cache Settings Are Stored

Two levels of settings are available for controlling cache configuration: global and local. Use these settings to customize the caching behavior of the Identity Manager User Application. Table 14-1 on page 152 describes the cache configuration settings.

Table 14-1 *Cache Configuration Settings*

Level	Description

Global settings	Global settings are stored in a central location (the Identity Vault) so that multiple application servers can use the same setting values. For example, someone with a cluster of application servers would typically use global settings for the cluster configuration values.
	
	To find the global settings in your Identity Vault, look for the following object under your User Application driver:
	
	`configuration.AppDefs.AppConfig`
	
	For example:
	
	`configuration.AppDefs.AppConfig.MyUserApplicationDriver.MyDriverSet.MyOrg`
	
	The XmlData attribute of the configuration object contains the global settings data.

Level	Description
Local setting	Local settings are stored separately on each application server so that an individual server can override the value of one or more global settings. For example, you might want to specify a local setting to remove an application server from the cluster specified in the global settings, or to reassign a server to a different cluster. For example: `tomcat/server/IDMProv/conf/sys-configuration-xmldata.xml`. If your server has local settings, that data is contained in this file. If no local settings have been specified, the file won't exist.

You should think of global settings as the default values for every application server that uses a particular instance of the User Application driver. When you change a global setting, you are affecting each of those servers (at the next restart of the identity applications), except for those cases where an individual server specifies a local override.

How Cache Settings Are Displayed

The Caching page displays the current cache settings (from the latest User Application restart). It also displays the corresponding global and local values of those settings, and lets you change them (for use at the next User Application restart).

The global settings always have values. The local settings are optional.

Basic Cache Settings

These cache settings apply to both clustered and non-clustered application servers.

To configure basic cache settings:

1. Go to the Caching page.
2. In the **Cache Configuration** section of the page, specify global or local values for the following settings, as appropriate:

Setting	What to do
Lock Acquisition Timeout	Specify the time interval (in milliseconds) that the cache waits for a lock to be acquired on an object. You might want to increase this setting if the User Application gets a lot of lock timeout exceptions in the application log. The default is 15000 ms.
Wake Up Interval Seconds	Specify the time interval (in seconds) that the cache eviction policy waits before waking up to do the following: ◆ Process the evicted node events ◆ Clean up the size limit and age-out nodes
Eviction Policy Class	Specify the classname for the cache eviction policy that you want to use. The default is the LRU eviction policy that JBoss Cache provides: `org.jboss.cache.eviction.LRUPolicy` If appropriate, you can change this to another eviction policy that JBoss Cache supports.

Setting	What to do
Max Nodes	Specify the maximum number of nodes allowed in the cache. For no limit, specify: `0` You can customize this setting for some cache holders. See "Customizable Cache Holders" on page 154.
Time To Live Seconds	Specify the time to idle (in seconds) before the node is swept away. For no limit, specify: `0` You can customize this setting for some cache holders. See "Customizable Cache Holders" on page 154.
Max Age	Specifies the number of seconds an entry should be allowed to stay in the cache holder since its creation time. For no time limit, specify: `0` This setting is only available for "Customizable Cache Holders" on page 154.

These settings are required, which means that there must be a global value for each, and optionally a local value too.

If you want to override the global value of a setting with a local value, select the **Enable Local** check box for that setting. Then specify the local value. (Make sure that all of your local values are valid. Otherwise, you won't be able to save your changes.)

NOTE: For those settings where **Enable Local** is deselected, any existing local values are deleted when you save.

3 Click **Save**.

4 When you're ready for your saved settings to take effect, restart the User Application on the applicable application servers.

Customizable Cache Holders

You can customize the **Max Nodes**, **Time To Live**, and **Max Age** settings for some cache holders. The cache holders are listed in Table 14-2.

Table 14-2 Customizable Cache Holders

Cache Holder Name	Description
DirectoryAbstractionLayerDefinitions	Caches the Directory Abstraction Layer definitions to optimize performance for all data model operations. See "Flushing the Directory Abstraction Layer Cache" on page 151.

Cache Holder Name	Description
DirectoryService.ContainerCacheHolder	Caches containers in the directory layer. Containers are shared by many users and groups, and reading them from the directory layer involves both network communication (with the LDAP server) and object creation. By default, the cache is limited to 50 containers, and the LRUs have a default Time To Live (TTL) of 10 minutes. Depending on the directory topography in your enterprise, you might need to adjust the maximum number of nodes or the TTL if you find the performance is suffering because of queries to the LDAP server for container objects. Making settings too high in combination with a large number of usable containers can cause unneeded memory consumption and net lower performance from the server.
DirectoryService.DelProxyRuntimeServiceDelegate	Caches delegate assignments.
DirectoryService.DelProxyRuntimeService.Delegation	Caches user availability settings.
DirectoryService.DelProxyRuntimeService.Delegator	Caches the delegator entities.
DirectoryService.DelProxyRuntimeService.Proxy	Caches proxy assignments.
DirectoryService.GroupCacheHolder	Caches groups in the directory layer. Groups are often shared by many users, and reading them from the directory layer involves both network communication (with LDAP server) and object creation. By default, the cache is limited to 500 groups, and the LRUs have a default TTL of 10 minutes. Depending on the user/group topography in your enterprise, you might need to adjust the maximum number of nodes or the TTL if you find the performance is suffering because of queries to the LDAP server for groups objects. Settings that are too high, in combination with a large number of usable groups, can cause unneeded memory consumption, and net lower performance from the server.

Cache Holder Name	Description
DirectoryService.MemberhipCacheHolder	Caches the relationship between a user and a set of groups. Querying the set of groups a user belongs to can be a network and CPU intensive operation on the LDAP server, especially if dynamic groups are enabled. For this reason, relationships are cached with an expiration interval so that changes in the criteria for inclusion/exclusion in a group (such as time-based dynamic groups) are reflected. The default Max Age is five minutes. However, if you use dynamic groups which have a requirement for finer grained time control, then you can adjust the Max Age on this cache holder to be just below the minimum time your finest grained time based dynamic group requires. The lower this value is, the more times the user's groups are queried during a session. Setting a value too high keeps the user/ group relationships in memory perhaps longer than the user's session needlessly consuming memory.
DirectoryService.RolesMembershipCacheHolder	Caches the application role membership list by role.
DirectoryService.TeamManagerRuntime.Team	Caches the application team instances and team provisioning requests.
DirectoryService.UserCacheHolder	Caches users in the directory layer. Reading users from the directory layer involves both network communication (with LDAP server) and object creation. By default, the cache is limited to 1000 users, and the LRUs have a default TTL of 10 minutes. Depending on the user topography in your enterprise, you might need to adjust the maximum number of nodes or the TTL if you find the performance is suffering because of queries to the LDAP server for user objects. Making settings too high combined with a large number of different users logging in can cause unneeded memory consumption, and net lower performance from the server.
GlobalCacheHolder	The general purpose cache holder. This configuration applies to all caches that are not customizable (that is, all cache holders not listed in this table.)
JUICE	Caches the resource bundles used by the user interface controls and DN display expression lookup results. Changing the setting of the cache holder has a performance impact for the DN display expression lookups because they are frequently used in the User Application. The low value should be at least 300 seconds, but a higher value than 900 seconds is ok. A lower value should be used if the customer is frequently changing the attributes that are used in the DN display expression

Cache Holder Name	Description
RoleManager.RolesCacheHolder	Caches user role memberships listed by user.
Workflow.Model.Process	Caches the provisioning process XML object structure.
Workflow.Model.Request	Caches the provisioning request XML object structure.
Workflow.Provisioning	Caches provisioning request instances that have not completed. The default maximum capacity for the LRU cache is 500. The capacity can be modified by clicking the **Administration/ Provisioning** and choosing the Engine and Cluster settings. The Process Cache Maximum Capacity appears on this page. This cache reduces the memory footprint for workflow processing without compromising performance.

Cache Settings for Clusters

This section discusses how to configure caching when you run the Identity Manager User Application across a cluster of application servers.

In the Identity Manager User Application, cluster support for caching is implemented via *JGroups*. JGroups is an open-source clustering architecture that can run on a Tomcat application server.

The User Application's cluster consists of nodes on a network that run JGroups and use a common Group ID. By default, the Group ID provided for the User Application's cluster is a UUID that looks like this:

```
c373e901aba5e8ee9966444553544200
```

The UUID helps ensure uniqueness, so that the Group ID of the User Application's cluster does not conflict with the Group IDs of other clusters in your environment.

How Caching Works with a Cluster

When you start the User Application, the application's cluster configuration settings on the **Caching** page determine whether to participate in a cluster and invalidates cache changes in the other nodes in that cluster. If clustering is enabled, the User Application accomplishes this by sending cache entry invalidation messages to each node as changes occur.

In most cases, you should use global settings when configuring a cluster. However, global settings might be a problem if you need to use TCP, becasue the IP address of the server must be specified in the JGroups initialization string for each server. You can use local settings to specify a JGroups initialization string. For more information, see "Configuring Cache Settings for Clusters" on page 158.

Preparing to Use a Cluster

To use caching across a cluster:

1. Set up your JGroups cluster. This involves using the User Application installation program to install the Identity Manager User Application to each application server in the cluster (see Section , "High Availability Design," on page 46).
2. Enable the use of that cluster in the User Application's cache configuration settings

   See "Configuring Cache Settings for Clusters" on page 158.

Configuring Cache Settings for Clusters

After you have a cluster ready to use, you can specify settings for the support of caching across that cluster.

1 Go to the Caching page.

2 In the **Cluster Configuration** section of the page, specify global or local values for the following settings, as appropriate:

Setting	What to do
Cluster Enabled	Select **True** to invalidate cache changes to the other nodes in the cluster specified by Group ID. If you don't want to participate in a cluster, select **False**.
Group ID	Specify the Group ID of the JGroups cluster in which you want to participate. There's no need to change the default Group ID that's provided for the User Application's cluster, unless you want to use a different cluster. The Group ID must be unique and must not match any of the known JBoss cluster names such as DefaultPartition and Tomcat-Cluster. **TIP:** To see the Group ID in logging messages, make sure that the level of the caching log (`com.sssw.fw.cachemgr`) is set to Info or higher.
Cluster Properties	Specify the JGroups protocol stack for the cluster specified by Group ID. This setting is for experienced administrators who might need to adjust the cluster properties. Otherwise, you should not change the default protocol stack. To see the current cluster properties, click **view**. For details on the JGroups protocol stack, go to www.jboss.org/wiki/Wiki.jsp?page=JGroups (http://www.jboss.org/wiki/Wiki.jsp?page=JGroups).

If you want to override the global value of a setting with a local value, select the **Enable Local** check box for that setting. Then specify the local value. For those settings where **Enable Local** is unselected, any existing local values are deleted when you save.

WARNING: If you specify local settings and enter an incorrect configuration in the JGroups initialization string, the cache cluster function might not start. Unless you know how to configure JGroups correctly and understand the protocol stack, you should not use local settings.

Make sure that all nodes in your cluster specify the same Group ID and Cluster Properties. To see these settings for a particular node, you must access the Identity Manager user interface running on that node—by browsing to the URL of the user interface on that server—and then display the Caching page there.

To use the TCP protocol instead of the default UDP protocol, you can add a token to the global settings for the **Cluster Properties**. For example, `IDM_HOST_ADDR`. You can then edit the `hosts` file on each server in the cluster to specify the IP address for that server. For more information, see "Configuring User Application Caching to use TCP" on page 159.

3 Click **Save**.

4 When you're ready for your saved settings to take effect, restart the User Application on the applicable application servers.

Configuring User Application Caching to use TCP

You can configure caching for the User Application to use TCP in a local or global mode.

Configuring in a Local Mode

In a local mode, the configuration is stored in the local file system of the User Application server. You must complete the configuration process on each server running User Application in the cluster.

1. Configure a common host name entry corresponding to the local IP address entry on each node of the cluster.

   For example, on Linux,

   `/etc/hosts` entry on Node 1 should have: `192.200.100.1 node1.example.com node1 idmapps`

   `/etc/hosts` entry on Node 2 should have: `192.200.100.2 node2.example.com node2 idmapps`

2. Log in as User Application administrator and navigate to **Administration > Application Configuration > Caching Management**.

3. Under **Cluster and Cache Configuration** section, override the global values with local values for the following properties:

   3a For **Cluster Enabled**, select **Enable Local** and set **Local** to **True**.

   3b For **Group ID**, select **Enable Local** and copy the value from the **Current** column into the **Local** column. By default, the value is `c373e901aba5e8ee9966444553544200`.

   3c For **Cluster Properties**, select **Enable Local** and copy the following text into the **Local** column:

```
TCP(bind_addr=idmapps;start_port=[<Node1
port>];loopback=true):TCPPING(initial_hosts=<IP Address or Hostname of
Node1>[<Node1 port>],<IP Address or Hostname of Node2>[<Node2
port>];port_range=0;timeout=3500;num_initial_members=3):MERGE2(min_interva
l=5000;max_interval=10000):FD(shun=true;timeout=2500;max_tries=5):ENCRYPT(
encrypt_entire_message=true;sym_init=128;sym_algorithm=AES/ECB/
PKCS5Padding;asym_init=512;asym_algorithm=RSA):VERIFY_SUSPECT(timeout=1500
):Pbcast.NAKACK(gc_lag=100;retransmit_timeout=3000):Pbcast.STABLE(desired_
avg_gossip=20000):Pbcast.GMS(join_timeout=5000;shun=false;print_local_addr
=true)
```

   You must paste the text as a single string without carriage returns.

   For example:

```
TCP(bind_addr=idmapps;start_port=7815;loopback=true):TCPPING(initial_hosts
=192.200.100.1[7815],192.100.100.2[7815];port_range=0;timeout=3500;num_ini
tial_members=3):MERGE2(min_interval=5000;max_interval=10000):FD(shun=true;
timeout=2500;max_tries=5):ENCRYPT(encrypt_entire_message=true;sym_init=128
;sym_algorithm=AES/ECB/
PKCS5Padding;asym_init=512;asym_algorithm=RSA):VERIFY_SUSPECT(timeout=1500
):Pbcast.NAKACK(gc_lag=100;retransmit_timeout=3000):Pbcast.STABLE(desired_
avg_gossip=20000):Pbcast.GMS(join_timeout=5000;shun=false;print_local_addr
=true)
```

   The properties in the string are defined by JGroups. For more information, visit JGroups documentation (http://www.jgroups.org/manual/html/user-advanced.html).

4 For **Cluster Properties**, click **view** and perform the following actions:

4a Set **bind_addr** to the common hostname configured in Step 1.

4b Set a value for **start_port**.

You must take into account the ports that are already in use as well as the value for **port_range** to avoid port conflicts. This might need you to find an unused port.

4c Change the IP addresses for **TCPPING** to include the IP addresses of all the nodes in the cluster and their **start_port** values.

The list should begin with the local IP address.

5 Save your changes.

The User Application writes the changes to the local file system for your server. Verify that the `ism-configuration.properties` file is updated with entries similar to the following:

```
com.sssw.fw.cluster.enabled = true

com.sssw.fw.cluster.GroupIdentifier = c373e901aba5e8ee9966444553544200

com.sssw.fw.cluster.properties = TCP(bind_addr=idmapps;start_port=[<Node1
port>];loopback=true:TCPPING(initial_hosts=<IP Address or Hostname of
Node1>[<Node1 port>],<IP Address or Hostname of Node2>[<Node2
port>];port_range=0;timeout=3500;num_initial_members=3):MERGE2(min_interval=50
00;max_interval=10000):FD(shun=true;timeout=2500;max_tries=5):ENCRYPT(encrypt_
entire_message=true;sym_init=128;sym_algorithm=AES/ECB/
PKCS5Padding;asym_init=512;asym_algorithm=RSA):VERIFY_SUSPECT(timeout=1500):Pb
cast.NAKACK(gc_lag=100;retransmit_timeout=3000):Pbcast.STABLE(desired_avg_goss
ip=20000):Pbcast.GMS(join_timeout=5000;shun=false;print_local_addr=true)
```

For example:

```
com.sssw.fw.cluster.enabled = true
com.sssw.fw.cluster.GroupIdentifier = c373e901aba5e8ee9966444553544200
com.sssw.fw.cluster.properties =
TCP(bind_addr=idmapps;start_port=7815;loopback=true):TCPPING(initial_hosts=192
.200.100.1[7815],192.100.100.2[7814];port_range=0;timeout=3500;num_initial_mem
bers=3):MERGE2(min_interval=5000;max_interval=10000):FD(shun=true;timeout=2500
;max_tries=5):ENCRYPT(encrypt_entire_message=true;sym_init=128;sym_algorithm=A
ES/ECB/
PKCS5Padding;asym_init=512;asym_algorithm=RSA):VERIFY_SUSPECT(timeout=1500):Pb
cast.NAKACK(gc_lag=100;retransmit_timeout=3000):Pbcast.STABLE(desired_avg_goss
ip=20000):Pbcast.GMS(join_timeout=5000;shun=false;print_local_addr=true)
```

Ensure that you make these changes for all servers in the cluster and verify that the `ism-configuration.properties` file is updated on each cluster node. Any server that does not have these changes will use the global settings.

6 Modify the XmlData attribute of the User Application driver (for example, `cn=configuration,cn=appdefs,cn=appconfig,User Application Driver,cn=driverset,ou=system`) to include entries similar to the following:

```
<property>
        <key>com.netiq.idm.cis.perm.groupId</key>
        <value>com.netiq.idm.cis.perm.groupId</value>
</property>

<property>
        <key>com.netiq.idm.cis.channelConfig</key>
<value>TCP(bind_addr=idmapps;start_port=[<Node1
port>];loopback=true):TCPPING(initial_hosts=<IP Address or Hostname of
Node1>[<Node1 port>],<IP Address or Hostname of Node2>[<Node2
port>];port_range=0;timeout=3500;num_initial_members=3):MERGE2(min_interval=50
00;max_interval=10000):FD(shun=true;timeout=2500;max_tries=5):ENCRYPT(encrypt_
entire_message=true;sym_init=128;sym_algorithm=AES/ECB/
PKCS5Padding;asym_init=512;asym_algorithm=RSA):VERIFY_SUSPECT(timeout=1500):pb
cast.NAKACK(gc_lag=100;retransmit_timeout=3000):pbcast.STABLE(desired_avg_goss
ip=20000):pbcast.GMS(join_timeout=5000;shun=false;print_local_addr=true)
</value>
</property>
```

Specify IP Address or hostname of Node1 and Node 2 for your configuration in the `<value>` element. For example:

```
<value>TCP(bind_addr=idmapps;start_port=7816;loopback=true):TCPPING(initial_ho
sts=192.200.100.1[7816],192.100.100.2[7816];port_range=0;timeout=3500;num_init
ial_members=3):MERGE2(min_interval=5000;max_interval=10000):FD(shun=true;timeo
ut=2500;max_tries=5):ENCRYPT(encrypt_entire_message=true;sym_init=128;sym_algo
rithm=AES/ECB/
PKCS5Padding;asym_init=512;asym_algorithm=RSA):VERIFY_SUSPECT(timeout=1500):pb
cast.NAKACK(gc_lag=100;retransmit_timeout=3000):pbcast.STABLE(desired_avg_goss
ip=20000):pbcast.GMS(join_timeout=5000;shun=false;print_local_addr=true)
</value>
```

IMPORTANT: Ports used in this step and Step 4c must be different.

7 In a text editor, open the `server.xml` file from the `/opt/netiq/idm/apps/tomcat/conf` directory and add the following attributes to `Cluster` property:

```
<Cluster className="org.apache.catalina.ha.tcp.SimpleTcpCluster"
channelSendOptions="6" channelStartOptions="3"/>
```

Ensure that you update the `server.xml` file for all servers in the cluster.

8 Restart the servers in the cluster.

Configuring in a Global Mode

In this mode, the configuration is stored in the Identity Vault and available to all the nodes in the cluster.

1 Configure a common host name entry corresponding to the local IP address entry on each node of the cluster.

For example, on Linux,

`/etc/hosts` entry on Node 1 should have: `192.200.100.1 node1.example.com node1 idmapps`

`/etc/hosts` entry on Node 2 should have: `192.200.100.2 node2.example.com node2 idmapps`

2 Log in as User Application administrator and navigate to **Administration > Application Configuration > Caching Management**.

3 Under **Cluster and Cache Configuration** section, override the local values with global values for the following properties:

 3a For **Cluster Enabled**, set **Global** to **True** and deselect **Enable Local**.

 3b For **Group ID**, set **Global** to **True**, deselect **Enable Local** and copy the value from **Current** column into **Global** column. By default, the value is `c373e901aba5e8ee9966444553544200`.

 3c For **> Cluster Properties**, set **Global** to **True**, deselect **Enable Local** and copy the following text into **Global** column:

```
TCP(bind_addr=idmapps;start_port=[<Node1
port>];loopback=true):TCPPING(initial_hosts=<IP Address or Hostname of
Node1>[<Node1 port>],<IP Address or Hostname of Node2>[<Node2
port>];port_range=0;timeout=3500;num_initial_members=3):MERGE2(min_interva
l=5000;max_interval=10000):FD(shun=true;timeout=2500;max_tries=5):ENCRYPT(
encrypt_entire_message=true;sym_init=128;sym_algorithm=AES/ECB/
PKCS5Padding;asym_init=512;asym_algorithm=RSA):VERIFY_SUSPECT(timeout=1500
):pbcast.NAKACK(gc_lag=100;retransmit_timeout=3000):pbcast.STABLE(desired_
avg_gossip=20000):pbcast.GMS(join_timeout=5000;shun=false;print_local_addr
=true)
```

 You must paste the text as a single string without carriage returns.

 For example:

```
TCP(bind_addr=idmapps;start_port=7816;loopback=true):TCPPING(initial_hosts
=192.200.100.1[7816],192.100.100.2[7816];port_range=0;timeout=3500;num_ini
tial_members=3):MERGE2(min_interval=5000;max_interval=10000):FD(shun=true;
timeout=2500;max_tries=5):ENCRYPT(encrypt_entire_message=true;sym_init=128
;sym_algorithm=AES/ECB/
PKCS5Padding;asym_init=512;asym_algorithm=RSA):VERIFY_SUSPECT(timeout=1500
):pbcast.NAKACK(gc_lag=100;retransmit_timeout=3000):pbcast.STABLE(desired_
avg_gossip=20000):pbcast.GMS(join_timeout=5000;shun=false;print_local_addr
=true)
```

 The properties in the string are defined by JGroups. For more information, visit JGroups documentation (http://www.jgroups.org/manual/html/user-advanced.html).

4 For **Cluster Properties**, click **view** and perform the following actions:

 4a Set **bind_addr** to the common host name entry you created in Step 1.

 4b Set a value for **start_port**.

 You must take into account the ports that are already in use as well as the value for **port_range** to avoid port conflicts. This might need you to troubleshoot to find an unused port.

 4c Change the IP addresses for **TCPPING** to include the IP addresses of all the nodes in the cluster and their **start_port** values.

 The list should begin with the local IP address.

5 Save your changes.

6 Modify the XmlData attribute of the User Application driver (for example, `cn=configuration,cn=appdefs,cn=appconfig,User Application Driver,cn=driverset,ou=system`) to include entries similar to the following:

```
<property>
        <key>com.netiq.idm.cis.perm.groupId</key>
        <value>com.netiq.idm.cis.perm.groupId</value>
 </property>

<property>
       <key>com.netiq.idm.cis.channelConfig</key>
<value>TCP(bind_addr=idmapps;start_port=[<Node1
port>];loopback=true):TCPPING(initial_hosts=<IP Address or Hostname of
Node1>[<Node1 port>],<IP Address or Hostname of Node2>[<Node2 port>];
;port_range=0;timeout=3500;num_initial_members=3):MERGE2(min_interval=5000;max
_interval=10000):FD(shun=true;timeout=2500;max_tries=5):ENCRYPT(encrypt_entire
_message=true;sym_init=128;sym_algorithm=AES/ECB/
PKCS5Padding;asym_init=512;asym_algorithm=RSA):VERIFY_SUSPECT(timeout=1500):Pb
cast.NAKACK(gc_lag=100;retransmit_timeout=3000):Pbcast.STABLE(desired_avg_goss
ip=20000):Pbcast.GMS(join_timeout=5000;shun=false;print_local_addr=true)
</value>
</property>
```

Specify IP Address or hostname of Node1 and Node 2 for your configuration in the `<value>` element. For example:

```
<value>TCP(bind_addr=idmapps;start_port=7816;loopback=true):TCPPING(initial_ho
sts=192.200.100.1[7816],192.100.100.2[7816];port_range=0;timeout=3500;num_init
ial_members=3):MERGE2(min_interval=5000;max_interval=10000):FD(shun=true;timeo
ut=2500;max_tries=5):ENCRYPT(encrypt_entire_message=true;sym_init=128;sym_algo
rithm=AES/ECB/
PKCS5Padding;asym_init=512;asym_algorithm=RSA):VERIFY_SUSPECT(timeout=1500):Pb
cast.NAKACK(gc_lag=100;retransmit_timeout=3000):Pbcast.STABLE(desired_avg_goss
ip=20000):Pbcast.GMS(join_timeout=5000;shun=false;print_local_addr=true)
</value>
```

IMPORTANT: Ports used in this step and Step 3c must be different.

7 In a text editor, open the `server.xml` file from the `/opt/netiq/idm/apps/tomcat/conf` directory and add the following attributes to `Cluster` property:

```
<Cluster className="org.apache.catalina.ha.tcp.SimpleTcpCluster"
channelSendOptions="6" channelStartOptions="3"/>
```

Ensure that you update the `server.xml` file for all servers in the cluster.

8 Restart the servers in the cluster.

Driver Status

You can use the Driver Status pane to determine the expiration status of your driver.

The Driver Status pane displays the following two entries:

- Driver Name
- Expiration Date

  The Expiration Date displays one of the following values:

  1. Unlimited (if the activation has occurred)
  2. Expiration date of the driver (if the driver is a trial driver)

Identity Vault Settings

You can use the Identity Vault Settings pane to:

- Change the credentials used by the Identity Manager User Application when connecting to the Identity Vault (LDAP provider)
- Change the credentials for the guest account, if your system is configured to use a specific guest account, rather than LDAP anonymous account.
- View other LDAP properties of the Identity Manager User Application. The values of these settings are determined when you install the User Application.

The user interface displays different fields depending on how you configured the guest account during installation. If you specified a guest account, the user interface includes fields that let you update the credentials for that account. If you have configured your system to use the LDAP Public Anonymous account, the user interface displays this message: `The application is configured to use public anonymous account. To use a specific guest account, enable the guest account using the ldap configuration tool.`

To administer Identity Vault settings:

1. On the Application Configuration page, select **Identity Vault Settings** from the navigation menu on the left.
2. Examine and modify the settings, as appropriate. For details, see:"LDAP Settings You Can Change" on page 164.
3. If you make changes that you want to apply, click **Submit**.

LDAP Settings You Can Change

On the Identity Vault Connection Settings panel, you can modify settings for the credentials for:

- The Identity Manager User Application whenever it connects to the Identity Vault (LDAP provider).
- The guest account (if configured).

The initial values for the credentials are specified during installation. These installation values are written to the sys-configuration-xmldata file. If you make changes to these credentials via the Administration tab, your changes are saved to the User Application's database; they are not saved to the sys-configuration-xmldata file. After values are written to the database, the User Application no longer checks the values written to the sys-configuration-xmldata file. This means that you cannot use the configupdate utility to change the credentials because they are ignored. However, you can use configupdate to change the type of guest user (LDAP Guest or Public Anonymous Account).

Table 14-3 *LDAP Parameters*

Setting	What to do
Identity Vault Administrator	Type the name of a user who has full administrator rights in the Identity Vault. The Identity Manager User Application needs to access the Identity Vault as an administrator in order to function. It is typical to specify the Identity Vault's `root` administrator as the LDAP connection username. The `root` administrator has full control over the tree, so you need not assign any special trustee rights. For example: `cn=admin,o=myorg` If you specify some other user, you need to assign inheritable trustee rights to the properties [All Attributes Rights] and [Entry Rights] on your User Application driver. **NOTE:** To avoid confusion, it is recommended that you do not specify the User Application's User Application Administrator as the LDAP connection username. It is best to use separate accounts for these two different purposes.
Identity Vault Administrator Password and Confirm Identity Vault Administrator Password	Type the password that is currently set for that username in the Identity Vault.
Guest Username	Type the guest user's distinguished name
Confirm Guest Password	Type the password for the guest user.

If TLS is enabled for your LDAP server, you might encounter the following error when you update the Admin username and password: `Unable to authenticate to LDAP Provider. Disable this error by disabling TLS via iManager`.

Logging Configuration

You can use the Logging page to control the levels of logging messages you want the Identity Manager User Application to generate. For information about understanding how logging works in an identity applications environment, see Chapter 7, "Setting Up Logging in the Identity Applications," on page 71.

The Identity Manager User Application implements logging by using a custom-developed logging framework that integrates with log4j, an open-source logging package distributed by The Apache Software Foundation. By default, event messages are logged to both of the following:

- The system console of the application server where the Identity Manager User Application is deployed
- A log file on that application server. For example:

  ```
  /opt/netiq/idm/apps/tomcat/logs/catalina.out
  ```

  This is a rolling log file. After it reaches a certain size, it rolls over to another file.

Logs for all identity applications components including OSP are logged to the `catalina.out` file. OSP logs are also stored in a separate file, `osp-idm-<`*`date of log generation`*`>.log` file located in `/opt/netiq/idm/apps/tomcat/logs/`. Logging is turned off by default and must be enabled in the `setenv.sh` file in the `/TOMCAT_INSTALLED_HOME/bin/` directory. By default, logs for User Application and Role and Resource Service drivers are added to DSTrace.

Changing Log Levels

Logging requirements vary widely; therefore, NetIQ cannot make recommendations regarding what information you need in each package that suits your business needs. You can control the amount of information that is written to a particular log by changing the level that is set for it. By default, all logs are set to *Info*, which is an intermediate level.

1. Go to the Logging page.
2. At the top of the page, locate the package whose level you want to change.
3. Use the drop-down list to select one of the following levels:

Level	Description
Fatal	The least detail. Writes fatal errors to the log.
Error	Writes errors (plus all of the above) to the log.
Warn	Writes warnings (plus all of the above) to the log.
Info	Writes informational messages (plus all of the above) to the log.
Debug	Writes debugging information (plus all of the above) to the log.
Trace	The most detail. Writes tracing information (plus all of the above) to the log.

4. Repeat Step 2 and Step 3 for other logs, as needed.
5. Click **Submit**.

   You can change the log level for all of the logs to one setting by selecting **Change log level** of all above logs and using the drop-down list to select the level.

Adding Logs for Other Packages

You can add logs for other packages used by the User Application.

1. Go to the Logging page:
2. At the bottom of the page, select **Add Log Level for Package**, then use the drop-down list to select the package.
3. Choose a log level from the drop-down, then click **Submit**.

Sending Log Messages to an Auditing Service

You can use the Logging page to control whether the Identity Manager User Application sends event message output to an auditing service. Logging is off by default, unless you turn it on when installing the User Application.

To toggle logging on/off:

1. Go to the Logging page.

2 Select or deselect the following settings, as appropriate:
   - **Also send logging messages to audit service**
   - **Also send logging messages to OpenXDAS**
3 Click **Submit**.

Persisting Your Log Settings

By default, changes you make on the Logging page stay in effect until the next application-server restart or User Application redeployment. After that, the log settings revert to their default values.

However, the Logging page does offer you the option of persisting your changes to its settings. If you turn on this feature, values for the log settings are stored in a logging configuration file on the application server where the Identity Manager User Application is deployed. For example, the `<installdir>/tomcat/server/IDMProv/conf/` directory.

To toggle persistence of settings on or off:

1 Go to the Logging page.
2 Select or deselect the following setting, as appropriate: **Persist the logging changes**
3 Click **Submit**.

Portal Settings

You can use the Portal page to view characteristics of the Identity Manager User Application.The settings are for informational purposes and cannot be changed.The values of these settings are set in the User Application WAR. (**Default** reflects your current choice from the page.)

Working with the Import and Export Tools

You can use the Tools page to export or import portal content (pages and portlets) used in the Identity Manager User Application. This content is also known as the *portal configuration state* and it includes:

- Container and shared pages (including each page's assigned portlets, and each portlet's preferences and settings)
- Portlet registrations

Table 14-4 *Portal Data Export and Import Tools*

Tool	How it works
Portal Data Export	Generates XML descriptions of a set of selected container and shared pages, and portlets. The XML files are stored in a portal data export ZIP file that can be used as input to the Portal Data Import tool.
Portal Data Import	Accepts a portal data export ZIP file as input. Uses the portal data export ZIP file to generate container and shared pages, and portlets in a portal (User Application).

The Export and Import tools enable you to move the portal configuration state from one portal (User Application) to another, as needed. Table 14-4 on page 167 describes how these tools work.

You can use the Portal Data Export and Import tools to:

- Move your portal configuration state from a test (source) environment to a production (target) environment
- Update the configuration state of a portal incrementally
- Clone a portal
- Optionally, overwrite the configuration state on the target portal

Requirements

To use the Portal Data Export and Import tools, make sure that the Identity Manager User Application (portal) is deployed and running on your source and target application servers.

It is not required that your source and target servers access the same Identity Vault; they can access different ones, if appropriate. The users, groups, and containers in those Identity Vaults are not required to be the same.

Restrictions

You cannot use the Portal Data Export and Import tools to:

- Export or import portal configuration state when a server is currently servicing user requests
- Export or import portal classes and resources
- Export or import portlet classes and resources
- Export or import the identity and provisioning data used in a portal
- Export or import administration settings other than for pages and portlets
- Migrate configuration state from an earlier portal version to a later version (the portals must be the same version)

Exporting Portal Data

This section describes how to export a portal's configuration state to a portal data export ZIP file.

1. If you are performing an incremental update, back up the target portal.
2. On the Application Configuration page, select **Portal Data Export** from the navigation menu on the left.

   The Portal Data Export panel displays.
3. Follow the on-screen instructions to select the portal pages and portlets that you want to export.

   Some portlets that you have not selected for export might still be exported. If you export a page that contains a portlet, but do not select that portlet for export, the portlet is still exported (to ensure that a runtime error does not occur for the exported page).
4. When you are done making selections, click **Export Portal Data**.

   Your new portal data export ZIP file is generated, with a default name that includes the current date and time. For example:

   ```
   PortalData.21-Oct-05.09.12.16.zip
   ```

You are then prompted to save this ZIP file locally (or to open it in an appropriate archive utility). For example:

5 Save the portal data export ZIP file to an appropriate location.

Importing Portal Data

This section describes how to import a portal data export ZIP file to a portal.

NOTE: Remember that, during the import, your target application server must be running but not currently servicing user requests.

1 If you are performing an incremental update, back up the target portal.

2 On the Tools page, select **Portal Data Import** from the navigation menu on the left.

The Portal Data Import panel displays

3 Specify the following general import settings:

Setting	What to Do
Archive	Click **Browse** to select the portal data export ZIP file to import. For example: `PortalData.21-Oct-05.09.12.16.zip`
Import security settings?	Select one of the following: ◆ **Yes**: If you want to import the permissions that the portal data export ZIP file specifies for access to pages and portlets by users, groups, and containers. Make sure that the users, groups, and containers involved exist in the target portal's Identity Vault; permissions for missing entities fail to be imported. ◆ **No**: If you want to ignore the permissions that the portal data export ZIP file specifies.

4 Click **View Import Archive**.

The panel displays more specifics about your selected portal data export ZIP file and how you want to import it:

5 Specify the following detailed import settings:

Setting	What to Do
Replace existing data?	Select one of the following: ◆ **Yes**: If you want the contents of the portal data export ZIP file to overwrite corresponding pages and portlets that already exist in the target portal. For example, if the portal data export ZIP file contains a shared page named MyPage and the target portal contains a shared page named MyPage, that existing page is overwritten in the target portal. ◆ **No**: If you want to skip the import for all existing pages and portlets.

Setting	What to Do
Access level for imported objects	Select one of the following: ◆ **All Users**: For unrestricted access to imported pages and portlets. ◆ **Administrator only**: For restricted access to imported pages and portlets. If you chose to import security settings, then this access level is applied only to those imported pages and portlets where a security setting failed to be imported, typically because specified users, groups, or containers do not exist in the target portal's Identity Vault. If you chose not to import security settings, then this access level is applied to all pages and portlets that are imported.
Import group settings?	(If you chose to import security settings) Select one of the following: ◆ **Yes**: If you want to import the default container page and default shared page assignments that the portal data export ZIP file specifies for groups. Make sure that the groups involved exist in the target portal's Identity Vault; assignments for missing groups fail to be imported. ◆ **No**: If you want to ignore the default page assignments that the portal data export ZIP file specifies for groups.
Import Container Pages **Import Shared Pages** **Import Portlets**	Follow the on-screen instructions to select the pages and portlets that you want to import from the portal data export ZIP file to the target portal. **NOTE:** Some portlets that you have not selected for import might still be imported. If you import a page that contains a portlet, but do not select that portlet for import, the portlet is still imported to ensure that a runtime error does not occur for the imported page.
Please map the portlet application names... Archive/ Local	Use the **Archive** and **Local** drop-down menus to map the portlet application names in the archive (portal data export ZIP file) to existing portlet applications on the local (target) application server.

6 When you're ready to begin the import, click **Import Portal Data**.

When the import completes, the Portal Data Import Results panel displays.

Unsuccessful imports display in red. To troubleshoot import or export problems, look at your application server's system console or log file (such as `tomcat/server/IDMProv/log/catalana.out`) for messages from the following User Application log:

```
com.novell.afw.portal.util
```

7 Test the target portal to ensure that you imported the data that you expected.

Password Management Configuration

This section describes how to configure password self-service and user authentication features to your Identity Manager User Application.

About Password Management Features

The password management features supported by an Identity Manager User Application encompass user authentication and password self-service. When you put these features into use, they enable your application to:

- Prompt for *login* information (username and password) to authenticate against eDirectory
- Provide users with password change self-service
- Provide users with forgotten password self-service (including prompting for challenge responses, displaying a password hint, or allowing a password change, as needed). You can configure forgotten password self-service to run inside the firewall (the default), or you can configure it to run outside the firewall.
- Provide users with challenge question self-service
- Provide users with password hint self-service

Required Setup in eDirectory

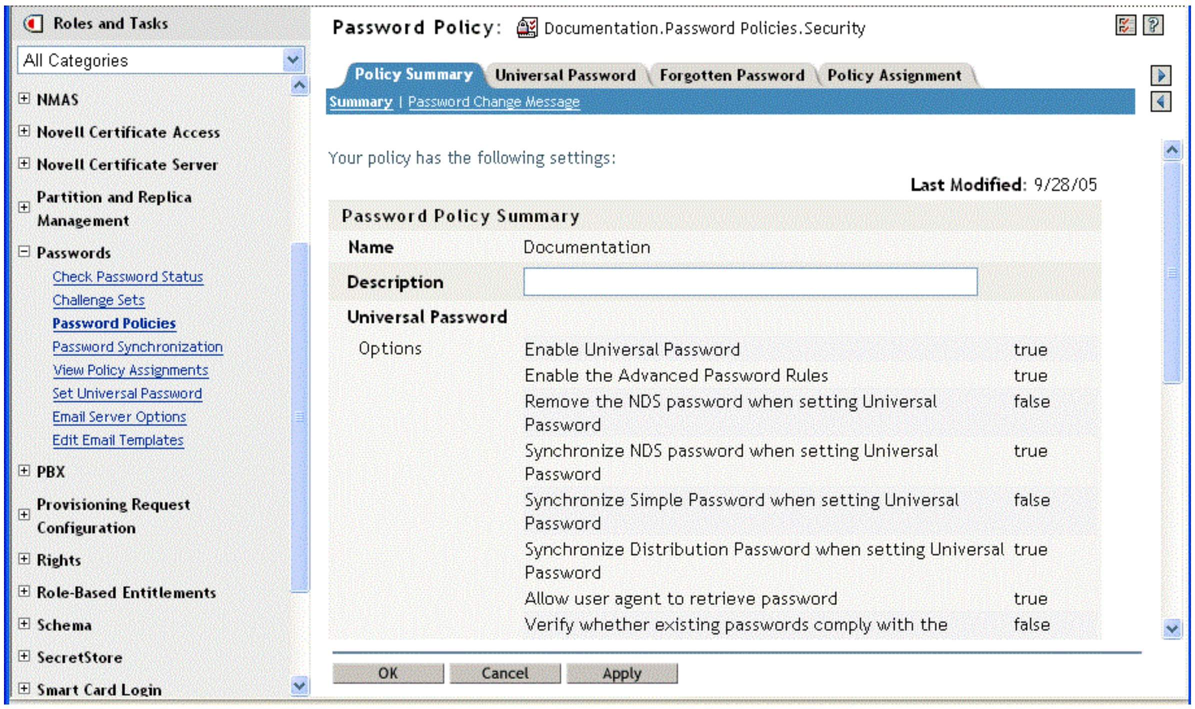
Before you can use most of the password self-service and user authentication features, you need to do the following in eDirectory:

- Enable **Universal Password**
- Create one or more password policies
- Assign the appropriate password policies to users

A password policy is a collection of administrator-defined rules that specify the criteria for creating and replacing user passwords. NetIQ Identity Manager takes advantage of NMAS (NetIQ Modular Authentication Service) to enforce password policies that you assign to users in eDirectory.

You can use NetIQ iManager to perform the required setup steps.

Figure 14-1 *Sample Password Policy*



Password Policy: Documentation.Password Policies.Security

Your policy has the following settings:

Last Modified: 9/28/05

Password Policy Summary

Name	Documentation	
Description		
Universal Password		
Options	Enable Universal Password	true
	Enable the Advanced Password Rules	true
	Remove the NDS password when setting Universal Password	false
	Synchronize NDS password when setting Universal Password	true
	Synchronize Simple Password when setting Universal Password	false
	Synchronize Distribution Password when setting Universal Password	true
	Allow user agent to retrieve password	true
	Verify whether existing passwords comply with the	false

This password policy specifies:

- Universal Password settings
- Settings to deal with forgotten-password situations
- Assignments that apply the policy to specific users

Case-Sensitive Passwords

By default passwords are not case-sensitive. You can create a password policy that allows case-sensitive passwords. You can specify the **Allow the password to be case-sensitive** in the **Password Policies > Universal Password > Advanced Password Rules**. If you enable case-sensitive password, you must also enable the **Allow user to retrieve password** setting. It is enabled by default, but you can verify it through the iManager **Password Policies > Universal Password > Configuration Options** tab.

Password Policy Compliance

If you enable Universal Password, it is recommended that you also configure the system to verify that existing passwords comply with the password policy. You can configure this through iManager. In iManager, go to **Passwords > Password Policies > Universal Password > Configuration Options**. Make sure the following option is selected: **Verify whether existing passwords comply with password policy (verification occurs on login)**. This ensures that users created through the User Application are forwarded to the Change Password page to enter a password that complies with the Identity Manager password policy.

Configuring Challenge Response

The Challenge Response self-service page lets users:

- Set up the valid responses to administrator-defined challenge questions, and set up user-defined challenge questions and responses
- Change the valid responses to administrator-defined challenge questions, and change user-defined challenge questions and responses

NOTE: The password management facility makes passwords case-sensitive, by default, and also allows you to configure case sensitivity for passwords. This is not the case with the Challenge Response facility. Challenge Response answers are not case sensitive, and cannot be configured to support case sensitivity.

TIP: If you have localized the Challenge Response questions in iManager set the **Login** Configuration setting Enable Locale Check to True.

Requirements

The Challenge Response requirements are described Table 14-5 on page 173.

Table 14-5 Challenge Response Requirements

Topic	Requirements
Password policy	A password policy with forgotten password enabled and a challenge set.
Universal Password	Does not require Universal Password to be enabled.
eDirectory configuration	Requires that you grant supervisor rights to the LDAP Administrator for the container in which the logged-in user resides. Granting these privileges allows the user to write a challenge response to the secret store. For example, suppose the LDAP realm administrator is cn=admin, ou=sample, n=netiq and you log in as cn=user1, ou=testou, o=netiq. You need to assign cn=admin, ou=sample, n=netiq as a trustee of **testou**, and grant supervisor rights on **[All attribute rights]**.

Using the Challenge Response Feature

To use the Challenge Response feature, you need to know about the following:

- "How Challenge Response Is Used During Login" on page 173
- "How Challenge Response Is Used in the User Application" on page 173

How Challenge Response Is Used During Login

During the login process, the Login page automatically redirects to Challenge Response whenever the user needs to set up challenge questions and responses (for example, the first time a user attempts to log in to the application after an administrator assigns the user to a password policy in iManager. The password policy must have forgotten password enabled and include a challenge set).

How Challenge Response Is Used in the User Application

By default, the User Application provides users with self-service for changing challenge questions and responses.

Configuring Challenge Response

The Challenge Response Configuration settings (on the **Administration** tab) are described in the following table.

Setting	Description
Mask Response Text	Choosing Yes means that user-entered response text is masked with asterisk (*) characters.

Configuring Login

The Login page performs a very robust user authentication supported by Identity Manager (through Universal Password, password policies, and NMAS). The Login page redirects to the other password pages as needed during the login process.

Requirements

The Login page requirements are listed in Table 14-6 below.

Table 14-6 *Login Requirements*

Topic	Requirements
Password policy	This page does not require a password policy, unless you want to use advanced password rules or let users click the **Forgot Password** link.
Universal Password	This page does not require Universal Password to be enabled, unless you want to use a password policy with advanced password rules.
SSL	This page uses SSL, so make sure that your application server is properly configured to support SSL connections to your LDAP realm.

Use the **Password Module Setup Login Action** to configure the following settings:

Table 14-7 *Login Configuration Settings*

Configuration Setting	Description
Allow ID Wildcard	If True, users can specify the first few characters of a username and a list of usernames that include those characters is displayed so the use can select the user to login as.
Enable Forgot Password Link	If True, the User Application Login page displays the **Forgot Password** link.
Enable Hint Migration	If True, any existing hints are moved from the nsimHint to the nsimPasswordReminder.
Enable Locale Check	If True, and the user has not set their locale preferences, the User Application displays a page that allows them to set their preferred locale.
Enable Password Autocomplete	If True and supported by the browser, the user's browser opens a window asking if the user wants to save the login credentials. If False (the default), the user does not receive a browser prompt to save the login credentials.

Guest Container Page	Allows you to specify a custom guest container page. For example, you might specify any of the following values to direct the user to the MyOrgChart page:
	
	`/IDMProv/portal/cn/DefaultContainerPage/MyOrgChart`
	`/portal/cn/DefaultContainerPage/MyOrgChart`
	`http://localhost:9000/IDMProv/portal/cn/`
	`DefaultContainerPage/MyOrgChart`
	
	The default value is:
	
	`GuestContainerPage`

Logout URL	This value specifies the URL that a user is redirected to after the user presses the Logout button in the User Application.

Configuration Setting	Description

Password Change Return Page	This value specifies the URL that a user is redirected to after a password change. If you specify an URL for this setting, the User Application displays a link to the redirect page, along with a success message when the password has been changed.
	
	This setting only works when accessing the User Application via NetIQ Access Manager. If you access the User Application without going through Access Manager, the Password Change Return Page link will not display.
	
	Furthermore, this setting only works within the context of the User Application and not when you access the ChangePassword.jsp directly. If you access the ChangePassword.jsp directly, you will not see a link displayed that redirects to the Password Change Return Page.
	
	Stand-alone access to the ChangePassword.jsp When accessing ChangePassword.jsp directly, if you want users to receive a success message, you need to add the following URL parameter:
	
	`?changePasswordForcedLogout=true`
	
	For example:
	
	`http://myserver/IDMProv/jsps/pwdmgt/ChangePassword.jsp?changePasswordForcedLogout=true`
	
	Otherwise, the user will not receive a success message after changing their password.
	
	Using NetIQ Access Manager's Expired Password Servlet If you are using NetIQ Access Manager and want to utilize Password Expiration, then the URL for the Password Expiration Servlet within NetIQ Access Manager will need to be similar to the following:
	
	`http(s)://%server%:%port%/%context%/jsps/pwdmgt/ChangePassword.jsp?changePasswordForcedLogout=true&idp_return_url=<RETURN_URL>&store=<STOREID>&dn=<USERID>&action=expire`
	
	For example:
	
	`http://myserver.netiq.com/IDMProv/jsps/pwdmgt/ChangePassword.jsp?changePasswordForcedLogout=true&idp_return_url=<RETURN_URL>&store=<STOREID>&dn=<USERID>&action=expire`

Enable Password Expiration Warning	This setting gives you the ability to enable or disable the expired password warning. This feature is useful in configurations where another product has detected an expired password and already warned the user prior to redirecting to the Identity Manager portlets.
Using SSL Login	This setting gives you the ability to configure the Login to redirect to https. If you set **Using SSL Login** to true, then when user goes to the login.jsp (either directly or through a redirect from NONE SSL page), the login.jsp page will be presented with https with the SSL port configured (Server SSL Port). After user logs in, he see the https (SSL) Home page.
Server SSL Port	Specifies the SSL port that the User Application is running on.

Using the Login Page

To use the Login page, you need to know about the following:

- "How Login Redirects to Other Pages" on page 176
- "Using Grace Logins" on page 176

How Login Redirects to Other Pages

At runtime, the Login page redirects to other password pages, depending on what's needed to complete the login process. Table 14-8 on page 176 directs you to descriptions.

Table 14-8 *Login Directions to Other Pages*

If the user	Login redirects to
Clicks the link Forgot Password	Forgot Password page
Needs to set up challenge questions and responses	Challenge response page
Needs to set up a password hint	Hint Definition page
Needs to reset an invalid password	Change password page

Using Grace Logins

If you use a grace login, the Login page displays a warning message that asks you to change your password and indicates the number of grace logins that remain. If you are on your last login, the Login page redirects you to the Change Password page.

Configuring Password Sync Status

Password Sync Status lets users check the progress of the password change process on connected systems. You can specify a different image to represent each connected system. To set up password sync status checking:

- Define the connected applications whose status the user should be able to view during the synchronization process. You define the connected applications in the Password Sync Status Application Settings described in Table 14-10 on page 178.
- Define the settings for the password sync status page displayed to users. These settings are described in Table 14-9, "Password Sync Status Client Settings," on page 177.

By default, the User Application Administrator can view the password sync status of other users when the User Application Administrator accesses the Password Sync Status page. The administrator can access the sync status for another user by specifying the other user's DN, then clicking **Check Sync Status**.

In addition to the User Application Administrator, you can define a set of users to perform the Check Sync Status for other users (for troubleshooting or other purposes). The members of a group called PasswordManagement are also automatically allowed to view the password synchronization status of other users. This group does not exist by default. If you choose to create this group, it must meet the following conditions:

- Named `PasswordManagement`.
- Given privileges to the Identity Vault. The group must have rights to read the user's eDirectory object attribute for users whose password synchronization status they need to view. The system accesses the DirXML-passwordSyncstatus, the pwdChangedTime, and the DirXML-Associations attributes.

Table 14-9 *Password Sync Status Client Settings*

Configuration Setting	Description
Password Sync Buffer Time (milliseconds)	The password sync status checking compares time stamps across different Identity Vaults and connected systems. This buffer time is intended to account for differences between the system times on these different machines. This time is added to the time stamp on the user object's password change attribute to determine if a change has occurred. It is used like this: The Password Sync Status process uses the buffer time as follows: ◆ If the time stamp value (password sync time) in DirXML-PasswordSyncStatus for the connected system is older than the last password change time stamp (pwdChangedTime attribute of user object) + password sync buffer time, then the status is considered old and the system continues polling for an updated status for the connected system. ◆ If the time stamp value in DirXML-PasswordSyncStatus for the connected system is newer than the last password change time stamp + password sync buffer time, then the password sync functionality returns the status code or message and displays the updated status of the connected system. ◆ The last password change time stamp is populated to the user object after the user's password change. This functionality is available in NMAS 3.1.3 and higher.
Image Per Row	The number of application images to display per row in the Identity Self-Service Password Sync Status page.
Individual Application Timeout (milliseconds)	The amount of time that the Password Sync Status process waits for a response for each connected application's status before checking for the next one.
All Application Timeout (milliseconds)	This value indicates the amount of time allowed for the entire password sync status process (of all connected systems) to complete. Before this timeout is reached, the password sync process continues to poll until all status values are updated or this timeout is reached. When the timeout status is reached, the system displays an error message to the user that indicates that a timeout condition has been reached.

Configuration Setting	Description
Process Count	The number of times each connected system is checked for the password sync status.
Pass Phrase	If the DirXML-PasswordSyncStatus contains a password hash, then the value entered in this field is compared to that value. If they are not equal, the User Application displays an invalid hash message.
Application Image Size Limit (bytes)	Lets you set the maximum size (in bytes) of the application image that can be uploaded. You specify this image in the Application Image setting described in Table 14-10.
Show Password Sync Status After Password Change	If this field is set to true, after the user changes a password, the interface presents the Password Sync Status screen. If this field is set to false, the Password Sync Status screen is not displayed after a password change.

The password Sync Status Application Settings are described in Table 14-10.

Table 14-10 *Password Sync Status Application Settings*

Configuration Setting	Description
Password Synchronization Application Name	The name used to describe the connected application. You can enter the application name in multiple locales. To add a language (locale): 1. Click **Add Language (+)**. 2. Type the Application Name for the desired localized languages in the appropriate field. 3. Click **Save**. If you do not specify localized application names, the value specified in the **Password Synchronization Application Name** is used.
Application DirXML-PasswordSyncStatus GUID	You can get the driver GUID by browsing the attributes on the driver object in one of two ways: ◆ Click the browse button next to this field. This browse button obtains only GUIDs of drivers in the current driverset that the resides in the User Application driver. ◆ Use iManager to browse for the driver (use the **General - Other** tab, used when modifying the object) and manually copy and paste the GUID into this field.
Application Image	The name of the connected application Image to upload. The Application Image size can be configured from the Application Image Size Limit field in the Password Sync Status Client Settings section. Supported file types are .bmp, .jpeg, .jpg, .gif, and .png.

Configuration Setting	Description
Application Filter	Optional. Specify an LDAP filter that allows or prohibits users' viewing the application name on their Check Password Synchronization pages. You can use any standard LDAP filter.
Dependent Driver	Optional. Specify any additional driver this application depends on. If any driver in the dependent driver chain is not visible to the user, the driver specified by Application DirXML-PasswordSyncStatus GUID is also not visible to the user. If any driver in the dependent driver chain fails to check password sync status, the driver specified by Application DirXML-PasswordSyncStatus GUID also fails to check password sync status. You can get the driver GUID by browsing the attributes on the driver object in one of two ways: ◆ Use the object selector button beside the Dependent Driver field. This method saves the application driver's fully distinguished name (FDN). When a user checks password sync status, this FDN is compared to the value of the FDN field in the DirXML-Associations attribute of the user object. If the two FDNs do not match, this application is not visible to the user. If there is a match, and if the DirXML-Associations attribute's driver status field is not 0 and the driver data field is not null, this application is visible to the user. ◆ Manually enter the GUID for the dependent driver. Use this method when this application driver is not from the current driverset that the resides in the User Application driver. This method does not save an FDN. When a user checks password sync status, FDNs are not compared, and this dependent driver is visible to the user unless you apply an Application Filter that excludes the user.

Configuring Password Hint Change

This self-service page lets users set up or change their password hints, which can be displayed or e-mailed as a clue in forgotten password situations.

Requirements

The Password Hint Change requirements are listed in Table 14-11.

***Table 14-11** Password Hint Change Requirements*

Topic	Requirements
Universal Password	Does not require Universal Password to be enabled.

Using the Password Hint Change Page

To use the Password Hint Change page, you need to know about the following:

- "How Password Hint Change Is Used During Login" on page 180
- "Using Password Hint Change in the User Application" on page 180

How Password Hint Change Is Used During Login

During the login process, the Login page automatically redirects to the Password Hint Change page whenever users need to set up their password hints. For example, the first time a user attempts to log in to the application after an administrator assigns the user to a password policy in iManager, the password policy has forgotten password enabled and has the action set to **Email hint to user** or **Show hint on page**.

Using Password Hint Change in the User Application

By default, the User Application provides users with self-service for changing a password hint.

Configuring Change Password

This self-service page lets users change (reset) their Universal Passwords, according to the assigned password policy. It uses that policy to display the rules that the new password must conform to.

If Universal Password is not enabled, this page changes the user's eDirectory (simple) password, as permitted in the user's Password Restrictions.

There are no Password Change configuration settings.

Requirements

The Change Password page requirements are listed in Table 14-12.

Table 14-12 Change Password Requirements

Topic	Requirements
Directory Abstraction Layer configuration	No directory abstraction layer configuration is required for this page.
Password policy	This page does not require a password policy, unless you want to use advanced password rules (with Universal Password enabled).
Universal Password	To use this page for a Universal Password, the setting **Allow user to initiate password change** must be enabled in the Advanced Password Rules of the user's assigned password policy. To use this page for an eDirectory (simple) password, the setting **Allow user to change password** must be enabled in the user's Password Restrictions.

Using the Change Password Page

To use the Change Password page, you need to know about the following:

- "How Change Password Is Used During Login" on page 181
- "Using Change Password in the User Application" on page 181

How Change Password Is Used During Login

During the login process, the Login page automatically redirects to the Change Password page whenever the user needs to reset an invalid password. For example, the first time a user attempts to log in to an application after an administrator implements a password policy that requires users to reset their passwords.

The Forgot Password page also redirects to Change Password automatically if the user's assigned password policy specifies reset password as the action for forgotten password situations.

Using Change Password in the User Application

By default, the User Application provides users with the password change self-service using the Change Password page.

NOTE: On Firefox, if you allow the browser to save passwords, you may see a confusing pop-up message that asks the following question when you confirm a password change: "Would you like to have password manager change the stored password for <*user*>?". The user specified in the message may not be the same as the user who logged into the User Application. This message is generated by the Firefox password manager. To turn off this message, you need to disable the password manager in Firefox by deselecting the **Remember passwords sites** checkbox under **Passwords** on the **Tools>Options>Security** page.

Web Services

This section describes how to access basic information about the SOAP endpoints for the User Application. This information includes the WSDL document, remote interface, and type mappings for each endpoint.

Directory Layer Service

To access information about the Directory Layer Service:

1. Select the **Application Configuration** tab.
2. Select **Web Services** from the left navigation menu.
3. Select **Directory Layer Service**.

   The user interface displays the Directory Layer Service page.

   For more information about the Directory Layer Service, see Chapter 23, "Directory Abstraction Layer (VDX) Web Service," on page 357.

Metrics Service

To access information about the Metrics Service:

1. Select the **Application Configuration** tab.
2. Select **Web Services** from the left navigation menu.
3. Select **Metrics Service**.

   The user interface displays the Metrics Service page.

   For more information about the Metrics Service, see Chapter 21, "Metrics Web Service," on page 329.

Notification Service

To access information about the Notification Service:

1. Select the **Application Configuration** tab.
2. Select **Web Services** from the left navigation menu.
3. Select **Notification Service**.

   The user interface displays the Notification Service page.

   For more information about the Notification Service, see Chapter 22, "Notification Web Service," on page 347.

Provisioning Service

To access information about the Provisioning Service:

1. Select the **Application Configuration** tab.
2. Select **Web Services** from the left navigation menu.
3. Select **Provisioning Service**.

The user interface displays the Provisioning Service page.

For more information about the Provisioning Service, see Chapter 20, “Provisioning Web Service,” on page 261.

Role Service

To access information about the Role Service:

1. Select the **Application Configuration** tab.
2. Select **Web Services** from the left navigation menu.
3. Select **Role Service**.

   The user interface displays the Role Service page.

   For more information about the Role Service, see Chapter 24, “Role Web Service,” on page 381.

15 Page Administration

This section describes how to use the Page Admin page on the **Administration** of the Identity Manager user interface.

About Page Administration

You use the Page Admin page to control the pages displayed in the Identity Manager User Application and who has permission to access them. The user interface includes two types of pages.

Table 15-1 *Page Types*

Type of Page	Description
Container	Container pages wrap shared pages with a consistent look and feel, corporate branding, and navigation approach.
Shared	Shared pages provide a coherent set of content that is used for a specific purpose (such as updating a user's profile). They are called shared pages because they offer services used by multiple people.

About Container Pages

This section introduces you to some container pages that play an important role in the Identity Manager user interface:

- "GuestContainerPage" on page 185
- "DefaultContainerPage" on page 186
- "Admin Container Page" on page 186

Keep in mind that you can modify these container pages if necessary. You also have the option of adding your own container pages.

To learn about working with container pages, see Section , "Creating and Maintaining Container Pages," on page 187.

GuestContainerPage

After logging in to the identity applications, the users arrive at the Identity Manager user interface and see the container page named GuestContainerPage.

The GuestContainerPage layout is divided into three regions, which display the following portlets:

Table 15-2 Layout Regions

Portlet	Description
HeaderPortlet	Displays the header information and top-level controls for the user interface
Shared Page Navigation	Displays a vertical menu from which the user can select a shared page to display
Portal Page Controller	Displays the shared page that the user has currently selected via the Shared Page Navigation portlet

DefaultContainerPage

By default, after users log in to the Identity Manager user interface, they go to the container page named DefaultContainerPage.

The DefaultContainerPage layout is divided into three regions, which display the portlets described in Table 15-3.

Table 15-3 Default Container Page Portlets

Portlet	Description
HeaderPortlet	Displays the header information and top-level controls for the user interface
Shared Page Navigation	Displays a vertical menu from which the user can select a shared page to display
Portal Page Controller	Displays the shared page that the user has currently selected via the Shared Page Navigation portlet
Session Timeout Warning	Displays an alert message whenever a user's session is about to time out

After user login, DefaultContainerPage automatically opens the **Identity Self-Service** in HeaderPortlet.

Admin Container Page

By default, when User Application Administrators (and other authorized users) click the **Administration** tab of the Identity Manager user interface, they go to the container page named Admin Container Page.

The Admin Container Page layout is divided into two regions, which display the portlets described in Table 15-4.

Table 15-4 *Default Admin Container Page Portlets*

Portlet	Description
HeaderPortlet	Displays the header information and top-level controls for the user interface
Admin List Display	Displays a second level of tabs from which the user can select an administration action to perform
Portal Page Controller	Displays a shared page that corresponds to the currently selected by the user via the Admin List Display portlet
Session Timeout Warning	Displays an alert message whenever a user's session is about to time out

About Shared Pages

The Identity Manager user interface includes many shared pages, which provide the major content within its container pages. You can modify these shared pages if necessary. You also have the option of adding your own shared pages.

To learn about working with shared pages, see Section , "Creating and Maintaining Shared Pages," on page 192.

A Typical Shared Page

As an example of one of these shared pages, Organization Chart is the default shared page that DefaultContainerPage displays after users log in to the Identity Manager user interface.

The Organization Chart layout consists of just one region, which displays just one portlet (the Org Chart portlet).

An Exception to Page Usage

In this section, you have seen how these top-level tabs of the Identity Manager user interface are based on pages:

- The **Identity Self-Service** uses the DefaultContainerPage
- The **Administration** uses the Admin Container Page

However, the **Work Dashboard** is based on a different architecture and cannot be manipulated through Page Admin.

Creating and Maintaining Container Pages

The process of creating and maintaining container pages involves the following steps:

1. Create a new container page or select an existing container page, as described in Section , "Creating Container Pages," on page 188.
2. Add content (in the form of portlets) to the page, as described in Section , "Adding Content to a Container Page," on page 190.

   You can also delete content from the page, as described in Section , "Deleting Content from a Container Page," on page 190.

3 Choose a portal layout, as described in Section , "Modifying the Layout of a Container Page," on page 191.

4 Arrange the order and position of content on the selected layout, as described in Section , "Arranging Content on the Container Page," on page 191.

5 Immediately display the new page by specifying the container page URL in your browser, as described in Section , "Displaying a Container Page," on page 192.

You can switch layouts for container pages without losing page contents. When you apply a new layout to a container page, portlets in the page are automatically displayed using the new layout. You might need to fine-tune the content placement in the new layout.

Creating Container Pages

You can create container pages from scratch or by copying existing pages. This section describes both procedures.

To create a container page from scratch:

1 On the Page Admin page, select **Maintain Container Pages**.

   The Maintain Container Pages panel displays.

2 Select the **New** page action (in the bottom left section of the panel).

   An untitled, uncategorized container page is created.

3 Specify the page properties of the container page:

Property	What to do
Page Link Name (URI)	Specify the URI name for the page (as it is to appear within the user interface URL). For example, if you specify the URI: `MyContainerPage` it appears within the URL like this: `http://myappserver:8080/IDMProv/portal/cn/` *`MyContainerPage`* **NOTE:** The User Application does not support multibyte characters in the Page Link Name (URI) for a portal page. Multi-byte characters are supported in the Page Name.
Page Name	Specify the display name for the page. For example: `My Container Page` Click **Localize** to specify localized versions of this name for other languages.
Navigation Priority	Specify one of the following: ◆ **None** if you don't need to assign a priority to this container page. ◆ **Set value** to assign a priority to this container page, relative to other container pages. The priority must be an integer between 0 and 9999, where 0 is the lowest priority and 9999 is the highest. Setting priority values is useful if you want to ensure a particular order when pages are listed by priority, or if you want to ensure a particular selection when multiple default pages exist (in the case of a user who belongs to multiple groups).
Default Shared Page	See Section , "Selecting a Default Shared Page for a Container Page," on page 198.
Assign Categories	Select zero or more of the following categories in which you want the page to belong: ◆ Administration ◆ General Assigning categories is useful if you want to ensure proper organization when pages are listed by category, or if you want to ensure an appropriate subset when pages are filtered by category. **You Cannot Create New Administration Pages** The administrator cannot new Administration pages. If you attempt to create a new page in the Administration category, the page will not be displayed under Application Configuration.
Description	Type text that describes the page.

4 Click **Save Page** (at the bottom of the page properties section).

To create a container page by copying an existing page:

1. On the Page Admin page, select **Maintain Container Pages**.

   The Maintain Container Pages panel displays (as shown in the previous procedure).
2. In the list of container pages, select the page you want to copy.

   If the list is long, you can refine it (by category or starting text) to more easily find the desired page.
3. Select the **Copy** page action (in the bottom left section of the panel).

   A new container page is created with the name `Copy of OriginalPageName`.
4. Specify the page properties of the container page (as described in the previous procedure).
5. Click **Save Page** (at the bottom of the page properties section).

Adding Content to a Container Page

After you create a container page, the next step is to add content by selecting portlets to place on the page. You can use prebuilt portlets supplied with the Identity Manager User Application or other portlets you have registered.

To add content to a container page:

1. Open a new or existing page on the Maintain Container Pages panel, then click the **Select Content** page task (at the bottom of the panel).

   The Content Selector displays in a new browser window.
2. If you want to display a specific category of available content, select a category from the **Filter** list.
3. Select one or more portlets from the **Available Content** list.

   Hold down Control to select multiple non-contiguous portlets from the list; use Shift to make multiple contiguous selections.
4. Click **Add** to move your choices to the **Selected Content** list.
5. You can click **Content Preferences** to edit the preferences of any portlet you have selected for your container page. The preference values you specify take effect for the instance of the portlet that appears on your page.
6. Click **Save Contents**.

   Now that you have chosen the content for your container page, you can select a new layout as described in Section , “Modifying the Layout of a Container Page,” on page 191, or arrange the content on the current layout as described in Section , “Arranging Content on the Container Page,” on page 191.

Deleting Content from a Container Page

In the process of creating container pages, you might want to delete content by removing portlets from a page. You can use the Content Selector or Layout Selector, as described in the following procedures.

To delete content from a container page using the Content Selector:

1. Open a page on the Maintain Container Pages panel, then click the **Select Content** page task (at the bottom of the panel).

   The Content Selector displays in a new browser window as shown in Step 1 on page 190.

2 Select a portlet you want to delete from the **Selected Content** list and click **Remove**.

   The portlet is removed from the page.

3 Click **Save Contents**.

To delete content from a container page using the Layout Selector:

1 Open a page on the Maintain Container Pages panel, then click the **Arrange Content** page task (at the bottom of the panel).

   The Layout Selector displays in a new browser window, showing the portlets on that page.

2 Click the **X** button for a portlet you want to remove.

3 When you're prompted for confirmation, click **OK**.

   The portlet is removed from the page.

4 Click **Save Layout**.

Modifying the Layout of a Container Page

When you modify the layout of a container page, existing content is shifted to accommodate the new layout. In some cases, you might need to fine-tune the end result.

To modify the layout of a container page:

1 Open a page on the Maintain Container Pages panel, then click the **Select Layout** page task (at the bottom of the panel).

   The Portal Layouts list displays in a new browser window.

2 Scroll through the choices and select the layout you want.

3 Click **Select Layout**.

Arranging Content on the Container Page

After you have designated the content and layout for your container page, you can position the content in the selected layout, add other portlets in specific locations, or delete portlets.

1 Open a page on the Maintain Container Pages panel, then click the **Arrange Content** page task (at the bottom of the panel).

   The Layout Selector displays in a new browser window, showing the portlets on that page.

2 To add a portlet to the page:

   2a Click **Add Content** in the desired layout frame.

      The Portlet Selector displays in a new browser window.

   2b If you want to display a specific category of available content, select a category from the **Filter** drop-down list.

   2c Select a portlet you want from the **Available Content** list.

   2d Click **Select Content**.

      The Portlet Selector closes and the portlet you selected appears in the target layout frame of the Layout Selector.

3 If you want to move a portlet to a different location in the layout, follow these browser-specific steps:

Browser	What to do
Internet Explorer	1. Move your cursor over the title bar of the portlet until the cursor changes to a hand shape. 2. Hold down the left mouse button and drag the portlet to the desired location in the layout.
Mozilla	1. Click the portlet you want to move. 2. Click inside the destination layout frame.
	The portlet moves to the destination.

4 If you want to remove a portlet from the layout, follow these steps:

4a Click the **X** button for the portlet you want to remove.

4b When you're prompted for confirmation, click **OK**.

The portlet is removed from the layout.

5 To edit the preferences of a portlet:

5a Click the pencil button for the portlet you want to edit.

The portlet's **Content Preferences** display in your browser.

5b Change preference values, as appropriate.

The preference values you specify take effect for the instance of the portlet that appears on your page.

5c Click **Save Preferences**.

6 Click **Save Layout** to record your changes and close the Layout Selector.

Displaying a Container Page

You can display your page by going to the container page URL in your browser. Specify the following URL in your web browser:

```
http://server:port/IDM-war-context/portal/cn/container-page-name
```

For example, to display the container page named MyContainerPage:

```
http://myappserver:8080/IDMProv/portal/cn/MyContainerPage
```

Creating and Maintaining Shared Pages

The process of creating and maintaining shared pages involves the following steps:

1 Create a new shared page or select an existing shared page, as described in Section , "Creating Shared Pages," on page 193.

2 Add content (in the form of portlets) to the page, as described in Section , "Adding Content to a Shared Page," on page 195.

You might also want to delete content from the page, as described in Section , "Deleting Content from a Shared Page," on page 196.

3 Choose a portal layout, as described in Section , "Modifying the Layout of a Shared Page," on page 196.

4 Arrange the order and position of content on the selected layout, as described in Section , "Arranging Content on the Shared Page," on page 196.

5 Display the new page by entering the shared page URL in your browser, as described in Section , "Displaying a Shared Page," on page 197.

Shared Pages and Layouts

Shared pages are not tightly bound to portal layouts. That means you can switch layouts for shared pages without losing any page contents. When a new layout is applied, any portlets that have been added to the page are automatically displayed using the new layout. You might need to fine-tune the content placement in the new layout.

Creating Shared Pages

You can create shared pages from scratch or by copying existing pages. This section describes both procedures.

To create a shared page from scratch:

1 On the Page Admin page, select **Maintain Shared Pages**.

2 Select the **New** page action (in the bottom left section of the panel).

An untitled, uncategorized shared page is created.

3 Specify the page properties of the shared page:

Property	What to do

Page Link Name (URI)	Specify the URI name for the page (as it is to appear within the user interface URL). For example, if you specify the URI:
	`MySharedPage`
	it appears within the URL like this:
	`http://myappserver:8080/IDMProv/portal/cn/ MyContainerPage/MySharedPage`
	NOTE: The User Application does not support multibyte characters in the Page Link Name (URI) for a portal page. Multi-byte characters are supported in the Page Name.

Page Name	Specify the display name for the page. For example: `My Shared Page` You can click **Localize** to specify localized versions of this name for other languages.
Navigation Priority	Specify one of the following: ◆ **None** if you don't need to assign a priority to this shared page. ◆ **Set value** to assign a priority to this shared page, relative to other shared pages. The priority must be an integer between 0 and 9999, where 0 is the highest priority and 9999 is the lowest. Setting priority values is useful if you want to ensure a particular order when pages are listed by priority, or if you want to ensure a particular selection when multiple default pages exist (in the case of a user who belongs to multiple groups).
Parent Page	If you want this shared page to be the child of another shared page, click **Select Parent**. Make sure that both the parent and child pages belong to the **same categories** (to prevent display problems). At runtime, the end user sees this relationship when using the Shared Page Navigation portlet. When displaying the list of shared pages, it shows children indented under their parents. Child pages do not inherit content, preferences, or settings from their parent pages. Conversely, parent pages do not automatically display the content of child pages along with their own content.

Property	What to do
Assign Categories	Select zero or more of the following categories in which you want the page to belong: ◆ Administration ◆ Directory Management ◆ General ◆ Guest Pages ◆ Information Management ◆ Password Management Assigning categories is useful if you want to ensure proper organization when pages are listed by category, or if you want to ensure an appropriate subset when pages are filtered by category. **NOTE:** **Guest Pages** is a special category used to identify shared pages that can be displayed prior to user login but not after.
Description	Type text that describes the page.

4 Click **Save Page** (at the bottom of the page properties section).

To create a shared page by copying an existing page:

1 On the Page Admin page, select **Maintain Shared Pages**.

The Maintain Shared Pages panel displays as shown in "To create a shared page from scratch:" on page 193.

2 In the list of shared pages, select the page you want to copy.

If the list is long, you can refine it (by category or starting text) to more easily find the desired page.

3 Select the **Copy** page action (in the bottom-left section of the panel).

A new shared page is created with the name Copy of OriginalPageName.

4 Specify the page properties of the shared page as described in "To create a shared page from scratch:" on page 193.

5 Click **Save Page** (at the bottom of the page properties section).

Adding Content to a Shared Page

After you create a shared page, the next step is to add content by selecting portlets to place on the page. You can use prebuilt portlets supplied with the Identity Manager User Application or other portlets you have registered.

1 Open a new or existing page on the Maintain Shared Pages panel, then click the **Select Content** page task (at the bottom of the panel).

2 If you want to display a specific category of available content, select a category from the **Filter** drop-down list.

3 Select one or more portlets from the **Available Content** list.

Hold down the Ctrl key to select multiple non-contiguous portlets from the list; use the Shift key to make multiple contiguous selections.

4 Click **Add** to move your choices to the **Selected Content** list.

5 You can click **Content Preferences** to edit the preferences of any portlet you have selected for your shared page. The preference values you specify take effect for the instance of the portlet that appears on your page.

6 Click **Save Contents**.

Now that you have chosen the content for your shared page, you can select a new layout as described in Section , “Modifying the Layout of a Shared Page,” on page 196, or arrange the content on the current layout as described in Section , “Arranging Content on the Shared Page,” on page 196.

Deleting Content from a Shared Page

In the process of creating shared pages, you might want to delete content by removing portlets from a page. You can use the Content Selector or Layout Selector, as described in the following procedures.

1 Open a page on the Maintain Shared Pages panel, then click the **Select Content** page task (at the bottom of the panel).

  The Content Selector displays in a new browser window.

2 Select a portlet you want to delete from the **Selected Content** list and click **Remove**.

  The portlet is removed from the page.

3 Click **Save Contents**.

To delete content from a shared page by using the Layout Selector:

1 Open a page on the Maintain Shared Pages panel, then click the **Arrange Content** page task (at the bottom of the panel).

  The Layout Selector displays in a new browser window, showing the portlets on that page.

2 Click the **X** button for a portlet you want to remove.

3 When you’re prompted for confirmation, click **OK**.

  The portlet is removed from the page.

4 Click **Save Layout**.

Modifying the Layout of a Shared Page

When you modify the layout of a shared page, existing content is shifted to accommodate the new layout. In some cases, you might need to fine-tune the end result.

To modify the layout of a shared page:

1 Open a page on the Maintain Shared Pages panel, then click the **Select Layout** page task (at the bottom of the panel).

2 Scroll through the choices and select the layout you want.

3 Click **Select Layout**.

Arranging Content on the Shared Page

After you have designated the content and layout for your shared page, you can position the content in the selected layout, add other portlets in specific locations, or delete portlets.

To arrange content on a shared page:

1 Open a page on the Maintain Shared Pages panel, then click the **Arrange Content** page task (at the bottom of the panel).

The Layout Selector displays in a new browser window, showing the portlets on that page.

2 If you want to add a portlet to the page:

2a Click **Add Content** in the desired layout frame.

The Portlet Selector displays in a new browser window.

2b If you want to display a specific category of available content, select a category from the **Filter** drop-down list.

2c Select a portlet you want from the **Available Content** list.

2d Click **Select Content**.

The Portlet Selector closes and the portlet you selected appears in the target layout frame of the Layout Selector.

3 If you want to move a portlet to a different location in the layout, follow these browser-specific steps:

Browser	What to do
Internet Explorer	1. Move your cursor over the title bar of the portlet until the cursor changes to a hand shape. 2. Hold down the left mouse button and drag the portlet to the desired location in the layout.
Mozilla Firefox	1. Click the portlet you want to move. 2. Click inside the destination layout frame.
	The portlet moves to the destination.

4 If you want to remove a portlet from the layout:

4a Click the **X** button for the portlet you want to remove.

4b When you're prompted for confirmation, click **OK**.

The portlet is removed from the layout.

5 If you want to edit the preferences of a portlet:

5a Click the pencil button for the portlet you want to edit.

The portlet's Content Preferences display in your browser.

5b Change preference values, as appropriate.

The preference values you specify take effect for the instance of the portlet that appears on your page.

5c Click **Save Preferences**.

6 Click **Save Layout** to record your changes and close the Layout Selector.

Displaying a Shared Page

To display your shared page, go to this URL in your Web browser:

`http://server:port/IDM-war-context/portal/pg/shared-page-name`

For example, to display the shared page named *MySharedPage*:

```
http://myappserver:8080/IDMProv/portal/pg/MySharedPage
```

Setting Default Pages for Groups

You can assign a default container page and a default shared page for any authorized group of users. These settings affect the container page those users see when they log in and the shared page they see on the container page.

When users belong to multiple groups with default page assignments, Navigation Priority is used in determining which container page and shared page to display.

To assign a default container page or a default shared page to a group:

1. Open a page on the Maintain Container Pages panel or the Maintain Shared Pages panel, then click the **Set As Default** page task (at the bottom of the panel).

   The Page Defaults dialog box displays in a new browser window.
2. Specify values for the following search settings:

Setting	What to do
Search for	Groups is automatically selected.
Starts with	If you want to: ◆ Find all available groups, then make this setting blank. ◆ Find a subset of those groups, then enter the starting characters of the CN values you want. (Case is not considered. Wildcards are not supported.) For example, searching for groups that start with `S` would narrow your search results to something like this: `cn=Sales,ou=groups,o=MyOrg cn=Service,ou=groups,o=MyOrg cn=Shipping,ou=groups,o=MyOrg` Searching for groups that start with `Se` would return: `cn=Service,ou=groups,o=MyOrg`

3. Click **Go**.

   The results of your search appear in the **Results** list.
4. Select the groups for whom this page is to be a default, then click the **Add** (>) button.

   Hold down the Ctrl key to make multiple selections.
5. Click **Save**, then click **Close**.

Selecting a Default Shared Page for a Container Page

You can assign a default shared page to each container page you have. The user interface considers this page assignment when determining what to display.

1. Open a container page on the Maintain Container Pages panel.
2. In the page properties section, look for Default Shared Page and click **Select Default**.

   The Choose a Default Shared Page dialog box displays in a new browser window.
3. If the shared page list is long, you can refine it by category or starting text to more easily find the desired page.

4. Select a shared page to use as the default for the container page or select **None** for no default.
5. Click **Save** to accept your selection and close the dialog.
6. Click **Save Page** (at the bottom of the page properties section).

16 RBPM Provisioning and Security Configuration

This section describes the tasks that you can perform from the RBPM Provisioning and Security page.

About RBPM Provisioning and Security Configuration

The Administration tab now provides a new **RBPM Provisioning and Security** tab, which replaces the **Provisioning** and the **Security** tab. This incorporates left navigation options that were previously available on the **Provisioning** and the **Security** tab. In addition, it includes several new left navigation options that give administrators the ability to assign security permissions in accordance with the new consolidated security model.

Provisioning Configuration

The Provisioning Configuration actions allow you to configure the Delegation and Proxy Service, the Digital Signature Service, the provisioning user interface settings, and the Workflow Engine and clustering.

To access the Provisioning Configuration actions, you need to be a Configuration Administrator.

Configuring Delegation and Proxy Settings

Configuring the Delegation and Proxy Service

To configure the Delegation and Proxy Service:

1. Select the **RBPM Provisioning and Security** tab.
2. Select **Delegation and Proxy** from the left navigation menu.

   The user interface displays the Delegation and Proxy page. To configure the service, you need to make some changes in the Delegation and Proxy Service Settings box.
3. Check the **Allow All Requests** option if you want to display the **All** option in the Resource Search Criteria drop-down list for the Team Delegate Assignments action. When the **All** option is available, a delegate assignment can be defined that applies to all resource categories.
4. Define the retention period for delegate, proxy, and availability assignments:

Field	Description
Retention time for Delegation assignments	Specifies the number of minutes to retain delegate assignments in the directory after they have expired. The default is 0, which indicates that the assignments will be removed after the expiration time has been reached.

Field	Description
Retention time for Proxy assignments	Specifies the number of minutes to retain proxy assignments in the directory after they have expired. The default is 0, which indicates that the assignments will be removed after the expiration time has been reached.
Retention time for Availability settings	Specifies the number of minutes to retain availability settings in the directory after they have expired. The default is 0, which indicates that the assignments will be removed after the expiration time has been reached.

5 Select the email templates you want to use for delegation, proxy, and availability notifications:

Field	Description
Delegation notification template	Specifies the language-independent name for the template to use for delegation email notifications. After the template name has been specified, the notification engine can determine which language-specific template to use at runtime. For details on creating and editing email templates, see "Working with Email Templates" on page 243.
Proxy notification template	Specifies the language-independent name for the template to use for proxy email notifications. After the template name has been specified, the notification engine can determine which language-specific template to use at runtime. For details on creating and editing email templates, see "Working with Email Templates" on page 243.
Availability notification template	Specifies the language-independent name for the template to use for availability email notifications. After the template name has been specified, the notification engine can determine which language-specific template to use at runtime. For details on creating and editing email templates, see "Working with Email Templates" on page 243.

Scheduling Synchronization and Cleanup

To configure the Synchronization and Cleanup Service:

1 Select the **RBPM Provisioning and Security** tab.

2 In the **Provisioning Configuration** group of actions, select **Delegation and Proxy** from the left navigation menu.

The user interface displays the Delegation and Proxy page. To schedule synchronization and cleanup, you need to make some changes in the Synchronization and Cleanup Service box.

3 To specify how often you want to activate the synchronization service, type the activation interval (in minutes) in the **Synchronization Service Activation Interval** field. The default value is 0, which means that the service is not activated.

When the synchronization service runs, any modifications (or deletions) made to delegate assignments are synchronized with the corresponding availability settings for the user.

4. To specify how often you want to activate the cleanup service, select **Cleanup Service Activation Interval**, then type the activation interval (in minutes). Alternatively, select **Cleanup Date** and use the calendar tool to specify the date when you want to activate the service. The default value is 0, which means that the service is not activated.

   If no cleanup date is specified, the date is set to null. If no cleanup interval is specified, the interval is set to 0. When a cleanup date is specified, the interval is set to be 0. When an interval value other than 0 is specified, the date is set to null. If you check the cleanup interval option without putting in a number (the default is 0), the interface will show the original cleanup date after you submit the page, just as if you had not performed a submit.

   When the cleanup service runs, all obsolete proxy and delegate assignments are removed from the system.

If the cleanup service has been activated, the **Last cleanup performed** field indicates when the last cleanup was performed.

Configuring the Provisioning UI Display Settings

This section provides instructions on configuring various user interface settings. Some of the settings control system-wide behavior within the User Application. Others are specific to the Work Dashboard.

To access the Provisioning UI Display Settings:

1. Select the **Administration** tab.
2. Select the **RBPM Provisioning and Security** tab.
3. Select **Provisioning UI Display Settings** from the left navigation menu.

   The user interface displays the Provisioning UI Display Settings page. To configure the display settings for the Work Dashboard, you can make changes in the Task Settings and Request Status Settings box, which appear after the General Display Settings.

After you change the settings, you must restart Tomcat in order for the changes to take effect.

Configuring the General Display Settings

The **Administration** tab in the User Application provides several settings you can use to control how result sets are processed and displayed on pages within the application. To configure the settings for result sets and pagination:

1. On the **Provisioning UI Display Settings** page, scroll down to the **General Display Settings** section of the page.
2. Modify any of the following settings, and click **Save**.

Setting	Description
Default number of results displayed per page	Specifies the default number of rows to display in lists shown on the **Roles and Resources** tab. When a user initiates a query on any of the pages listed above, the User Application caches the data obtained by the query, and returns the number of rows specified for this setting to the browser. Each time the user requests to see the next page, another set of rows is returned from the cache. The default value for this setting is 25.
Options for number of results displayed per page (use spaces to separate values)	Allows you to specify additional values that the user can select to override the default number of rows displayed on the My Roles, View Request Status, Browse Role Catalog, and Manage Role Relationships pages. The list of values you type must be separated by spaces. Note that the number specified in the **Default number of results displayed per page** control is always included in the list of values for the user to select. The default value for this setting is 5 10 50 100 500. **NOTE:** This setting also applies to the Team Tasks page on the Work Dashboard tab and to the Object Selector. The default number of rows displayed on the Team Tasks page and in the Object Selector, however, is not controlled by the **Default number of results displayed per page** setting. The default number of rows for team tasks is set at 5, and the default number of rows for the Object Selector is set at 10.

Setting	Description
Threshold for browser-based sorting and filtering	Specifies the maximum amount of memory (expressed in rows) for the client browser to use for sorting and filtering. If you specify a very high value, client-side sorting and filtering will be very fast, but an excessive amount of memory might be used on the client. If you specify a very low value, the client-side memory usage might be low, but sorting and filtering might also be too slow. This setting applies only if the size of the result set is less than or equal to the threshold value. If the size of the result set is larger than the threshold value specified, sorting and filtering operations are performed on the server. The default value for this setting is 1000.

Configuring the Task Settings

To configure the administrative settings for the Tasks list on the Work Dashboard:

1. Scroll down to the **Task Settings** box.
2. To specify whether you want the Task List to be displayed when users first open the dashboard, select either the **Yes** or **No** radio button for the **Expand Task List in default view of Work Dashboard** option.
3. To set the default sort column for the task list, pick the column in the **Task Notifications List default sort** field. Indicate whether the sort order will be ascending or descending by selecting or deselecting the **Descending** checkbox.

   The default sort column is required in the task list display. When you select a default sort column, this column is automatically added to the **User default columns** list.

   To allow the user to override the default sort column and sort order, click the the **Allow user to override** checkbox.
4. To include a column in the task list, select it in the **Available Columns** list box, and drag them to the **User default columns** list box. To remove a column, select it in the **User default columns** list box and drag it to the **Available Columns** list box. You can select multiple columns to include or exclude by using the Ctrl or Shift key while clicking on the columns.

   To allow the user to override the column selections you've made, click the **Allow user to override** checkbox. When you click this checkbox, the user interface displays the **Available columns for User override** list box. Any columns you add to the **Available columns for User override** list box are included in the **Available columns** list that the user sees on the Work Dashboard. To allow the user to override the default column list, select and drag one or more columns to the **Available columns for User override** list box from either the **User default columns** list box or the **Available Columns** list box. When you add a column to the **Available columns for User override** list box, that column is automatically removed from the list box from which you dragged it.
5. To specify how the task details should be displayed when the user clicks on a task, select one of the following options:

Option	Description
In line with list	Displays the details within the Task Notifications list, directly under the task selected. This is the default.
In modal dialog	Displays the details in a separate dialog box that must appears on top of the Task Notifications list. After viewing the details for a task, the user needs to close the dialog to see the list again.

6 To allow the user to claim a task automatically by simply opening the task details, select **yes** for the **Auto-claim when opening Task Details** option. When this option is set to **no**, the user must explicitly select **Claim** to claim a task.

Configuring the Request Status Settings

To configure the administrative settings for the Request Status list on the Work Dashboard:

1 Scroll down to the Request Status Settings box.

2 To set the default sort column for the request status list, pick the column in the **Request Status List default sort** field. Indicate whether the sort order will be ascending or descending by selecting or deselecting the **Descending** checkbox.

The default sort column is required in the request status list display. When you select a default sort column, this column is automatically added to the **User default columns** list.

To allow the user to override the default sort column and sort order, click the the **Allow user to override** checkbox.

3 To include a column in the request status list, select it in the **Available Columns** list box, and drag them to the **User default columns** list box. To remove a column, select it in the **User default columns** list box and drag it to the **Available Columns** list box. You can select multiple columns to include or exclude by using the Ctrl or Shift key while clicking on the columns.

To allow the user to override the column selections you've made, click the **Allow user to override** checkbox. When you click this checkbox, the user interface displays the **Available columns for User override** list box. Any columns you add to the **Available columns for User override** list box are included in the **Available columns** list that the user sees on the Work Dashboard. To allow the user to override the default column list, select and drag one or more columns to the **Available columns for User override** list box from either the **User default columns** list box or the **Available Columns** list box. When you add a column to the **Available columns for User override** list box, that column is automatically removed from the list box from which you dragged it.

4 To specify how the request status details should be displayed when the user clicks on one of the items requested, select one of the following options:

Option	Description
In line with list	Displays the details within the Request Status list, directly under the request selected. This is the default.
In modal dialog	Displays the details in a separate dialog box that must appears on top of the Task Notifications list. After viewing the details for a task, the user needs to close the dialog to see the list again.

Configuring the Workflow Engine and Cluster Settings

This section provides instructions on configuring the Workflow Engine and on configuring cluster settings. These settings apply to all engines in the cluster. When any of these settings are changed, other engines in the cluster will detect these changes in the database and use the new values. The engines check for changes to these settings at the same rate as specified by the pending process interval.

When the workflow engine starts up it checks to see if its engine ID is already in use by another node in the cluster. When this is the case, the workflow engine checks the cluster database to see if the status of the engine is SHUTDOWN or TIMEDOUT. If it is, the workflow engine starts. If the status is STARTING or RUNNING, the workflow engine logs a warning, then waits for a heartbeat time out to occur. If the heartbeat time out occurs, that means that the other workflow engine with the same ID was not shut down properly, so it's safe to start. If the heartbeat timer is updated, that means another workflow engine with the same ID is running in the cluster, so the workflow engine cannot start. You can specify the heartbeat time out (the maximum elapsed time between heartbeats before a workflow engine is considered timed out) by setting **Heartbeat Interval** and **Heartbeat Factor**. For more information about configuring these settings, see "Configuring the Workflow Cluster" on page 209.

The process cache settings and heartbeat settings require a server restart to take effect.

Configuring the Workflow Engine

To configure the Workflow Engine settings:

1 Select the **Provisioning** tab.

2 Select **Engine and Cluster Settings** from the left navigation menu.

The user interface displays the Workflow Configuration Settings page. To configure the engine, you need to make some changes in the Workflow Engine box.

3 To change an engine setting, click the target field for the setting and type the new value. The engine settings are described below:

Engine Setting	Description
Email Notification (per workflow engine)	Enables or disables email notifications for the entire workflow engine. Defaults to enabled.
Web Service Activity Timeout (minute)	Specifies the default Web Service activity timeout in minutes. The default is 50 minutes.

Engine Setting	Description
User Activity Timeout (hour, 0 for no timeout)	Specifies the default user activity timeout. The default is 0 days, which indicates no timeout.
Completed Process Timeout (day)	Specifies the number of days that a completed process state is kept in the workflow database system. The default is 120 days.
Completed Process Cleanup Interval (hour)	Specifies how often the engine checks for and removes completed processes that have been in the workflow database system for longer than the completed process timeout. The default is 12 hours.
Pending Process Interval (second)	User activities that are executed on an engine which the process is not bound to are put into a pending state. This interval specifies how often to check for pending activities in order to continue their execution. The default is 30 seconds.
Retry Queue Interval (minute)	Activities that fail because of suspected database connectivity issues are put on a retry queue. This interval specifies how often the engine attempts to retry these activities. The default is 15 minutes.
Maximum Thread Pool Size	The maximum number of threads that the engine uses to execute activities. The default is 20.
Minimum Thread Pool Size	The minimum number of threads that the engine uses to execute activities. When a thread is requested and fewer than the minimum are in the pool, a new thread will be created even if there are idle threads in the pool. The default is 10.
Initial Thread Pool Size	Number of prestarted threads in the pool when it is created. The default is 5.
Thread Keep Alive Time (second)	If the pool is larger than the minimum size, excess threads that have been idle for more than the keep alive time will be destroyed. The default is 5 minutes.
Process Cache Load Factor	The load factor specifies how full the cache is allowed to get before increasing its capacity. If the number of entries in the cache exceeds the product of the load factor multiplied by the current capacity, then the capacity is increased. The default is 0.75.
Process Cache Initial Capacity	The process cache is backed by a hash map. The capacity is the number of buckets in the hash map. The initial capacity is the number of buckets at the time the cache is created. The default is 700.

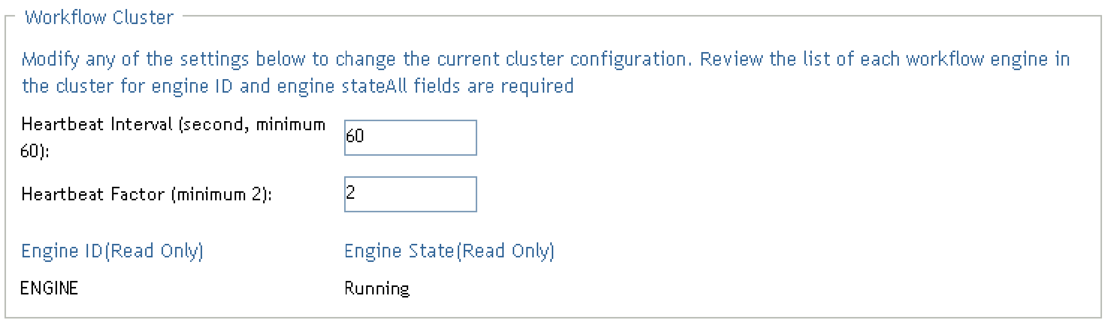
Engine Setting	Description
Process Cache Maximum Capacity	Before adding a process to the cache, if the number of processes in the cache equals or exceeds the Process Cache Maximum Capacity, the cache attempts to remove the oldest inactive process from the cache. The maximum capacity is a soft limit, so the number of processes in the cache might exceed the Process Cache Maximum Capacity if there are no inactive processes (only active processes) in the cache. A good value for this setting should be less than product of the Process Cache Initial Capacity and the Process Cache Load Factor. This gives the cache a chance to remove older inactive processes from the cache before having to increase its capacity. Take the following example: Process Cache Initial Capacity = 700; Process Cache Load Factor =.75; Process Cache Maximum Capacity = 500; Number of processes in cache = 500; In this case, the number of processes in the cache that will trigger the cache to grow its capacity and perform a rehash would be 525, because the Initial capacity multiplied by the load factor is equal to 525.In this example, when there are 500 processes in the cache, the cache is approaching the point where it must increase its size and perform a rehash, which is at 525 processes. When another process is added to the cache, the engine attempts to remove the least recently used inactive process instead of letting the cache get closer to 525 processes. The default is 500.
Maximum Engine Shutdown Timeout (minute)	The engine attempts to shutdown gracefully. When shutting down it stops queuing new activities for execution and attempts to complete any activities already queued. This timeout specifies the maximum time that the engine waits for all queued activities and threads executing activities to complete. If this time is exceeded, the engine halts processing of queued activities and attempts to stop all threads executing activities. The default is 1 minute.

Configuring the Workflow Cluster

To configure the Workflow Cluster settings:

1. Select the **Provisioning** tab.
2. Select **Engine and Cluster Settings** from the left navigation menu.

   The user interface displays the Workflow Configuration Settings page. To configure cluster settings, you need to make some changes in the Workflow Cluster box.


Workflow Cluster

Modify any of the settings below to change the current cluster configuration. Review the list of each workflow engine in the cluster for engine ID and engine stateAll fields are required

Heartbeat Interval (second, minimum 60):	60
Heartbeat Factor (minimum 2):	2
Engine ID(Read Only)	Engine State(Read Only)
ENGINE	Running

3 To change a cluster setting, click the target field for the setting and type the new value. The cluster settings are described below:

Cluster Setting	Description
Heartbeat Interval (second, minimum 60)	Specifies the interval at which the workflow engine's heartbeat is updated. When the workflow engine starts up, it detects if its engine ID is already being used by another node in the cluster and refuses to start if the ID is in use. The User Application database maintains a list of engine IDs and engine states. If an engine crashes and is restarted, its last state in the database indicates that it is still running. The workflow engine therefore uses a heartbeat timer, which writes heartbeats at the specified interval, to determine if an engine with its ID is still running in the cluster. If it's already running, it refuses to start. The minimum value for the heartbeat interval is 60 seconds.
Heartbeat Factor (minimum 2)	Specifies the factor that is multiplied with the hearbeat interval to arrive at the heartbeat timeout. The timeout is the maximum elapsed time permitted between heartbeats before an engine will be considered timed out. The minimum value for the heartbeat factor is 2.

Team Configuration

The Team Configuration page allows you to create teams and define permissions for these teams. A team definition specifies a domain type (Provisioning, Role, or Resource), as well as a set of team members and managers. The Team Configuration page is accessible to the following users:

Table 16-1 *User Access to the Team Configuration Page*

User	Capabilities
Security Administrator	Can perform all operations on the Team Configuration page.

User	Capabilities
Other Domain Administrators	Can define a team for the domain over which the administrator has authority.
Team Manager	Can view a team definition for which he/she is configured to be the manager. When a team manager edits a team, the team definition itself is read-only, because the team manager cannot modify the team configuration.

The members of a team can be specified individually as a set of users, groups, or containers, or can be defined based on a business relationship, such as the Manager-Employee relationship. Alternatively, the team member list can include all users within the container.

When a team definition includes a container or group in its membership list, the User Application expands the list within the container or group to show the users within the container or group. Therefore, the User Application only allows the team manager to specify a particular user within the container or group as the recipient for a team request; the team manager is not permitted to specify a container or group as the recipient for a team request.

The managers for a team can be a one or more users or groups. When you define a team, you can specify whether you want the team managers to also be members of the team.

The permissions for a team define the actions that team members can take on a particular scope of object instances within the domain type selected for a team. For example, if you select the Role domain as the domain type for a team, the team permissions determine what actions the members can take on the set of role instances selected as the scope for the team. These permission might specify, for the selected scope of roles, that members can perform actions such as assigning roles to users, viewing role assignments, and reporting on role assignments.

Viewing Team Configurations

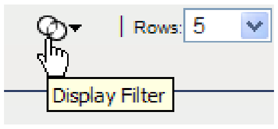
To view existing team configurations:

1 Select **Team Configuration** on the **RBPM Provisioning and Security** tab.

  The Team Configuration page displays a list of team configurations currently defined.

Filtering the Team List

1 Click the Display Filter button in the upper right corner of the Resource Catalog display.



2 Specify a filter string for the team name or description in the Filter dialog, or select a particular domain, and click **Filter**:

3 To remove the current filter, click **Reset**.

Setting the Maximum Number of Rows on a Page

1 Click on the Rows dropdown list and select the number of rows you want to be displayed on each page:.

Scrolling within the Team List

1 To scroll to another page in the resource list, click on the Next, Previous, First or Last button at the bottom of the list.

Sorting the Team List

To sort the team list:

1 Click the header for the column you want to sort on.

  The pyramid-shaped sort indicator shows you which column is the new sort column. When the sort is ascending, the sort indicator is shown in its normal, upright position.

  When the sort is descending, the sort indicator is upside down.

  The default sort column is the Resource Name column.

If you override the default sort column, your sort column is added to the list of required columns. Required columns are indicated with an asterisk (*).

When you modify the sort order for the task list, your preference is saved in the Identity Vault along with your other user preferences.

Creating New Teams

To define a new team:

1 Click the **New** button at the top of the Team Configuration display.

  The **New Team** dialog displays.

2 Select one of the following domains:

  - **Provisioning Domain**
  - **Role Domain**
  - **Resource Domain**

  The domain determines what types of objects the team members can act on. A team can only be associated with a single domain.

  NOTE: If a particular user has been designated as a domain administrator, NetIQ recommends that this user should not also be designated as a manager of a team for the same domain for which the user is a domain administrator.

3 Provide a name and description for the team.

4 In the **Managers** control, select the users and groups that will be managers of the team.

5 In the **Members** control:

5a Indicate whether the managers will also be members of the team by selecting or deselecting the **Also include selected managers in members list** checkbox.

5b Define the members of the team by selecting one of the following radio buttons:

Option	Description
All Users	Includes all users in the container.
Relationship	Includes all users that have a relationship with the users in the **Managers** list. For example, if you select the Manager-Employee relationship, the members report directly to the users in the **Managers** list.
Select Members	Includes the users, groups, and containers you select.

6 Click **Save** to preserve your team configuration settings.

Once you've saved a team, the **Permissions** section is added to the page, and the Team Permissions Configuration interface is displayed.

The Team Permissions Configuration interface includes buttons for adding new permissions, deleting permissions and refreshing the display. The Permissions section of the page does not include an **Edit** button because the details associated with each permission are shown in the Permissions list. If a particular team permission is not properly defined, you can simply delete the permission and add a new one in its place.

7 To define the permissions for the team, click **New**.

This interface shows controls that apply to the domain selected for the team. These controls allow you to specify which objects are within the scope of the team and which permissions team members have with respect to these objects.

8 Follow these steps to define permissions for a team that uses the **Provisioning** domain:

8a To include all provisioning request definitions, click the **All Provisioning Request Definition** button.

8b To select provisioning request definitions individually, choose the **Select Provisioning Request Definition** radio button, and use the Object Selector to pick one or more provisioning request definitions:.

8c Once you've defined the scope for the team, choose the permissions you want to allow for each object by selecting the object and picking the desired permissions in the **Permissions** control.

The provisioning permissions are the same for team configurations as for RBPM administrator assignments.

8d To define permissions that apply to the User Application driver as a whole, open the **Add User Application Driver Permisions** section of the page and select the permissions you want to allow with this assignment.

8e Click **Save** to save the permissions for the selected objects or containers.

To delete a permission, select the permission and click **Delete**.

To refresh the list of permissions for the team, click **Refresh**.

9 Follow these steps to define permissions for a team that uses the **Role** domain:

9a To include all roles in all levels in the roles hierarchy, choose **All Role Levels** in the **Role Level** control.

To include all roles at a particular level in the role hierarchy, choose one of the following levels:

- **Business Role**
- **IT Role**
- **Permission Role**

To include all roles in a particular sub container under the selected role level, use the Object Selector to select the sub container.

9b To select roles individually, choose **Select Roles** radio button, and use the Object Selector to pick one or more roles.

9c Once you've defined the role scope for the team, choose the permissions you want to allow for each object by selecting the object and picking the desired permissions in the **Permissions** control.

The following role permissions are supported in team configurations:

- View Role
- Assign Role
- Revoke Role
- Assign Role to Group and Container
- Revoke Role from Group and Container

These role permissions have the same behavior as for RBPM administrator assignments.

9d Click **Save** to save the permissions for the selected objects or containers.

To delete a permission, select the permission and click **Delete**.

To refresh the list of permissions for the team, click **Refresh**.

10 Follow these steps to define permissions for a team that uses the **Resource** domain:

10a To include all resources, click the **All Resources** button.

10b To select resources individually, choose the **Select Resources** radio button, and use the Object Selector to pick one or more resources.

10c Once you've defined the resource scope for the team, choose the permissions you want to allow for each object by selecting the object and picking the desired permissions in the **Permissions** control.

The following resource permissions are supported in team configurations:

- View Resource
- Assign Resource
- Revoke Resource

These resource permissions have the same behavior as for RBPM administrator assignments. See "Shared Pages and Layouts" on page 193 for details on these resource permissions.

10d Click **Save** to save the permissions for the team.

To delete a permission, select the permission and click **Delete**.

To refresh the list of permissions for the team, click **Refresh**.

11 Click **Save** to save the team configuration and team permissions.

Editing an Existing Team

To edit an existing team:

1. Select a previously defined team and click **Edit**.

   When a team manager edits a team, the team definition itself is read-only, because the team manager cannot modify the team configuration.
2. Make your changes to the team settings and click **Save**.

Deleting Teams

To delete an existing team:

1. Select a previously defined team and click **Delete**.

Refreshing the Team List

To refresh the list of teams:

1. Click **Refresh**.

Navigation Access Permissions

The Navigation Access Permissions page allows you to set the access permissions for some of the navigation items within the User Application. It allows you to control access to three of the main header tabs with the application: Roles and Resources tab, Identity Self-Service tab, and Work Dashboard tab. In addition, it allows you to define permissions for lower-level navigation items within the Provisioning and Security, Roles and Resources, and Work Dashboard areas of the application.

NOTE: The Compliance and Administration tabs cannot be configured through the Navigation Access Permissions page. The Compliance tab is only visible to Compliance Administrators, and the Administration tab is only visible to Security Administrators, Domain Administrators (such as the Role Domain Administrator and Resource Domain Administrator), and Configuration Administrators.

To define navigation access permissions:

1. Select **Navigation Access Permissions** on the **RBPM Provisioning & Security** tab.

   The Navigation Access Permissions page displays.
2. Click on the **Name** drop-down list to see the navigation items for which you can define permissions.

   The navigation areas appear in bold. Within each area, you can see the items.
3. Select the navigation item for which you want to define permissions.
4. Select one or more trustees for the navigation item. When a trustee logs on to the User Application, the navigation item is displayed. Otherwise, the navigation item is hidden. You can add users, groups, roles, and containers as trustees.

   Each navigation item has a set of default trustees that is suitable for the services that can be accessed through the navigation item. Most of the navigation items listed are self-explanatory. For those items that require additional explanation, you can find details below.

Make a Process Request By default, the Make a Process Request navigation item is shown on the Work Dashboard. To hide the Make a Process Request item, remove all trustees for this item. If you remove all trustees, only Configuration Administrators will be able to see the item. To show the Make a Process Request item on the Work Dashboard again, select **Make a Process Request** and choose the users, groups, roles, or containers that you want to be able to access the item.

Assign Resource Controls whether you see the **Assign** button on the **Resource Assignments** section of the Work Dashboard. The root container is specified as the default trustee for this permission at installation time.

Remove Resource Assignments Controls whether you see the **Remove** button on the **Resource Assignments** section of the Work Dashboard. The root container is specified as the default trustee for this permission at installation time.

Assign Role Controls whether you can see the **Assign** button on the **Role Assignments** section of the Work Dashboard. The root container is specified as the default trustee at installation time.

Remove Role Assignments Controls whether you can use the **Remove** button on the **Role Assignments** section of the Work Dashboard. The root container is specified as the default trustee at installation time.

5. To make the currently selected navigation item the default for the navigation area, select **Check to make this the default navigation item for selected area**.

   The **Check to make this the default navigation item for selected area** control is not available for navigation items within the Work Dashboard area.

6. Click **Save**.

   If you add a user as a trustee for a navigation item, and this user is a member of a container that was previously added as a trustee, this user will have access to the navigation item, but will not be added to the list of trustees.

NOTE: If a user does not have access to the default tab (or to the default menu item within a navigation area), the User Application will attempt to display a tab (or menu item) for which the user has authorization. If the user has not been given authorization for any tab or menu item, the default page will display. If the user is not authorized for the default page, or if the user goes directly to an unauthorized bookmark, an error message is displayed indicating that the user does not have the proper authorization.

If the user has been authorized to access a tab, but nothing under the tab, the page will still show and an error message will be displayed indicating that the user does not have the proper authorization. Conversely, if the tab has not been authorized, the tab will not show. However, if the user is authorized to access menu items under the tab, the user will be able to access these menu items by using bookmarks.

Proxy Mode When a user is in proxy mode, the navigation access permissions for menu items on the Dashboard will show the proxied user's permissions, not the permissions for the logged in user. For all other navigation, the menu items will be controlled by the permissions set for the logged in user. The **Manage** control (for selecting a user, group, role, or container) is not available in proxy mode, even if a user is proxying for a user that is a Domain Administrator or Domain Manager.

V Configuring and Managing Provisioning Workflows

These sections describe how to configure and manage provisioning requests and workflows:

17 Configuring the User Application Driver to Start Workflows

This section describes the User Application driver and how to configure it to automatically trigger a workflow based on an event in the Identity Vault.

About the User Application Driver

The User Application driver is responsible for starting provisioning workflows and for notifying the User Application of changes in the Identity Vault. For example, when you make changes to the directory abstraction layer using the Designer for Identity Manager. Only the Subscriber channel is used in this driver. The driver processes messages from the Identity Vault to the User Application running on an application server. Although there are events that occur in the User Application that are reported back to the Identity Vault, these events do not flow through the Publisher channel of the User Application driver.

When the application server is started, the driver establishes a session with the application server. The driver sends messages to the User Application running on the application server (for example, “retrieve a new set of virtual directory definitions”).

The source components of the driver include:

- `ComposerDriverShim.jar` – The Composer Driver Shim. It is installed in the `lib` directory `\Netiq\NDS\lib` in Windows or the `classes` directory `/usr/lib/dirxml/classes` in Linux.
- `srvprvUAD.jar` – The Application Driver Shim. It is installed in the `lib` directory `\Netiq\NDS\lib` in Windows or the `classes` directory `/usr/lib/dirxml/classes` in Linux.
- `UserApplicationDriver.xml` – A file that contains configuration data for setting up the new driver. It is installed in the `DirXML.Drivers` directory, which is `\Tomcat\webapps\nps\DirXML.Drivers` in Windows and either `/opt/netiq/eDirectory/lib/dirxml/rules/` or `/var/opt/netiq/iManager/nps/DirXML.Drivers` in Linux.

The User Application driver components are installed when you install Identity Manager. Before you can run the Identity Manager User Application, you must add the User Application driver to a new or existing driver set, and activate the driver.

Depending on your work environment, very little configuration of the User Application driver might be required, or you might want to implement a complex set of business rules in the driver policies. The User Application driver provides the same flexible mechanisms for data synchronization as other Identity Manager drivers.

Setting Up Workflows to Start Automatically

Workflows are automatically started when a user starts a provisioning request by requesting a resource. In addition, the User Application driver listens for events in the Identity Vault and, when configured to do so, responds to events by starting the appropriate provisioning workflows. For example, you can configure the User Application driver to automatically start a provisioning workflow if a new user is added to the Identity Vault. You configure the User Application driver to automatically start workflows using Identity Manager policies and rules.

About Policies

You can use filters and policies with the User Application driver in the same way that you can with other Identity Manager drivers. When an event occurs in the Identity Vault, Identity Manager creates an XML document that describes the event. The XML document is passed along the channel to the connected system (in this case, the connected system is the User Application). Filters and policies associated with a driver allow you to define how to respond to the event, and in the process transform that XML document to the format that is expected by the connected system. Identity Manager provides several categories of policies (for example, Event Transformation, Command Transformation, Schema Mapping, Output Transformation) that you can apply, in a prescribed order, to transform the XML document.

This section provides an example of starting a workflow based on events in the Identity Vault. Although any of the policies can be used to trigger a workflow, the example presented in this section demonstrates the easiest and most useful method.

When you create a User Application driver, an Event Transformation Policy is created for use by the driver. The Event Transformation Policy is responsible for creating the XML document that is processed by the remaining Subscriber channel policies.

NOTE: Do not change the Event Transformation policy that was created when the User Application driver was created. The DN of this policy begins with `Manage.Modify.Subscriber`. Changing this policy might cause the workflow process to fail.

An empty Schema Mapping Policy is also created. You can use this policy as a starting point for triggering a workflow, based on events in the Identity Vault.

Using the Policy Builder

The Policy Builder provides a Start Workflow action that simplifies the process of setting up a workflow to start automatically.

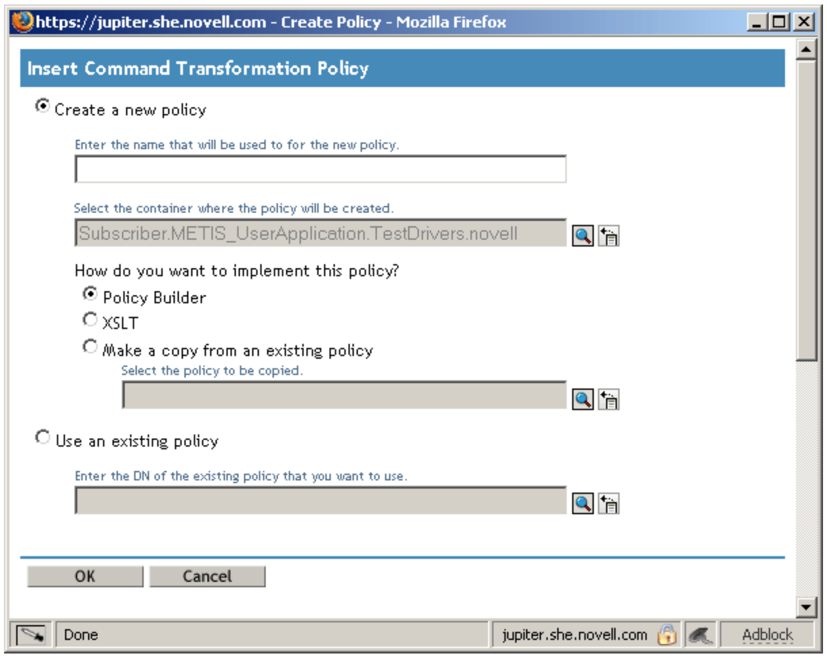
1 In iManager, expand the **Identity Manager** Role, then click **Identity Manager Overview**.

2 Specify a driver set.

3 Click the driver for which you want to manage policies. The **Identity Manager Driver Overview** opens.

4 Click the policy that you want to edit.

5 Click **Insert** to open the Policy Builder.


https://jupiter.she.novell.com - Create Policy - Mozilla Firefox
Insert Command Transformation Policy

[✓ Create a new policy]

Enter the name that will be used to for the new policy.

Select the container where the policy will be created.
Subscriber.METIS_UserApplication.TestDrivers.novell

How do you want to implement this policy?
[✓ Policy Builder]
XSLT
Make a copy from an existing policy
Select the policy to be copied.

Use an existing policy

Enter the DN of the existing policy that you want to use.

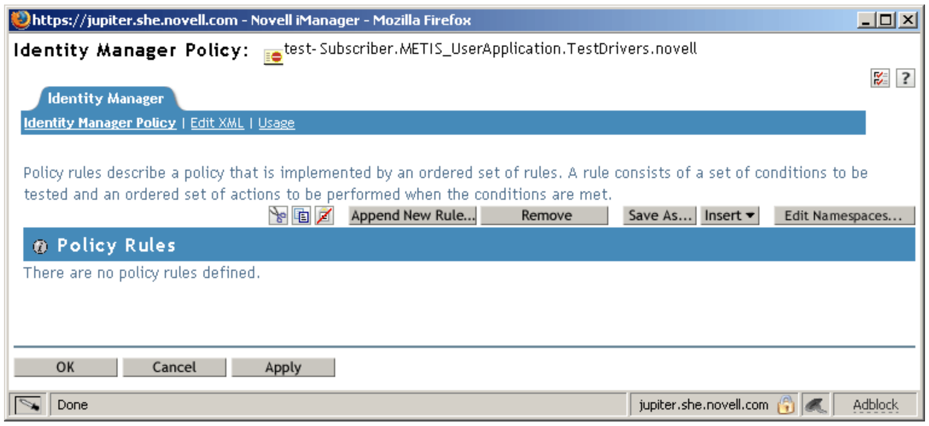
6 Click **Create a new policy**.

7 Type a name for the policy.

8 Click **Policy Builder**.

9 Click **OK**.

iManager displays a screen that lists defined policy rules.


https://jupiter.she.novell.com - Novell iManager - Mozilla Firefox

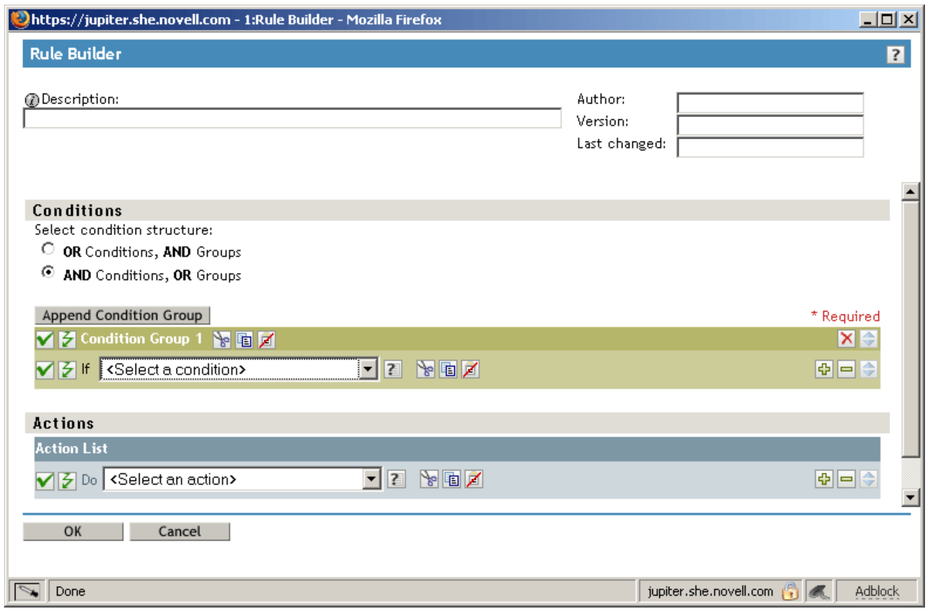
Identity Manager Policy: test- Subscriber.METIS_UserApplication.TestDrivers.novell

Policy rules describe a policy that is implemented by an ordered set of rules. A rule consists of a set of conditions to be tested and an ordered set of actions to be performed when the conditions are met.

There are no policy rules defined.

10 Click **Append New Rule**.

iManager displays the **Rule Builder**.


https://jupiter.she.novell.com - 1:Rule Builder - Mozilla Firefox

Rule Builder

Description:

Author:
Version:
Last changed:

Conditions

Select condition structure:

( ) OR Conditions, AND Groups
(•) AND Conditions, OR Groups

Append Condition Group   * Required

Condition Group 1

If <Select a condition>

Actions

Action List

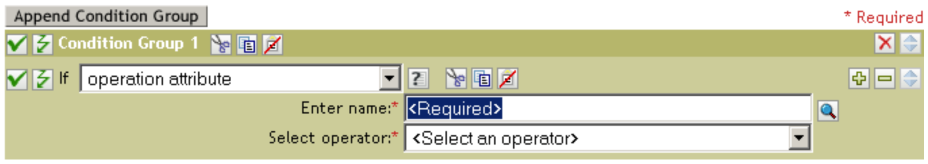
Do <Select an action>

OK Cancel

Done   jupiter.she.novell.com   Adblock

11 Type a Description for the rule.

12 Select operation attribute for the If condition in Condition Group 1.


Append Condition Group   * Required

Condition Group 1

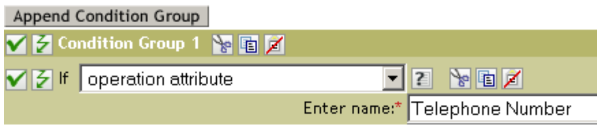
If operation attribute

Enter name:* <Required>

Select operator:* <Select an operator>

13 Use the Browse attributes button for the Enter name field to specify the Identity Vault attribute that you want to use to start the workflow.

For example, to start a workflow when a telephone number changes, select the Telephone Number attribute.


Append Condition Group

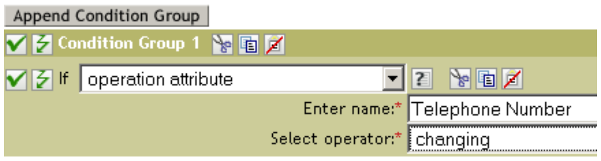
Condition Group 1

If operation attribute

Enter name:* Telephone Number

14 Use the Select Operator list to select the operator to use to test the specified attribute.

For example, to start a workflow when a telephone number changes, select changing.


Append Condition Group

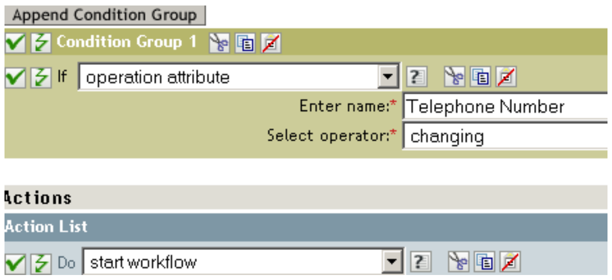
Condition Group 1

If operation attribute

Enter name:* Telephone Number

Select operator:* changing

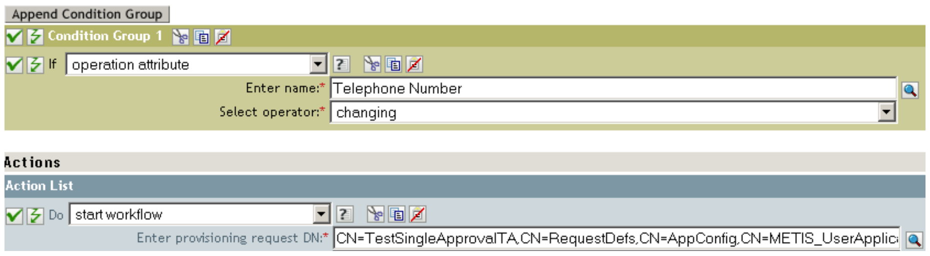
15 Select start workflow from the Action list.



If operation attribute
Enter name:* Telephone Number
Select operator:* changing

Do start workflow

16 Use the Object Selector in the **Enter provisioning request DN** field to select the provisioning request definition that you want to be executed when the **if** condition is true.

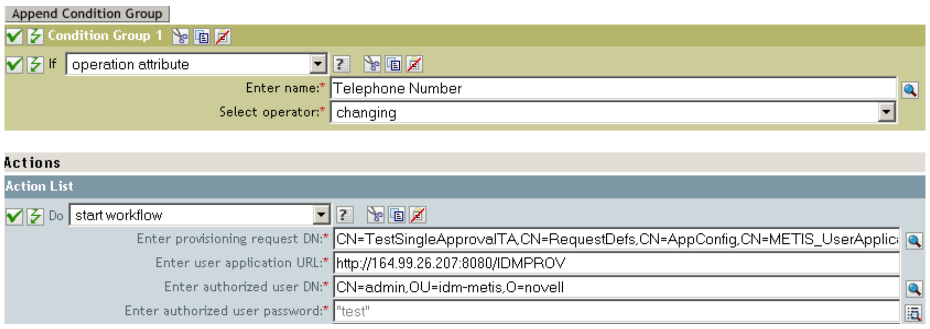


If operation attribute
Enter name:* Telephone Number
Select operator:* changing

Do start workflow
Enter provisioning request DN:* CN=TestSingleApprovalTA,CN=RequestDefs,CN=AppConfig,CN=METIS_UserApplic

The **Enter user application URL** and **Enter authorized user DN fields** are filled in automatically.

17 Type the password for the User Application administrator in the **Enter authorized user password** field.



If operation attribute
Enter name:* Telephone Number
Select operator:* changing

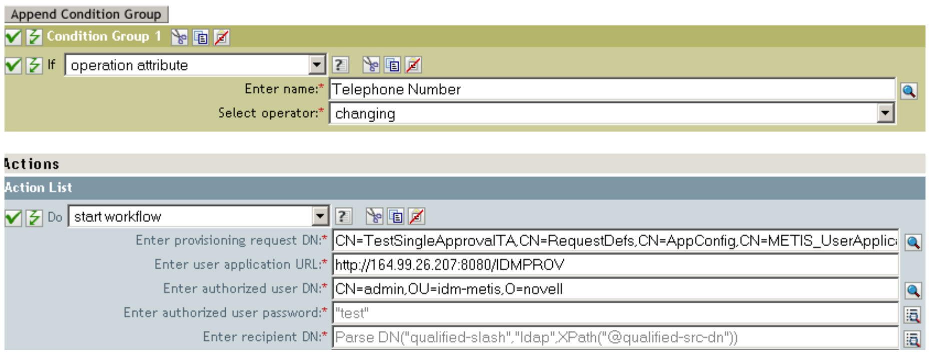
Do start workflow
Enter provisioning request DN:* CN=TestSingleApprovalTA,CN=RequestDefs,CN=AppConfig,CN=METIS_UserApplic
Enter user application URL:* http://164.99.26.207:8080/IDMPROV
Enter authorized user DN:* CN=admin,OU=idm-metis,O=novell
Enter authorized user password:* "test"

We recommend using a named password, because typing a password in clear text is a security risk.

18 In the **Enter recipient DN** field, specify the DN of the recipient of the workflow in LDAP format.

The expression for the recipient DN must evaluate to a DN that conforms to RFC 2253 format (in other words, cn=user,ou=organizational unit,o=organization). For example, you can click the **Argument Builder** button in the **Enter recipient DN** field to create the following expression to pass the recipient's DN to the workflow:

```
Parse DN("qualified-slash","ldap",XPath("@qualified-src-dn"))
```

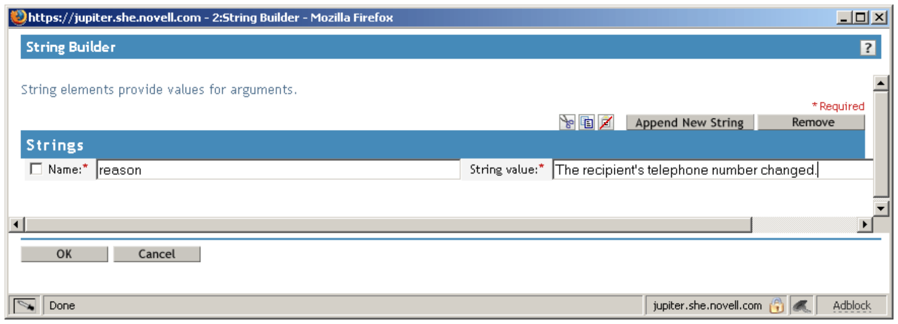


If operation attribute
Enter name:* Telephone Number
Select operator:* changing

Do start workflow
Enter provisioning request DN:* CN=TestSingleApprovalTA,CN=RequestDefs,CN=AppConfig,CN=METIS_UserApplic
Enter user application URL:* http://164.99.26.207:8080/IDMPROV
Enter authorized user DN:* CN=admin,OU=idm-metis,O=novell
Enter authorized user password:* "test"
Enter recipient DN:* Parse DN("qualified-slash","ldap",XPath("@qualified-src-dn"))

19 Specify the arguments for the workflow in the **Enter additional arguments** field.

You must use this field to specify the **reason** attribute, which is required by the workflow. You can click the **String Builder** button in the **Enter additional arguments** field to specify the **reason** attribute and create a value for the attribute (for example, “the recipient’s telephone number has changed”).



String elements provide values for arguments.

* Required

Name:* reason String value:* The recipient's telephone number changed.

20 Click **OK** to close the Rule Builder.

21 Click **OK** to close the Policy Builder.

22 Click **OK** to close the Policies screen.

23 Make sure that you add any attributes needed by the workflow to the filter.

In the example described in this procedure, you would need to add **Telephone Number** and **CN** to the filter.

18 Managing Provisioning Request Definitions

This section provides instructions for managing provisioning request definitions.

About the Provisioning Request Configuration Plug-in

You can use the Provisioning Request Configuration plug-in to iManager to view a read-only display of a provisioning request definition that was created in the Designer for Identity Manager. This plug-in allows you to delete, activate, inactivate and retire existing provisioning request definitions.

NOTE: The Provisioning Request Configuration plug-in to iManager does not allow you to create or edit provisioning request definitions. To create or edit a provisioning request definition, you need to use the Designer for Identity Manager.

You can find the Provisioning Request Configuration plug-in in the Identity Manager category in iManager. The plug-in includes the Provisioning Requests task in the Provisioning Configuration role. The Provisioning Requests task consists of the panels described in Table 18-1.

Table 18-1 *Provisioning Requests Task: Panels*

Panel	Description
Provisioning Driver Selection	Gives you the opportunity to select an Identity Manager User Application driver. The driver contains a set of predeployed provisioning request definitions, so you need to pick a driver before you can begin configuring your provisioning requests.
Provisioning Request Configuration	Provides tools that let you: ◆ Browse the available provisioning request definitions and select one to configure ◆ Create a new provisioning request definition based on an existing definition ◆ Set the properties of a provisioning request definition ◆ Assign the provisioning request definition to a provisioned resource ◆ Edit the addressee and timeout settings for each activity in the associated workflow When you choose to create a new provisioning request or edit an existing one, the plug-in runs the Provisioning Request Configuration Wizard.

Working with the Installed Templates

You can define provisioning request definitions from scratch in the Designer for Identity Manager. Alternatively, you can define provisioning requests by modeling them after the provisioning request templates that ship with the product. To use the templates, you define new objects based on the installed templates and customize these objects to suit the needs of your organization.

The installed templates let you determine the number of approval steps required for the request to be fulfilled. You can configure a provisioning request to require:

- No approvals
- One approval step
- Two approval steps
- Three approval steps
- Four approval steps
- Five approval steps

You can also specify whether you want to support sequential or parallel processing, and whether you want to approve or deny the request in the event that the workflow times out during the course of processing.

Identity Manager ships with the templates listed in Table 18-2.

***Table 18-2** Templates for Provisioning Requests*

Template	Description
Self Provision Approval	Allows a provisioning request to be fulfilled without any approvals.
One Step Approval (Timeout Approves)	Requires a single approval for the provisioning request to be fulfilled. If an activity times out, the activity approves the request and the work item forwards to the next activity.
Two Step Sequential Approval (Timeout Approves)	Requires two approvals for the provisioning request to be fulfilled. If an activity times out, the activity approves the request and the work item forwards to the next activity. This template supports sequential processing.
Three Step Sequential Approval (Timeout Approves)	Requires three approvals for the provisioning request to be fulfilled. If an activity times out, the activity approves the request and the work item forwards to the next activity. This template supports sequential processing.
Four Step Sequential Approval (Timeout Approves)	Requires four approvals for the provisioning request to be fulfilled. If an activity times out, the activity approves the request and the work item forwards to the next activity. This template supports sequential processing.

Template	Description
Five Step Sequential Approval (Timeout Approves)	Requires five approvals for the provisioning request to be fulfilled. If an activity times out, the activity approves the request and the work item forwards to the next activity. This template supports sequential processing.
One Step Approval (Timeout Denies)	Requires a single approval for the provisioning request to be fulfilled. If an activity times out, the workflow denies the request. This template supports sequential processing.
Two Step Sequential Approval (Timeout Denies)	Requires two approvals for the provisioning request to be fulfilled. If an activity times out, the workflow denies the request. This template supports sequential processing.
Three Step Sequential Approval (Timeout Denies)	Requires three approvals for the provisioning request to be fulfilled. If an activity times out, the workflow denies the request. This template supports sequential processing.
Four Step Sequential Approval (Timeout Denies)	Requires four approvals for the provisioning request to be fulfilled. If an activity times out, the workflow denies the request. This template supports sequential processing.
Five Step Sequential Approval (Timeout Denies)	Requires five approvals for the provisioning request to be fulfilled. If an activity times out, the workflow denies the request. This template supports sequential processing.
Two Step Parallel Approval (Timeout Approves)	Requires two approvals for the provisioning request to be fulfilled. If an activity times out, the activity approves the request and the work item forwards to the next activity. This template supports parallel processing.
Three Step Parallel Approval (Timeout Approves)	Requires three approvals for the provisioning request to be fulfilled. If an activity times out, the activity approves the request and the work item forwards to the next activity. This template supports parallel processing.
Four Step Parallel Approval (Timeout Approves)	Requires four approvals for the provisioning request to be fulfilled. If an activity times out, the activity approves the request and the work item forwards to the next activity. This template supports parallel processing.

Template	Description
Five Step Parallel Approval (Timeout Approves)	Requires five approvals for the provisioning request to be fulfilled. If an activity times out, the activity approves the request and the work item forwards to the next activity. This template supports parallel processing.
Two Step Parallel Approval (Timeout Denies)	Requires two approvals for the provisioning request to be fulfilled. If an activity times out, the workflow denies the request. This template supports parallel processing.
Three Step Parallel Approval (Timeout Denies)	Requires three approvals for the provisioning request to be fulfilled. If an activity times out, the workflow denies the request. This template supports parallel processing.
Four Step Parallel Approval (Timeout Denies)	Requires four approvals for the provisioning request to be fulfilled. If an activity times out, the workflow denies the request. This template supports parallel processing.
Five Step Parallel Approval (Timeout Denies)	Requires five approvals for the provisioning request to be fulfilled. If an activity times out, the workflow denies the request. This template supports parallel processing.

Workflows and provisioned resources. When you create a new provisioning request definition, you bind it to a provisioned resource. You can change the provisioned resource associated with the request definition, but not the workflow or its topology.

Categories for provisioning requests. Each provisioning request template is also bound to a category. Categories provide a convenient way to organize provisioning requests for the end user. The default category for all provisioning request templates is **Entitlements**. The category key, which is the value of the srvprvCategoryKey attribute, is **entitlements** (lowercase).

You can create your own categories by using the directory abstraction layer editor. When you create a new category, make sure the category key (the value of srvprvCategoryKey) is lowercase. This is necessary to ensure that categories work properly in the Identity Manager User Application.

For details on creating provisioning categories, see the *Identity Manager User Application: Design Guide*.

Configuring a Provisioning Request Definition

Before configuring a provisioning request definition, you need to select the User Application driver that contains the definition. Having selected the driver, you can create a new provisioning request definition or edit an existing definition. You can also delete provisioning request definitions, change the status of a request definition, or define rights for a request definition.

Selecting the Driver

To select a User Application driver:

1 Select the **Identity Manager** category in iManager.

2 Open the **Provisioning Request Configuration** role.

3 Click the **Provisioning Requests** task.

iManager displays the User Application Driver panel.

4 Specify the driver name in the **User Application Driver** field, then click **OK**.

iManager displays the Provisioning Request Configuration panel. The Provisioning Request Configuration panel displays a list of available provisioning request definitions.

The installed templates appear in dark text with a status of **Template**. Request definitions that are templates do not display hypertext links because they are read only.

NOTE: If the request definitions were configured to use localized text, the names and descriptions for these definitions show text that is suitable for the current locale.

Changing the driver. When you have selected a driver, the driver selection remains in effect for the duration of your iManager session, unless you select a new driver. To select a new driver, click the **Actions** command, then choose **Select User Application Driver** from the **Actions** menu.

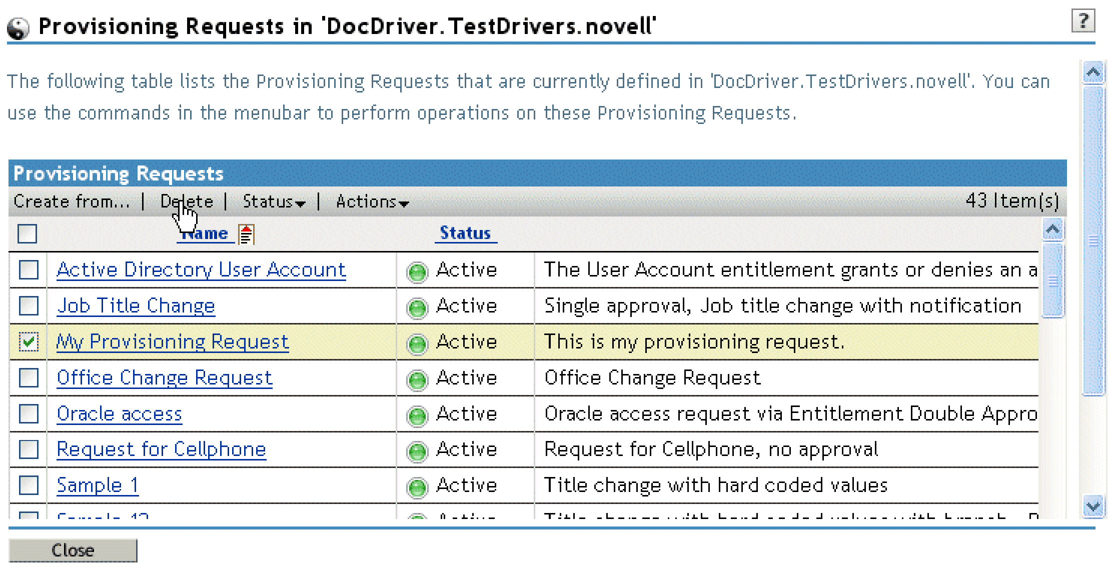
Deleting a Provisioning Request

To delete a provisioning request:

1 Select the provisioning request you want to delete by clicking the check box next to the name.

You are not permitted to delete a provisioning request that is a template.

2 Click the **Delete** command in the Provisioning Request Configuration panel.


Provisioning Requests in 'DocDriver.TestDrivers.novell'

The following table lists the Provisioning Requests that are currently defined in 'DocDriver.TestDrivers.novell'. You can use the commands in the menubar to perform operations on these Provisioning Requests.

Provisioning Requests

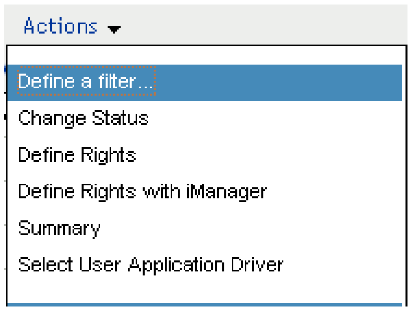
Create from... | Delete | Status | Actions   43 Item(s)

☐	Name	Status	
☐	Active Directory User Account	Active	The User Account entitlement grants or denies an a
☐	Job Title Change	Active	Single approval, Job title change with notification
✓	My Provisioning Request	Active	This is my provisioning request.
☐	Office Change Request	Active	Office Change Request
☐	Oracle access	Active	Oracle access request via Entitlement Double Appro
☐	Request for Cellphone	Active	Request for Cellphone, no approval
☐	Sample 1	Active	Title change with hard coded values

Filtering the List of Requests

To filter the list of requests:

1. Click the **Actions** command in the Provisioning Request Configuration panel.
2. Click the **Define a Filter** command on the **Actions** menu.



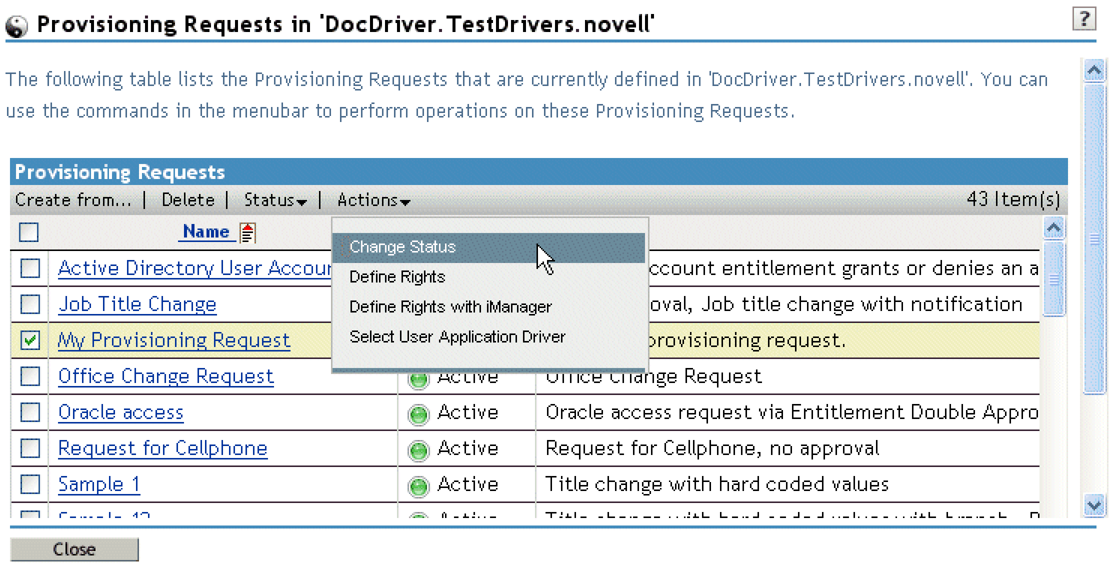
Specify the filter characteristics:

Choice	Description
Turn off filtering	Disables any existing filtering for the list.
Filter for status equals	Filters based on the status. You can filter the list based on any of the following status codes: **Active** **Inactive** **Template** **Retired**
Filter for category equals	Filters based on category. Select any of the defined categories.
Filter for description contains	Allows you to search for text in the request description. Type the string you want to search for.

Changing the Status of an Existing Provisioning Request

To change the status of an existing provisioning request:

1. Select the provisioning request for which you want to change status by clicking the check box beside the name.
2. Click the **Actions** command in the Provisioning Request Configuration panel.
3. Click the **Change Status** command on the **Actions** menu.


Provisioning Requests in 'DocDriver.TestDrivers.novell'

The following table lists the Provisioning Requests that are currently defined in 'DocDriver.TestDrivers.novell'. You can use the commands in the menubar to perform operations on these Provisioning Requests.

Provisioning Requests

Create from... | Delete | Status | Actions — 43 Item(s)

	Name	Status	Description
☐	Active Directory User Accour		ccount entitlement grants or denies an a
☐	Job Title Change		oval, Job title change with notification
✓	My Provisioning Request		provisioning request.
☐	Office Change Request	Active	Office Change Request
☐	Oracle access	Active	Oracle access request via Entitlement Double Appro
☐	Request for Cellphone	Active	Request for Cellphone, no approval
☐	Sample 1	Active	Title change with hard coded values

4 Click the status in the **Status** menu:

Status	Description
Active	Available for use.
Inactive	Temporarily unavailable for use.
Retired	Permanently disabled.

5 Click the button for the correct action (**Grant** or **Revoke**).

6 Click **Finish**.

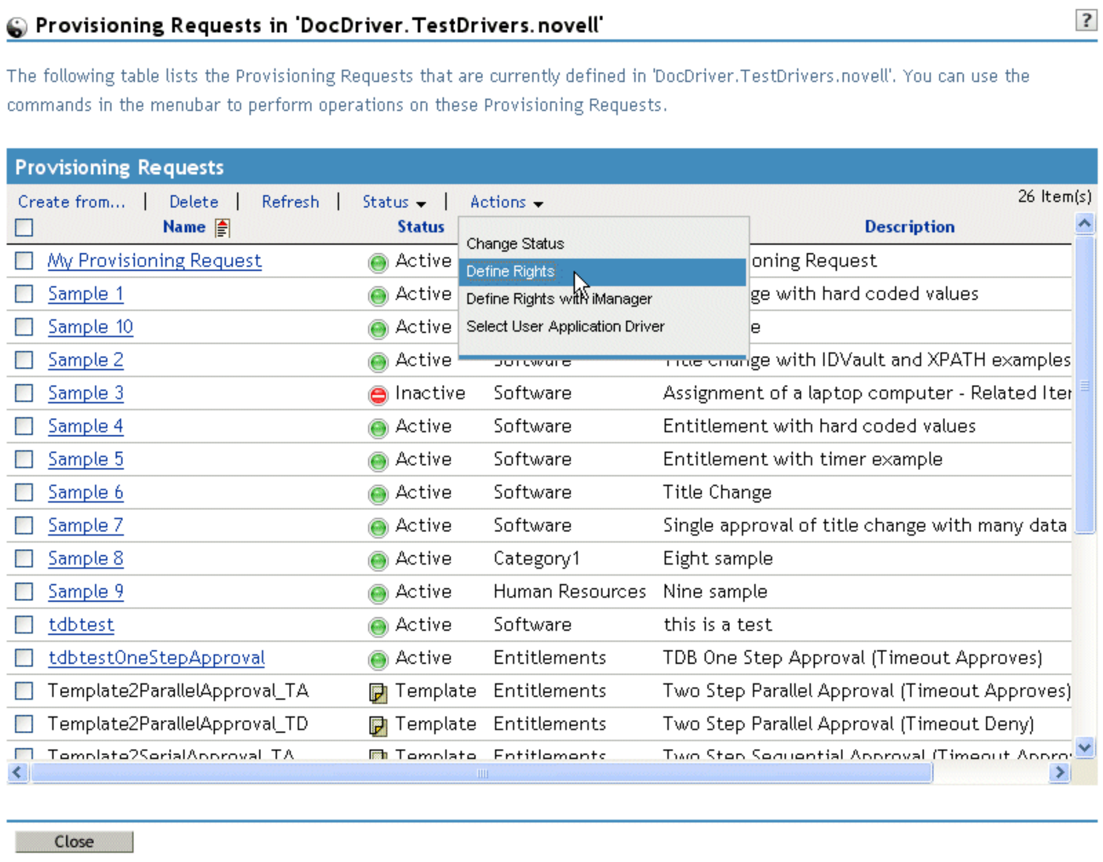
Defining Rights on an Existing Provisioning Request

To define rights on an existing provisioning request:

1 Select the provisioning request for which you want to define rights by clicking the check box beside the name.

2 Click the **Actions** command in the Provisioning Request Configuration panel.

3 Click the **Define Rights** command on the **Actions** menu.


Create from... | Delete | Refresh | Status | Actions
26 Item(s)
Change Status
Define Rights
Define Rights with iManager
Select User Application Driver
Close

Provisioning Requests in 'DocDriver.TestDrivers.novell'

The following table lists the Provisioning Requests that are currently defined in 'DocDriver.TestDrivers.novell'. You can use the commands in the menubar to perform operations on these Provisioning Requests.

Provisioning Requests

Name	Status		Description
My Provisioning Request	Active		oning Request
Sample 1	Active		ge with hard coded values
Sample 10	Active		e
Sample 2	Active		ge with IDVault and XPATH examples
Sample 3	Inactive	Software	Assignment of a laptop computer - Related Iter
Sample 4	Active	Software	Entitlement with hard coded values
Sample 5	Active	Software	Entitlement with timer example
Sample 6	Active	Software	Title Change
Sample 7	Active	Software	Single approval of title change with many data
Sample 8	Active	Category1	Eight sample
Sample 9	Active	Human Resources	Nine sample
tdbtest	Active	Software	this is a test
tdbtestOneStepApproval	Active	Entitlements	TDB One Step Approval (Timeout Approves)
Template2ParallelApproval_TA	Template	Entitlements	Two Step Parallel Approval (Timeout Approves)
Template2ParallelApproval_TD	Template	Entitlements	Two Step Parallel Approval (Timeout Deny)
Template2SerialApproval_TA	Template	Entitlements	Two Step Sequential Approval (Timeout Appro

4 Specify the rights for the request.

To define rights on a provisioning request with iManager:

1 Select the provisioning request for which you want to define rights by clicking the check box beside the name.

2 Click the **Actions** command in the Provisioning Request Configuration panel.

3 Click the **Define Rights with iManager** command on the **Actions** menu.

19 Managing Provisioning Workflows

This section provides instructions for managing provisioning workflows at runtime. It also provides instructions for configuring email notification for provisioning workflows.

About the Workflow Administration Plug-in

The Workflow Administration plug-in to iManager provides a browser-based interface that lets you view the status of workflow processes, reassign activities within a workflow, or terminate a workflow in the event that it is stopped and cannot be restarted.

You can find the Workflow Administration plug-in in the Identity Manager category in iManager. The plug-in includes the **Workflows** task in the **Workflow Administration** role.

The Workflow Administration role also includes the **Email Templates** and **Email Server Options** tasks. These tasks are shortcuts to other tasks listed under the Passwords role.

The Workflows task comprises the panels listed in Table 19-1.

Table 19-1 *Workflows Task: Panels*

Panel	Description
Workflows	Provides the primary user interface for administering provisioning workflows. The interface lists workflows currently being processed and lets you perform various actions on these workflows. When you first start the Workflows task, the Workflows panel requires that you select a User Application driver. The driver points to a workflow server. You need to select a driver before you can log in to the server and begin workflow administration. When you have selected a driver, you can specify search criteria for selecting the workflows to manage.
Workflow Detail	Provides a read-only user interface for viewing the details about a specific workflow.

Managing Workflows

This section includes procedures for managing provisioning workflows using the Workflow Administration plug-in.

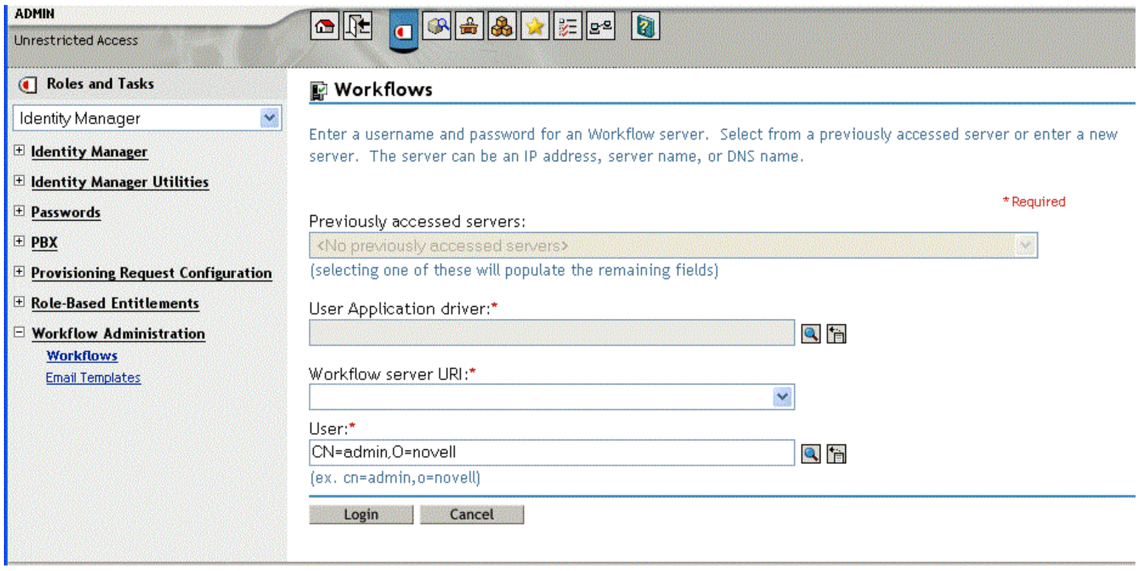
Connecting to a Workflow Server

Before you can begin managing workflows, you need to connect to a workflow server. If the User Application driver is bound to a single workflow server, you can simply specify the name of the driver to use. If the driver is associated with multiple workflow servers, you need to select the target workflow server.

To connect to a workflow server:

1 Select the Identity Managercategory in iManager.
2 Open the **Workflow Administration** role.
3 Click the **Workflows** task.

iManager displays the Workflows panel.



ADMIN
Unrestricted Access

Roles and Tasks

Identity Manager

- Identity Manager
- Identity Manager Utilities
- Passwords
- PBX
- Provisioning Request Configuration
- Role-Based Entitlements
- Workflow Administration
  - Workflows
  - Email Templates

Workflows

Enter a username and password for an Workflow server. Select from a previously accessed server or enter a new server. The server can be an IP address, server name, or DNS name.

* Required

Previously accessed servers:
<No previously accessed servers>
(selecting one of these will populate the remaining fields)

User Application driver:*

Workflow server URI:*

User:*
CN=admin,O=novell
(ex. cn=admin,o=novell)

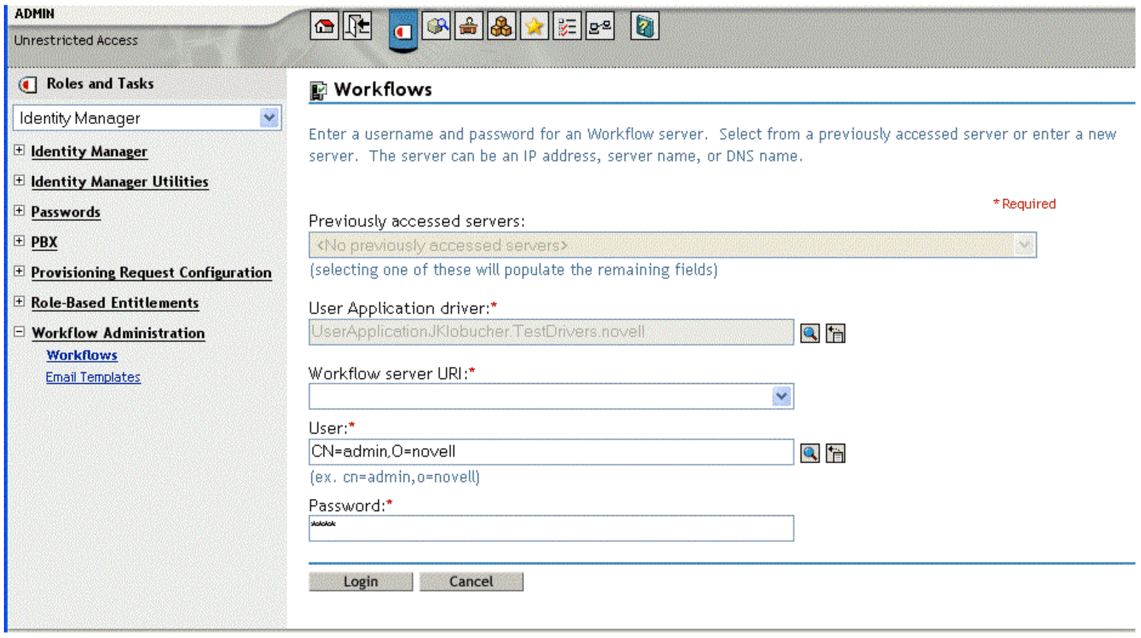
Login Cancel

4 If you accessed the target workflow server previously, you can select the server from the **Previously accessed servers** drop-down list.

iManager fills in the remaining fields on the panel.

5 If you have not yet accessed a workflow server, specify the driver name in the **User Application Driver** field, then click **OK**.

iManager fills in the **Workflow server URI** and **User** fields.



ADMIN
Unrestricted Access

Roles and Tasks

Identity Manager

- Identity Manager
- Identity Manager Utilities
- Passwords
- PBX
- Provisioning Request Configuration
- Role-Based Entitlements
- Workflow Administration
  - Workflows
  - Email Templates

Workflows

Enter a username and password for an Workflow server. Select from a previously accessed server or enter a new server. The server can be an IP address, server name, or DNS name.

* Required

Previously accessed servers:
<No previously accessed servers>
(selecting one of these will populate the remaining fields)

User Application driver:*
UserApplicationJKlobucher.TestDrivers.novell

Workflow server URI:*

User:*
CN=admin,O=novell
(ex. cn=admin,o=novell)

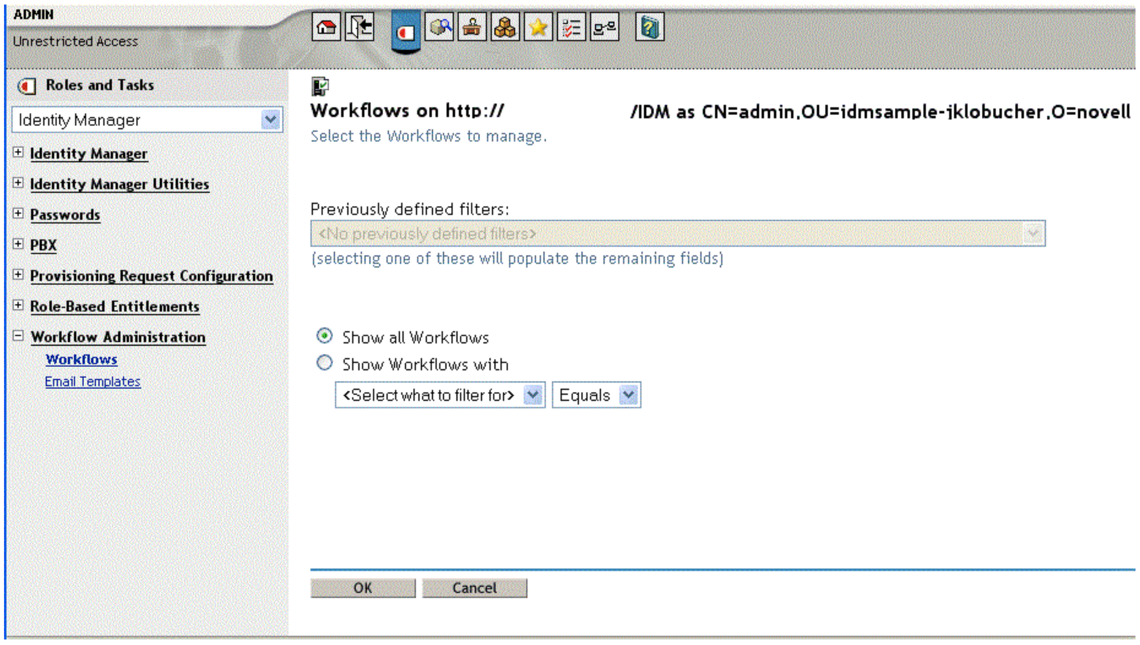
Password:*
*****

Login Cancel

6 Type the password for the user in the **Password** field.

7 Click *Login*.

The Workflow Administration plug-in displays a page that allows you to specify a filter for finding workflows:



Workflows on http:// /IDM as CN=admin,OU=idmsample-jklobucher,O=novell

Select the Workflows to manage.

Previously defined filters: <No previously defined filters>

(selecting one of these will populate the remaining fields)

[✓ Show all Workflows]

Show Workflows with

<Select what to filter for> Equals

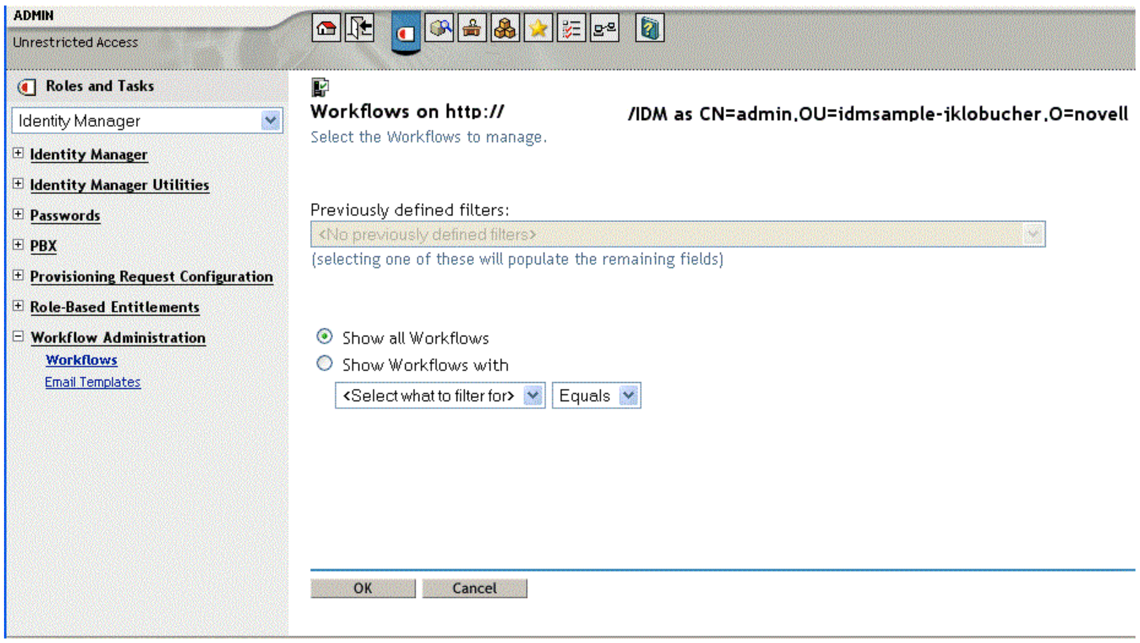
Restricting Access to Workflows

When you install the Roles Based Provisioning Module with the default settings, all users can view all workflows when searching for them. To restrict access to workflows to only the workflow trustees, use NetIQ eDirectory to add an Inheritance Rights Filter (IRF) on the `AppConfig` container, which is located under the User Application driver. For information about adding an IRF, see the *eDirectory Administration Guide*.

Finding Workflows that Match Search Criteria

If the target workflow server is running a large number of workflow processes, you might want to filter the list of workflows you see in iManager. To do this, you can specify search criteria.

1 Select **Show Workflows with**.


ADMIN
Unrestricted Access

Roles and Tasks

Identity Manager

- Identity Manager
- Identity Manager Utilities
- Passwords
- PBX
- Provisioning Request Configuration
- Role-Based Entitlements
- Workflow Administration
  - Workflows
  - Email Templates

Workflows on http://   /IDM as CN=admin,OU=idmsample-jklobucher,O=novell
Select the Workflows to manage.

Previously defined filters:
<No previously defined filters>
(selecting one of these will populate the remaining fields)

Show all Workflows [✓]
Show Workflows with
<Select what to filter for>   Equals

OK   Cancel

By default, **Show all Workflows** is selected. Do not change the default if you want to see the complete list of workflows on the server.

2 Select the attribute for which you want to specify criteria.

Attribute	Description
Creation time	Time that the workflow was initiated.
Initiator	Username of the requestor.
Recipient	Username of the recipient.
Process Status	Status of the workflow process as a whole (Completed, Running, or Terminated).
Approval status	Status of the approval process (Approved, Denied, or Retracted).
Entitlement status	Status of the entitlement initiated by the provisioning request (Error, Fatal, Success, Unknown, or Warning).

3 Select an operator:

Operator	Comment
Equals	Supported for all attributes.
Before	Only supported for the Creation time attribute.
After	Only supported for the Creation time attribute.
Between	Only supported for the Creation time attribute.

4 Specify a value in the field below the attribute and operator.

For **Creation time**, you can use the **Date and time** control to select the value. For **Initiator** and **Recipient**, you can use **Object History** or **Object Selector** to specify a value. For all other attributes, select the value from the drop-down list.

5 Click **OK**.

iManager displays the workflows you have selected on the Workflows panel.

Changing the target server and filter. When you have selected a workflow server, this selection remains in effect for the duration of your iManager session, unless you select a new server. To select a new server, click the **Actions** command, then choose **Select Server** from the **Actions** menu.

To specify different search criteria, choose *Define Filter* on the **Actions** menu.

Controlling the Active Workflows Display

The Workflows panel lists the workflows that match the search criteria you specified. In addition to filtering the list, you can control the display. For example, you can specify how often to refresh the list and sort the list on a particular column.

Refreshing the List of Workflows

When the workflow server is very busy, the list of active workflows can change very frequently. In this case, you should refresh the list of active workflows running on the server.

1. Click the **Refresh** command in the Workflows panel.
2. Specify the refresh interval you want to use by selecting one of these options from the **Refresh** menu:
   - Refresh Off
   - Refresh Now
   - 10 seconds
   - 30 seconds
   - 60 seconds
   - 5 minutes
3. Click **OK**.

Using Quick Filters to Control the Display

Sometimes you might want to show or hide workflows that have a particular status.

1 Click the **Quick Filters** command in the Workflows panel.

2 Select one of the following choices to filter the items in the list:

Choice	Description
Show all workflows	Disables all previous filters and displays all workflows in process.
Hide/show completed workflows	Hides or shows workflows that have completed processing.
Hide/show terminated workflows	Hides or shows workflows that have been terminated.
Hide/show stopped workflows	Hides or shows workflows that have been stopped by user action.
Hide/show running workflows	Hides or shows workflows that are still running.

Sorting the List of Workflows

If you have a large number of request definitions, you might want to sort the list by a particular column, such as **Name** or **Description**.

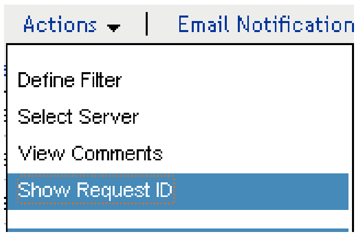
1 Click the heading for the sort column.

Displaying the Process Request ID

You can display and sort data based on the internal process ID for a request.

1 Click the **Actions** command in the Workflows panel.

2 Click **Show Request ID** on the **Actions** menu.



Depending on your display, you might need to scroll to the right to see the **Request ID** column.

To sort the data based on the process request ID, click the heading for the **Request ID** column.

Terminating a Workflow Instance

If you do not want a workflow instance to continue its processing, you can terminate the workflow.

1 Select the workflow in the Workflows panel by clicking the check box next to the workflow name.

2 Click the **Terminate** command in the Workflows panel.

Viewing Details about a Workflow Instance

When you have displayed a set of running workflows on a particular server, you can select a workflow instance to see more details about the running process.

NOTE: If a workflow instance uses a serial processing design pattern, the display shows a single activity as current because only one user can act on the work item at any point in time. However, if the workflow handles parallel processing and branching, there might be multiple current activities for a workflow instance.

To view details about a particular workflow instance:

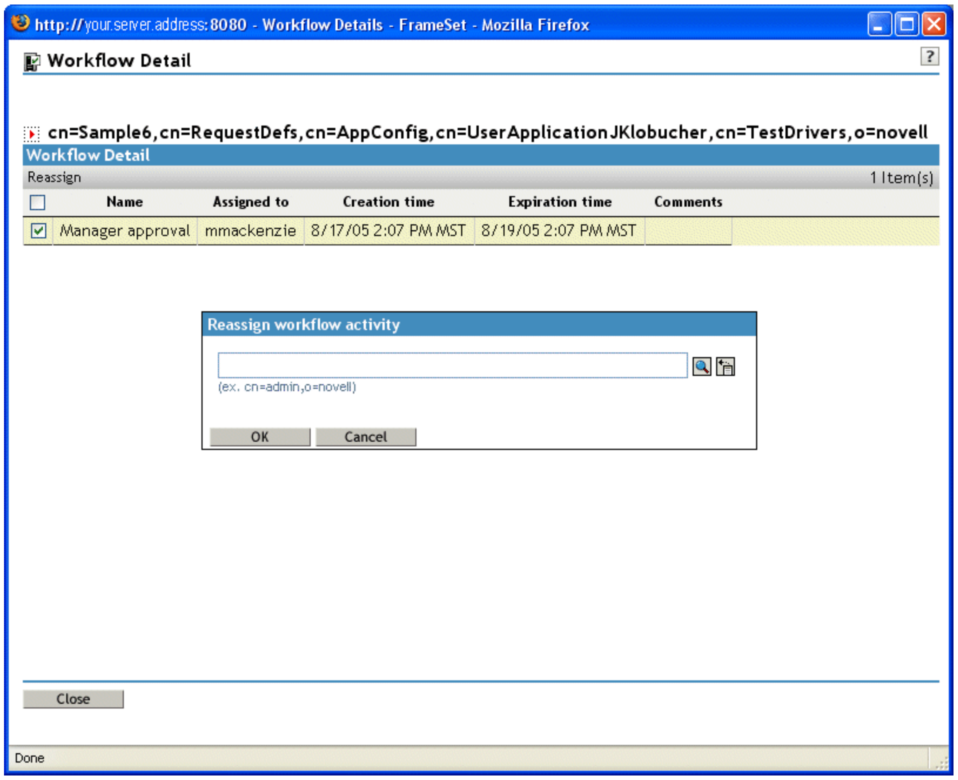
1. Click the name of the workflow instance in the Workflows panel.

   iManager displays the Workflow Detail panel.

Reassigning a Workflow Instance

If a workflow instance has stopped and cannot be restarted, you can reassign the work item to another user or group.

1. Select the current activity associated with the workflow by clicking the check box next to the name in the Workflow Detail panel.
2. Click the **Reassign** command in the Workflow Detail panel.


http://your.server.address:8080 - Workflow Details - FrameSet - Mozilla Firefox
Workflow Detail
Reassign workflow activity
(ex. cn=admin,o=novell)
OK
Cancel
Close
Done

cn=Sample6,cn=RequestDefs,cn=AppConfig,cn=UserApplication JKlobucher,cn=TestDrivers,o=novell

Workflow Detail

Reassign — 1 Item(s)

	Name	Assigned to	Creation time	Expiration time	Comments
✓	Manager approval	mmackenzie	8/17/05 2:07 PM MST	8/19/05 2:07 PM MST	

3. Select the user or group to which you want to reassign the work item.

Managing Workflow Processes in a Cluster

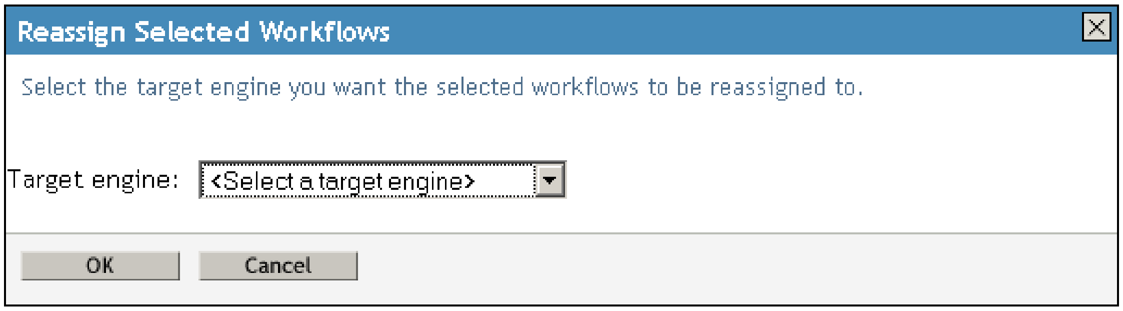
You can use the Workflows screen to reassign processes from one workflow engine to another. For example, you could use this feature to reassign processes back to a failed workflow engine when the workflow engine is brought back online, or you could redistribute processes to other engines when an engine is permanently removed from the cluster.

The source engine(s) must be a in a SHUTDOWN or TIMEDOUT state. The target engine must be restarted in order to restart the processes that were reassigned to that engine.

Reassigning a Process from One Workflow Engine to Another

1 In the Workflows panel, select the workflow that you would like to reassign by clicking the check box next to the workflow name.

2 Select **Actions > Reassign**.


Reassign Selected Workflows

Select the target engine you want the selected workflows to be reassigned to.

Target engine: <Select a target engine>

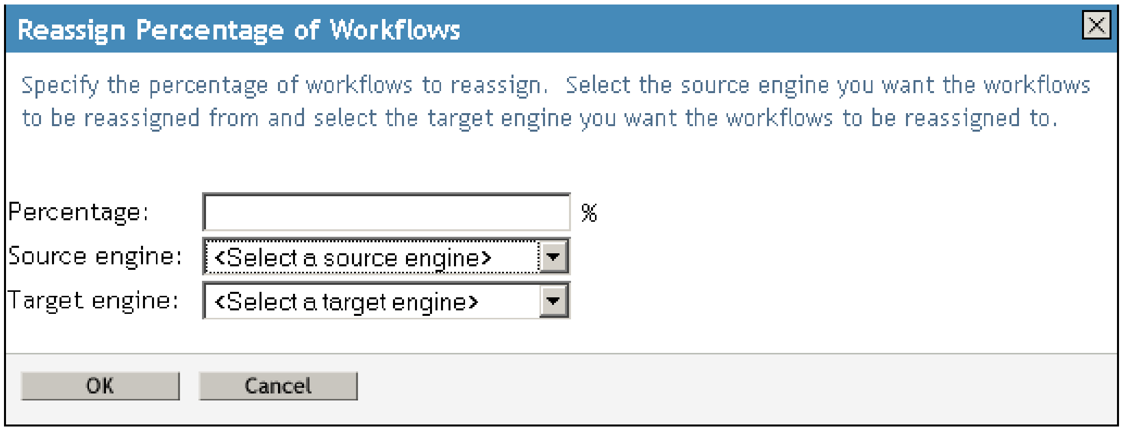
3 Select the workflow engine to which you want to reassign the workflow process from the **Target Engine** list.

4 Click **OK**.

Reassigning a Percentage of Processes from One Workflow Engine to Another

1 In the Workflows panel, select the workflow that you would like to reassign by clicking the check box next to the workflow name.

2 Select **Actions > Reassign Percentage**.


Reassign Percentage of Workflows

Specify the percentage of workflows to reassign. Select the source engine you want the workflows to be reassigned from and select the target engine you want the workflows to be reassigned to.

Percentage: %

Source engine: <Select a source engine>

Target engine: <Select a target engine>

3 In the **Percentage** field, type the percentage of workflow processes that you would like to reassign from one workflow engine to another.

4 Use the **Source engine** list to select the workflow engine from which you want to reassign processes.

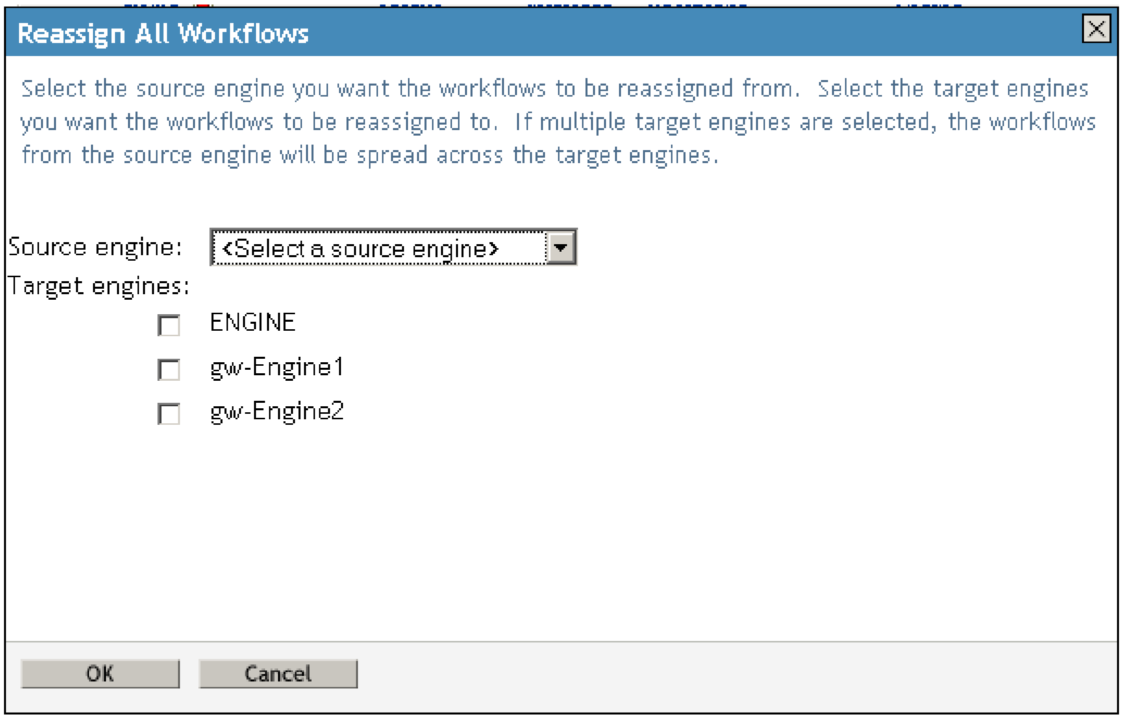
5 Use the **Target engine** field to select the workflow engine to which you want to reassign processes.

6 Click **OK**.

Reassigning All Processes from One Workflow Engine to Another

1 In the Workflows panel, select the workflow that you would like to reassign by clicking the check box next to the workflow name.

2 Select **Actions > Reassign All**.



Reassign All Workflows

Select the source engine you want the workflows to be reassigned from. Select the target engines you want the workflows to be reassigned to. If multiple target engines are selected, the workflows from the source engine will be spread across the target engines.

Source engine: <Select a source engine>

Target engines:

☐ ENGINE

☐ gw-Engine1

☐ gw-Engine2

3 Use the **Source engine** list to select the workflow engine from which you want to reassign processes.

4 Select the workflow engines to which you would like to reassign processes by clicking the check box next to the name of the workflow engine.

If you select multiple target engines, the processes from the source engine will be evenly distributed to the target engine.

5 Click **OK**.

Configuring the Email Server

A workflow process often sends email notifications at various points in the course of its execution. For example, an email might be sent when a user assigns a workflow activity to a new addressee.

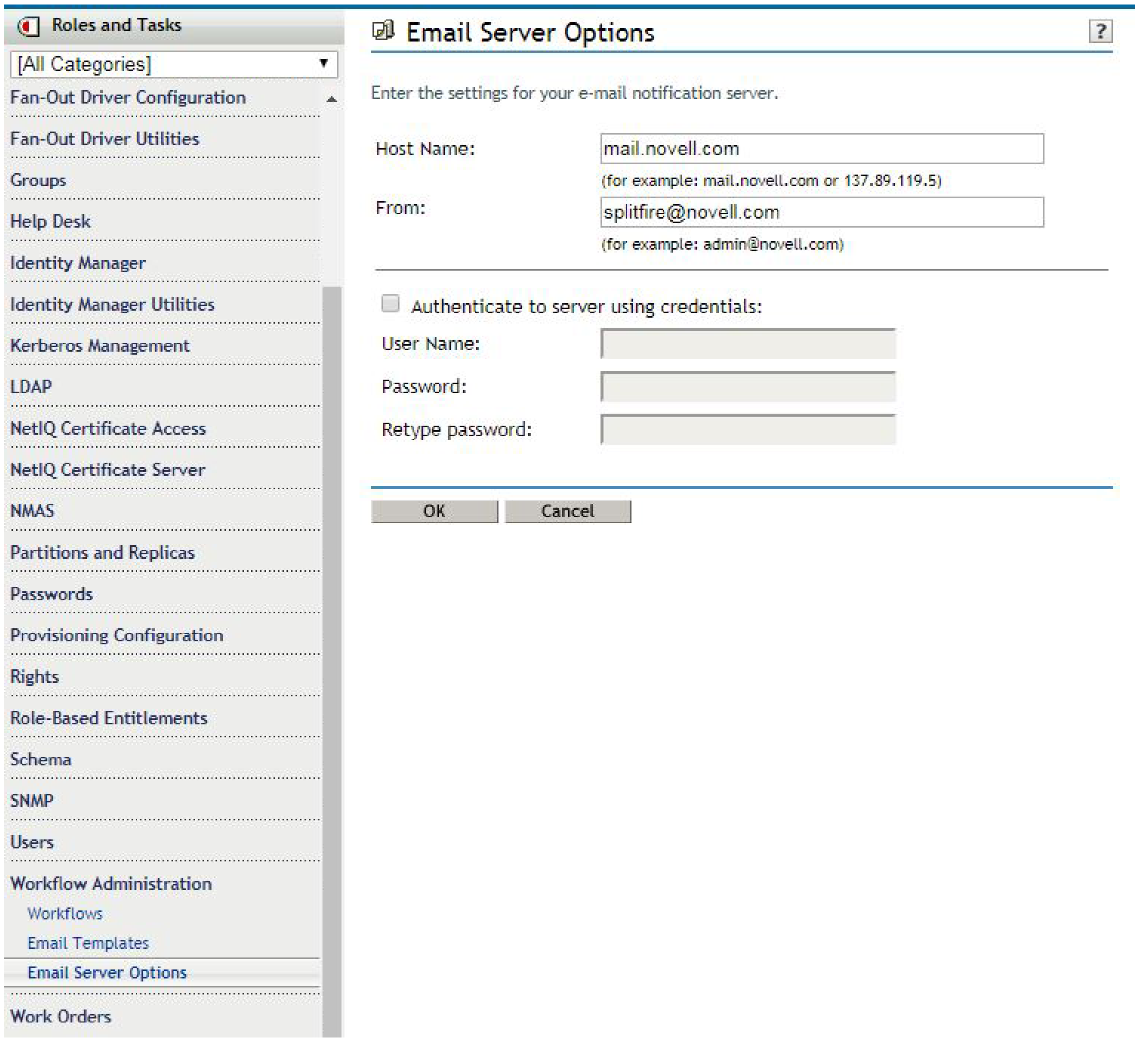
Before you can take advantage of the email notification capabilities of Identity Manager, you need to configure the SMTP email server. To do this, you need to use the **Email Server Options** task within the Workflow Administration role in iManager.

NOTE: This task is a shortcut to the **Email Server Options** task under the Passwords role.

To configure the email server:

1. Select the Identity Managercategory in iManager.
2. Open the **Workflow Administration** role.
3. Click on the **Email Server Options** task.

   iManager displays the Email Server Options panel.



Enter the settings for your e-mail notification server.

Host Name:	mail.novell.com
	(for example: mail.novell.com or 137.89.119.5)
From:	splitfire@novell.com
	(for example: admin@novell.com)

☐ Authenticate to server using credentials:

User Name:	
Password:	
Retype password:	

4. Type the name (or IP address) of the host server in the **Host Name** field.
5. Type the email address for the sender in the **From** field.

When the recipient opens the email, this text is displayed in the **From** field of the email header. Depending on your mail server settings, the text in this field might need to match a valid sender in the system in order to allow the mail server to do reverse lookups or authentication. An example is helpdesk@company.com instead of descriptive text such as The Password Administrator.

6. If your server requires authentication before sending email, select the **Authenticate to server using credentials** check box and specify the username and password.
7. When you are finished, click **OK**.

Working with Email Templates

Identity Manager includes email notification templates that are designed specifically for workflow-based provisioning. These email templates include the following.

- **New Provisioning Request** (Provisioning Notification)
- **Availability Setting Notification** (Availability)
- **Delegate Assignment Notification** (Delegate)
- **Provisioning Approval Notification** (Provisioning Approval Completed Notification)
- **Reminder - A request is waiting on your approval** (Provisioning Reminder)
- **Proxy Assignment Notification** (Proxy)
- **New Role Request** (Role Request Notification)
- **Role Request Approval Notification** (Role Request Approval Completed Notification)
- **Compliance Task** (Attestation Notification)
- **New Resource Request** (Resource Request Notification)
- **Resource Request Approval Notification** (Resource Request Approval Completed Notification)

The subject lines are listed first above. The template names (as they appear in iManager and Designer) are given in parentheses.

You can edit the templates to change the content and format of email messages. You can also create new templates. If you create new templates, you need to follow these naming conventions.

- The language-independent version of the Provisioning Notification template can have any name you like. The default template for notification email messages is called:

  `Provisioning Notification`
- The language-independent version of the Provisioning Reminder template can have any name you like. The default template for reminder email messages is called:

  `Provisioning Reminder`
- Each delegation template must have a name that begins with the word:

  `delegate`

  The language-independent name can be followed by one or more characters that describe the purpose or content of the template.
- Each proxy template must have a name that begins with the word:

  `proxy`

  The language-independent name can be followed by one or more characters that describe the purpose or content of the template.
- Each availability template must have a name that begins with the word:

`availability`

The language-independent name can be followed by one or more characters that describe the purpose or content of the template.

Each language-specific version of a template must have a suffix that provides a language code (for example, _fr for French, _es for Spanish, and so forth).

To create or edit an email template, use the **Email Templates** task within the Workflow Administration role in iManager.

NOTE: This task is a shortcut to the **Edit Email Templates** task under the Passwords role.

You also can create and edit email templates in Designer.

When you create a User Application driver in iManager or Designer, any email notification templates that are missing from the standard set of email notification templates are replaced. Existing email notification templates are not updated. This is to prevent overwriting email notification templates that you have customized. You can manually update the existing email notification templates using Designer. For more information, see About Email Notification Templates in the *NetIQ Identity Manager - Administrator's Guide to Designing the Identity Applications* and Setting Up E-Mail Notification Templates in the *NetIQ Designer for Identity Manager Administration Guide*.

NOTE: When you use a localized email template in a provisioning request definition, the preferred locale setting of the recipient of the notification is ignored. For example, the Provisioning Notification of a request using a localized email notification template of Spanish will only send a Spanish email, regardless of the preferred locale setting for the user.

Default Content and Format

This section shows you what the content of the email templates looks like after you install the product. It also describes the replacement tags that can be used in the email template.

New Provisioning Request

This template identifies the provisioning request definition that triggered the email message. In addition, it includes a URL that redirects the addressee to the task that requires approval, as well as a URL that displays the complete list of tasks pending for that user.

```
Hi,

A new provisioning request has been submitted that requires your approval.

Request name: $requestTitle$
Submitted by: $initiatorFullName$
Recipient: $recipientFullName$

Please review the details of this request at $PROTOCOL$://$HOST$:$PORT$/
$TASK_DETAILS$ to take the appropriate action.

You can review a list of all requests pending your approval at $PROTOCOL$://
$HOST$:$PORT$/$TASKLIST_CONTEXT$.
```

Table 19-2 New Provisioning Request Template: Replacement Tags

Tag	Description
`$userFirstName$`	The first name of the addressee.
`$requestTitle$`	The display name of the provisioning request definition.
`$initiatorFullName$`	The full name of the initiator.
`$recipientFullName$`	The full name of the recipient.
`$PROTOCOL$`	The protocol for URLs included in the email message.
`$SECURE_PROTOCOL$`	The secure protocol for URLs included in the email message.
`$HOST$`	The host for the Tomcat application server that is running the identity applications. For information about setting the value for this parameter, see "Modifying Default Values for the Template" on page 255.
`$PORT$`	The port for the Identity Manager User Application. For information about setting the value for this parameter, see "Modifying Default Values for the Template" on page 255.
`$SECURE_PORT$`	The secure port for the Identity Manager User Application. For information about setting the value for this parameter, see "Modifying Default Values for the Template" on page 255.
`$TASKLIST_CONTEXT$`	The page that displays the list of all requests pending for the addressee.
`$TASK_DETAILS$`	The page that displays details for the request for which this email message was generated.

Availability Setting Notification

This template identifies a user whose availability has been updated. It includes the start time and expiration time of the period for which the user is unavailable, and the resources for which the user is unavailable.

```
Hi,

$submitterFirstName$ $submitterLastName$ has updated availability settings for
  $userFirstName$ $userLastName$.
  This user has $operation$ an availability setting that applies to the following
resources:

  $resources$

 This setting indicates that $userFirstName$ $userLastName$ is unavailable to work
on these resources during the timeframe outlined below:

  Start time: $startTime$
  Expiration time: $expirationTime$

  When a user is unavailable, any delegates assigned may handle resource requests
for that user.

You can review a list of your availability settings at $PROTOCOL$://$HOST$:$PORT$/
$AVAILABILITY_CONTEXT$.
```

Table 19-3 Availability Setting Notification Template: Replacement Tags

Tag	Description
`$submitterFirstName$`	The first name of the user who updated the availability setting.
`$PROTOCOL$`	The protocol for URLs included in the email message.
`$PORT$`	The port for the Identity Manager User Application. For information about setting the value for this parameter, see "Modifying Default Values for the Template" on page 255.
`$startTime$`	The start time of the workflow for this provisioning request.
`$resources$`	The resources (provisioning requests) for which the addressee is unavailable.
`$SECURE_PROTOCOL$`	The secure protocol for URLs included in the email message.
`$expirationTime$`	The time at which the availability will expire.
`$submitterLastName$`	The last name of the user who updated the availability setting.
`$SECURE_PORT$`	The secure port for the Identity Manager User Application. For information about setting the value for this parameter, see "Modifying Default Values for the Template" on page 255.
`$userFirstName$`	The first name of the user to whom this availability setting applies.
`$userLastName$`	The last name of the user to whom this availability setting applies.
`$HOST$`	The host for the Tomcat application server that is running the identity applications. For information about setting the value for this parameter, see "Modifying Default Values for the Template" on page 255.
`$ASSIGNMENT_LIST_CONTEXT$`	The context or path of the URL to the provisioning User Application.

Delegate Assignment Notification

This template notifies a user when a provisioning request has been submitted that requires the user's approval. It includes the name of the request, the user who submitted the request, and the full name of the recipient. It includes links for viewing the provisioning request and for viewing all provisioning requests awaiting the user's approval.

```
Hi,

A new provisioning request has been submitted that requires your approval.

Request name: $requestTitle$
Submitted by: $initiatorFullName$
Recipient: $recipientFullName$

Please review the details of this request at $PROTOCOL$://$HOST$:$PORT$/
$TASK_DETAILS$ to take the appropriate action.

You can review a list of all requests pending your approval at $PROTOCOL$://
$HOST$:$PORT$/$TASKLIST_CONTEXT$.
_SUBJECT
```

***Table 19-4** Delegate Assignment Notification: Replacement Tags*

Tag	Description
`$submitterFirstName$`	The first name of the user who assigned the delegate.
`$PROTOCOL$`	The protocol for URLs included in the email message.
`$PORT$`	The port for the Identity Manager User Application For information about setting the value for this parameter, see "Modifying Default Values for the Template" on page 255.
`$resources$`	The resources (provisioning requests) for which the delegate is available.
`$SECURE_PROTOCOL$`	The secure protocol for URLs included in the email message.
`$fromUsers$`	The users for which the assigned delegate is authorized to handle resource requests.
`$relationship$`	The relationship defined in the directory abstraction layer that was selected for this delegate assignment.
`$expirationTime$`	The time at which the delegate assignment will expire.
`$fromContainers$`	The containers for which the assigned delegate is authorized to handle resource requests.
`$fromGroups$`	The groups for which the assigned delegate is authorized to handle resource requests.
`$submitterLastName$`	The last name of the user who assigned the delegate.
`$SECURE_PORT$`	The secure port for the Identity Manager User Application. For information about setting the value for this parameter, see "Modifying Default Values for the Template" on page 255.
`$userFirstName$`	The first name of the user who has been assigned as a delegate.
`$userLastName$`	The last name of the user who has been assigned as a delegate.

Tag	Description
`$HOST$`	The host for the Tomcat application server that is running the identity applications. For information about setting the value for this parameter, see "Modifying Default Values for the Template" on page 255.
`$ASSIGNMENT_LIST_CONTEXT$`	The context or path of the URL to the provisioning User Application.

Provisioning Approval Notification

This template notifies a user when an approval process for a provisioning request submitted by the user has been completed.

```
Hi,

The approval process of your provisioning request has completed.

Request name: $requestTitle$
Request id: $requestId$
Submitted by: $initiatorFullName$
Submitted on: $requestSubmissionTime$
Recipient: $recipientFullName$

Status: $requestStatus$
```

Table 19-5 *Provisioning Approval Notification: Replacement Tags*

Tag	Description
`$initiatorFullName$`	The full name of the initiator.
`$requestSubmissionTime$`	The time at which the request was submitted.
`$requestTitle$`	The display name of the provisioning request definition.
`$requestId`	The ID of the provisioning request.
`$recipientFullName$`	The full name of the recipient.

Reminder - A Request Is Waiting on Your Approval

This template reminds a user that a provisioning request that requires the user's approval is waiting in a queue for approval. It includes the name of the request, the user who submitted the request, and the recipient. It includes links for viewing the provisioning request and for viewing all provisioning requests awaiting the user's approval.

```
Hi,

This is a reminder that a provisioning request is sitting in your queue waiting on
your approval.

Request name: $requestTitle$
Submitted by: $initiatorFullName$
Recipient: $recipientFullName$

Please review the details of this request at $PROTOCOL$://$HOST$:$PORT$/
$TASK_DETAILS$ to take the appropriate action.

You can review a list of all requests pending your approval at $PROTOCOL$://
$HOST$:$PORT$/$TASKLIST_CONTEXT$.
```

Table 19-6 *Reminder - A request is waiting on your approval: Replacement Tags*

Tag	Description
`$TASKLIST_CONTEXT$`	The page that displays the list of all requests pending for the addressee.
`$PROTOCOL$`	The protocol for URLs included in the email message.
`$PORT$`	The port for the Identity Manager User Application. For information about setting the value for this parameter, see "Modifying Default Values for the Template" on page 255.
`$SECURE_PROTOCOL$`	The secure protocol for URLs included in the email message.
`$initiatorFullName$`	The full name of the initiator.
`$recipientFullName$`	The full name of the recipient.
`$TASK_DETAILS$`	The page that displays details for the request for which this email message was generated.
`$SECURE_PORT$`	The secure port for the Identity Manager User Application. For information about setting the value for this parameter, see "Modifying Default Values for the Template" on page 255.
`$userFirstName$`	The first name of the addressee.
`$HOST$`	The host for the Tomcat application server that is running the identity applications. For information about setting the value for this parameter, see "Modifying Default Values for the Template" on page 255.
`$requestTitle$`	The display name of the provisioning request definition.

Proxy Assignment Notification

This template notifies the recipient that a proxy has been assigned. The user who has been assigned as a proxy is identified, as are the users, groups, and containers for which the user is authorized to act as proxy. It includes links for viewing the recipient's list of proxy assignments.

```
Hi,

A proxy assignment that authorizes a user to act as proxy for
one or more users, groups, or containers was $operation$ by: $submitterFirstName$
$submitterLastName$.
Unlike delegate assignments, proxy assignments are independent of resource
requests, and therefore apply to all work and settings actions.

The user selected as proxy is:

$userFirstName$  $userLastName$

The assigned proxy is authorized to handle all work for these users, groups, and
containers:

Users: $fromUsers$
Groups: $fromGroups$
Containers: $fromContainers$

This proxy assignment expires at:

$expirationTime$


You can review a list of your proxy assignments at $PROTOCOL$://$HOST$:$PORT$/
$PROXY_CONTEXT$.
```

Table 19-7 *Proxy Assignment Notification: Replacement Tags*

Tag	Description
`$submitterFirstName$`	The first name of the user who assigned the proxy.
`$PROTOCOL$`	The protocol for URLs included in the email message.
`$PORT$`	The port for the Identity Manager User Application. For information about setting the value for this parameter, see "Modifying Default Values for the Template" on page 255.
`$resources$`	The resources (provisioning requests) for which the proxy is available.
`$SECURE_PROTOCOL$`	The secure protocol for URLs included in the email message.
`$fromUsers$`	The users for which the assigned proxy is authorized to handle resource requests.
`$expirationTime$`	The time at which the proxy assignment will expire.
`$fromContainers$`	The containers for which the assigned proxy is authorized to handle resource requests.
`$fromGroups$`	The groups for which the assigned proxy is authorized to handle resource requests.
`$submitterLastName$`	The last name of the user who assigned the proxy.

Tag	Description
`$SECURE_PORT$`	The secure port for the Identity Manager User Application. For information about setting the value for this parameter, see "Modifying Default Values for the Template" on page 255.
`$userFirstName$`	The first name of the user who has been assigned as a proxy.
`$userLastName$`	The last name of the user who has been assigned as a proxy.
`$HOST$`	The host for the Tomcat application server that is running the identity applications. For information about setting the value for this parameter, see "Modifying Default Values for the Template" on page 255.
`$ASSIGNMENT_LIST_CONTEXT$`	The context or path of the URL to the provisioning User Application.

New Role Request

This template identifies the provisioning request definition that triggered the email message. In addition, it includes a URL that redirects the addressee to the task that requires approval, as well as a URL that displays the complete list of tasks pending for that user.

```
Hi,

A new role request has been submitted that requires your approval.

Request name: $requestTitle$
Submitted by: $initiatorFullName$
Recipient: $recipientFullName$

Please review the details of this role request at $PROTOCOL$://$HOST$:$PORT$/
$TASK_DETAILS$ to take the appropriate action.

You can review a list of all role requests pending your approval at $PROTOCOL$://
$HOST$:$PORT$/$TASKLIST_CONTEXT$.
```

Table 19-8 *New Role Request Template: Replacement Tags*

Tag	Description
`$userFirstName$`	The first name of the addressee.
`$requestTitle$`	The display name of the request definition.
`$initiatorFullName$`	The full name of the initiator.
`$recipientFullName$`	The full name of the recipient.
`$PROTOCOL$`	The protocol for URLs included in the email message.
`$SECURE_PROTOCOL$`	The secure protocol for URLs included in the email message.

Tag	Description
`$HOST$`	The host for the Tomcat application server that is running the identity applications. For information about setting the value for this parameter, see "Modifying Default Values for the Template" on page 255.
`$PORT$`	The port for the Identity Manager User Application. For information about setting the value for this parameter, see "Modifying Default Values for the Template" on page 255.
`$SECURE_PORT$`	The secure port for the Identity Manager User Application. For information about setting the value for this parameter, see "Modifying Default Values for the Template" on page 255.
`$TASKLIST_CONTEXT$`	The page that displays the list of all requests pending for the addressee.
`$TASK_DETAILS$`	The page that displays details for the request for which this email message was generated.

Role Request Approval Notification

This template notifies a user when an approval process for a role request submitted by the user has been completed.

```
Hi,

The approval process of your role request has completed.

Request name: $requestTitle$
Request id: $requestId$
Submitted by: $initiatorFullName$
Submitted on: $requestSubmissionTime$
Recipient: $recipientFullName$

Status: $requestStatus$
```

Table 19-9 *Role Request Approval Notification: Replacement Tags*

Tag	Description
`$initiatorFullName$`	The full name of the initiator.
`$requestSubmissionTime$`	The time at which the request was submitted.
`$requestTitle$`	The display name of the provisioning request definition.
`$requestId`	The ID of the role request.
`$recipientFullName$`	The full name of the recipient.

Compliance Task

This template notifies an attester when an attestation process has assigned a task to the attester.

```
Hi,

A new compliance activity has been submitted that requires your attention.

Request name: $requestTitle$
Submitted by: $initiatorFullName$

Please review the details of this compliance activity request at $PROTOCOL$://
$HOST$:$PORT$/$TASK_DETAILS$ to take the appropriate action.

You can review a list of all requests pending your action at $PROTOCOL$://
$HOST$:$PORT$/$TASKLIST_CONTEXT$.
```

Table 19-10 *Compliance Task: Replacement Tags*

Tag	Description
`$initiatorFullName$`	The full name of the initiator.
`$requestTitle$`	The display name of the attestation request.

New Resource Request

This template identifies the resource request definition that triggered the email message. In addition, it includes a URL that redirects the addressee to the task that requires approval, as well as a URL that displays the complete list of tasks pending for that user.

```
Hi,

A new resource request has been submitted that requires your approval.

Request name: $requestTitle$
Submitted by: $initiatorFullName$
Recipient: $recipientFullName$

Please review the details of this role request at $PROTOCOL$://$HOST$:$PORT$/
$TASK_DETAILS$ to take the appropriate action.

You can review a list of all resource requests pending your approval at
$PROTOCOL$://$HOST$:$PORT$/$TASKLIST_CONTEXT$.
```

Table 19-11 New Resource Request Template: Replacement Tags

Tag	Description
`$userFirstName$`	The first name of the addressee.
`$requestTitle$`	The display name of the request definition.
`$initiatorFullName$`	The full name of the initiator.
`$recipientFullName$`	The full name of the recipient.
`$PROTOCOL$`	The protocol for URLs included in the email message.
`$SECURE_PROTOCOL$`	The secure protocol for URLs included in the email message.
`$HOST$`	The host for the Tomcat application server that is running the identity applications.
`$PORT$`	The port for the Identity Manager User Application.
`$SECURE_PORT$`	The secure port for the Identity Manager User Application.
`$TASKLIST_CONTEXT$`	The page that displays the list of all requests pending for the addressee.
`$TASK_DETAILS$`	The page that displays details for the request for which this email message was generated.

Resource Request Approval Notification

This template notifies a user when an approval process for a resource request submitted by the user has been completed.

```
Hi,

The approval process of your resource request has completed.

Request name: $requestTitle$
Request id: $requestId$
Submitted by: $initiatorFullName$
Submitted on: $requestSubmissionTime$
Recipient: $recipientFullName$

Status: $requestStatus$
```

Table 19-12 Role Request Approval Notification: Replacement Tags

Tag	Description
`$initiatorFullName$`	The full name of the initiator.
`$requestSubmissionTime$`	The time at which the request was submitted.
`$requestTitle$`	The display name of the provisioning request definition.
`$requestId`	The ID of the role request.
`$recipientFullName$`	The full name of the recipient.

Editing Email Templates

You can change the content or format of the supplied email templates. For information about creating email templates, see “Configuring Email Notification” in the *NetIQ Identity Manager Administration Guide.*

To edit a template:

1 Select the **Identity Manager** category in iManager.

2 Open the **Workflow Administration** role.

3 Click the **Email Templates** task.

   iManager displays the **Edit Email Templates** panel.

4 Click the name of the email template that you would like to edit.

   iManager displays the **Modify Email Message** screen.

5 Make your changes in the **Message Body** box.

6 If necessary, copy one or more of the supplied tags in the **Replacement Tags** list to include dynamic text in the message body.

   For a description of the replacement tags, see “Default Content and Format” on page 244.

7 When you are finished, click **OK**.

Modifying Default Values for the Template

At installation time, you can set default values for several of the replacement tags used in email templates. After you have completed the installation, you can also modify these values by using the User Application Configuration tool.

1 Run the `configupdate.sh` script in the `idm` folder.

```
./configupdate.sh
```

   On Windows, run `configupdate.bat`.

2 Make changes as necessary to any of the following fields:

Field	Description
Email Notify Host	Used to replace the $HOST$token in email templates used in approval flows. If left blank, computed by the server.
Email Notify Port	Used to replace the $PORT$token in email templates used in approval flows.
Email Notify Secure Port	Used to replace the $SECURE_PORT$token in email templates used in approval flows.

3 Click **OK** to confirm your changes.

Adding Localized Email Templates

To add localized email templates:

1 Select the **Identity Manager** category in iManager.

2 Open the **Workflow Administration** role.

3 Click the **Email Templates** task.

iManager displays the **Edit Email Templates** panel.

4 Identify the email template (without any locale in the name) that you want to copy.

   4a Write down the template name to use in Step 5.

   4b Click the template subject to open the template and view its message subject, body, and replacement tags.

   4c Copy the message subject, body (to be translated), and replacement tags that you want to use in your new template.

   4d Click **Cancel**.

5 Click **Create**, then enter the template name with a locale extension. For example, to create a Forgot Hint template in German, enter the name Forgot Hint_de, where _de signifies Deutsch (German).

If you use a two-letter language and two-letter country code, this works fine. If you attempt to use a locale with a variant such as en_US_TX, only the variant and language are considered. Do not use locale variants when naming email templates.

6 Click **OK**.

7 In the template list, click the newly created template, for example Forgot Hint_de, and enter the translated subject and message body. Be sure to preserve the replacement tags surrounded by the dollar ($) sign in the message body.

8 If necessary, copy one or more of the supplied tags in the **Replacement Tags** list to include dynamic text in the message body.

For a description of the replacement tags, see "Default Content and Format" on page 244.

9 Click **Apply**.

10 Click **OK**.

NOTE: Email templates only send localized content if the preferred locale is set for the user (to whom the mail is sent).

Allowing a Named Password to be Retrieved over LDAP

You can add a boolean definition to the User Application driver to allow a named password to be retrieved over LDAP from a workflow. To take advantage of this feature, you need to create a global configuration value "allow-fetch-named-passwords".

Here's a sample definition:

```
<definitions>
    <definition display-name="Allow Named Password to be retrieved over LDAP"
name="allow-fetch-named-passwords" type="boolean">
        <value>false</value>
        <description>Allow Named Password to be retrieved over LDAP. If the
value is true, then the named password value can be fetched using the LDAP
extension
com.novell.nds.dirxml.ldap.GetNamedPasswordRequest/
com.novell.nds.dirxml.ldap.GetNamedPasswordResponse.</description>
    </definition>
</definitions>
```

If the global configuration is not present, the runtime functions as if the definition is present and the value is set to false. If you then try to use the GCV script method getValueForNamedPassword(String valueKey), an exception is thrown since the permission is set to false. If you want to be able to use the method, then the value for allow-fetch-named-passwords variable must be true.

If the gcv variable allow-fetch-named-passwords does not exist, you have to create the variable and set it to `true`. If it already exists, you can simply need to set the value to true.

NOTE: To retrieve a named password, you must use the GCV script method getValueForNamedPassword on a GCV of the `password-ref` type, which points to the named password. You cannot use the get script method.

To add the GCV value for the `allow-fetch-named-passwords` option:

1 In iManager, double click on the User Application driver.

2 Click on the Global Configuration Values tab.

3 Click on the *Add* button.

4 Fill out the definition, as described below:

  4a Specify `allow-fetch-named-passwords` as the name for the global configuration definition.

  4b Specify `Allow Named Password to be retrieved over LDAP` as the display name.

  4c Provide a description for the definition.

  4d Specify **boolean** as the Type.

5 Click *OK*.

6 Set the value to true or false and click *Apply*.

7 Create a named password in your User Application driver.

8 Create a GCV of the type `password-ref` that points to the named password you want to be able to read.

9 In your workflow, use the function getValueForNamedPassword to retrieve the value of the named password, using the following syntax:

```
GCV.getValueForNamedPassword('PasswordRefGCV')
```

VI Web Service Reference

These sections describe the Web Service endpoints provided for the User Application.

20 Provisioning Web Service

This section describes the Provisioning Web Service, which allows SOAP clients to access Provisioning functionality.

About the Provisioning Web Service

The Identity Manager User Application includes a workflow system that executes approval flows. A workflow process is based on a provisioning request definition, which is an XML document stored in the Identity Vault. The provisioning request definition describes an arbitrary topology using activities and links. For example, a provisioning request to grant an entitlement might have a workflow that collects approvals from relevant users and writes the entitlement to the directory.

To support access by third-party software applications, the provisioning workflow system includes a Web service endpoint. The endpoint offers all provisioning functionality (for example, allowing SOAP clients to start a new approval flow, or list currently executing flows). The Web service is built using the NetIQ Web Service SDK (WSSDK), which supports the WS-I Basic Profile, thus guaranteeing interoperability with other standards based SOAP implementations.

This Appendix describes the provisioning Web service in detail and shows how to access it using the Web or by writing a Java or C# client. We provide an overview of the operations in the SOAP endpoint and describe how to use the Web interface. We show how to develop a Java client using the SOAP toolkit included with Identity Manager provisioning, followed by how to write a C# client using Mono. The sample source code a the Java client and associated ANT build file is provided.

Provisioning Web Service Overview

Identity Manager is composed of two main systems: the Identity Vault and the workflow application. The Identity Vault is capable of connecting to a large number of different systems such as databases, financial systems, and other enterprise applications, and keep these systems synchronized. The rules for synchronizing the remote systems can be very complex and the Identity Vault engine supports a sophisticated scripting language for expressing the rules.

The workflow application is composed of several subsystems. The User Application provides a user-interface for workflows. The User Application is a Web application for requesting and managing approval flows. The Web application runs in a portal, which also includes administration portlets. The workflow application contains a security layer, a directory abstraction layer and a logging subsystem, which can send log events to NetIQ Sentinel. The workflow subsystem is responsible for executing approval flows. The User Application runs on a Tomcat application server and uses a database (for example, Oracle) for persistence.

The Web service for the workflow system is only used by the User Application driver, which is capable of listening to certain events emitted by the Identity Vault engine and convert these events into an appropriate SOAP message. For example, when a specific attribute in the Identity Vault changes, the Identity Vault engine emits an event, which the User Application picks up from the subscriber channel. The User Application driver then sends a SOAP message to the provisioning Web service to start a new approval flow.

Removing Administrator Credential Restrictions

By default, the requirement for invoking the public interfaces for the SOAP services is that the HTTP session logged in user must have administrator credentials. The Provisioning and Directory Services require Provisioning Administrator credentials. The Role Service and Resource Service require Role Administrator and Resource Administrator credentials respectively. The restrictions can be removed to allow a session with a logged in user who does not have administrator credentials to invoke the methods for the services by changing the configuration settings for the service. The details for changing the Provisioning Service follow. Instructions for the other SOAP services are provided with the documentation for these services.

To remove the administrator credential restriction for the Provisioning Service:

1. Open the `ism-configuration.properties` file, located by default in the `/netiq/idm/apps/tomcat/conf` directory.
2. Change `WorkflowService/SOAP-End-Points-Accessible-By-ProvisioningAdminOnly` to `false`.
3. Save and close the file.

These are the methods that can be invoked by users without Provisioning Administrator credentials if the WorkflowService/SOAP-End-Points-Accessible-By-ProvisioningAdminOnly property is set to false:

- getAllProvisioningRequests(String)
- getDataItems(String workId)
- getDefinitionByID(String definitionID, String recipient)
- getProvisioningCategories()
- getProvisioningRequests(String recipient, String category, String operation)
- getWork(String workId)
- getWorkEntries(T_WorkEntryQuery query, int maxRecords)
- start(String processId, String recipient, DataItemArray items)
- startAsProxy(String processId, String recipient, DataItemArray items, String proxyUser)
- startAsProxyWithDigitalSignature(String processId, String recipient, DataItemArray items, String digitalSignature, SignaturePropertyArray digitalSignaturePropertyArray, String proxyUser)
- startWithCorrelationId(String processId, String recipient, DataItemArray items, String digitalSignature, SignaturePropertyArray digitalSignaturePropertyArray, String proxyUser, String correlationId)
- startWithDigitalSignature(String processId, String recipient, DataItemArray items, String digitalSignature, SignaturePropertyArray digitalSignaturePropertyArray)

All other methods for this service always require Provisioning Administrator credentials independent of whether the WorkflowService/SOAP-End-Points-Accessible-By-ProvisioningAdminOnly property is set to false.

Provisioning Web Service Method Categories

The methods provided by the provisioning Web service endpoint are divided into six categories:

***Table 20-1** Provisioning Web Service Operation Categories*

Category	Description
Comments	Methods for retrieving comments and for adding a comment to a pending user activity
Configuration	Methods for getting and setting configuration parameters for the workflow system (for example, timeouts, thread pool settings).
Miscellaneous	Several unrelated methods (for example, for getting a JPG with a provisioning request's topology, for getting the XML definition of a provisioning request, and for getting the XML for the request form).
Processes	Methods for getting information about running and completed workflow processes.
Provisioning Requests	Methods for working with provisioning requests (for example, listing available provisioning requests, listing provisioning categories)
Work Entries	Methods for retrieving and manipulating work entries (items awaiting approval).

The methods provided by the provisioning Web service are described in detail in "Provisioning Web Service API" on page 273.

Developing Clients for the Provisioning Web Service

Web Access to the Provisioning Web Service

A SOAP-based Web service is usually accessed by inserting a SOAP message in the body of an HTTP Post request.The Web service toolkit used to build the provisioning Web service also supports access using HTTP GET. In other words, you can open the URL of the Web service endpoint in a browser and interact with the Web service. In particular, the provisioning Web service lets you invoke each of its operations.

Accessing the Test Page

You can access the provisioning Web Service endpoint using a URL similar to the following:

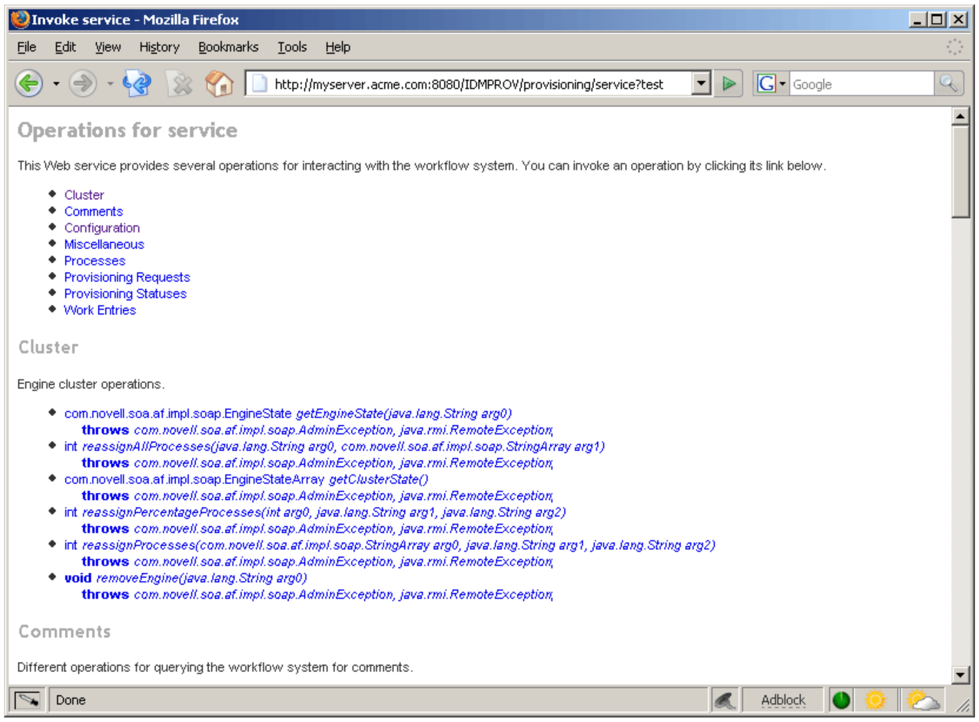
```
http://server:port/warcontext/provisioning/service?test
```

For example, if your server is named "myserver", your User Application is listening on port 8080, and your User Application war file is named "IDMPROV", the URL would be:

```
http://myserver:8080/IDMPROV/provisioning/service?test
```

The following page is displayed:

Figure 20-1 *Web Service Test Page*


Invoke service - Mozilla Firefox
File Edit View History Bookmarks Tools Help
http://myserver.acme.com:8080/IDMPROV/provisioning/service?test
Google
Done
Adblock

Operations for service

This Web service provides several operations for interacting with the workflow system. You can invoke an operation by clicking its link below.

- Cluster
- Comments
- Configuration
- Miscellaneous
- Processes
- Provisioning Requests
- Provisioning Statuses
- Work Entries

Cluster

Engine cluster operations.

- com.novell.soa.af.impl.soap.EngineState *getEngineState(java.lang.String arg0)*
  throws *com.novell.soa.af.impl.soap.AdminException, java.rmi.RemoteException;*
- int *reassignAllProcesses(java.lang.String arg0, com.novell.soa.af.impl.soap.StringArray arg1)*
  throws *com.novell.soa.af.impl.soap.AdminException, java.rmi.RemoteException;*
- com.novell.soa.af.impl.soap.EngineStateArray *getClusterState()*
  throws *com.novell.soa.af.impl.soap.AdminException, java.rmi.RemoteException;*
- int *reassignPercentageProcesses(int arg0, java.lang.String arg1, java.lang.String arg2)*
  throws *com.novell.soa.af.impl.soap.AdminException, java.rmi.RemoteException;*
- int *reassignProcesses(com.novell.soa.af.impl.soap.StringArray arg0, java.lang.String arg1, java.lang.String arg2)*
  throws *com.novell.soa.af.impl.soap.AdminException, java.rmi.RemoteException;*
- **void** *removeEngine(java.lang.String arg0)*
  throws *com.novell.soa.af.impl.soap.AdminException, java.rmi.RemoteException;*

Comments

Different operations for querying the workflow system for comments.

You can also access the SOAP endpoint by going to the **Administration** within the User Application. To do this, you need to select the **Application Configuration** tab, then select **Web Services** from the left-navigation menu. After selecting **Web Services**, pick the Web Service endpoint you want from the list.

WARNING: The test page is disabled by default. Since some of the methods allow data to be updated, the test page presents a potential security vulnerability and should not be allowed in a production environment. For details on enabling the test page, see the instructions provided for the Role Service in "Enabling the Test Page" on page 383.

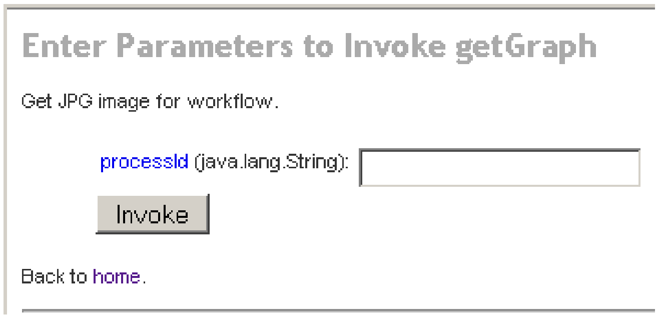
Entering Arguments for Operations

To see an example of an operation that is particularly useful to invoke from the browser, scroll down to the **Miscellaneous** section and click **getGraph**.

NOTE: The Graphviz program must be installed on the computer where the application server and the IDM User Application is running. For more information about Graphviz, see Graphviz (http://www.graphviz.org).

A page is displayed that allows you to enter the parameters for the getGraph method.

Figure 20-2 Parameters for getGraph Method


Enter Parameters to Invoke getGraph

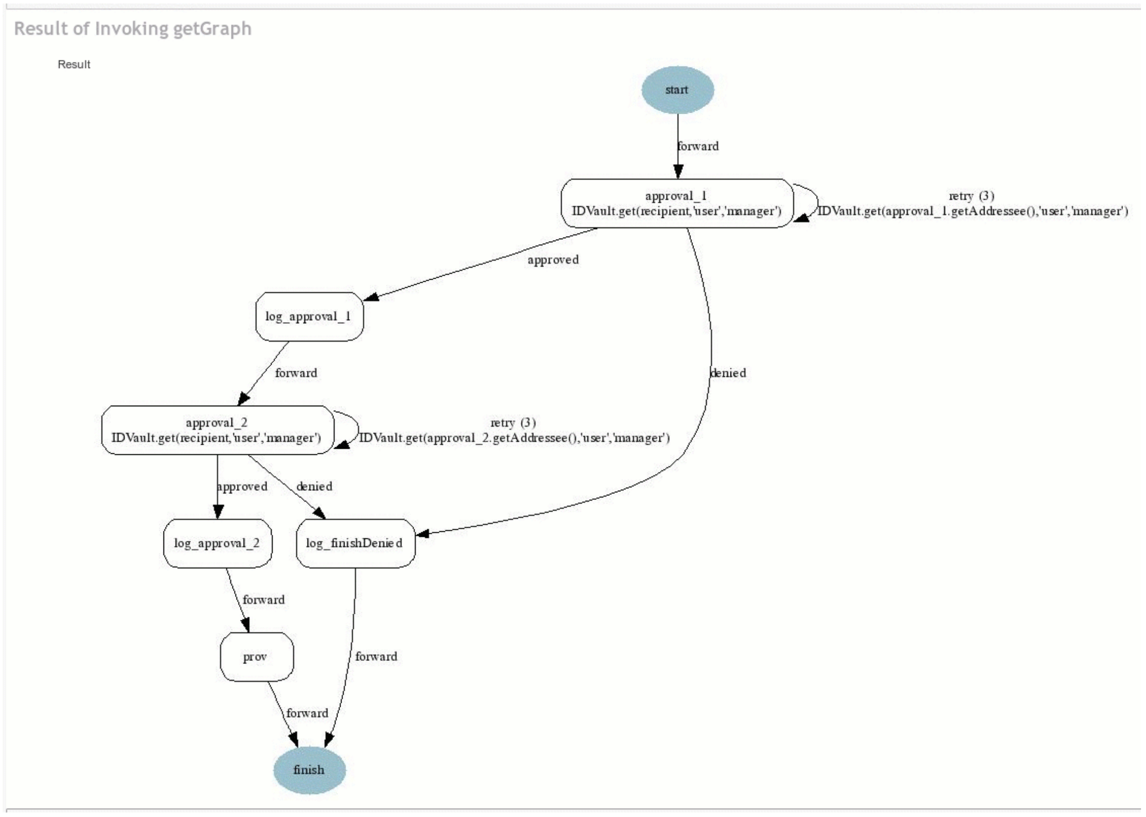
Get JPG image for workflow.

processId (java.lang.String):

Back to home.

The method takes one argument, which is the distinguished name of a provisioning request. Enter the DN, and the underlying workflow is displayed as a JPG file..

Figure 20-3 Output of getGraph


Result of Invoking getGraph

Result

start
forward
approval_1
IDVault.get(recipient,'user','manager')
retry (3)
IDVault.get(approval_1.getAddressee(),'user','manager')
approved
log_approval_1
forward
denied
approval_2
IDVault.get(recipient,'user','manager')
retry (3)
IDVault.get(approval_2.getAddressee(),'user','manager')
approved
denied
log_approval_2
log_finishDenied
forward
prov
forward
forward
finish

A Java Client for the Provisioning Web Service

This section describes how to develop a simple Java client for the provisioning Web service, which lists all the processes in the workflow system. For complete source code for the client, see "Sample Code for the Java Client" on page 269.

Prerequisites

To develop a Java client you must install a supported Java Developer's Kit. Also, a client program needs the following JAR files:

activation.jar
commons-httpclient.jar
IDMfw.jar
IDMrbac.jar
log4j.jar
saaj-api.jar
wssdk.jar
commons-codec-1.3.jar
commons-logging.jar
jaxrpc-api.jar
mail.jar
workflow.jar
xpp3.jar

Developing a Java Client

Developing a client that accesses a Web service consists of two steps:

- Get the stub, which is the object that represents the remote service
- Invoke one or more of the operations available in the remote service

The Java programming model for Web services is very similar to RMI. The first step is to lookup the stub using JNDI:

```
InitialContext ctx = new InitialContext();
ProvisioningService service = (ProvisioningService)
ctx.lookup("xmlrpc:soap:com.novell.soa.af.impl.soap.ProvisioningService");
Provisioning prov = service.getProvisioningPort();
```

The first line of code creates the initial context for JNDI lookups. The second line looks up the service object, which is a kind of factory that can be used to retrieve the stub for the provisioning Web service. The last line gets the provisioning stub from the service.

Before invoking an operation on the provisioning stub, it is necessary to set some properties, including the credentials used for authentication on the service, as well as the endpoint URL.

```
Stub stub = (Stub) prov;
// set username and password
stub._setProperty(Stub.USERNAME_PROPERTY, USERNAME);
stub._setProperty(Stub.PASSWORD_PROPERTY, PASSWORD);
// set the endpoint URL
stub._setProperty(Stub.ENDPOINT_ADDRESS_PROPERTY, url);
```

These and other stub properties are described in more detail in “Frequently Used Stub Constants” on page 267. Now that we have a fully configured stub, we can invoke the getAllProcesses operation and dump information about each of the processes returned on the console:

```
// invoke the getAllProcesses method
ProcessArray array = prov.getAllProcesses();
Process[] procs = array.getProcess();
// print process array
System.out.println("list of all processes:");
if (procs != null) {
for (int i = 0; i < procs.length; i++) {
System.out.println(" process with request identifier " +
procs[i].getRequestId());
System.out.println(" initiator = " + procs[i].getInitiator());
System.out.println(" recipient = " + procs[i].getRecipient());
System.out.println(" processId = " + procs[i].getProcessId());
procs[i].getCreationTime().getTime());
if (null != procs[i].getCompletionTime()) {
System.out.println(" completed = " +
procs[i].getCompletionTime().getTime());
}
System.out.println(" approval status = " +
procs[i].getApprovalStatus());
System.out.println(" process status = " +
procs[i].getProcessStatus());
if (i != procs.length - 1)
System.out.println();
}
}
```

A method invocation on the stub results in a SOAP message being sent using the HTTP transport to the provisioning Web service. For operations that have arguments, the stub takes care of marshaling those Java objects into XML. The Web service returns a SOAP message, and the stub unmarshals the XML, in this case converting it into a ProcessArray Java object.

Running the Client

The sample ANT build file has a target for running the client (see "Sample Ant File" on page 272). The client needs the JAR files described in "Prerequisites" on page 265 to be in the CLASSPATH. You can change the code to have a different default address for the provisioning Web service SOAP endpoint, or simply specify it as a command line argument. For example:

```
ant -Durl=http://www.company.com:80/IDMProv/provisioning/service run
```

Frequently Used Stub Constants

The com.novell.soa.ws.portable.Stub class (which is part of WSSDK) supports several properties that can be used to configure a stub instance (for example, to fine-tune aspects of the HTTP communication). The following table lists a small subset of these properties, which are frequently used:

Table 20-2 *Provisioning Web Service Stub Constants*

Property	Type	Description
ENDPOINT_ADDRESS_PROPERTY	java.lang.String	The URL of the Web service. The URL protocol scheme can be HTTP or HTTPS depending on the requirements of the server. The path portion should be: `/`*`IDMProv`*`/provisioning/service`

Property	Type	Description
HTTP_HEADERS	java.util.Map	Additional HTTP headers as String name/value pairs.
HTTP_TIME_OUT	java.lang.Integer	The number of milliseconds to wait to establish a connection to the host before timing out.
HTTP_MAX_TOTAL_CONNECTIONS	java.lang.Integer	The number of concurrent connections that this client program can establish to all server hosts it accesses. The default limit is 20.
HTTP_MAX_HOST_CONNECTIONS	java.lang.Integer	The number of concurrent connections this client program can establish to an individual server host. The default limit is 2. This value may not exceed that of `HTTP_MAX_TOTAL_CONNECTIONS`, so if a client requires more than 20 connections to the server, it must also set `HTTP_MAX_TOTAL_CONNECTIONS` to the desired value.
USERNAME	java.lang.String	The user ID for HTTP authentication.
PASSWORD	java.lang.String	The password for HTTP authentication.
HTTP_PROXY_HOST	java.lang.String	The host DNS name of a proxy. Setting this property requires setting HTTP_PROXY_PORT as well.
HTTP_PROXY_PORT	java.lang.Integer	The port to use on a proxy. Setting this property requires setting HTTP_PROXY_HOST as well.
HTTP_PROXY_AUTH_SCHEME	java.lang.Integer	The authentication scheme (Basic or Digest) to use for a proxy.
HTTP_PROXY_USERNAME	java.lang.String	The user ID for HTTP authentication using a proxy.
HTTP_PROXY_PASSWORD	java.lang.String	The password for HTTP authentication via proxy.

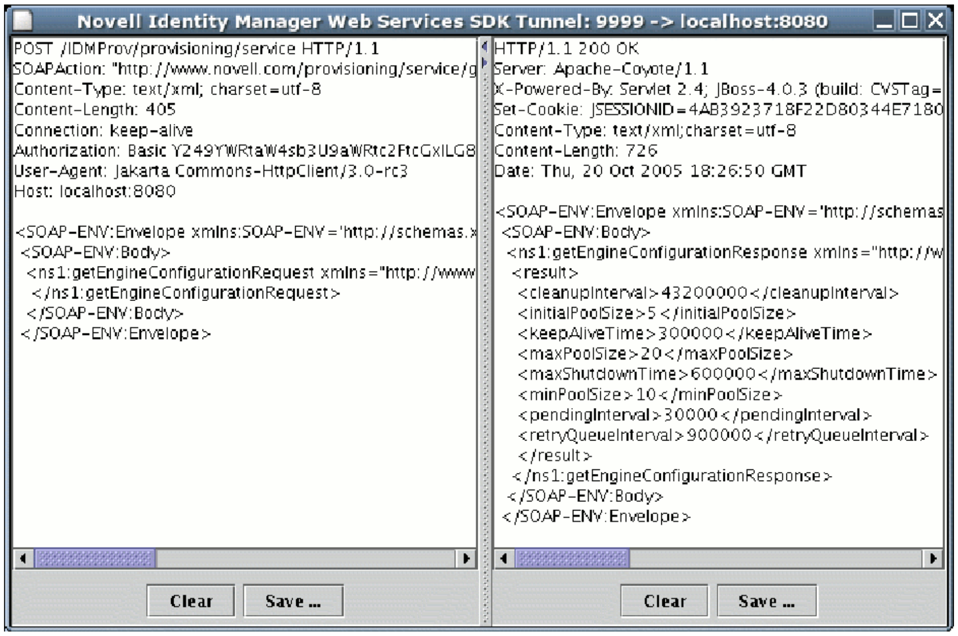
The TCP Tunnel

The TCP Tunnel is a useful tool for looking at the SOAP messages that are exchanged between a client and a server. The ANT build file (see "Sample Ant File" on page 272) has a target for starting the tunnel. Once the tunnel starts you need to enter the port on which the tunnel will listen, and the host/port of the remote Web service. The default settings cause the tunnel to listen on port 9999 and connect to a service running on localhost port 8080. The client program (see "Developing a Java Client" on page 266) uses the first command line parameter to set the ENDPOINT_ADDRESS_PROPERTY. Using the default values, you can run the client using the following command, after starting the tunnel:

```
ant -Durl=http://localhost:9999/IDMProv/provisioning/service run
```

Figure 20-4 shows the TCP tunnel with a request SOAP message in the left panel and the message in the right panel.

Figure 20-4 *TCP Tunnel*


Novell Identity Manager Web Services SDK Tunnel: 9999 -> localhost:8080
Clear
Save ...
Clear
Save ...

```
POST /IDMProv/provisioning/service HTTP/1.1
SOAPAction: "http://www.novell.com/provisioning/service/g
Content-Type: text/xml; charset=utf-8
Content-Length: 405
Connection: keep-alive
Authorization: Basic Y249YWRtaW4sb3U9aWRtc2FtcGxILG8
User-Agent: Jakarta Commons-HttpClient/3.0-rc3
Host: localhost:8080

<SOAP-ENV:Envelope xmlns:SOAP-ENV='http://schemas.x
 <SOAP-ENV:Body>
  <ns1:getEngineConfigurationRequest xmlns="http://www
   </ns1:getEngineConfigurationRequest>
  </SOAP-ENV:Body>
 </SOAP-ENV:Envelope>
```

```
HTTP/1.1 200 OK
Server: Apache-Coyote/1.1
X-Powered-By: Servlet 2.4; JBoss-4.0.3 (build: CVSTag=
Set-Cookie: JSESSIONID=4AB3923718F22D80344E7180
Content-Type: text/xml;charset=utf-8
Content-Length: 726
Date: Thu, 20 Oct 2005 18:26:50 GMT

<SOAP-ENV:Envelope xmlns:SOAP-ENV='http://schemas
 <SOAP-ENV:Body>
  <ns1:getEngineConfigurationResponse xmlns="http://w
   <result>
    <cleanupInterval>43200000</cleanupInterval>
    <initialPoolSize>5</initialPoolSize>
    <keepAliveTime>300000</keepAliveTime>
    <maxPoolSize>20</maxPoolSize>
    <maxShutdownTime>600000</maxShutdownTime>
    <minPoolSize>10</minPoolSize>
    <pendingInterval>30000</pendingInterval>
    <retryQueueInterval>900000</retryQueueInterval>
    </result>
   </ns1:getEngineConfigurationResponse>
  </SOAP-ENV:Body>
 </SOAP-ENV:Envelope>
```

Sample Code for the Java Client

The following is the code for the Java client for listing all processes in the workflow system

```
package com.novell.examples;
import javax.naming.InitialContext;
import com.novell.soa.af.impl.soap.AdminException;
import com.novell.soa.af.impl.soap.Process;
import com.novell.soa.af.impl.soap.ProcessArray;
import com.novell.soa.af.impl.soap.Provisioning;
import com.novell.soa.af.impl.soap.ProvisioningService;
import com.novell.soa.ws.portable.Stub;
public class Client
{
private static final String USERNAME = "admin";
private static final String PASSWORD = "test";
public static void main(String[] args)
{
try {
String url = args.length > 0 ? args[0] :
"http://localhost:8080/IDMProv/provisioning/service";
listProcesses(url);
} catch (AdminException ex) {
System.out.println("command failed: " + ex.getReason());
} catch (Exception ex) {
ex.printStackTrace();
}
}
private static void listProcesses(String url)
throws Exception
{
// get the stub
InitialContext ctx = new InitialContext();
ProvisioningService service = (ProvisioningService)
ctx.lookup("xmlrpc:soap:com.novell.soa.af.impl.soap.ProvisioningService");
Provisioning prov = service.getProvisioningPort();
Stub stub = (Stub) prov;
// set username and password
stub._setProperty(Stub.USERNAME_PROPERTY, USERNAME);
stub._setProperty(Stub.PASSWORD_PROPERTY, PASSWORD);
// set the endpoint URL
stub._setProperty(Stub.ENDPOINT_ADDRESS_PROPERTY, url);
// invoke the getAllProcesses method
ProcessArray array = prov.getAllProcesses();
Process[] procs = array.getProcess();
// print process array
System.out.println("list of all processes:");
if (procs != null) {
for (int i = 0; i < procs.length; i++) {
System.out.println(" process with request identifier " +
procs[i].getRequestId());
System.out.println(" initiator = " + procs[i].getInitiator());
System.out.println(" recipient = " + procs[i].getRecipient());
System.out.println(" processId = " + procs[i].getProcessId());
System.out.println(" created = " +
procs[i].getCreationTime().getTime());
if (null != procs[i].getCompletionTime()) {
System.out.println(" completed = " +
procs[i].getCompletionTime().getTime());
}
System.out.println(" approval status = " +
procs[i].getApprovalStatus());
System.out.println(" process status = " +
procs[i].getProcessStatus());
if (i != procs.length - 1)
System.out.println();
}
}
}
}
```

Developing a Mono Client

The previous section described how to create a Java client using the Web service toolkit and the pre-compiled stub code included with Identity Manager. This section describes how to develop a client using just the WSDL for the provisioning Web service. This example uses Mono and creates a C# client that changes the default retention time of 120 days for completed workflows to 30.

Prerequisites

To get started, you need to download Mono and install it on your system (see the Mono Project Website (http://www.mono-project.com/)). The version of Mono available at the time this document was written did not support complex schema types in which an element has the nillable attribute set to true. Because this construct is used in the provisioning WSDL, you must manually edit the Provisioning.WSDL file and remove the three places where `nillable="true"` is used.

Generating the Stub

Compared to the Java client developed in "Developing a Java Client" on page 266, there is one additional step required when building the C# client. Since the stub for accessing the Web service SOAP endpoint is not provided, you must generate the stub from the WSDL document. Mono includes a compiler called `wsdl` that processes the WSDL file and creates the stub. You can download the WSDL file from your User Application server by accessing the following URL:

```
http://myserver:8080/IDMProv/provisioning/service?wsdl
```

Replace "myserver" with the name of your server, and "IDMProv" with the name of your User Application war file.

Compile the WSDL file using the following command:

```
wsdl Provisioning.wsdl
```

This will generate a C# file called ProvisioningService.cs, which you need to compile into a DLL using the following Mono C# compiler command:

```
mcs /target:library /r:System.Web.Services.dll ProvisioningService.cs
```

Compared to the Java client, the resulting `ProvisioningService.dll` file is the equivalent of `workflow.jar`, which contains the stub code and supporting classes for accessing the provisioning Web service. The following is the source code for the simple C# client that sets the flow retention time and displays the new value on the console:

```
using System;
using System.Net;
class provclient {
public static void Main(string [] args) {
// create the provisioning service proxy
ProvisioningService service = new ProvisioningService();
// set the credentials for basic authentication
service.Credentials = new NetworkCredential("admin", "test");
service.PreAuthenticate = true;
// set the value for completed request retention to 30 days
setCompletedProcessTimeoutRequest req = new
setCompletedProcessTimeoutRequest();
req.arg0 = 30;
service.setCompletedProcessTimeout(req);
// display the new value on the console
getCompletedProcessTimeoutResponse res = service.getCompletedProcessTimeout(new
getCompletedProcessTimeoutRequest());
Console.WriteLine(res.result);
}
}
```

You need to edit the file using the administrator credentials on your deployed Identity Manager system. Compile the client using the following command:

```
mcs /r:ProvisioningService.dll /r:System.Web provclient.cs
```

This generates the `provclient.exe` file.

Running the Client

Use the following command to run the client:

```
mono provclient.exe
```

Sample Ant File

The sample Ant file includes useful targets for extracting the necessary JAR files from the Identity Manager installation, compiling and running the Java client, and for launching the TCP Tunnel.

```
<?xml version="1.0"?>
<project name="client" default="all" basedir=".">
<target name="all" depends="clean, extract, compile"></target>
<!-- main clean target -->
<target name="clean">
<delete quiet="true" dir="classes"/>

<delete quiet="true" dir="lib"/>
</target>
<!-- init sets up the build environment -->
<target name="init">
<mkdir dir="classes"/>
<copy todir="${basedir}/lib">
<fileset dir="${basedir}" includes="log4j.properties"/>
</copy>
<!-- classpath -->
<path id="CLASSPATH">
<pathelement location="${basedir}/classes"/>
<fileset dir="${basedir}/lib" includes="*.jar"/>
</path>
</target>
<!-- extract -->
<target name="extract">
<property name="idm.home" value="/opt/netiq/idm3"/>
<property name="tomcat.lib" value="${idm.home}/tomcat-4.0.3/server/IDMProv/lib"/>
<mkdir dir="lib"/>
<unzip src="${idm.home}/IDMProv.war" dest="${basedir}/lib">
<patternset>
<include name="WEB-INF/lib/commons-codec-1.3.jar"/>
<include name="WEB-INF/lib/commons-httpclient.jar"/>
<include name="WEB-INF/lib/commons-logging.jar"/>
<include name="WEB-INF/lib/jaxrpc-api.jar"/>
<include name="WEB-INF/lib/saaj-api.jar"/>
<include name="WEB-INF/lib/xpp3.jar"/>
<include name="WEB-INF/lib/workflow.jar"/>
<include name="WEB-INF/lib/wssdk.jar"/>
<include name="WEB-INF/lib/IDMfw.jar"/>
</patternset>
</unzip>
<move todir="${basedir}/lib">
<fileset dir="${basedir}/lib/WEB-INF/lib" includes="*.jar"/>
</move>
<delete quiet="true" dir="${basedir}/lib/WEB-INF"/>
<copy todir="${basedir}/lib">
<fileset dir="${tomcat.lib}" includes="activation.jar, mail.jar, log4j.jar"/>
</copy>
</target>
<!-- tunnel -->
<target name="tunnel" depends="init">
<java classname="com.novell.soa.ws.impl.tools.tcptunnel.Tunnel" fork="true"
spawn="true">
<classpath refid="CLASSPATH"/>
</java>
</target>
<!-- compile -->
```

```
<target name="compile" depends="init">
<javac srcdir="${basedir}" destdir="classes"
includes="Client.java">
<classpath refid="CLASSPATH"/>
</javac>
</target>
<!-- run -->
<target name="run" depends="init">
<property name="url" value="http://localhost:8080/IDMProv/provisioning/service"/>
<java classname="com.novell.examples.Client" fork="true">
<arg line="${url}"/>
<classpath refid="CLASSPATH"/>
</java>
</target>
</project>
```

Sample Log4J File

The following log4j file sets the default log level to “error”:

```
log4j.rootCategory=ERROR, R
log4j.appender.R=org.apache.log4j.ConsoleAppender
log4j.appender.R.layout=org.apache.log4j.PatternLayout
log4j.appender.R.layout.ConversionPattern=%-5p: %m%n
```

Provisioning Web Service API

This section provides details about the Provisioning Web service methods.

All of the methods throw com.novell.soa.af.impl.soap.AdminException and java.rmi.RemoteException. To improve readability, the throws clause has been omitted from the method signatures.

Processes

This section provides reference information for each Processes method.

getProcessesByQuery

Used to get information about processes.

Method Signature

```
com.novell.soa.af.impl.soap.ProcessArray
getProcessesByQuery(com.novell.soa.af.impl.soap.T_ProcessInfoQuery query, int
maxRecords)
```

Example

```
        //

   // Query information about processes for a user that are running and
        // have not been approved yet.
        String logic = "AND";
        T_ProcessInfoOrder order = T_ProcessInfoOrder.APPROVAL_STATUS;
        int CHOICE_SIZE = 4;
        Integer approvalStatusInteger = new Integer(ProcessConstants.PROCESSING);
        Integer processStatusInteger = new Integer(ProcessConstants.RUNNING);
        //
        // Setup the query with the above params
        T_ProcessInfoQueryChoice [] choice = new
T_ProcessInfoQueryChoice[CHOICE_SIZE];
        choice[0] = new T_ProcessInfoQueryChoice();
        choice[0].setApprovalStatus(approvalStatusInteger);
        choice[1] = new T_ProcessInfoQueryChoice();
        choice[1].setProcessStatus(processStatusInteger);
        choice[2] = new T_ProcessInfoQueryChoice();
        choice[2].setRecipient(recipient);
        choice[3] = new T_ProcessInfoQueryChoice();
        choice[3].setRequestId(requestId);

        int maxRecords = -1;
        T_ProcessInfoQuery processInfoQuery =
                new T_ProcessInfoQuery(T_Logic.fromString(logic), order, choice);
        ProcessArray processArray = stub.getProcessesByQuery(processInfoQuery,
maxRecords);
```

getProcessesByStatus

Used to get information about processes with a specified status (for example, running processes).

Method Signature

```
public com.novell.soa.af.impl.soap.ProcessArray
getProcessesByStatus(com.novell.soa.af.impl.soap.T_ProcessStatus status)
```

Example

```
      T_ProcessStatus processStatus = T_ProcessStatus.Running;
      //
      // Get processes by status
       ProcessArray processArray = stub.getProcessesByStatus(processStatus);
       Process [] process = processArray.getProcess();
```

getProcesses

Used to get information about processes, specified by processID.

Method Signature

```
com.novell.soa.af.impl.soap.ProcessArray getProcesses(java.lang.String id, long
time,com.novell.soa.af.impl.soap.T_Operator op, java.lang.String initiator,
java.lang.String recipient)
```

Parameters

Parameter	Description
processId	The process Id (java.lang.String).
creationTime	The time at which the process was started (long).
op	The operator to use. The operators are: EQ - equals LT - less than LE - less than or equal to GT - greater than GE - greater than or equal to
initiator	The initiator of the workflow.
recipient	The recipient of the approval activity.

Example

```
       int processMatchCount = 0;
       T_Operator operator = T_Operator.GT;
       long currentTimeInMillis = System.currentTimeMillis();
       String [] requestIds = requestIdArray.getString();
       //
       // Initialize and start a provisioning request
       HashMap provMap = new HashMap();
       provMap.put(Helper.RECIPIENT, recipient);
       provMap.put(I"Provisioning_Request_To_Start_Key", "Enable Active Directory
Account (Mgr Approve-No Timeout)");
       //
       // Start request
       // Calls method startProvisioningRequest on the provUtils
       // utility object which refers to a utility class that does not
       // ship with the Identity Manager User Application.
String requestId = provUtils.startProvisioningRequest(provMap, null);
       sleep(5);

       Process process = stub.getProcess(requestId);
       if(process != null)
       {
            String processId = process.getProcessId();
            String initiator = process.getInitiator();

            ProcessArray processArray = stub.getProcesses(processId,
currentTimeInMillis, operator, initiator, recipient);
       }
```

getAllProcesses

Used to get information about all running and completed provisioning requests.

Method Signature

```
com.novell.soa.af.impl.soap.ProcessArray getAllProcesses()
```

Example

```
    ProcessArray array = stub.getAllProcesses();
    Process [] processes = array.getProcess();
     if(_process != null)
    {
        sb = new StringBuffer();
        sb.append("\nProcess List:");
        for(int index = 0; index < _process.length; index++)
        {
            String processId = _process[index].getProcessId();
            String approvalStatus = _process[index].getApprovalStatus();
            Calendar completionTime = _process[index].getCompletionTime();
            Calendar creationTime = _process[index].getCreationTime();
            String engineId = _process[index].getEngineId();
            String proxy = _process[index].getProxy();
            String initiator = _process[index].getInitiator();
            String processName = _process[index].getProcessName();
            String processStatus = _process[index].getProcessStatus();
            String p_recipient = _process[index].getRecipient();
            String p_requestId = _process[index].getRequestId();
           int valueOfapprovalStatus = _process[index].getValueOfApprovalStatus();
            int valueOfprocessStatus = _process[index].getValueOfProcessStatus();
            String version = _process[index].getVersion();
        }
```

getProcessesArray

Used to limit the number of processes returned. If the limit you specify is less than the system limit, the number you specify is returned. If you exceed the system limit, the Workflow Engine returns the system limit. If the limit you specify is less than or equal to 0, the Workflow Engine returns all processes.

Method Signature

```
com.novell.soa.af.impl.soap.ProcessArray getProcessesArray(int maxRecords);
```

Example

```
    /**
     * Method to augment the getAllProcesses() method that impose limits
     * on the number of processes returned.
     * @throws TestProgramException
     */
    public void adding_Limits_To_getProcessArray_TestCase()
    throws TestProgramException
    {
        String recipient =
ServiceUtils.getInstance().getLoginData().getUsername(LoginData.RECIPIENT_TYPE);
        String requestNameToStart =
provUtils.getProvisioningResourceNameForRecipient(recipient,
                "Enable Active Directory");
        //
        // Get the stub
        Provisioning stub = ServiceUtils.getInstance().getProvisioningStub();
        try
        {
            //
            // Start multiple requests
            final int NUMBER_OF_REQUESTS_TO_START = 2;

            Map map = MapUtils.createAndSetMap(new Object[] {
                    Helper.RECIPIENT, recipient,

IProvisioningConstants.PROVISIONING_REQUEST_TO_START, requestNameToStart});
            //
            // Start request(s)
            StringArray requestIdArray =
                provUtils.startMultipleProvisioningRequests(map, null,
NUMBER_OF_REQUESTS_TO_START);
            LoggerUtils.sleep(3);
            LoggerUtils.sendToLogAndConsole("Started " +
NUMBER_OF_REQUESTS_TO_START + " provisioning requests");
            //
            // New method to limit the number of processes returned
            //
            // Test Results : maxProcesses <= 0 returns all processes
            //                maxProcesses up to system limit returns maxProcess
count
            //                maxProcesses > system limit returns system limit
            int maxProcesses = 10;
            ProcessArray processArray = stub.getProcessesArray(maxProcesses);
            Process [] processes = processArray.getProcess();
            if(processes != null)
            {
                LoggerUtils.sendToLogAndConsole("Process count returned: " +
processes.length);
               Assert.assertEquals("Error: Processes returned shouldn't exceed max
count.",
                        maxProcesses, processes.length);
            }
        }
        catch(AdminException error)
        {
            RationalTestScript.logError(error.getReason() );
            throw new TestProgramException(error.getReason() );
        }
        catch(RemoteException error)
        {
            RationalTestScript.logError(error.getMessage() );
            throw new TestProgramException(error.getMessage() );
        }
    }
```

getProcessesById

Used to get information about a specific process, specified by the Process Id.

Method Signature

```
com.novell.soa.af.impl.soap.ProcessArray getProcessesById(java.lang.String id)
```

Example

```
    Process [] allProcesses = stub.getAllProcesses().getProcess();
    if(allProcesses != null)
    {
          String processId = allProcesses[0].getProcessId;
          ProcessArray array = stub.getProcessesById(processId);
          Process [] processes = array.getProcess();
     }
```

terminate

Used to terminate a running provisioning request.

Method Signature

```
void terminate(java.lang.String requestId,
com.novell.soa.af.impl.soap.T_TerminationType state, java.lang.String comment)
```

Parameters

Parametere	Description
requestId	The Id of the provisioning request.
state	The reason for terminating the process. The choices are: RETRACT ERROR
comment	Adds a comment about the terminate action.

Example

```
     //
     // Initialize and start a provisioning request
     HashMap provMap = new HashMap();
     provMap.put(Helper.RECIPIENT, recipient);
     provMap.put(I"Provisioning_Request_To_Start_Key", "Enable Active Directory
Account (Mgr Approve-No Timeout)");
     //
     // Start request
     // Calls method startProvisioningRequest on the provUtils
     // utility object which refers to a utility class that does not
     // ship with the Identity Manager User Application.
String requestId = provUtils.startProvisioningRequest(provMap, null);
     sleep(5);
     //
     // Now retract the request
     T_TerminationType terminationType = T_TerminationType.RETRACT;
    stub.terminate(requestId, terminationType, terminationType.getValue() + " the
request");
```

getProcess

Used to get information about a running or completed provisioning request, specified by Request ID.

Method Signature

```
com.novell.soa.af.impl.soap.Process getProcess(java.lang.String requestId)
```

Example

```
     //
     // Initialize and start a provisioning request
     HashMap provMap = new HashMap();
     provMap.put(Helper.RECIPIENT, recipient);
     provMap.put(I"Provisioning_Request_To_Start_Key", "Enable Active Directory 
Account (Mgr Approve-No Timeout)");
     //
     // Start request

       // Calls method startProvisioningRequest on the provUtils
       // utility object which refers to a utility class that does not
       // ship with the Identity Manager User Application.
     String requestId = provUtils.startProvisioningRequest(provMap, null);
     sleep(5);

    Process process = stub.getProcess(requestId);
    if(process != null)
    {
        boolean bMatchProcess = false;
        if( (recipient.compareTo(process.getRecipient()) == 0) && 
(requestId.compareTo(process.getRequestId()) == 0) )
        {
            bMatchProcess = true;
        }
        if(bMatchProcess)
        {
            String msg = "Found process with requestId : " + requestId;
            LoggerUtils.sendToLogAndConsole(msg);
        }
        //
        // Assert if we could not find a match
        Assert.assertTrue("Could not find process with request id: " + requestId, 
bMatchProcess);
    }
```

getProcessesByCreationTime

Used to get information about processes created between the current time and the time at which the workflow process was created.

Method Signature

```
com.novell.soa.af.impl.soap.ProcessArray getProcessesByCreationTime(long time, 
com.novell.soa.af.impl.soap.T_Operator op)
```

Parameters

Parameter	Description
creationTime	The time at which the process was started.
op	The operator to use. The operators are: EQ - equals LT - less than LE - less than or equal to GT - greater than GE - greater than or equal to

Example

```
     T_Operator operator = T_Operator.GT;
    //
    // Get processes with operator relative to the current time
    long currentTime = System.currentTimeMillis();//currentDateTime.getTime();
    ProcessArray processArray = stub.getProcessesByCreationTime(currentTime, 
operator);
```

getProcessesByApprovalStatus

Used to get information about processes with a specified approval status (Approved, Denied, or Retracted).

Method Signature

```
com.novell.soa.af.impl.soap.ProcessArray 
getProcessesByApprovalStatus(com.novell.soa.af.impl.soap.T_ApprovalStatus status)
```

Example

```
    T_ApprovalStatus approvalStatus = T_ApprovalStatus.Approved;
    //
    // Get all the processes based upon approval status above
    ProcessArray processArray = stub.getProcessesByApprovalStatus(approvalStatus);
    Process [] processes = processArray.getProcess();
```

getProcessesByRecipient

Used to get information about processes that have a specific recipient Id.

Method Signature

```
com.novell.soa.af.impl.soap.ProcessArray getProcessesByRecipient(java.lang.String 
recipient)
```

Example

```
    String recipient = "cn=ablake,ou=users,ou=idmsample-komodo,o=netiq";
    //
    // Get processes by recipient
    ProcessArray processArray = stub.getProcessesByRecipient(recipient);
    Process [] process = processArray.getProcess();
```

getProcessesByInitiator

Used to get information about processes that have a specific initiator Id.

Method Signature

```
com.novell.soa.af.impl.soap.ProcessArray getProcessesByInitiator(java.lang.String
initiator)
```

Example

```
    String initiator = "cn=admin,ou=idmsample-komodo,o=netiq";

    //
    // Get processes by initiator
    ProcessArray processArray = stub.getProcessesByInitiator(initiator);
    Process [] process = processArray.getProcess();
```

setResult

Used to set the entitlement result (approval status) of a previously completed provisioning request.

Method Signature

```
void setResult(java.lang.String requestId,
com.novell.soa.af.impl.soap.T_EntitlementState state,
com.novell.soa.af.impl.soap.T_EntitlementStatus status, java.lang.String message)
```

Parameters

Parameter	Description
requestId	The Id of the provisioning request.
state	The state of the provisioning request. The possible values are: Unknown Granted Revoked
status	The status of the provisioning request. The possible values are: Unknown Success Warning Error Fatal Submitted
message	A message about the entitlement result.

Example

```
     //
     // Initialize and start a provisioning request
     HashMap provMap = new HashMap();
     provMap.put(Helper.RECIPIENT, recipient);
     provMap.put(I"Provisioning_Request_To_Start_Key", "Enable Active Directory
Account (Mgr Approve-No Timeout)");
     //
     // Start request
     // Calls method startProvisioningRequest on the provUtils
     // utility object which refers to a utility class that does not
     // ship with the Identity Manager User Application.
     String requestId = provUtils.startProvisioningRequest(provMap, null);
     sleep(5);

     //
     // Get the process id for this running process
     Process process = stub.getProcess(requestId);
     String processId = null;
     if (process != null)
        processId = process.getProcessId();
    //
    // Reset the state of the provisioning request
    T_EntitlementState newEntitlementState =
T_EntitlementState.Revoked;
    T_EntitlementStatus newEntitlementStatus = T_EntitlementStatus.Success;
    String comment = "Revoked the provisioning request";
    stub.setResult(processId, newEntitlementState, newEntitlementStatus, comment);
```

getProcessesByCreationInterval

Used to get information about processes started between two specified times.

Method Signature

```
com.novell.soa.af.impl.soap.ProcessArray getProcessesByCreationInterval(long
start, long end)
```

Parameters

Parameter	Description
startTime	The start time (YYYY/MM/DD).
endTime	The end time (YYYY/MM/DD).

Example

```
     long startTime = System.currentTimeMillis();
     //
     // Initialize and start a provisioning request
     HashMap provMap = new HashMap();
     provMap.put(Helper.RECIPIENT, recipient);
     provMap.put(I"Provisioning_Request_To_Start_Key", "Enable Active Directory
Account (Mgr Approve-No Timeout)");
     //
     // Start request
     // Calls method startProvisioningRequest on the provUtils
     // utility object which refers to a utility class that does not
     // ship with the Identity Manager User Application.
     String requestId = provUtils.startProvisioningRequest(provMap, null);
     sleep(5);

    long endTime = System.currentTimeMillis();
    //
    // Get all the processes between the start and end time    ProcessArray
processArray = stub.getProcessesByCreationInterval(startTime, endTime);
    Process [] processes = processArray.getProcess();
```

Provisioning

This section provides reference information for each Provisioning method.

multiStart

Used to start a workflow request for each specified recipient.

Method Signature

```
com.novell.soa.af.impl.soap.StringArray multiStart(java.lang.String processId,
com.novell.soa.af.impl.soap.StringArray recipients,
com.novell.soa.af.impl.soap.DataItemArray items)
```

Parameters

Parameter	Description
processId	The Id of the provisioning request to start.
recipients	The DN of each recipient.
dataItem	The list of data items for the provisioning request.

Example

```
     ProvisioningRequestArray requestArray =
stub.getAllProvisioningRequests(recipient);

    //
    // If there are some then,
    if(requestArray != null)
    {
        String Id = " ";
        StringArray requestIdStringArray = null;
        String [] listOfRecipients = {recipient, addressee};
        //
        // Select a provisioning resource
        String requestNameToStart = "Enable Active Directory Account (Mgr Approve-
No Timeout)";
        //
        // Loop thru and find the request that we want to start
        ProvisioningRequest [] requests = requestArray.getProvisioningrequest();
        for(int index = 0; index < requests.length; index++)
        {
            //
            // Is this the name of the request to start?
            if(requests[index].getName().compareTo(requestNameToStart) == 0)
            {
                //
                // Get the current associated data items. Replicate a new
                // dataitem array excluding the null values.
                Id = requests[index].getId();
                DataItem [] dataItem = requests[index].getItems().getDataitem();
                if(dataItem != null)
                // Call method replicateDataItemArray on the
                // provUtils utility object, which refers to a
                // utility class that does not ship with the
                // Identity Manager User Application.
                {
                    DataItemArray newDataItemArray =
provUtils.replicateDataItemArray(dataItem);
                    //
                    // Create a string array initializing with multiple recipients
                    StringArray listOfRecipientsStringArray = new
StringArray(listOfRecipients);
                    //
                   // Start the request for multiple recipients
                    logStep("Calling stub.multiStart(" + Id +
",listOfRecipientsStringArray,newDataItemArray)");
                    requestIdStringArray = stub.multiStart(Id,
listOfRecipientsStringArray, newDataItemArray);
            }
        }
}
```

start

Used to start a provisioning request.

Method Signature

```
java.lang.String start(java.lang.String processId, java.lang.String recipient,
com.novell.soa.af.impl.soap.DataItemArray items)
```

Parameters

Parameter	Description
processId	The Id of the provisioning request to start.
recipient	The DN of each recipient.
dataItem	The list of data items for the provisioning request.

Example

```
       //
       // Initialize and start a provisioning request
       HashMap provMap = new HashMap();
       provMap.put(Helper.RECIPIENT, recipient);
       provMap.put(I"Provisioning_Request_To_Start_Key", "Enable Active Directory
Account (Mgr Approve-No Timeout)");
       //
       // Start request
       // Calls method startProvisioningRequest on the provUtils
       // utility object which refers to a utility class that does not
       // ship with the Identity Manager User Application.
       String requestId = provUtils.startProvisioningRequest(provMap, null);
       sleep(5);
```

The example above calls the startProvisioningRequest method. This method is not part of the IDM User Application. We show it here to finish illustrating the example:

```
          /**
           *Method to start a provisioning request using the supplied
           *Map and dataitem object. Handling of digital certificate
           *resources is also handled.
           * @param _map
           * @param _in_dataItem
           * @return String
           * @throws TestProgrammException
           */
          public String startProvisioningRequest(Map _map, DataItem []
          _in_dataItem) throws TestProgramException
         {
            String requestId = null;
            try
            {
               String recipient  =(String)_map.get(Helper.RECIPIENT);
               String requestToStart =
(String)_map.get(IProvisioningConstants.PROVISIONING_REQUEST_TO_START);
               String proxyUser  =(String)_map.get(IWorkFlowConstants.PROXY_USER);
               String digitalSignature =
String)_map.get(IDigitalSignatureConstants.DIGITAL_SIGNATURE);
               RationalTestScript.logInfo("Step: Calling
startProvisioningRequest(_map)");
               //
               //Get the stub
              Provisioning stub = ServiceUtils.getInstance().getProvisioningStub();
               //
       //Get all the available resource requests for the recipient
       RationalTestScript.logInfo("Step: Calling stub.getAllProvisioningRequests("
+ recipient + ")");
       ProvisioningRequestArray requestArray =
stub.getAllProvisioningRequests(recipient);

       if(requestArray != null)
       {
           //
           //Get the provisioning request from the array
           ProvisioningRequest request =
getProvisioningRequestFromArray(requestArray, requestToStart);
           if(request != null)
       {
       DataItem [] dataItem = null;
       DataItemArray newDataItemArray = null;
       //
       // If the supplied data item is null then just replicate
       // what currently exists with the request.
       if(_in_dataItem == null)
       {
           //
           // Use the current data item associated with the request
           dataItem = request.getItems().getDataitem();
           if(dataItem != null)
           {
               newDataItemArray = replicateDataItemArray(dataItem);
           }
       }
       else
       {
           //
           // Set the incoming data item array
```

```
            newDataItemArray = new DataItemArray();
            newDataItemArray.setDataitem(_in_dataItem);
        }
        //
        // Start the Provisioning request for the recipient
        if(proxyUser == null && digitalSignature == null)
           {
               RationalTestScript.logInfo("Step: Calling stub.start(" +
request.getId() + "," + recipient + "dataItemArray)");
                         requestId = stub.start(
                                 request.getId(),
                                 recipient,
                                 newDataItemArray);
           }
            else if(proxyUser != null && digitalSignature == null)
            }
                  .

            .
           .
```

getAllProvisioningRequests

Used to return an array of available provisioning requests.

Method Signature

```
com.novell.soa.af.impl.soap.ProvisioningRequestArray
getAllProvisioningRequests(java.lang.String recipient)
```

Example

```
    //

    // Get all the provisioning requests for this recipient

    ProvisioningRequestArray provReqArray =
stub.getAllProvisioningRequests(recipient);
    ProvisioningRequest [] provRequest = provReqArray.getProvisioningrequest();
    if(provRequest != null)
    {
        String description = provRequest[0].getDescription();
        String category = provRequest[0].getCategory();
        String digitialSignatureType = provRequest[0].getDigitalSignatureType();
        String requestId = provRequest[0].getId();
        DataItemArray itemArray = provRequest[0].getItems();
        String legalDisclaimer = provRequest[0].getLegalDisclaimer();
        String name = provRequest[0].getName();
        String operation = provRequest[0].getOperation();
    }
```

getProvisioningRequests

Used to return an array of provisioning requests for a specified category and operation.

Method Signature

```
com.novell.soa.af.impl.soap.ProvisioningRequestArray
getProvisioningRequests(java.lang.String recipient, java.lang.String category,
java.lang.String operation)
```

Parameters

Parameter	Description
recipient	The recipient of the provisioning request.
category	The category of the provisioning request.
operation	The provisioning request operation (0=Grant,1=Revoke, 2=Both)

Example

```
    String operation = IProvisioningRequest.GRANT;
    try
    {
        //
        // Get the stub
        Provisioning stub = ServiceUtils.getInstance().getProvisioningStub();
        logStep("Calling stub.getProvisioningCategories()");
        StringArray categoriesStringArray = stub.getProvisioningCategories();
        String [] categories = categoriesStringArray.getString();
        //
        // Loop thru and get the provisioning requests for each category
        for(int index = 0; index < categories.length; index++)
        {
            //
            // Get the provisioning request based upon recipient
            logStep("Calling stub.getProvisioningRequests(" + recipient + "," +
categories[index] + "," + operation + ")");
            ProvisioningRequestArray provRequestArray =
stub.getProvisioningRequests(recipient, categories[index], operation);
            ProvisioningRequest [] provRequests =
provRequestArray.getProvisioningrequest();
        }
```

getProvisioningCategories

Used to get the list of available provisioning categories.

Method Signature

```
com.novell.soa.af.impl.soap.StringArray getProvisioningCategories()
```

Example

```
StringArray categoriesStringArray = stub.getProvisioningCategories();
String [] categories = categoriesStringArray.getString();
```

startAsProxy

Used to start a workflow as a proxy.

Method Signature

```
java.lang.String startAsProxy(java.lang.String processId, java.lang.String
recipient, com.novell.soa.af.impl.soap.DataItemArray items, java.lang.String
proxyUser)
```

Parameters

Parameter	Description
processId	The Id of the provisioning request.
recipient	The recipient of the provisioning request.
Items	The data items for the provisioning request.
proxyUser	The DN of the proxy user.

Example

```
    ProvisioningRequestArray requestArray =
stub.getAllProvisioningRequests(recipient);
    //
    // If there are some then,
    if(requestArray != null)
    {
        String Id = " ";
        String requestId = " ";
        String requestNameToStart = "Enable Active Directory Account (Mgr Approve-
No Timeout)";
        //
        // Loop thru and find the request that we want to start
        ProvisioningRequest [] requests = requestArray.getProvisioningrequest();
        for(int index = 0; index < requests.length; index++)
        {
            //
            // Is this the name of the request to start?
            if(requests[index].getName().compareTo(requestNameToStart) == 0)
            {
                //
                // Get the current associated data items. Replicate a new
                // dataitem array excluding the null values.
                Id = requests[index].getId();
                DataItem [] dataItem = requests[index].getItems().getDataitem();
                if(dataItem != null)
                {
                    // Call method replicateDataItemArray on the
                    // provUtils utility object, which refers to a
                    // utility class that does not ship with the
                    // Identity Manager User Application.
                    DataItemArray newDataItemArray =
provUtils.replicateDataItemArray(dataItem);
                    //
                    // Start the Provisioning request for the recipient
                    logStep("Calling stub.startAsProxy(" + Id + "," + recipient +
",newDataItemArray," + proxyUser + ")");
                   requestId = stub.startAsProxy(Id, recipient, newDataItemArray,
proxyUser);
                }
            }
        }
    }
```

getProvisioningStatuses

Used to get the status of provisioning requests.

Method Signature

```
com.novell.soa.af.impl.soap.ProvisioningStatusArray
getProvisioningStatuses(com.novell.soa.af.impl.soap.T_ProvisioningStatusQuery
query, int maxRecords)
```

Parameters

Parameter	Description
query	Used to specify the provisioning status query. The query has the following components: ◆ `choice` - the parameters used to filter the results. You can specify multiple parameters. The possible parameters are: Recipient - a DN RequestID ActivityID Status (an integer) State (an integer) ProvisioningTime (YYYY/MM/DD) ResultTime (YYYY/MM/DD) ◆ `logic` - AND or OR ◆ `order` - the order in which to sort the results. Possible values for `order` are: ACTIVITY_ID RECIPIENT PROVISIONING_TIME RESULT_TIME STATE STATUS REQUEST_ID MESSAGE

Parameter	Description
maxRecords	Used to specify maximum number of records to retrieve. A value of -1 returns unlimited records.

Example

```
     //
     // Initialize and start a provisioning request
     HashMap provMap = new HashMap();
     provMap.put(Helper.RECIPIENT, recipient);
     provMap.put(I"Provisioning_Request_To_Start_Key", "Enable Active Directory
Account (Mgr Approve-No Timeout)");
     //
     // Start request
     // Calls method startProvisioningRequest on the provUtils
     // utility object which refers to a utility class that does not
     // ship with the Identity Manager User Application.
     String requestId = provUtils.startProvisioningRequest(provMap, null);
     sleep(5);
     //
     //
    T_ProvisioningStatusQueryChoice [] choice = new
T_ProvisioningStatusQueryChoice[3];
    choice[0] = new T_ProvisioningStatusQueryChoice();
    choice[0].setRecipient(recipient);
    choice[1] = new T_ProvisioningStatusQueryChoice();
    choice[1].setRequestId(requestId);
    choice[2] = new T_ProvisioningStatusQueryChoice();
    choice[2].setStatus(new Integer(ProcessConstants.PROCESSING) );
    //
    // Initialize the query
    T_ProvisioningStatusQuery query = new T_ProvisioningStatusQuery(T_Logic.AND,
T_ProvisioningStatusOrder.STATUS, choice);
    //
    // Make the query
    StringBuffer sb = new StringBuffer();
    int maxRecords = -1;

    ProvisioningStatusArray provStatusArray = stub.getProvisioningStatuses(query,
maxRecords);
```

startWithDigitalSignature

Used to start a workflow and specify that a digital signature is required.

Method Signature

```
java.lang.String startWithDigitalSignature(java.lang.String processId,
java.lang.String recipient, com.novell.soa.af.impl.soap.DataItemArray items,
java.lang.String digitalSignature,
com.novell.soa.af.impl.soap.SignaturePropertyArray digitalSignaturePropertyArray)
```

Parameters

Parameter	Description
processId	The request identifier.
recipient	The request recipient.
items	The data items for the provisioning request.
digital signature	The digital signature.
digitalSignaturePropertyArray.	The digital signature property map.

Example

```
    String recipient = 
ServiceUtils.getInstance().getLoginData().getUsername(LoginData.RECIPIENT_TYPE);
    //
    // Get the digital signature string for admin
    String digitalSignature = 
DigitalSignatureUtils.getDigitalSignatureFromFile(IDigitalSignatureConstants.ADMIN
_DIGITAL_SIGNATURE_FILENAME);


    ProvisioningRequestArray requestArray = 
stub.getAllProvisioningRequests(recipient);
    //
    // If there are some then,

   if(requestArray != null)
    {
        String Id = " ";
        String requestId = " ";
        String requestNameToStart = "Enable Active Directory Account (Mgr Approve-
No Timeout)";
        //
        // Loop thru and find the request that we want to start
        ProvisioningRequest [] requests = requestArray.getProvisioningrequest();
        for(int index = 0; index < requests.length; index++)
        {
            //
            // Is this the name of the request to start?
            if(requests[index].getName().compareTo(requestNameToStart) == 0)
            {
                //
                // Get the current associated data items. Replicate a new
                // dataitem array excluding the null values.
                Id = requests[index].getId();
                DataItem [] dataItem = requests[index].getItems().getDataitem();
                if(dataItem != null)
                {
                    // Call method replicateDataItemArray on the
                    // provUtils utility object, which refers to a
                    // utility class that does not ship with the
                    // Identity Manager User Application.
                    DataItemArray newDataItemArray =
provUtils.replicateDataItemArray(dataItem);
                    //
                    // Start a digitally signed provisioning resource for the
recipient
                    requestId = stub.startWithDigitalSignature(request.getId(),
recipient, newDataItemArray, digitalSignature, null); // Don't get any property
values (optional)
                }
            }
        }
    }
```

startAsProxyWithDigitalSignature

Used to start a workflow using a proxy for the initiator, and specify that a digital signature is required.

Method Signature

```
java.lang.String startAsProxyWithDigitalSignature(java.lang.String processId,
java.lang.String recipient, com.novell.soa.af.impl.soap.DataItemArray items,
java.lang.String digitalSignature,
com.novell.soa.af.impl.soap.SignaturePropertyArray digitalSignaturePropertyArray,
java.lang.String proxyUser)
```

Parameters

Parameter	Description
processId	The request identifier.
recipient	The request recipient.
items	The data items for the provisioning request.
digital signature	The digital signature.
digitalSignaturePropertyArray.	The digital signature property map.
proxyUser	The DN of the proxy user.

Example

```
    //
    // Get the digital signature string for admin
    String digitalSignature =
DigitalSignatureUtils.getDigitalSignatureFromFile(IDigitalSignatureConstants.ADMIN
_DIGITAL_SIGNATURE_FILENAME);


    ProvisioningRequestArray requestArray =
stub.getAllProvisioningRequests(recipient);
    //
    // If there are some then,
    if(requestArray != null)
    {
        String Id = " ";
        String requestId = " ";
        String requestNameToStart = "Enable Active Directory Account (Mgr Approve-
No Timeout)";
        //
        // Loop thru and find the request that we want to start
        ProvisioningRequest [] requests = requestArray.getProvisioningrequest();
        for(int index = 0; index < requests.length; index++)
        {
            //
            // Is this the name of the request to start?
            if(requests[index].getName().compareTo(requestNameToStart) == 0)
            {
                //
                // Get the current associated data items. Replicate a new
                // dataitem array excluding the null values.
                Id = requests[index].getId();
                DataItem [] dataItem = requests[index].getItems().getDataitem();
                if(dataItem != null)
                {
                    // Call method replicateDataItemArray on the
                    // provUtils utility object, which refers to a
                    // utility class that does not ship with the
                    // Identity Manager User Application.
                    DataItemArray newDataItemArray =
provUtils.replicateDataItemArray(dataItem);
                    //
                   // Start a digitally signed provisioning resource as  proxy for
the recipient

                     requestId =
stub.startAsProxyWithDigitalSignature(request.getId(), recipient,
newDataItemArray, digitalSignature, null, proxyUser);
                }
            }
        }
    }
```

startWithCorrelationId

Used to start a workflow with a correlation ID. The correlation ID provides a way to track a set of related workflow processes. When started with this method, workflow processes can be queried and sorted by correlation ID.

Method Signature

```
java.lang.String startWithCorrelationId(java.lang.String processId,
java.lang.String recipient, com.novell.soa.af.impl.soap.DataItemArray items,
java.lang.String signature, com.novell.soa.af.impl.soap.SignaturePropertyArray
props, java.lang.String proxyUser, java.lang.String correlationId)
     throws com.novell.soa.af.impl.soap.AdminException, java.rmi.RemoteException;
```

Parameters

Parameter	Description
processId	The request identifier.
recipient	The request recipient.
items	The data items for the provisioning request.
digital signature	The digital signature.
digitalSignaturePropertyArray	The digital signature property map.
proxyUser	The DN of the proxy user.
correlationID	The string that identities the correlation ID. The correlation ID cannot be longer than 32 characters.

Work Entries

This section provides reference information for each Work Entries method.

forward

Used to forward a task to the next activity in the workflow with the appropriate action (approve, deny, refuse).

Method Signature

```
void forward(java.lang.String wid, com.novell.soa.af.impl.soap.T_Action action,
com.novell.soa.af.impl.soap.DataItemArray items, java.lang.String comment)
```

Parameters

Parameter	Description
wid	The work Id.
action	The action to take (approve, deny, refuse).
items	The data items required by the workflow.
comment	The comment.

Example

```
     //
     // Initialize and start a provisioning request
     HashMap provMap = new HashMap();
     provMap.put(Helper.RECIPIENT, recipient);
     provMap.put(I"Provisioning_Request_To_Start_Key", "Enable Active Directory 
Account (Mgr Approve-No Timeout)");
     //
     // Start request
     // Calls method startProvisioningRequest on the provUtils
     // utility object which refers to a utility class that does not
     // ship with the Identity Manager User Application.
     String requestId = provUtils.startProvisioningRequest(provMap, null);
     sleep(5);
     //
    // Get the process id for this running process
    Process process = stub.getProcess(requestId);
    String processId = null;
    if(process != null)
        processId = process.getProcessId();

    T_Action action = T_Action.APPROVE;

    T_Logic logic = T_Logic.AND;

    T_WorkEntryOrder workEntryOrder = T_WorkEntryOrder.REQUEST_ID;

    T_WorkEntryQueryChoice [] workEntryqueryChoice =  new 
T_WorkEntryQueryChoice[3];
    workEntryqueryChoice[0] = new T_WorkEntryQueryChoice();
    workEntryqueryChoice[0].setRecipient(recipient);
    workEntryqueryChoice[1] = new T_WorkEntryQueryChoice();
    workEntryqueryChoice[1].setRequestId(requestId);
    workEntryqueryChoice[2] = new T_WorkEntryQueryChoice();
    workEntryqueryChoice[2].setProcessId(processId);
    //
    // Create work entry query
    T_WorkEntryQuery query = new T_WorkEntryQuery(logic, _workEntryOrder, 
workEntryqueryChoice);
    //
    // Get all work entries (max records)
    WorkEntryArray workEntryArray = stub.getWorkEntries(query, -1);

    WorkEntry [] workEntry = workEntryArray.getWorkentry();

    if(workEntry != null

    {
         for(int wIndex = 0; wIndex < workEntry.length; wIndex++)
        {
            String workId = workEntry[wIndex].getId();
            //
            //
            LoggerUtils.sendToLogAndConsole("Forwarding : " + 
workEntry[wIndex].getActivityName() + " work id: " + workId);
    //
           // Get the dataitem for this item of work
            DataItemArray dataItemArray = stub.getWork(workId);
            DataItem [] dataItem = dataItemArray.getDataitem();
            DataItemArray newDataItemArray = null;
            if(dataItem != null)
                // Call method replicateDataItemArray on the
                // provUtils utility object, which refers to a
                // utility class that does not ship with the
                // Identity Manager User Application.
                newDataItemArray = provUtils.replicateDataItemArray(dataItem);
            else
                throw new TestProgramException("DataItem is null.");
            //
            // Claim request for recipient
           String comment = _action.toString() + " this request: " + requestId + "
for " + recipient;
            stub.forward(workId, _action, newDataItemArray, comment);
        }

    }
```

reassignWorkTask

Used to reassign a task from one user to another.

Method Signature

```
void reassignWorkTask(java.lang.String wid, java.lang.String addressee,
java.lang.String comment)
```

Parameters

Parameter	Description
wid	The Id of the task.
addressee	The addressee of the task.
comment	A comment about the task.

Example

```
       //
       // Initialize and start a provisioning request
       HashMap provMap = new HashMap();
       provMap.put(Helper.RECIPIENT, recipient);
       provMap.put(I"Provisioning_Request_To_Start_Key", "Enable Active Directory
Account (Mgr Approve-No Timeout)");
       //
       // Start request
       // Calls method startProvisioningRequest on the provUtils
       // utility object which refers to a utility class that does not
       // ship with the Identity Manager User Application.
       String requestId = provUtils.startProvisioningRequest(provMap, null);
       sleep(5);
      //
      // Get the process id for this running process
      Process process = stub.getProcess(requestId);
      if(process != null)
      {
            String processId = process.getProcessId();
            String initiator = process.getInitiator();
            //
            // Setup for the query
            HashMap map = new HashMap();
            map.put(Helper.REQUESTID, requestId);
            map.put(Helper.RECIPIENT, recipient);
            map.put(Helper.PROCESSID, processId);
            map.put(Helper.INITIATOR, initiator);
            WorkEntry [] workEntry = workEntryUtils.getWorkEntriesUsingQuery(map, 
T_WorkEntryOrder.REQUEST_ID, T_Logic.AND);

            if(workEntry == null)
                throw new TestProgramException("Work list is empty.");
            //
            // Reassign the work entry from recipient to the addressee
            //
            // Should only be one item
            String reassignComment = null;
            String workId = workEntry[0].getId();
            if(workId != null)
            {
                //
                // Reassign work entry(s) to addressee
                reassignComment = "Reassigning work entry " + workId + " from " + 
recipient + " to " + addressee;
                stub.reassign(workId, addressee, reassignComment);
               LoggerUtils.sendToLogAndConsole("Reassign work entry " + workId + " 
from " + recipient + " to " + addressee);
            }
    }
```

getWork

Used to retrieve data items for a work entry identified by the Id (UUID) of a task.

Method Signature

`com.novell.soa.af.impl.soap.DataItemArray getWork(java.lang.String workId)`

Example

```
       //
       // Initialize and start a provisioning request
       HashMap provMap = new HashMap();
       provMap.put(Helper.RECIPIENT, recipient);
       provMap.put(I"Provisioning_Request_To_Start_Key", "Enable Active Directory 
Account (Mgr Approve-No Timeout)");
       //
       // Start request
       // Calls method startProvisioningRequest on the provUtils
       // utility object which refers to a utility class that does not
       // ship with the Identity Manager User Application.
       String requestId = provUtils.startProvisioningRequest(provMap, null);
       sleep(5);
       //
       // Get the process id for this running process
      Process process = stub.getProcess(requestId);
      if(process != null)
      {
            String processId = process.getProcessId();
            String initiator = process.getInitiator();
            //
            // Setup for the query
            HashMap map = new HashMap();
            map.put(Helper.REQUESTID, requestId);
            map.put(Helper.RECIPIENT, recipient);
            map.put(Helper.PROCESSID, processId);
            map.put(Helper.INITIATOR, initiator);
            WorkEntry [] workEntry = workEntryUtils.getWorkEntriesUsingQuery(map,
T_WorkEntryOrder.REQUEST_ID, T_Logic.AND);
            //
            // Do assertion here
           Assert.assertNotNull("WorkEntry is null for recipient : " + recipient +
" with request id : " + requestId, workEntry);
            DataItemArray dataItemArray = stub.getWork(workEntry[0].getId() );
            DataItem [] dataItem = dataItemArray.getDataitem();
            if(dataItem != null)
                LoggerUtils.sendToLogAndConsole(dataItem[0].getName());
      }
```

forwardWithDigitalSignature

Used to forward a provisioning request with a digital signature and optional digital signature properties. For example, this can be used by an administrator to force a user-facing activity to be approved, denied or refused.

Method Signature

```
void forwardWithDigitalSignature(java.lang.String wid,
com.novell.soa.af.impl.soap.T_Action action,
com.novell.soa.af.impl.soap.DataItemArray items, java.lang.String comment,
java.lang.String digitalSignature,
com.novell.soa.af.impl.soap.SignaturePropertyArray digitalSignaturePropertyArray)
```

Parameters

Parameter	Description
wid	The workId.
action	The action to take (approve, deny, refuse).
items	The data items required by the workflow.
comment	A comment about the action.
digitalSignature	The digital signature.
digitalSignaturePropertyArray	The digital signature property map.

Example

```
     //
     // Initialize and start a provisioning request
     HashMap provMap = new HashMap();
     provMap.put(Helper.RECIPIENT, recipient);
     provMap.put(I"Provisioning_Request_To_Start_Key", "Enable Active Directory
Account (Mgr Approve-No Timeout)");
     //
     // Start request
     // Calls method startProvisioningRequest on the provUtils
     // utility object which refers to a utility class that does not
     // ship with the Identity Manager User Application.
     String requestId = provUtils.startProvisioningRequest(provMap, null);
     sleep(5);
     //
    // Get the process id for this running process
    Process process = stub.getProcess(requestId);
    String processId = null;
    if(process != null)
        processId = process.getProcessId();

    T_Action action = T_Action.APPROVE;

    T_Logic logic = T_Logic.AND;

    T_WorkEntryOrder workEntryOrder = T_WorkEntryOrder.REQUEST_ID;


 // Get the digital signature string for admin
 String digitalSignature =
DigitalSignatureUtils.getDigitalSignatureFromFile(IDigitalSignatureConstants.ADMIN
_DIGITAL_SIGNATURE_FILENAME);

    T_WorkEntryQueryChoice [] workEntryqueryChoice =  new
T_WorkEntryQueryChoice[3];
    workEntryqueryChoice[0] = new T_WorkEntryQueryChoice();
    workEntryqueryChoice[0].setRecipient(recipient);
    workEntryqueryChoice[1] = new T_WorkEntryQueryChoice();
    workEntryqueryChoice[1].setRequestId(requestId);
    workEntryqueryChoice[2] = new T_WorkEntryQueryChoice();
    workEntryqueryChoice[2].setProcessId(processId);
    //
    // Create work entry query
    T_WorkEntryQuery query = new T_WorkEntryQuery(logic, _workEntryOrder,
workEntryqueryChoice);
    //
    // Get all work entries (max records)
    WorkEntryArray workEntryArray = stub.getWorkEntries(query, -1);

    WorkEntry [] workEntry = workEntryArray.getWorkentry();

    if(workEntry != null

    {
         for(int wIndex = 0; wIndex < workEntry.length; wIndex++)
        {
            String workId = workEntry[wIndex].getId();
            //
            //
            LoggerUtils.sendToLogAndConsole("Forwarding : " +
workEntry[wIndex].getActivityName() + " work id: " + workId);
            //
            // Get the dataitem for this item of work
            DataItemArray dataItemArray = stub.getWork(workId);
            DataItem [] dataItem = dataItemArray.getDataitem();
            DataItemArray newDataItemArray = null;
            if(dataItem != null)
                  // Call method replicateDataItemArray on the
                  // provUtils utility object, which refers to a
                  // utility class that does not ship with the
                  // Identity Manager User Application.
                newDataItemArray = provUtils.replicateDataItemArray(dataItem);
            else
                throw new TestProgramException("DataItem is null.");
            //
            // Claim request for recipient
           String comment = _action.toString() + " this request: " + requestId + "
for " + recipient;
            stub.forwardWithDigitalSignature(workId, _action, newDataItemArray,
comment, digitalSignature, null);
  }

    }
```

forwardAsProxy

Used to forward a provisioning request. For example, this can be used by an administrator to force a user-facing activity to be approved, denied or refused.

Method Signature

```
void forwardAsProxy(java.lang.String wid, com.novell.soa.af.impl.soap.T_Action
action, com.novell.soa.af.impl.soap.DataItemArray items, java.lang.String comment,
java.lang.String proxyUser)
```

Parameters

Parameter	Description
wid	The workId (activity Id).
action	The action to take (approve, deny, refuse).
items	The data items required by the workflow.
comment	The comment to add to the activity.
proxyUser	The DN of the proxy user.

Example

```
     //
     // Initialize and start a provisioning request
     HashMap provMap = new HashMap();
     provMap.put(Helper.RECIPIENT, recipient);
     provMap.put(I"Provisioning_Request_To_Start_Key", "Enable Active Directory
Account (Mgr Approve-No Timeout)");
     //
     // Start request
     // Calls method startProvisioningRequest on the provUtils
     // utility object which refers to a utility class that does not
     // ship with the Identity Manager User Application.
     String requestId = provUtils.startProvisioningRequest(provMap, null);
     sleep(5);
     //
    // Get the process id for this running process
    Process process = stub.getProcess(requestId);
    String processId = null;
    if(process != null)
        processId = process.getProcessId();

    T_Action action = T_Action.APPROVE;

    T_Logic logic = T_Logic.AND;

    T_WorkEntryOrder workEntryOrder = T_WorkEntryOrder.REQUEST_ID;


    T_WorkEntryQueryChoice [] workEntryqueryChoice =  new
T_WorkEntryQueryChoice[3];
    workEntryqueryChoice[0] = new T_WorkEntryQueryChoice();
    workEntryqueryChoice[0].setRecipient(recipient);
    workEntryqueryChoice[1] = new T_WorkEntryQueryChoice();
    workEntryqueryChoice[1].setRequestId(requestId);
    workEntryqueryChoice[2] = new T_WorkEntryQueryChoice();
    workEntryqueryChoice[2].setProcessId(processId);
    //
    //  work entry query
    T_WorkEntryQuery query = new T_WorkEntryQuery(logic, _workEntryOrder,
workEntryqueryChoice);
    //
    // Get all work entries (max records)
    WorkEntryArray workEntryArray = stub.getWorkEntries(query, -1);

    WorkEntry [] workEntry = workEntryArray.getWorkentry();

    if(workEntry != null

    {
         for(int wIndex = 0; wIndex < workEntry.length; wIndex++)
        {
            String workId = workEntry[wIndex].getId();
            //
            //
            LoggerUtils.sendToLogAndConsole("Forwarding : " +
workEntry[wIndex].getActivityName() + " work id: " + workId);
            //
            // Get the dataitem for this item of work
            DataItemArray dataItemArray = stub.getWork(workId);
            DataItem [] dataItem = dataItemArray.getDataitem();
            DataItemArray newDataItemArray = null;
            if(dataItem != null)
                // Call method replicateDataItemArray on the
                // provUtils utility object, which refers to a
                // utility class that does not ship with the
                // Identity Manager User Application.
                newDataItemArray = provUtils.replicateDataItemArray(dataItem);
            else
                throw new TestProgramException("DataItem is null.");
            //
            // Claim request for recipient
           String comment = _action.toString() + " this request: " + requestId + "
for " + recipient;
            String proxyUser =
ServiceUtils.getInstance().getLoginData().getUsername(LoginData.PROXY_TYPE);
            stub.forwardAsProxy(workId, _action, newDataItemArray, comment,
proxyUser);        }

    }
```

unclaim

Used to unclaim a provisioning request. This method only works if the request was claimed in the User Application. You cannot unclaim a request once it has been forwarded using the SOAP interface, because the `forward` API method (see "forward" on page 295) claims and forwards in one operation.

Method Signature

```
void unclaim(java.lang.String wid, java.lang.String comment)
```

Parameters

Parameter	Description
workId	The Id of the activity to unclaim.
comment	A comment about the action.

Example

```
    // Action and Approval Types
    final int SELECTED_ACTION = 0; final int CLAIMED_SELECTED_ACTION = 0;
    T_Action [] action = {T_Action.APPROVE, T_Action.REFUSE, T_Action.DENY};
    T_ApprovalStatus [] claimedAction = {T_ApprovalStatus.Approved,
T_ApprovalStatus.Retracted, T_ApprovalStatus.Denied};
    //
    // Get the process id for this running process
    Process process = stub.getProcess(requestId);
    String processId = null;
    if(process != null)
        processId = process.getProcessId();

    HashMap map = new HashMap();
    map.put(Helper.REQUESTID, requestId);
    map.put(Helper.RECIPIENT, recipient);
    map.put(Helper.PROCESSID, processId);
    //
    // Claim the request
    WorkEntry workEntry = workEntryUtils.claimWorkEntry(map,
action[SELECTED_ACTION]);
    if(workEntry != null)
    {
        //
        // Now unclaim the entry
        String workId = workEntry.getId();
       stub.unclaim(workId, "Unclaiming this work item : " + workId + " for request
id : " + requestId);
   }
```

forwardAsProxyWithDigitalSignature

Used to forward a provisioning request with a digital signature and digital signature properties. For example, this can be used by an administrator to force a user-facing activity to be approved, denied or refused.

Method Signature

```
void forwardAsProxyWithDigitalSignature(java.lang.String wid,
com.novell.soa.af.impl.soap.T_Action action,
com.novell.soa.af.impl.soap.DataItemArray items, java.lang.String comment,
java.lang.String digitalSignature,
com.novell.soa.af.impl.soap.SignaturePropertyArray digitalSignaturePropertyArray,
java.lang.String proxyUser)
```

Parameters

Parameter	Description
wid	The workId (activity Id).
action	The action to take (approve, deny, refuse).
items	The data items required by the workflow.
comment	The comment to add to the activity.
digitalSignature	The digital signature.
digitalSignaturePropertyArray	The digital signature property map.
proxyUser	The DN of the proxy user.

Example

```
     //
     // Initialize and start a provisioning request
     HashMap provMap = new HashMap();
     provMap.put(Helper.RECIPIENT, recipient);
     provMap.put(I"Provisioning_Request_To_Start_Key", "Enable Active Directory
Account (Mgr Approve-No Timeout)");
     //
     // Start request
     // Calls method startProvisioningRequest on the provUtils
     // utility object which refers to a utility class that does not
     // ship with the Identity Manager User Application.
     String requestId = provUtils.startProvisioningRequest(provMap, null);
     sleep(5);
     //
    // Get the process id for this running process
    Process process = stub.getProcess(requestId);
    String processId = null;
    if(process != null)
        processId = process.getProcessId();


    T_Action action = T_Action.APPROVE;

    T_Logic logic = T_Logic.AND;

    T_WorkEntryOrder workEntryOrder = T_WorkEntryOrder.REQUEST_ID;

    T_WorkEntryQueryChoice [] workEntryqueryChoice =  new
T_WorkEntryQueryChoice[3];
    workEntryqueryChoice[0] = new T_WorkEntryQueryChoice();
    workEntryqueryChoice[0].setRecipient(recipient);
    workEntryqueryChoice[1] = new T_WorkEntryQueryChoice();
    workEntryqueryChoice[1].setRequestId(requestId);
    workEntryqueryChoice[2] = new T_WorkEntryQueryChoice();
    workEntryqueryChoice[2].setProcessId(processId);
    //
    //  work entry query
    T_WorkEntryQuery query = new T_WorkEntryQuery(logic, _workEntryOrder,
workEntryqueryChoice);
    //
    // Get all work entries (max records)
    WorkEntryArray workEntryArray = stub.getWorkEntries(query, -1);

    WorkEntry [] workEntry = workEntryArray.getWorkentry();

    if(workEntry != null

    {
         for(int wIndex = 0; wIndex < workEntry.length; wIndex++)
        {
            String workId = workEntry[wIndex].getId();
            //
            //
            LoggerUtils.sendToLogAndConsole("Forwarding : " +
workEntry[wIndex].getActivityName() + " work id: " + workId);
            //
            // Get the dataitem for this item of work
            DataItemArray dataItemArray = stub.getWork(workId);
            DataItem [] dataItem = dataItemArray.getDataitem();
            DataItemArray newDataItemArray = null;
            if(dataItem != null)
                // Call method replicateDataItemArray on the
                // provUtils utility object, which refers to a
                // utility class that does not ship with the
                // Identity Manager User Application.
                newDataItemArray = provUtils.replicateDataItemArray(dataItem);
            else
                throw new TestProgramException("DataItem is null.");
            //
            // Claim request for recipient
           String comment = _action.toString() + " this request: " + requestId + "
for " + recipient;
            String digitalSignature =
DigitalSignatureUtils.getDigitalSignatureFromFile(IDigitalSignatureConstants.MMACK
ENZIE_DIGITAL_SIGNATURE_FILENAME);
            String proxyUser =
ServiceUtils.getInstance().getLoginData().getUsername(LoginData.PROXY_TYPE);

            stub.forwardAsProxyWithDigitalSignature(workId, _action,
newDataItemArray, comment, digitalSignature, null, proxyUser);
        }

    }
```

reassign

Used to reassign a task from one user to another.

Method Signature

```
void reassign(java.lang.String wid, java.lang.String addressee, java.lang.String
comment)
```

Parameters

Parameter	Description
wid	The Id of the activity to be reassigned.
addressee	The addressee of the activity.
comment	A comment about the action.

Example

```
       //
       // Initialize and start a provisioning request
       HashMap provMap = new HashMap();
       provMap.put(Helper.RECIPIENT, recipient);
       provMap.put(I"Provisioning_Request_To_Start_Key", "Enable Active Directory
Account (Mgr Approve-No Timeout)");
       //
       // Start request
       // Calls method startProvisioningRequest on the provUtils
       // utility object which refers to a utility class that does not
       // ship with the Identity Manager User Application.
       String requestId = provUtils.startProvisioningRequest(provMap, null);
       sleep(5);
       //
      // Get the process id for this running process
      Process process = stub.getProcess(requestId);
      if(process != null)
      {
            String processId = process.getProcessId();
            String initiator = process.getInitiator();
            //
            // Setup for the query
            HashMap map = new HashMap();
            map.put(Helper.REQUESTID, requestId);
            map.put(Helper.RECIPIENT, recipient);
            map.put(Helper.PROCESSID, processId);
            map.put(Helper.INITIATOR, initiator);
            WorkEntry [] workEntry = workEntryUtils.getWorkEntriesUsingQuery(map,
T_WorkEntryOrder.REQUEST_ID, T_Logic.AND);

            if(workEntry == null)
                throw new TestProgramException("Work list is empty.");
            //
            // Reassign the work entry from recipient to the addressee
            //
            // Should only be one work item
            String reassignComment = null;
            String workId = workEntry[0].getId();
            if(workId != null)
            {
                //
                // Reassign work entry(s) to addressee
                reassignComment = "Reassigning work entry " + workId + " from " +
recipient + " to " + addressee;
                stub.reassign(workId, addressee, reassignComment);
               LoggerUtils.sendToLogAndConsole("Reassign work entry " + workId + "
from " + recipient + " to " + addressee);
            }
    }
```

getWorkEntries

Used to query the work entries (activities) and returns a list of `WorkEntry` objects that satisfy the query.

Method Signature

```
com.novell.soa.af.impl.soap.WorkEntryArray
getWorkEntries(com.novell.soa.af.impl.soap.T_WorkEntryQuery query, int maxRecords)
```

Parameters

Parameter	Description
query	Used to specify the query used to retrieve the list of activities. The query has the following components: ◆ `choice` - the parameters used to filter the results. You can specify multiple parameters. The possible parameters are: Addressee - Possible values for this parameter are a DN or `self`. Use `self` if you want to retrieve work entries for the caller of the query, as identified by the authentication header of the SOAP header. ProcessId RequestId ActivityId Status (an integer) Owner Priority CreationTime (YYYY/MM/DD) ExpTime (YYYY/MM/DD) CompletionTime (YYYY/MM/DD) Recipient Initiator ProxyFor ◆ `logic` - AND or OR ◆ `order` - the order in which to sort the results. Possible values for `order` are: ACTIVITY_ID RECIPIENT PROVISIONING_TIME RESULT_TIME STATE STATUS REQUEST_ID MESSAGE
maxRecords	Used to specify maximum number of records to retrieve. A value of -1 returns unlimited records.

Example

```
    T_Action action = T_Action.APPROVE;

    T_Logic logic = T_Logic.AND;

    T_WorkEntryOrder workEntryOrder = T_WorkEntryOrder.REQUEST_ID;

    T_WorkEntryQueryChoice [] workEntryqueryChoice =  new 
T_WorkEntryQueryChoice[3];
    workEntryqueryChoice[0] = new T_WorkEntryQueryChoice();
    workEntryqueryChoice[0].setRecipient(recipient);
    workEntryqueryChoice[1] = new T_WorkEntryQueryChoice();
    workEntryqueryChoice[1].setRequestId(requestId);
    workEntryqueryChoice[2] = new T_WorkEntryQueryChoice();
    workEntryqueryChoice[2].setProcessId(processId);
    //
    //  work entry query
    T_WorkEntryQuery query = new T_WorkEntryQuery(logic, _workEntryOrder, 
workEntryqueryChoice);
    //
    // Get all work entries (max records)
    WorkEntryArray workEntryArray = stub.getWorkEntries(query, -1);

    WorkEntry [] workEntry = workEntryArray.getWorkentry();
```

getQuorumForWorkTask

Used to get information about the quorum for a workflow activity. A quorum must have actually been specified for the workflow activity by the workflow designer for this method to work.

Method Signature

```
com.novell.soa.af.impl.soap.Quorum getQuorumForWorkTask((java.lang.String workId)
```

Example

```
     //

     // Note: Provisioning resource must contain a quorum in the flow for this api 
method to work

    //
    // Action and Approval Types
    final int SELECTED_ACTION = 0; final int CLAIMED_SELECTED_ACTION = 0;
    T_Action [] action = {T_Action.APPROVE, T_Action.REFUSE, T_Action.DENY};
    T_ApprovalStatus [] claimedAction = {T_ApprovalStatus.Approved, 
T_ApprovalStatus.Retracted, T_ApprovalStatus.Denied};
    //
    // Get the process id for this running process
    Process process = stub.getProcess(requestId);
    String processId = null;
    if(process != null)
        processId = process.getProcessId();
    //
    // Setup for the query
    HashMap map = new HashMap();
    map.put(Helper.REQUESTID, requestId);
    map.put(Helper.RECIPIENT, recipient);
    map.put(Helper.PROCESSID, processId);
    map.put(Helper.INITIATOR, process.getInitiator() );
    WorkEntry [] workEntry =
workEntryUtils.getWorkEntriesUsingQuery(map,
T_WorkEntryOrder.REQUEST_ID, T_Logic.AND);

    Assert.assertNotNull("WorkEntry is null for recipient : " +
recipient + " with request id : " + requestId, workEntry);
    //
    //
    String workId = workEntry[0].getId();

    Quorum quorum = stub.getQuorumForWorkTask(workId);

    Assert.assertNotNull("Quorum for work task is null for recipient :
" + recipient + " with request id : " + requestId, quorum);
    //

    // Extract some data
    int approvalCondition = quorum.getApprovalCondition();
    int status = quorum.getStatus();
    int approveCount = quorum.getApproveCount();
    int participantCount = quorum.getParticipantCount();
    int refuseCount = quorum.getRefuseCount();
```

resetPriorityForWorkTask

Used to reset the priority for a task. You should only use this method on provisioning requests that have a single approval branch.

Method Signature

```
void resetPriorityForWorkTask(java.lang.String workId, int priority,
java.lang.String comment)
```

Parameters

Parameter	Description
workId	The Id of the activity.
priority	The priority to set for the activity.
comment	A comment about the action.

Example

```
// Calls method getProvisioningResourceNameForRecipient
// on the provUtils utility object, which refers to a utility class
// that does not ship with the Identity Manager User Application.
String requestNameToStart =
provUtils.getProvisioningResourceNameForRecipient(recipient, "Enable
Active Directory Account");
    Map map = MapUtils.createAndSetMap(new Object[] {
            Helper.RECIPIENT, recipient,
            IProvisioningConstants.PROVISIONING_REQUEST_TO_START,
requestNameToStart});
    //
    // Try and start the provisioning request
     String requestId =
provWrapper.startProvisioningRequest(recipient, requestNameToStart);
    RationalTestScript.sleep(5);
    //
    // Get the process id for this running process
    Process process = stub.getProcess(requestId);
    if(process != null)
    {
        //
        // Setup for the query
        HashMap map = new HashMap();
        map.put(Helper.REQUESTID, requestId);
        map.put(Helper.RECIPIENT, recipient);
        map.put(Helper.PROCESSID, process.getProcessId());
        map.put(Helper.INITIATOR, process.getInitiator());
        WorkEntry [] workEntry =
workEntryUtils.getWorkEntriesUsingQuery(map,
T_WorkEntryOrder.REQUEST_ID, T_Logic.AND);
        //
        // Now reset the priority for this work item.
        String workId = workEntry[0].getId();
        String comment = "Resetting priority for this work item.";
        int priority = 0;
        stub.resetPriorityForWorkTask(workId, priority, comment);
}
```

Comments

This section provides reference information for each Comments method.

getCommentsByType

Used to get workflow comments that are of a specific type (for example, user, system).

Method Signature

```
com.novell.soa.af.impl.soap.CommentArray getCommentsByType(java.lang.String
requestId, com.novell.soa.af.impl.soap.T_CommentType type)
```

Parameters

Parameter	Description
requestId	The process identifier.
type	The comment type (User or System)

Example

```
       //
       // Initialize and start a provisioning request
       HashMap provMap = new HashMap();
       provMap.put(Helper.RECIPIENT, recipient);
       provMap.put(I"Provisioning_Request_To_Start_Key", "Enable
Active Directory Account (Mgr Approve-No Timeout)");
       //
       // Start request
       // Calls method startProvisioningRequest on the provUtils
       // utility object which refers to a utility class that does not
       // ship with the Identity Manager User Application.
       String requestId = provUtils.startProvisioningRequest(provMap,
null);
      sleep(5);
      //
      // Get the comments by type : either User or System
      T_CommentType [] commentTypes = {T_CommentType.User,
T_CommentType.System};

     for(int types = 0; types < commentTypes.length; types++)
    {
        CommentArray commentArray = stub.getCommentsByType(requestId,
commentTypes[types]);
        Comment [] comments = commentArray.getComment();
        if(comments != null)
        {
            for(int index = 0; index < comments.length; index++)
            {
                LoggerUtils.sendToLogAndConsole(" \nComment Type = " +
commentTypes[types].getValue() + "\n" +
                            "Activity Id: " +
comments[index].getActivityId() + "\n" +
                            "Comment : " + comments[index].getComment()
+ "\n" +
                            "User : " + comments[index].getUser() + "\n"
+
                            "System comment : " +
comments[index].getSystemComment() + "\n" +
                            "Time stamp : " +
comments[index].getTimestamp().getTime().toString() );
           }
        }
    }
```

getCommentsByActivity

Used to get the comments for a specific activity.

Method Signature

```
com.novell.soa.af.impl.soap.CommentArray getCommentsByActivity(java.lang.String
requestId, java.lang.String aid)
```

Parameters

Parameter	Description
requestId	The process identifier.
aid	The activity identifier.

Example

```
       //
       // Initialize and start a provisioning request
       HashMap provMap = new HashMap();
       provMap.put(Helper.RECIPIENT, recipient);
       provMap.put(I"Provisioning_Request_To_Start_Key", "Enable
Active Directory Account (Mgr Approve-No Timeout)");
       //
       // Start request
       // Calls method startProvisioningRequest on the provUtils
       // utility object which refers to a utility class that does not
       // ship with the Identity Manager User Application.
       String requestId = provUtils.startProvisioningRequest(provMap,
null);
      sleep(5);
      //
      // Get the process id for this running process
      Process process = stub.getProcess(requestId);
      if(process != null)
      {
            String processId = process.getProcessId();
            String initiator = process.getInitiator();
            //
            // Setup for the query
            HashMap map = new HashMap();
            map.put(Helper.REQUESTID, requestId);
            map.put(Helper.RECIPIENT, recipient);
            map.put(Helper.PROCESSID, processId);
            map.put(Helper.INITIATOR, initiator);
            WorkEntry [] workEntry =
workEntryUtils.getWorkEntriesUsingQuery(map,
T_WorkEntryOrder.REQUEST_ID, T_Logic.AND);
            //
            // Get the activity id associated with the item of work
            String activityId = workEntry[0].getActivityId();
            //
            // Get the comments based on activity
            if(activityId != null)
            {
                CommentArray commentArray =
stub.getCommentsByActivity(requestId, activityId);
                Comment [] comments = commentArray.getComment();
            }

    }
```

getCommentsByUser

Used to get the comments made by a specific user.

Method Signature

```
com.novell.soa.af.impl.soap.CommentArray getCommentsByUser(java.lang.String
requestId, java.lang.String user)
```

Parameters

Parameter	Description
requestId	The process identifier.
user	The the DN of the user (recipient) who created the comments

Example

```
       //
       // Initialize and start a provisioning request
       HashMap provMap = new HashMap();
       provMap.put(Helper.RECIPIENT, recipient);
       provMap.put(I"Provisioning_Request_To_Start_Key", "Enable
Active Directory Account (Mgr Approve-No Timeout)");
       //
       // Start request
       // Calls method startProvisioningRequest on the provUtils
       // utility object which refers to a utility class that does not
       // ship with the Identity Manager User Application.
       String requestId = provUtils.startProvisioningRequest(provMap,\
null);
      sleep(5);
     //
      // Get the comments by recipient (should be the same as user)
      CommentArray commentArray = stub.getCommentsByUser(requestId,
recipient);
      Comment [] comments = commentArray.getComment();
```

getCommentsByCreationTime

Used to get comments made at a specific time.

Method Signature

```
com.novell.soa.af.impl.soap.CommentArray
getCommentsByCreationTime(java.lang.String requestId, long time,
com.novell.soa.af.impl.soap.T_Operator op)
```

Parameters

Parameter	Description
requestId	The process identifier.
time	The time stamp.
op	The query operator to use. Possible values for operator are: EQ - equals LT - less than LE - less than or equal to GT - greater than GE - greater than or equal to

Example

```
       //
       // Initialize and start a provisioning request
       HashMap provMap = new HashMap();
       provMap.put(Helper.RECIPIENT, recipient);
       provMap.put(I"Provisioning_Request_To_Start_Key", "Enable
Active Directory Account (Mgr Approve-No Timeout)");
       //
       // Start request
       // Calls method startProvisioningRequest on the provUtils
       // utility object which refers to a utility class that does not
       // ship with the Identity Manager User Application.
       String requestId = provUtils.startProvisioningRequest(provMap,
null);
      sleep(5);
      //
      // Get comments by creation time for the provisioning request
started above.
      long currentTime = System.currentTimeMillis();
      LoggerUtils.sendToLogAndConsole("-->Current date = " + new
java.util.Date(currentTime).toString() );
      //
      //
      T_Operator operator = T_Operator.GT;
      CommentArray commentArray =
stub.getCommentsByCreationTime(requestId, currentTime, operator);
      Comment [] comments = commentArray.getComment();
```

addComment

Used to add a comment to a workflow activity.

Method Signature

```
void addComment(java.lang.String workId, java.lang.String comment)
```

Parameters

Parameter	Description
workId	The activity identifier (UUID).
comment	A comment about the activity.

Example

```
       //
       // Initialize and start a provisioning request
       HashMap provMap = new HashMap();
       provMap.put(Helper.RECIPIENT, recipient);
       provMap.put(I"Provisioning_Request_To_Start_Key", "Enable Active Directory
Account (Mgr Approve-No Timeout)");
       //
       // Start request

       // Calls method startProvisioningRequest on the provUtils
       // utility object which refers to a utility class that does not
       // ship with the Identity Manager User Application.

       String requestId = provUtils.startProvisioningRequest(provMap, null);
      sleep(5);
      //
      // Setup for the query
      HashMap map = new HashMap();
      map.put(Helper.REQUESTID, requestId);
      map.put(Helper.RECIPIENT, recipient);
      WorkEntry [] workEntry = workEntryUtils.getWorkEntriesUsingQuery(map,
T_WorkEntryOrder.REQUEST_ID, T_Logic.AND);
      //
      // Add comment to the work entry
      String workId = workEntry[0].getId();
      String processId = workEntry[0].getProcessId();
      String addComment = "Test comment for work id " + workId;
      stub.addComment(workId, addComment);
      sleep(2);
```

getComments

Used to get comments from a workflow.

Method Signature

```
com.novell.soa.af.impl.soap.CommentArray getComments(java.lang.String workId, int
maxRecords)
```

Parameters

Parameter	Description
workId	The activity Id (UUID).
maxRecords	An integer specifying the maximum number of records to retrieve.

Example

```
      //
      // Setup for the query
      HashMap map = new HashMap();
      map.put(Helper.RECIPIENT, addressee);
      WorkEntry [] workEntry =
workEntryUtils.getWorkEntriesUsingQuery(map,
T_WorkEntryOrder.ADDRESSEE, T_Logic.OR);
      //
      // Get all the comment records for this workId
      int maxRecords = -1;
      CommentArray commentArray = stub.getComments(workId, maxRecords);
      Comment [] comment = commentArray.getComment();
```

Configuration

This section provides reference information for each Configuration method.

setCompletedProcessTimeout

Used to set the timeout for completed processes. Processes that were completed more than timeout days ago are removed from the system. The default value is 120 days. The valid range is 0 days to 365 days.

Method Signature

```
void setCompletedProcessTimeout(int time)
```

Example

```
accessConfigurationSettings(SET_COMPLETED_PROCESS_TIMEOUT, new Integer(212) );
```

setEngineConfiguration

Used to set workflow engine configuration parameters.

Method Signature

```
void  setEngineConfiguration(com.novell.soa.af.impl.soap.Configuration config)
```

Parameters

Parameter	Description
minPoolSize	The minumum thread pool size.
maxnPoolSize	The maximum thread pool size.
initialPoolSize	The initial thread pool size.
keepAliveTime	Thread pool keep live time.
pendingInterval	The cluster synchronization time.

Parameter	Description
cleanupInterval	The interval between purging processes from databases.
retryQueueInterval	The interval between retrying failed processes.
maxShutdownTime	The maximum time to let threads complete work before engine shutdown.
userActivityTimeout	The default user activity timeout.
completedProcessTimeout	The default completed process timeout.
webServiceActivityTimeout	The default Web service activity timeout.
emailNotification	Turns email notification on or off.
processCacheInitialCapacity	The process cache initial capacity.
processCacheMaxCapacity	The process cache maximum capacity.
processCacheLoadFactor	The process cache load factor.
heartbeatInterval	The heartbeat interval.
heartbeatFactor	The heartbeat factor.

Example

```
accessConfigurationSettings(SET_ENGINE_CONFIGURATION, new Integer(313) );
```

getCompletedProcessTimeout

Used to get the timeout for completed processes.

Method Signature

```
int getCompletedProcessTimeout()
```

Example

```
accessConfigurationSettings(GET_COMPLETED_PROCESS_TIMEOUT, new Integer(121) );
```

setEmailNotifications

Used to globally enable or disable email notifications.

Method Signature

```
void setEmailNotifications(boolean enable)
```

Parameters

Parameter	Description
enable	Email notifications are enabled if true; otherwise they are disabled.

Example

```
accessConfigurationSettings(SET_EMAIL_NOTIFICATIONS, new Boolean(false) );
```

clearNIMCaches

Clear the NetIQ Integration Manager (previously named exteNd Composer) caches.

Method Signature

```
void clearNIMCaches()
```

Example

```
accessConfigurationSettings(CLEAR_NIM_CACHES, new Object() );
```

setWebServiceActivityTimeout

Used to set the timeout for Web service activities. The default value is 50 minutes. The valid range is 1 minute to 7 days.

Method Signature

```
void setWebServiceActivityTimeout(int time)
```

Parameters

Parameter	Description
time	The timeout value in minutes.

Example

```
accessConfigurationSettings(SET_WEBSERVICE_ACTIVITY_TIMEOUT, new Integer(767) );
```

getUserActivityTimeout

Used to get the timeout for user-facing activities.

Method Signature

```
int getUserActivityTimeout()
```

Example

```
accessConfigurationSettings(GET_USER_ACTIVITY_TIMEOUT, new Integer(3767) );
```

getEmailNotifications

Used to determine if global email notifications are enabled or disabled.

Method Signature

```
boolean getEmailNotifications()
```

Example

```
accessConfigurationSettings(GET_EMAIL_NOTIFICATIONS, new Boolean(true) );
```

setUserActivityTimeout

Used to set the timeout for user-facing activities. The default value is no timeout (a value of zero). The valid range is 1 hour to 365 days.

Method Signature

```
void setUserActivityTimeout(int time)
```

Parameters

Parameter	Description
time	The timeout value in hours.

Example

```
accessConfigurationSettings(SET_USER_ACTIVITY_TIMEOUT, new Integer(1767) );
```

getEngineConfiguration

Used to get the workflow engine configuration parameters.

Method Signature

```
com.novell.soa.af.impl.soap.Configuration getEngineConfiguration()
```

Example

```
accessConfigurationSettings(GET_ENGINE_CONFIGURATION, new Integer(141) );
```

getWebServiceActivityTimeout

Used to get the timeout for Web service activities.

Method Signature

```
int getWebServiceActivityTimeout()
```

Example

```
accessConfigurationSettings(GET_WEBSERVICE_ACTIVITY_TIMEOUT, new Integer(808) );
```

Miscellaneous

This section provides reference information for each Miscellaneous method.

getGraph

Used to get a JPG image of the workflow. The Graphviz program must be installed on the computer where the application server and the IDM User Application is running. For more information about Graphviz, see Graphviz (http://www.graphviz.org).

Method Signature

```
byte[] getGraph(java.lang.String processId)
```

Parameters

Parameters	Description
processId	The request Id.

Example

```
 //
     // Initialize and start a provisioning request
     HashMap provMap = new HashMap();
     provMap.put(Helper.RECIPIENT, recipient);
     provMap.put(I"Provisioning_Request_To_Start_Key", "Enable Active
Directory Account (Mgr Approve-No Timeout)");
     //
     // Start request
     // Calls method startProvisioningRequest on the provUtils
     // utility object which refers to a utility class that does not
     // ship with the Identity Manager User Application.
     String requestId = provUtils.startProvisioningRequest(provMap,
null);
     sleep(5);
     //

     //

     Process process = stub.getProcess(requestId);
     if(process != null)
    {
        byte [] graph = null;
        if( (recipient.compareTo(process.getRecipient()) == 0) &&
(requestId.compareTo(process.getRequestId()) == 0) )
        {
            graph = stub.getGraph(process.getProcessId() );
        }
        //
        // Do assert
        Assert.assertNotNull("Graph is null.", graph);
    }
```

getFlowDefinition

Used to get the XML for a provisioning request.

Method Signature

```
java.lang.String getFlowDefinition(java.lang.String processId)
```

Parameters

Parameters	Description
processId	The request Id.

Example

```
 //
     // Initialize and start a provisioning request
     HashMap provMap = new HashMap();
     provMap.put(Helper.RECIPIENT, recipient);
     provMap.put(I"Provisioning_Request_To_Start_Key", "Enable Active
Directory Account (Mgr Approve-No Timeout)");
     //
     // Start request
     // Calls method startProvisioningRequest on the provUtils
     // utility object which refers to a utility class that does not
     // ship with the Identity Manager User Application.
     String requestId = provUtils.startProvisioningRequest(provMap, null);
     sleep(5);
     //

     //

     Process process = stub.getProcess(requestId);
     if(process != null)
    {
        String XMLFlowDefinition = null;
        if( (recipient.compareTo(process.getRecipient()) == 0) &&
(requestId.compareTo(process.getRequestId()) == 0) )
        {
            XMLFlowDefinition = stub.getFlowDefinition(process.getProcessId() );
        }
        //
        // Do assert
        Assert.assertNotNull("Flow Definition is null.", XMLFlowDefinition);
    }
```

getFormDefinition

Used to get the XML for a form for a provisioning request.

Method Signature

```
java.lang.String getFormDefinition(java.lang.String processId)
```

Parameters

Parameters	Description
processId	The request Id.

Example

```
 //
     // Initialize and start a provisioning request
     HashMap provMap = new HashMap();
     provMap.put(Helper.RECIPIENT, recipient);
     provMap.put(I"Provisioning_Request_To_Start_Key", "Enable Active
Directory Account (Mgr Approve-No Timeout)");
     //
     // Start request
     // Calls method startProvisioningRequest on the provUtils
     // utility object which refers to a utility class that does not
     // ship with the Identity Manager User Application.
     String requestId = provUtils.startProvisioningRequest(provMap, null);
     sleep(5);
     //

     //

     Process process = stub.getProcess(requestId);
     if(process != null)
    {

         String XMLFormDefinition = null;
         if( (recipient.compareTo(process.getRecipient()) == 0) &&
(requestId.compareTo(process.getRequestId()) == 0) )
        {
            XMLFormDefinition =
stub.getFormDefinition(process.getProcessId() );
        }
        //
        // Do assert
        Assert.assertNotNull("Form Definition is null.",
XMLFormDefinition);
    }
```

getVersion

Used to get the version of the workflow system.

Method Signature

```
com.novell.soa.af.impl.soap.T_Version getVersion()
```

Example

```
 StringBuffer result = new StringBuffer();

     T_Version version = stub.getVersion();
     if (version != null)
    {
        result.append(" Major = " + version.getMajor() );
        result.append(" Minor = " + version.getMinor() );
        result.append(" Revision = " + version.getRevision() );

        System.out.println("Version Information " + result.toString());
    }
```

Cluster

This section provides reference information for each Cluster method.

getEngineState

Used to get the `IEngineState` for a workflow engine, specified by engine Id.

Method Signature

```
com.novell.soa.af.impl.soap.EngineState getEngineState(java.lang.String engineId)
```

Parameters

Parameter	Description
engineId	The Id of the workfow engine.

Example

```
 EngineStateArray engineStateArray = stub.getClusterState();
    EngineState [] engineState = engineStateArray.getEngineStates();
    if(engineState != null)
    {
        LoggerUtils.sendToLogAndConsole("EngineCount in cluster:" +
engineState.length);
        for(int index = 0; index < engineState.length; index++)
        {
            EngineState engine =
stub.getEngineState(engineState[index].getEngineId() );
            LoggerUtils.sendToLogAndConsole(
                "Engine Id: " + engine.getEngineId() + "\n" +
                "Engine status: " + engine.getEngineStatus() + "\n" +
                "Value of engine status: " +
engine.getValueOfEngineStatus() + "\n" +
                "Heartbeat: " + ( (engine.getHeartbeat() != null) ?
engine.getHeartbeat().getTime().toString() : "null") + "\n" +
                "Shutdown time: " + ((engine.getShutdownTime()!= null)
? engine.getShutdownTime().getTime().toString() : "null") + "\n" +
                "Start time: " + ((engine.getStartTime() != null) ?
engine.getStartTime().getTime().toString() : "null") );
        }
    }
```

reassignAllProcesses

Used to reassign all processes from the source engine to a list of target engines.

Method Signature

```
int reassignAllProcesses(java.lang.String sourceEngineId,
com.novell.soa.af.impl.soap.StringArray targetEngineIds)
```

Parameters

Parameter	Description
sourceEngineId	The Id of the source workflow engine.
targetEngineIds	The Ids of the target workflow engines.

getEngineState

Used to get a list that contains an IEngineState object for each engine in the cluster.

Method Signature

```
public com.novell.soa.af.impl.soap.EngineState getEngineState(java.lang.String
engineId)
```

Parameters

Parameter	Description
engineId	The Id of the workfow engine.

Example

```
 EngineStateArray engineStateArray = stub.getClusterState();
    EngineState [] engineState = engineStateArray.getEngineStates();
    if(engineState != null)
    {
        LoggerUtils.sendToLogAndConsole("EngineCount in cluster:" +
engineState.length);
        for(int index = 0; index < engineState.length; index++)
        {
            EngineState engine =
stub.getEngineState(engineState[index].getEngineId() );
            LoggerUtils.sendToLogAndConsole(
                "Engine Id: " + engine.getEngineId() + "\n" +
                "Engine status: " + engine.getEngineStatus() + "\n" +
                "Value of engine status: " +
engine.getValueOfEngineStatus() + "\n" +
                "Heartbeat: " + ( (engine.getHeartbeat() != null) ?
engine.getHeartbeat().getTime().toString() : "null") + "\n" +
                "Shutdown time: " + ((engine.getShutdownTime()!= null)
? engine.getShutdownTime().getTime().toString() : "null") + "\n" +
                "Start time: " + ((engine.getStartTime() != null) ?
engine.getStartTime().getTime().toString() : "null") );
        }
    }
```

reassignPercentageProcesses

Used to reassign a percentage of processes from the source engine to the target engine.

Method Signature

```
int reassignPercentageProcesses(int percent, java.lang.String sourceEngineId,
java.lang.String targetEngineId)
```

Parameters

Parameter	Description
percent	An integer representing the percentage of processes to be reassigned.
sourceEngineId	The Id of the source workflow engine.
targetEngineIds	The Id of the target workflow engine.

reassignProcesses

Used to reassign one or more processes from the source engine to the target engine.

Method Signature

```
int reassignProcesses(com.novell.soa.af.impl.soap.StringArray requestIds,
java.lang.String sourceEngineId, java.lang.String targetEngineId)
```

Parameters

Parameter	Description
requestIds	A list of requestIds of the processes to be reassigned.
sourceEngineId	The Id of the source workflow engine.
targetEngineIds	The Id of the target workflow engine.

removeEngine

Used to remove an engine from the cluster state table. The engine must be in the SHUTDOWN or TIMEDOUT state.

Method Signature

```
void removeEngine(java.lang.String engineId)
```

Parameters

Parameter	Description
engineId	The Id of the workflow engine to be removed.

21 Metrics Web Service

This section describes the Metrics Web Service, which provides metrics for provisioning workflows.

About the Metrics Web Service

The workflow engine includes a Web Service for gathering workflow metrics. The addition of the Metrics Web Service to the workflow engine lets you monitor an approval flow process. In addition, it provides indicators the business manager can use to modify the process for optimal performance.

The metrics are based on traditional business process flow management principles, which emphasize the need for metrics to be actionable. This ensures that the metrics provided match what an operations manager usually looks for when analyzing and optimizing business flows. Therefore, the metrics identify bottlenecks and provide other capacity indicators. The Metrics Web Service allows you to narrow down the metrics to a common and established set of data, instead of trying to anticipate the myriad of metrics and reports that can be created for a business process flow.

When working with the Metrics Web Service, you should keep in mind that the service is not intended to be an all-purpose metrics system:

- The Metrics Web Service is not a reporting tool or reporting engine. Consequently it does not use a complex query language.
- The Metrics Web Service is not designed as an all-purpose performance management system. This helps to limit the impact of the needed queries against the live system being monitored.

Operations management stresses three key internal process performance measures that together capture the essence of process flow. These three measures can serve as leading indicators of customer satisfaction: flow time, flow rate, and inventory.

With these measures, an operations manager can answer the following questions:

- On average, how much time does a provisioning request spend within the process boundaries? (Flow time)
- On average, how many provisioning requests pass through the process per unit of time? (Flow rate)
- On average, how many provisioning requests are within the process boundaries at any point in time? (Inventory)

These three measures are related by Little's law:

```
Inventory=Flow Rate*Flow Time
```

Web Service Semantics

The following semantics apply to the use of the Metrics Web Service:

- Activities in the Metrics Web Service refer only to user-facing activities (Approval Activities). Negligible running time and the impossibility of controlling the other activities make collecting metrics for these inappropriate.
- The Metrics Web Service distinguishes between Working Days and Calendar Days. Calendar Days refer to all days between two dates. Working Days refer only to working days between two dates. Since working days may be specified differently in different environments, all Working Days methods return a raw data set that can be used to compute what is appropriate. If no such detail is required, the Calendar Days method will readily return the appropriate metric.

Accessing the Test Page

The Metrics Web Service endpoint can be accessed at the following URL:

`http://`*`server`*`:`*`port`*`/`*`warcontext`*`/metrics/service`

You can also access the SOAP endpoint by going to the **Administration** within the User Application. To do this, you need to select the **Application Configuration** tab, then select **Web Services** from the left-navigation menu. After selecting **Web Services**, pick the Web Service endpoint you want from the list.

WARNING: The test page is disabled by default. Since some of the methods allow data to be updated, the test page presents a potential security vulnerability and should not be allowed in a production environment. For details on enabling the test page, see the instructions provided for the Role Service in "Enabling the Test Page" on page 383.

Web Service Methods Grouped by Security Permissions

The service is secured using Basic Authentication. Therefore, you should use SSL to connect to the service. The service uses the same security layer as the User Application and consequently not all service operations are allowed to all users. Only a Provisioning Administrator will have unconditional access to all the methods. On the other hand team managers will only have access to metrics that pertain to their team and team members.

Hence the Metrics Web Service operations are divided into 3 categories according to role and security permissions:

- Team manager operations
- Provisioning Application Administrator operations
- Utility operations

Team Metrics

Team managers can only retrieve metrics on a team for which they are managers. These are the methods are available to team managers:

Table 21-1 Team Metrics Methods

Method	Description
getClaimedFlowTimeCalendarDays	Returns the average time in hours the provisioning request was claimed for within the specified time interval
getClaimedFlowTimeWorkingDays	Returns the result set required to compute the average time the provisioning request was claimed for the specified time interval
getToClaimedFlowTimeCalendarDays	Returns the average time in hours it took the provisioning request to be claimed from the moment it was available to addressees
getToClaimedFlowTimeWorkingDays	Returns the average time it took the provisioning request to be claimed from the moment it was available to addresses, within the specified time interval
getClaimedInventory	Returns the average number of provisioning requests claimed within the specified interval
getClaimedThroughputWorkingDays	Returns the average number of provisioning requests claimed within the specified interval
getTeamLongestRunning	Returns a result set of the longest running request in seconds for which members of the team acted as addressees
getTeamFlowHistory	Returns a result set of the activity outcomes, addressee and addressee messages for the specified list of provisioning requests
getTeamHistoryForInitiators	Returns a result set of the provisioning request and their status for which members of the team acted as initiators
getTeamHistoryForRecipients	Returns a result set of the provisioning request and their status for which members of the team acted as recipients
getTeamRunningTime	Returns the average time in seconds the specified provisioning requests have been running
getTeamDecisionCount	Returns the number of decisions the team made as addressees for the specified provisioning request
getTeamInitiatedCount	Returns the number of provisioning requests initiated by the team
getTeamRecipientCount	Returns the provisioning requests for which a member of the team acts as a recipient

Provisioning Administrator Metrics

This role is unrestricted and may perform any of the service's operations. These are the methods that are only available to Provisioning Administrators.

Table 21-2 Provisioning Administrator Metrics Methods

Method	Description
getActivityFlowTimeCalendarDays	Returns the average time in hours the user activity took to complete
getActivityFlowTimeWorkingDays	Returns the result set required to compute the average time the user activity took to complete
getActivityInventory	Returns the average number of provisioning requests at any one time for the specified user activity
getActivityThroughputCalendarDays	Returns the average number of provisioning requests per hours that exited the specified user activity within the specified time interval
getActivityThroughputWorkingDays	Returns the result set required to compute average time it takes a provisioning request to complete for the specified time interval
getFlowTimeCalendarDays	Returns average time in hours it takes a provisioning request to complete for the specified time interval
getFlowTimeWorkingDays	Returns the result set required to compute average time it takes a provisioning request to complete for the specified time interval
getInventory	Returns the average number of provisioning requests in the system at any one time for the specified time interval
getLongestClaimed	Returns a result set of the provisioning requests that have been claimed but not acted upon (time in seconds)
getLongestRunning	Returns a result set of the longest running provisioning requests (time in seconds)
getFlowCount	Returns the number of provisioning requests
getFlowHistory	Returns a result set of the activity outcomes, addressee and addressee messages for the specified list of provisioning requests
getFlowHistoryForInitiators	Returns the list of provisioning requests and their status for the specified initiators
getFlowHistoryForRecipients	Returns the list of provisioning requests and their status for the specified recipients
getRunningTime	Returns the average running time in seconds for the provisioning requests that are currently running
getThroughputCalendarDays	Returns the average number of provisioning requests per hour that completed within the specified interval
getThroughputWorkingDays	Returns the result set required to compute the average number per hour of provisioning requests that completed within the specified interval

Utility Operations

Both team managers and administrators may perform these operations:

Table 21-3 *Utility Operations*

Method	Description
getVersion	Returns the server version of the Web service. This should always used to ensure version matching between client and server code.
getAllProvisioningFlows	Returns the list of provisioning flows that the logged in user can see
getUserActivityOnlyFlow	Returns a GraphViz DOT (http://www.graphviz.org/) representation of the provisioning workflow
getTeams	Returns the list of teams the logged in user manages
getTeamMembers	Returns the list of team members for the specified team

Specifying Filters

As mentioned above, the Metrics Webservice does not use a complex query language. Instead filters can be use to narrow results by criteria such as date ranges or approval statuses.

These are the filters you can specify (see type FilterConstants in service's WSDL):

Table 21-4 *Filters for Narrowing Metric Results*

Filter	Description
KEY_ACTIVITY_ID	A User Activity Id as defined in the provisioning request definition
KEY_APPROVAL_STATUS	The approval status for the provisioning request. Possible values are: ◆ ApprovalStatusProcessing ◆ ApprovalStatusDenied ◆ ApprovalStatusRefused ◆ ApprovalStatusApproved ◆ ApprovalStatusRetract ◆ ApprovalStatusError
KEY_ENTITLEMENT_STATE	The state of the entitlement associated with the provisioning request. Possible value are: ◆ EntitlementUnknown ◆ EntitlementGranted ◆ EntitlementRevoked

Filter	Description
KEY_ENTITLEMENT_STATUS	The status of the entitlement associated with the provisioning request. Possible values are: ◆ EntitlementSuccess ◆ EntitlementWarning ◆ EntitlementError ◆ EntitlementFatal
KEY_INITIATOR	The user DN of the workflow initiator
KEY_L_COMPLETION_TIME	The date indicating the start of the interval for workflow completion
KEY_S_COMPLETION_TIME	The date indicating the end of the interval for workflow completion
KEY_L_ENTITLEMENT_TIME	The date indicating the start of the interval for entitlement time
KEY_S_ENTITLEMENT_TIME	The date indicating the end of the interval for entitlement time
KEY_S_START_TIME	The date indicating the start of the interval for workflow start
KEY_L_START_TIME	The date indicating the end of the interval for workflow start
KEY_PROCESS_ID	The DN of the provisioning request
KEY_PROCESS_STATUS	The status of the provisioning request. Possible values are: ◆ ProcessStatusRunning ◆ ProcessStatusStopped ◆ ProcessStatusTerminated ◆ ProcessStatusCompleted
KEY_PROCESS_VERSION	The process version associated with the workflow version
KEY_RECIPIENT	The user DN of the workflow recipient
KEY_REQUEST_ID	The unique id associated with the workflow instance

Here is a Java example. Note that your code will obviously differ depending on the platform you use for your Web Service client:

```
HashMap map=new HashMap();

map.put(MetricsFilter.KEY_PROCESS_STATUS,

MetricsFilter.ProcessStatusRunning);

double flowtime = metrics.getFlowTimeCalendarDays(processId,

  processVer, activity, 5, calendar1.getTime(),

  calendar2.getTime(), MetricsFilter.ACTIVITY_CLAIMED,
  MetricsFilter.ACTIVITY_FORWARDED, map);

...
```

Please consult the WebService WSDL for more information:

`http://`*`server`*`:`*`port`*`/`*`warcontext`*`/metrics/service?WSDL`

Generating the Stub Classes

Before using the Web Service, you need to use the WSSDK tool or another SOAP tool kit to generate the stub classes. To allow your code to find the stub classes, you also need to add the JAR that contains the stub classes to your classpath.

If you want to use the NetIQ WSSDK tool, you can generate the client stubs by extracting the WSDL and running the wsdl2java utility. For example, you could run this command to generate the stubs in a package called com.novell.soa.af.metrics.soap.impl:

```
"C:\Program Files\Java\jdk1.6.0_31\bin\java" -cp "../lib/wssdk.jar;../lib/jaxrpc-
api.jar";"../lib/mail.jar";"../lib/activation.jar";"c:\Program
Files\Java\jdk1.6.0_31\lib\tools.jar"; com.novell.soa.ws.impl.tools.wsdl2java.Main
-verbose -ds gensrc -d C:\ -noskel -notie -genclient -keep -package
com.novell.soa.af.metrics.soap.impl -javadoc metrics.wsdl
```

You can change the wsdl2java parameters to suit your requirements.

Obtaining the Remote Interface

Before you can begin calling methods on the Metrics Web Service, you need to have a reference to the remote interface.

The code below shows how to obtain the remote interface.

```
import java.util.Locale;
import java.util.Properties;
import javax.naming.Context;
import javax.naming.InitialContext;
import javax.xml.rpc.Stub;
import com.novell.qa.soap.common.util.LoggerUtils;
import com.novell.qa.soap.common.util.LoginData;
import com.novell.qa.soap.common.util.ServiceUtils;
import com.novell.soa.af.ClusterException;
import com.novell.soa.af.impl.soap.Provisioning;
import com.novell.soa.af.impl.soap.ProvisioningService;
import com.novell.test.automator.framework.TestProgramException;
import com.rational.test.ft.script.RationalTestScript;
import com.novell.soa.af.metrics.soap.MetricsClientHelper;
import com.novell.soa.af.metrics.soap.MetricsStubWrapper;
import com.novell.soa.af.metrics.soap.impl.MetricsService;
import com.novell.soa.af.metrics.soap.impl.MetricsServiceException;
import com.novell.soa.af.metrics.soap.impl.IRemoteMetrics;


/**
* Method to obtain the remote interface to the Metrics endpoint
* @param _url
* @param _username
* @param _password
* @return IRemoteMetrics interface
* @throws Exception
*/
private IRemoteMetrics getStub(String _url, String _username, String _password)
throws Exception

{
   Properties properties = new Properties();
   properties.put(Context.INITIAL_CONTEXT_FACTORY,
"org.jnp.interfaces.NamingContextFactory");

    String lookup =
"xmlrpc:soap:com.novell.soa.af.metrics.soap.impl.MetricsService";

    InitialContext ctx = new InitialContext();
    MetricsService svc = (MetricsService) ctx.lookup(lookup);

    Stub stub = (Stub)svc.getIRemoteMetricsPort();

    stub._setProperty(Stub.USERNAME_PROPERTY, _username);
    stub._setProperty(Stub.PASSWORD_PROPERTY, _password);
    stub._setProperty(Stub.SESSION_MAINTAIN_PROPERTY, Boolean.TRUE);
    stub._setProperty(Stub.ENDPOINT_ADDRESS_PROPERTY, _url);

    return (IRemoteMetrics) stub;
}
```

Here’s the code to call the method defined above:

```
IRemoteMetrics stub = null;
        try
        {
            //
            // Get the stub
            String url = m_loginData.getURL();
            stub = getStub(url,_username,_password);
        }
        catch(Exception e)
        {
            String msg = e.getMessage();
            LoggerUtils.logError(msg);
            throw new TestProgramException(msg);
        }
        return stub;
```

In order for this code to work, the URL passed to the getStub() method would need to point to the SOAP endpoint, as shown below:

```
http://myserver:8080/IDMProv/metrics/service
```

The user name needs to be a fully qualified DN such as the following:

```
"cn=admin,ou=idmsample,o=netiq"
```

Metrics Configuration Settings

The Metrics Web Service impact on the live system is limited by 4 settings that may be modified in the `IDMfw.jar/WorkflowService-conf/config.xml` file:

Table 21-5 Metrics Configuration Settings

Key in config.xml	Description
<key>Metrics/TimeRequiredBetweenClientRequests</key>	Required time between client requests in ms (default is 250 ms)
<key>Metrics/MaxClients</key>	Maximum number of concurrent client sessions (default is 10)
<key>Metrics/MaxRows</key>	Maximum number of rows any query can return
<key>Metrics/MaxTeamMembers</key>	Maximum Number of Team Members
<key>Metrics/SecondsToAnythingDivider</key>	The divider used in all throughput computations (default 3600). Original values are in seconds so all throughputs are consequently per hour.

When the limit has been reached for any of these settings a Web Service fault is generated indicating the problem. In addition, for settings 1 and 2, the fault includes an error code.

- If the fault is caused by a TimeRequiredBetweenClientRequests error, the error code is 100.
- If the fault is caused by a MaxClients errors, the error code is 200.
- If the fault is caused by a closed client connection error, the error code is 300.

Client consumers of the Metrics Web Service will have to include in their code provisions for retrying a request. Here is a simple Java listing that shows how this can be achieved:

```
try {
      for (int i = 0; i < retries; i++) {
          try {
              return metrics.getFlowCount(strDN, strId, new
    HashMap());
          } catch (MetricsServiceException e) {
                  if (e.getErrorCode() == 100 //subsequent call
      error
                      || e.getErrorCode() == 200) { //too many
      clients
                      try {
                          Thread.sleep(retryPause);
                      }

      catch (Exception ex) {
                          // to nothing
                      }
                  } else {
                      throw e2;
                  }
```

```
                } else {
                    throw new RuntimeException(e);
                }
            } catch (Exception e) {
               throw e;
            }
        }
        throw new RuntimeException("Did not succeed making
    webserviceall");
      } catch (Exception e) {
         throw e;
      }
   }
...
```

Metrics Web Service API

This section provides details about the methods available with the Metrics web service.

All of the methods throw MetricsServiceException and RemoteException. To improve readability, the throws clause has been omitted from the method signatures.

Team Manager Methods

This section provides reference information for each method available to team managers.

getClaimedFlowTimeCalendarDays

Syntax: Here's the method signature:

```
double getClaimedFlowTimeCalendarDays(String processId, String processVersion,
Date startCompletionTime, Date endCompletionTime, String teamDN,Map filters)
```

getClaimedFlowTimeWorkingDays

Syntax: Here is the method signature:

```
MetricsResultset getClaimedFlowTimeWorkingDays(String processId, String
processVersion, Date startCompletionTime, Date endCompletionTime,String teamDN,
Map filters)
```

getToClaimedFlowTimeCalendarDays

Syntax: Here is the method signature:

```
 double getToClaimFlowTimeCalendarDays(String processId, String processVersion,
Date startCompletionTime, Date endCompletionTime, String teamDN,Map filters)
```

getToClaimedFlowTimeWorkingDays

Syntax: Here is the method signature:

```
  MetricsResultset getToClaimFlowTimeWorkingDays(String processId, String
processVersion, Date startCompletionTime, Date endCompletionTime,String teamDN,
Map filters)
```

getClaimedInventory

Syntax: Here is the method signature:

```
 double getClaimedInventory(String processId, String processVersion, Date
startCompletionTime, Date endCompletionTime, String teamDN, Map filters)
```

getClaimedThroughputCalendarDays

Syntax: Here is the method signature:

```
  double getClaimedThroughputCalendarDays(String processId, String processVersion,
Date startCompletionTime, Date endCompletionTime, String teamDN Map filters)
```

getClaimedThroughputWorkingDays

Syntax: Here is the method signature:

```
    MetricsResultset getClaimedThroughputWorkingDays(String processId, String
processVersion, Date startCompletionTime, Date endCompletionTime, String teamDN,
Map filters)
```

getTeamLongestRunning

Syntax: Here is the method signature:

```
MetricsResultset getTeamLongestRunning(String processId, String processVersion,
String teamDN, Map filters)
```

getTeamLongestClaimed

Syntax: Here is the method signature:

```
MetricsResultset getTeamLongestClaimed(String processId, String processVersion,
String teamDN, Map filters)
```

getTeamFlowHistory

Syntax: Here is the method signature:

```
MetricsResultset getTeamFlowHistory(List requestIds)
```

getTeamHistoryForInitiators

Syntax: Here is the method signature:

```
MetricsResultset getTeamHistoryForInitiators(String teamDN, Map filters)
```

getTeamHistoryForRecipients

Syntax: Here is the method signature:

```
MetricsResultset getTeamHistoryForRecipients(String teamDN, Map filters)
```

getTeamRunningTime

Syntax: Here is the method signature:

```
double getTeamRunningTime(String processId, String processVersion, String teamDN,
Map filters)
```

getTeamDecisionCount

Syntax: Here is the method signature:

```
int getTeamDecisionCount(String processId, String processVersion, String teamDN,
Map filters)
```

getTeamInitiatedCount

Syntax: Here is the method signature:

```
 int getTeamInitiatedCount(String processId, String processVersion, String teamDN,
Map filters)
```

getTeamRecipientCount

Syntax: Here is the method signature:

```
 int getTeamRecipientCount(String processId, String processVersion, String teamDN,
Map filters)
```

Provisioning Application Administrator Methods

This section provides reference information for each method available to the Provisioning Application Administrator.

getActivityFlowTimeCalendarDays

Syntax: Here is the method signature:

```
double getActivityFlowTimeCalendarDays(String processId, String processVer, String
activityId, Date startTime, Date completeTime, Map filters)
```

getActivityFlowTimeWorkingDays

Syntax: Here is the method signature:

```
    MetricsResultset getActivityFlowTimeWorkingDays(String processId, String
processVer, String activityId, Date startTime, Date completeTime, Map filters)
```

getActivityInventory

Syntax: Here is the method signature:

```
double getActivityInventory(String processId, String processVersion, String
activityId, Date startTime, Date completeTime, Map filters)
```

getActivityThroughputCalendarDays

Syntax: Here is the method signature:

```
double getActivityThroughputCalendarDays(String processId, String processVersion,
String activityId, Date startTime, Date completiontime, Map filters)
```

getActivityThroughputWorkingDays

Syntax: Here is the method signature:

```
 MetricsResultset getActivityThroughputWorkingDays(String processId, String
processVersion, String activityId, Date startTime, Date completiontime,    Map
filters)
```

getInventory

Syntax: Here is the method signature:

```
double getInventory(String processId, String processVersion, Date startTime, Date
completeTime, Map filters)
```

getLongestClaimed

Syntax: Here is the method signature:

```
 MetricsResultset getLongestClaimed(String processId, String processVersion, Map
filters)
```

getLongestRunning

Syntax: Here is the method signature:

```
MetricsResultset getLongestRunning(String processId, String processVersion, Map
filters)
```

getFlowCount

Syntax: Here is the method signature:

```
int getFlowCount(String processId, String processVersion, Map filters)
```

getFlowHistory

Syntax: Here is the method signature:

```
MetricsResultset getFlowHistory(List requestIds)
```

getFlowHistoryForInitiators

Syntax: Here is the method signature:

```
    MetricsResultset getFlowHistoryForInitiators(List initiators, Map filters)
```

getFlowHistoryForRecipients

Syntax: Here is the method signature:

```
MetricsResultset getFlowHistoryForRecipients(List recipients, Map filters)
```

getRunningTime

Syntax: Here is the method signature:

```
 double getRunningTime(String processId, String processVersion, Map filters)
```

getThroughputCalendarDays

Syntax: Here is the method signature:

```
double getThroughputCalendarDays(String processId, String processVersion, Date
startTime, Date completiontime, Map filters)
```

getThroughputWorkingDays

Syntax: Here is the method signature:

```
MetricsResultset getActivityThroughputWorkingDays(String processId, String
processVersion, String activityId, Date startTime, Date completiontime,    Map
filters)
```

Utility Methods

This section provides reference information for each utility method. Both team managers and administrators can call these methods.

getVersion

Syntax: Here is the method signature:

```
VersionVO getVersion()
```

getAllProvisioningFlows

Syntax: Here is the method signature:

```
MetricsResultset getAllProvisioningFlows()
```

getUserActivityOnlyFlow

Syntax: Here is the method signature:

```
BasicModelVO getUserActivityOnlyFlow(String processId, String processVer)
```

getTeams

Syntax: Here is the method signature:

```
MetricsResultset getTeams()
```

getTeamMembers

Syntax: Here is the method signature:

```
MetricsResultset getTeamMembers(String teamDN)
```

Metrics Web Service Examples

This section provides examples that show how to use the Metrics Web Service to gather workflow metrics. The examples assume that you have obtained a stub, as shown in "Obtaining the Remote Interface" on page 335, and potentially wrapped it in an object that handles the potential error conditions, as described in "Metrics Configuration Settings" on page 336.

General Examples

This example uses the KEY_APPROVAL_STATUS filter to compare the decision outcomes for a provisioning request type. This could be used to generate a pie chart for example.

```
FilterConstants constants=new FilterConstants();
Map<MetricsFilter, Object> map = new HashMap<MetricsFilter, Object>();
map.put(MetricsFilter.KEY_APPROVAL_STATUS,constants.getApprovalStatusApproved());
double accepted=stubWrapper.getFlowCount(processId,processVersion,map);
map.put(MetricsFilter.KEY_APPROVAL_STATUS,constants.getApprovalStatusDenied());
double denied=stubWrapper.getFlowCount(processId,processVersion,map);
map.put(MetricsFilter.KEY_APPROVAL_STATUS,constants.getApprovalStatusError());
double error=stubWrapper.getFlowCount(processId,processVersion,map);
map.put(MetricsFilter.KEY_APPROVAL_STATUS,constants.getApprovalStatusRetract());
double retracted=stubWrapper.getFlowCount(processId,processVersion,map);
map.put(MetricsFilter.KEY_APPROVAL_STATUS,
constants.getApprovalStatusRefused());
double refused = stubWrapper.getFlowCount(processId,
processVersion, map);
```

Additional filters may be specified by adding appropriate entries to the filter map. The following examples illustrate how you might add various types of filters.

Adding a start date filter

To add a start date filter (01/01/2006 < date < 02/01/2006):

```
Calendar startDate=Calendar.getInstance();
startDate.set(2006,0,1);
Calendar endDate=Calendar.getInstance();
endDate.set(2006,1,1);
map.put(MetricsFilter.KEY_L_START_TIME,startDate);
map.put(MetricsFilter.KEY_S_START_TIME,endDate)
```

Adding a completion date filter

To add a completion date filter (02/01/2005 < date <03/01/2005)

```
Calendar startDate=Calendar.getInstance();
startDate.set(2006,0,1);
Calendar endDate=Calendar.getInstance();
endDate.set(2006,1,1);
map.put(MetricsFilter.KEY_L_COMPLETION_TIME,startDate);
map.put(MetricsFilter.KEY_S_COMPLETION_TIME,endDate)
```

Narrowing requests to a specific initiator

To narrow down counted requests to a specific initiator

```
map.put(MetricsFilter.KEY_INITIATOR,"cn=admin,ou=idmsample,o=netiq");
```

Narrowing requests to a specific recipient

To narrow down counted requests to a specific recipient

```
map.put(MetricsFilter.KEY_RECIPIENT,"cn=admin,ou=idmsample,o=netiq");
```

Other Examples

The following examples illustrate the use of various methods for retrieving workflow counts.

Retrieving decision counts for a team

This example describes how to retrieve the various decision outcomes of a team. The team's DN is required and can be obtained by using the getTeams() method:

```
FilterConstants constants=new FilterConstants();
Map<MetricsFilter, Object> map = new HashMap<MetricsFilter, Object>();
map.put(MetricsFilter.KEY_ACTIVITY_END,
constants.getActivityApproved());
double accepted = stubWrapper.getTeamDecisionCount(processId,
processVersion, teamDN, map);
map.put(MetricsFilter.KEY_ACTIVITY_END,         constants.getActivityDenied());
double denied = stubWrapper.getTeamDecisionCount(processId,        processVersion,
teamDN, map);
map.put(MetricsFilter.KEY_ACTIVITY_END,
         constants.getActivityReassigned());
double reassigned = stubWrapper.getTeamDecisionCount(processId,
         processVersion, teamDN, map);
map.put(MetricsFilter.KEY_ACTIVITY_END,
         constants.getActivityRefused());
double refused = stubWrapper.getTeamDecisionCount(processId,
         processVersion, teamDN, map);
```

Retrieving decision counts for requests where team members are recipients

This example describes how to retrieve the various decisions outcomes for requests for which members of the team act as recipients

```
FilterConstants constants = new FilterConstants();
Map<MetricsFilter, Object> map = new HashMap<MetricsFilter, Object>();
map.put(MetricsFilter.KEY_APPROVAL_STATUS,
constants.getActivityApproved());
double accepted = stubWrapper.getTeamRecipientCount(processId, processVersion,
teamDN, map);
map.put(MetricsFilter.KEY_APPROVAL_STATUS,
constants.getApprovalStatusDenied());
double denied = stubWrapper.getTeamRecipientCount(processId, processVersion,
teamDN, map);
map.put(MetricsFilter.KEY_APPROVAL_STATUS, constants.getApprovalStatusError());
double error = stubWrapper.getTeamRecipientCount(processId, processVersion,
teamDN, map);
map.put(MetricsFilter.KEY_APPROVAL_STATUS, constants.getApprovalStatusError());
double retracted = stubWrapper.getTeamRecipientCount(processId, processVersion,
teamDN, map);
map.put(MetricsFilter.KEY_APPROVAL_STATUS, constants.getApprovalStatusRefused());
double refused = stubWrapper.getTeamRecipientCount(processId, processVersion,
teamDN, map);
```

Retrieving requests that have been claimed but not acted on

This example describes how to retrieve the requests started after 03/01/2006 that have been claimed but not acted upon.

```
Map<MetricsFilter, Object> map = new HashMap<MetricsFilter, Object>();
Calendar startDate=Calendar.getInstance();
startDate.set(2006,2,1);
map.put(MetricsFilter.KEY_L_START_TIME,startDate);
MetricsResultset rset = stubWrapper.getLongestClaimed(processId, processVersion,
map);
```

Retrieving the longest running requests started by a particular user

This example describes how to retrieve the longest running requests that have been started by initiator "cn=admin,ou=idmsample,o=netiq";

```
Map<MetricsFilter, Object> map = new HashMap<MetricsFilter, Object>();
map.put(MetricsFilter.KEY_INITIATOR,""cn=admin,ou=idmsample,o=netiq");
MetricsResultset rset = stubWrapper.getLongestRunning(processId, processVersion,
map);
```

Retrieving activity inventory

This example describes the average inventory for users handling decision with activity id "managerApproval" between 01/01/2006 and 02/01/2006

```
Map<MetricsFilter, Object> map = new HashMap<MetricsFilter, Object>();
Calendar startDate=Calendar.getInstance();
startDate.set(2006,0,1);
Calendar endDate=Calendar.getInstance();
endDate.set(2006,1,1);
MetricsResultset rset = stubWrapper.getActivityInventory(processId,
processVersion,"managerApproval", startDate, endDate, map );
```

Retrieving the Claimed Throughput and Inventory for a Team

This example describes the team's throughput and inventory over the time interval between 01/01/2006 and 02/01/2006

```
Map<MetricsFilter, Object> map = new HashMap<MetricsFilter, Object>();
Calendar startDate=Calendar.getInstance();
startDate.set(2006,0,1);
Calendar endDate=Calendar.getInstance();
endDate.set(2006,1,1);
double throughput = stubWrapper.getClaimedThroughputCalendarDays(processId,
processVersion, startDate, endDate,teamDN, map);
double inventory = stubWrapper.getClaimedInventory(processId, processVersion,
startDate, endDate, teamDN, map)
```

22 Notification Web Service

This section describes the Notification Web Service, which allows SOAP clients to use the email notification facility.

About the Notification Web Service

The Identity Manager User Application includes an email notification facility that lets you send email messages to notify users of changes in the state of the provisioning system, as well as tasks that they need to perform. To support access by third-party software applications, the notification facility includes a Web service endpoint. The endpoint lets you send an email message to one or more users. When you send an email, you include parameters that specify the target email address, the email template to use, and the replacement values for tokens in the email template.

This Appendix describes the programming interface for the Notification Web Service.

Accessing the Test Page

You can access the Notification Web Service endpoint using a URL similar to the following:

`http://`*`server`*`:`*`port`*`/`*`warcontext`*`/notification/service?test`

For example, if your server is named “myserver”, your User Application is listening on port 8080, and your User Application war file is named “IDMPROV”, the URL would be:

```
http://myserver:8080/IDMPROV/notification/service?test
```

You can also access the SOAP endpoint by going to the **Administration** within the User Application. To do this, you need to select the **Application Configuration** tab, then select **Web Services** from the left-navigation menu. After selecting **Web Services**, pick the Web Service endpoint you want from the list.

WARNING: The test page is disabled by default. Since some of the methods allow data to be updated, the test page presents a potential security vulnerability and should not be allowed in a production environment. For details on enabling the test page, see the instructions provided for the Role Service in “Enabling the Test Page” on page 383.

Accessing the WSDL

You can access the WSDL for the Notification Web Service using a URL similar to the following:

`http://`*`server`*`:`*`port`*`/`*`warcontext`*`/notification/service?wsdl`

For example, if your server is named “myserver”, your User Application is listening on port 8080, and your User Application war file is named “IDMPROV”, the URL would be:

```
http://myserver:8080/IDMPROV/notification/service?wsdl
```

Generating the Stub Classes

Before using the Web Service, you need to use the WSSDK tool or another SOAP tool kit to generate the stub classes. To allow your code to find the stub classes, you also need to add the JAR that contains the stub classes to your classpath.

If you want to use the NetIQ WSSDK tool, you can generate the client stubs by extracting the WSDL and running the wsdl2java utility. For example, you could run this command to generate the stubs in a package called com.novell.ws.client.notification:

```
"C:\Program Files\Java\jdk1.6.0_31\bin\java" -cp "../lib/wssdk.jar;../lib/jaxrpc-
api.jar";"../lib/mail.jar";"../lib/activation.jar";"c:\Program
Files\Java\jdk1.6.0_31\lib\tools.jar"; com.novell.soa.ws.impl.tools.wsdl2java.Main
-verbose -ds gensrc -d C:\ -noskel -notie -genclient -keep -package
com.novell.ws.client.notification -javadoc notification.wsdl
```

You can change the wsdl2java parameters to suit your requirements.

Notification Web Service API

This section provides details about the methods available with the Notification Web service. This API presumes you're using Java code generated by the WSSDK toolkit. The API will be different if you're using another Web Service toolkit.

All of the methods throw RemoteException. To improve readability, the throws clause has been omitted from the method signatures.

iRemoteNotification

This section provides reference information for each method associated with the iRemoteNotification interface.

getVersion

Returns the version number of the notification facility you're running.

Syntax: Here is the method signature:

```
VersionVO getVersion()
```

sendNotification

Sends an email notification.

Syntax: Here is the method signature:

```
void sendNotification(NotificationMap arg0)
```

BuiltInTokens

This section provides reference information for each method associated with the BuiltInTokens class.

BuiltInTokens constructor

The BuiltInTokens class has a single constructor.

Syntax: Here is the constructor for the BuiltInTokens class:

```
BuiltInTokens()
```

getTO

Returns the fixed string TO, which can be used as a key to identify the value for the TO system token.

Syntax: Here is the method signature:

```
public java.lang.String getTO()
```

getCC

Returns the fixed string CC, which can be used as a key to identify the value for the CC system token.

Syntax: Here is the method signature:

```
public java.lang.String getCC()
```

getBCC

Returns the fixed string BCC, which can be used as a key to identify the value for the BCC system token.

Syntax: Here is the method signature:

```
public java.lang.String getBCC()
```

getTO_DN

Returns the fixed string TO_DN, which can be used as a key to identify the value for the TO_DN system token.

Syntax Here is the method signature:

```
public java.lang.String getTO_DN()
```

getCC_DN

Returns the fixed string CC_DN, which can be used as a key to identify the value for the CC_DN system token.

Syntax: Here is the method signature:

```
public java.lang.String getCC_DN()
```

getBCC_DN

Returns the fixed string BCC_DN, which can be used as a key to identify the value for the BCC_DN system token.

Syntax: Here is the method signature:

```
public java.lang.String getBCC_DN()
```

getREPLYTO

Returns the fixed string REPLYTO, which can be used as a key to identify the value for the REPLYTO system token.

Syntax: Here is the method signature:

```
public java.lang.String getREPLYTO()
```

getREPLYTO_DN

Returns the fixed string REPLYTO_DN, which can be used as a key to identify the value for the REPLYTO_DN system token.

Syntax: Here is the method signature:

```
public java.lang.String getREPLYTO_DN()
```

getLOCALE

Returns the fixed string LOCALE, which can be used as a key to identify the value for the LOCALE system token.

Syntax: Here is the method signature:

```
public java.lang.String getLOCALE()
```

getNOTIFICATION_TEMPLATE_DN

Returns the fixed string NOTIFICATION_TEMPLATE, which can be used as a key to identify the value for the NOTIFICATION_TEMPLATE system token.

Syntax: Here is the method signature:

```
public java.lang.String getNOTIFICATION_TEMPLATE_DN()
```

Entry

The Entry class represents an entry in an EntryArray object. It is used to specify a token in an email template.

This section provides reference information for each method associated with the Entry class.

Entry constructors

The Entry class has two constructors.

Syntax 1: Here is the syntax for a constructor that takes no parameters:

```
Entry()
```

Syntax 2: Here is the syntax for a constructor that takes two parameters, the key value and an array of values:

```
Entry(java.lang.String KeyVal, StringArray ValuesVal)
```

getKey

Returns the key defined for the Entry object. The key identifies the token.

Syntax: Here is the method signature:

```
java.lang.String getKey()
```

setKey

Sets the key for the Entry object. The key identifies the token. If the object represents a built-in token, you can use the BuiltInTokens class to set the key. Otherwise, you can pass a string to the setKey method that specifies the key.

Syntax: Here is the method signature:

```
void setKey(java.lang.String KeyVal)
```

getValues

Returns a StringArray object representing the values for the Entry object.

Syntax: Here is the method signature:

```
StringArray getValues()
```

setValues

Sets the values for the Entry object.

Syntax: Here is the method signature:

```
void setValues(StringArray ValuesVal)
```

EntryArray

The EntryArray class is a container for an array of Entry objects. It is contained by the NotificationMap object.

This section provides reference information on the methods associated with the EntryArray class.

EntryArray constructors

The EntryArray class has two constructors.

Syntax 1: Here is the syntax for a constructor that takes no parameters:

```
EntryArray()
```

Syntax 2: Here is the syntax for a constructor that takes an array of Entry objects as a parameter:

```
EntryArray(Entry[] EntryVal)
```

getEntry

Returns the Entry object contained within this EntryArray object.

Syntax: Here is the method signature:

```
Entry[] getEntry()
```

setEntry

Sets the Entry object for this EntryArray object.

Syntax: Here is the method signature:

```
void setEntry(Entry[] EntryVal)
```

NotificationMap

The NotificationMap object is a map that contains an EntryArray object. It is passed to the sendNotification method on the stub.

This section provides reference information for the methods associated with the NotificationMap class.

NotificationMap constructors

The NotificationMap class has two constructors.

Syntax 1: Here is the syntax for a constructor that takes no parameters:

```
NotificationMap()
```

Syntax 2: Here is the syntax for a constructor that takes an EntryArray object as a parameter:

```
NotificationMap(EntryArray EntriesVal)
```

getEntries

Returns the EntryArray object contained by this NotificationMap object.

Syntax: Here is the method signature:

```
EntryArray getEntries()
```

setEntries

Sets the EntryArray object for this NotificationMap object.

Syntax: Here is the method signature:

```
void setEntries(EntryArray EntriesVal)
```

NotificationService

This section provides reference information for the NotificationService interface.

getIRemoteNotificationPort

Gets the stub for the remote service. The stub is a port of type IRemoteNotification.

Syntax: Here is the method signature:

```
IRemoteNotification getIRemoteNotificationPort() throws
javax.xml.rpc.ServiceException
```

StringArray

This section provides reference information for the StringArray class.

StringArray constructors

The StringArray class has two constructors.

Syntax 1: Here is the syntax for a constructor that takes no parameters:

```
StringArray()
```

Syntax 2: Here is the syntax for a constructor that takes a String array as a parameter:

```
StringArray(java.lang.String[] StringVal)
```

getString

Returns the array of strings defined for this StringArray object.

Syntax: Here is the method signature:

```
java.lang.String[] getString()
```

setString

Sets the array of strings for this StringArray object. This method is called by the second constructor, which takes a String array as a parameter.

Syntax: Here is the method signature:

```
void setString(java.lang.String[] StringVal)
```

VersionVO

This section provides reference information on the VersionVO class.

getValue

Returns the version number of the service.

Syntax: Here is the method signature:

```
java.lang.String getValue()
```

Notification Example

The following code example shows how one might use the Notification service to send an email message using a pre-defined system template. To get a reference to the SOAP endpoint for the Notification service, a call is made to the getNotificationStub() method. After acquiring the stub interface, the code sets the email notification template as well as values for the built-in tokens in the template. In addition, the code specifies values for the requestTitle and initiatorFullName tokens. For each token, the code creates an Entry object. Once all of the entries have been created, it packages the entry array into a map of type NotificationMap, which is then passed to the sendNotification method on the stub.

```
import java.util.Properties;

import javax.naming.Context;
import javax.naming.InitialContext;
import javax.xml.rpc.Stub;
import java.rmi.RemoteException;
//
// Notification imports
import com.novell.ws.client.notification.IRemoteNotification;
import com.novell.ws.client.notification.BuiltInTokens;
import com.novell.ws.client.notification.Entry;
import com.novell.ws.client.notification.EntryArray;
import com.novell.ws.client.notification.StringArray;
import com.novell.ws.client.notification.NotificationMap;
import com.novell.ws.client.notification.IRemoteNotification;
import com.novell.ws.client.notification.NotificationService;


public class NotificationTest
{
  private static final int LOCALHOST    = 0;  // localhost
  private static final int TESTSERVER      = 1;  // testserver
  private static final int SELECTED_URL     = TESTSERVER;

      private String [] SERVER_URLS = {
    "http://localhost:8080/IDMProv/notification/service",
    "http://testserver:8080/IDMProv/notification/service"
  };
  private String url = SERVER_URLS[SELECTED_URL];
  private String username = "cn=admin,ou=idmsample,o=netiq";
  private String password = "test";

  public void emailNotificationTestCase()
  throws Exception
  {
        System.out.println("\nCalling emailNotificationTestCase() test
case");

        try
        {
    String targetEmailAddress = "jsmith@somewhere.com";
            //
            // Get the notification stub
            IRemoteNotification notificationStub =
getNotificationStub(url, username, password);

            BuiltInTokens builtInTokens = new BuiltInTokens();
            //
            // Set the To: entry
            Entry to = new Entry();
            to.setKey(builtInTokens.getTO());
            StringArray arr = new StringArray(new
String[]{targetEmailAddress} );
            to.setValues(arr);
            //
            // Set which email template to use : list in iManager
(Workflow Admin->Email Templates)
            Entry notificationTemplate = new Entry();

notificationTemplate.setKey(builtInTokens.getNOTIFICATION_TEMPLATE_DN());
            //
            // Use one of the email templates specifying DN
            String EMAIL_TEMPLATE_NAME = "Provisioning Notification";
            String templateDN = "cn=" + EMAIL_TEMPLATE_NAME +
",cn=Default Notification Collection,cn=Security";
            arr = new StringArray(new String[]{templateDN} );
            notificationTemplate.setValues(arr);
            //
            // Substitute key values defined in email templates
            Entry token1 = new Entry();
            token1.setKey("requestTitle"); // key is %requestTitle%
            arr = new StringArray(new String[]{"Sample Email using
Notification Web Service"} );
            token1.setValues(arr);
            Entry token2 = new Entry();
            token2.setKey("initiatorFullName");
            arr = new StringArray(new String[]{username} );
            token2.setValues(arr);
            //
            // Setup the notification map
            NotificationMap map = new NotificationMap();
            Entry[] entries = new
Entry[]{to,notificationTemplate,token1,token2};
            EntryArray entryArray = new EntryArray();
            entryArray.setEntry(entries);
            map.setEntries(entryArray);
            //
            // Make the notification endpoint call
            notificationStub.sendNotification(map);
        }
        catch(RemoteException error)
        {
            System.out.println(error.getMessage() );
            throw new Exception(error.getMessage() );
        }
     }


   /**
     * Method to obtain the remote interface to the Notification
endpoint
     * @param _url
     * @param _username
     * @param _password
     * @return IRemoteNotification interface
     * @throws Exception
     */
    private IRemoteNotification getNotificationStub(String _url,
String _username, String _password)
    throws Exception
    {
        Properties properties = new Properties();
        properties.put(Context.INITIAL_CONTEXT_FACTORY,
"org.jnp.interfaces.NamingContextFactory");

        String lookup =
"xmlrpc:soap:com.novell.ws.client.notification.NotificationService";

        InitialContext ctx = new InitialContext();
        NotificationService svc = (NotificationService)
ctx.lookup(lookup);

        Stub stub = (Stub)svc.getIRemoteNotificationPort();

        stub._setProperty(Stub.USERNAME_PROPERTY, _username);
        stub._setProperty(Stub.PASSWORD_PROPERTY, _password);
        stub._setProperty(Stub.SESSION_MAINTAIN_PROPERTY,
Boolean.TRUE);
        stub._setProperty(Stub.ENDPOINT_ADDRESS_PROPERTY, _url);

        return (IRemoteNotification) stub;
    }

}
```

23 Directory Abstraction Layer (VDX) Web Service

This section describes the VDX Web Service, which allows SOAP clients to access the directory abstraction layer.

About the Directory Abstraction Layer (VDX) Web Service

The directory abstraction layer provides a logical view of the Identity Vault data. To support access by third-party software applications, the directory abstraction layer includes a Web service endpoint called the VDX Web Service. This endpoint lets you access the attributes associated with entities defined in the directory abstraction layer. It also lets you perform ad hoc searches for entities and execute predefined searches called global queries. You can think of global queries as stored procedures for LDAP.

This Appendix describes the programming interface for the VDX Web Service.

Accessing the Test Page

You can access the VDX Web Service endpoint using a URL similar to the following:

```
http://server:port/warcontext/vdx/service?test
```

For example, if your server is named “myserver”, your User Application is listening on port 8080, and your User Application war file is named “IDMPROV”, the URL would be:

```
http://myserver:8080/IDMPROV/vdx/service?test
```

You can also access the SOAP endpoint by going to the **Administration** within the User Application. To do this, you need to select the **Application Configuration** tab, then select **Web Services** from the left-navigation menu. After selecting **Web Services**, pick the Web Service endpoint you want from the list.

WARNING: The test page is disabled by default. Since some of the methods allow data to be updated, the test page presents a potential security vulnerability and should not be allowed in a production environment. For details on enabling the test page, see the instructions provided for the Role Service in “Enabling the Test Page” on page 383.

Accessing the WSDL

You can access the WSDL for the VDX Web Service using a URL similar to the following:

```
http://server:port/warcontext/vdx/service?wsdl
```

For example, if your server is named “myserver”, your User Application is listening on port 8080, and your User Application war file is named “IDMPROV”, the URL would be:

```
http://myserver:8080/IDMPROV/vdx/service?wsdl
```

Generating the Stub Classes

Before using the Web Service, you need to use the WSSDK tool or another SOAP tool kit to generate the stub classes. To allow your code to find the stub classes, you also need to add the JAR that contains the stub classes to your classpath.

If you want to use the NetIQ WSSDK tool, you can generate the client stubs by extracting the WSDL and running the wsdl2java utility. For example, you could run this command to generate the stubs in a package called com.novell.ws.client.vdx:

```
"C:\Program Files\Java\jdk1.6.0_31\bin\java" -cp "../lib/wssdk.jar;../lib/jaxrpc-
api.jar";"../lib/mail.jar";"../lib/activation.jar";"c:\Program
Files\Java\jdk1.6.0_31\lib\tools.jar"; com.novell.soa.ws.impl.tools.wsdl2java.Main
-verbose -ds gensrc -d C:\ -noskel -notie -genclient -keep -package
com.novell.ws.client.vdx -javadoc vdx.wsdl
```

You can change the wsdl2java parameters to suit your requirements.

Removing Administrator Credential Restrictions

The VDX Web Service supports two levels of security, one that restricts access to Provisioning Administrators and another that restricts access to the authenticated user. The default setting restricts access to all operations to the Provisioning Administrator.

You can modify the settings for security configuration in the `ism-configuration.properties` file, located by default in the `/netiq/idm/apps/tomcat/conf` directory. . Each property can be set to true or false. A value of true locks down the operation, whereas a value of false opens up the operation.

You can open up the VDX Web Service to authenticated users by setting the VirtualDataService/soap property to false. To open up a particular operation to authenticated users, you need to set the property for that operation (VirtualDataService/soap/*operation*) to false as well. If you set all of the properties to false, you can open up all operations to authenticated users. The *operation* names are the same as the names of the methods supported by the service.

Example To ensure that the security configuration opens up all operations within the VDX Web Service, the `ism-configuration.properties` file must have the following setting:

```
    VirtualDataService/soap = false
```

To restrict globalQuery, change the `VirtualDataService/soap/globalQuery` to `true` in the `ism-configuration.properties` file.

Even though the service does not require the Administrator credentials since you set the VirtualDataService/soap property to false, the globalQuery operation will still require the Administrator credentials since you set a property for the operation to true.

VDX Web Service API

This section provides details about the methods available with the VDX Web service. This API presumes you’re using Java code generated by the WSSDK toolkit. The API will be different if you’re using another Web Service toolkit.

All of the methods throw VdxServiceException. To improve readability, the throws clause has been omitted from the method signatures.

IRemoteVdx

This section provides reference information for each method associated with the IRemoteVdx interface.

getVersion

Returns the version number of the VDX service you're running.

Syntax: Here is the method signature:

```
VersionVO getVersion() throws java.rmi.RemoteException;
```

globalQuery

Allows you to execute predefined searches called global queries. Global queries are saved searches for LDAP. They provide some of the capabilities of stored procedures.

To define a global query, you need to use the directory abstraction layer editor. For details, see the chapter on the directory abstraction layer editor in the *Identity Manager User Application: Design Guide*.

Syntax: Here is the method signature:

```
java.lang.String[] globalQuery(java.lang.String queryDN, StringMap
queryParameterValues) throws VdxServiceException, java.rmi.RemoteException;
```

query

Allows you to perform ad hoc queries by specifying an entity, a set of attributes, and a query expression that filters the data returned.

Syntax: Here is the method signature:

```
EntityAttributeMap query(java.lang.String entityDefinition, java.lang.String[]
attributeKeys, java.lang.String queryFilter) throws VdxServiceException,
java.rmi.RemoteException;
```

Query Grammar

The queryFilter parameter of the query() method lets you pass in search criteria expressions that filter the data returned. This section describes the grammar for these expressions.

Query syntax 1: The simplest form of a query is the following:

```
RelationalExpression1
```

Query syntax 2: A query can also combine relational expressions with a logical operator:

```
RelationalExpession1 logicalOperator  RelationalExpression2
```

Query syntax 3: Alternatively, a query can use parentheses to set off the expressions:

```
(RelationalExpession1) logicalOperator  (RelationalExpression2)
```

Query syntax 4: A query can also use parentheses to set off sub queries:

```
RelationalExpession1 logicalOperator  (RelationalExpession2 logicalOperator1
RelationalExpression3)
```

Relational expressions must be separated by a logical operator which must remain the same. In other words, the following query is valid:

```
expression1 AND expression2 AND expression3
```

However, this query is not valid:

```
expression1 AND expression2 OR expression3
```

You can use parentheses to create a condition group, as in the following example:

```
expression1 AND (expression2 OR expression3)
```

Grammar for Relational Expressions

Relational expression syntax: A relational expression must conform to this syntax:

`attribute relationalOperator value`

Grammar for Operators and Values

Relational operators: The relational operator must be one of the following:

```
> , < , >= , <= , = , != , !< , !> , !<= , !>= , STARTWITH, !STARTWITH, IN , !IN ,
PRESENT, !PRESENT
```

Logical operators: The logical operator must be one of the following:

```
AND, OR
```

Value: The value side of an expression must be one of the following:

```
'foo',"foo", 1-9, true, false
```

The PRESENT and !PRESENT relational operators require no value.

getAttribute

Returns a single Attribute object that can be used to retrieve and examine data for an attribute in the directory abstraction layer.

Syntax: Here is the method signature:

```
Attribute getAttribute(java.lang.String objectDN, java.lang.String
entityDefinition, java.lang.String attributeKey) throws VdxServiceException,
java.rmi.RemoteException;
```

getAttributes

Returns an array of Attribute objects that can be used to retrieve and examine data in the directory abstraction layer.

Syntax: Here is the method signature:

```
Attribute[] getAttributes(java.lang.String objectDN, java.lang.String
entityDefinition, java.lang.String[] attributeKeys) throws VdxServiceException,
java.rmi.RemoteException;
```

Attribute

The Attribute class represents an attribute in the directory abstraction layer.

This section provides reference information for the Attribute class.

Attribute constructors

The Attribute class has two constructors.

Syntax 1: Here is the syntax for a constructor that takes no arguments:

```
Attribute()
```

Syntax 2: Here is the syntax for a constructor that takes arrays of all the supported data types as arguments:

```
Attribute(ByteArrayArray BinariesVal, BooleanArray BooleansVal, DateArray
DatesVal, IntegerArray IntegersVal, StringArray StringsVal, AttributeType TypeVal)
```

getBinaries

Returns the ByteArrayArray object for the attribute.

Syntax: Here is the method signature:

```
ByteArrayArray getBinaries()
```

setBinaries

Sets the ByteArrayArray object for the attribute.

Syntax: Here is the method signature:

```
void setBinaries(ByteArrayArray BinariesVal)
```

getBooleans

Returns the BooleanArray object for the attribute.

Syntax: Here is the method signature:

```
BooleanArray getBooleans()
```

setBooleans

Sets the BooleanArray object for the attribute.

Syntax: Here is the method signature:

```
void setBooleans(BooleanArray BooleansVal)
```

getDates

Returns the DateArray object for the attribute.

Syntax: Here is the method signature:

```
DateArray getDates()
```

setDates

Sets the DateArray object for the attribute.

Syntax: Here is the method signature:

```
void setDates(DateArray DatesVal)
```

getIntegers

Returns the IntegerArray object for the attribute.

Syntax: Here is the method signature:

```
IntegerArray getIntegers()
```

setIntegers

Sets the IntegerArray object for the attribute.

Syntax: Here is the method signature:

```
void setIntegers(IntegerArray IntegersVal)
```

getStrings

Returns the StringArray object for the attribute.

Syntax: Here is the method signature:

```
StringArray getStrings()
```

setStrings

Set the StringArray object for the attribute.

Syntax: Here is the method signature:

```
void setStrings(StringArray StringsVal)
```

getType

Returns the AttributeType object for the attribute.

Syntax: Here is the method signature:

```
AttributeType getType()
```

setType

Sets the AttributeType object for the attribute.

Syntax: Here is the method signature:

```
void setType(AttributeType TypeVal)
```

AttributeArray

This section provides reference information on the AttributeArray class.

AttributeArray constructors

The AttributeArray class has two constructors.

Syntax 1: Here is the syntax for a constructor that takes no parameters:

```
AttributeArray()
```

Syntax 2: Here is the syntax for a constructor that takes an array of Attribute objects as a parameter:

```
AttributeArray(Attribute[] AttributeVal)
```

getAttribute

Returns an array of Attribute objects.

Syntax: Here is the method signature:

```
Attribute[] getAttribute()
```

setAttribute

Sets the array of Attribute objects associated with the AttributeArray class.

Syntax: Here is the method signature:

```
void setAttribute(Attribute[] AttributeVal)
```

AttributeType

This section provides reference information on the AttributeType class.

AttributeType constructors

The AttributeType class supports a single constructor.

Syntax: Here is the syntax for the constructor:

```
protected AttributeType(java.lang.String value)
```

getValue

Returns a String that indicates the attribute type.

Syntax: Here is the method signature:

```
java.lang.String getValue()
```

BooleanArray

This section provides reference information for the BooleanArray class.

BooleanArray constructors

The BooleanArray class has two constructors.

Syntax 1: Here is the syntax for a constructor that takes no parameters:

```
BooleanArray()
```

Syntax 2: Here is the syntax for a constructor that takes a boolean value as a parameter:

```
BooleanArray(boolean[] BooleanVal)
```

getBoolean

Returns an array of boolean values for an attribute.

Syntax: Here is the method signature:

```
boolean[] getBoolean()
```

setBoolean

Sets an array of boolean values for an attribute.

Syntax: Here is the method signature:

```
void setBoolean(boolean[] BooleanVal)
```

ByteArrayArray

This section provides reference information on the ByteArrayArray class.

ByteArrayArray constructors

The ByteArrayArray class has two constructors.

Syntax 1: Here is the syntax for a constructor that takes no parameters:

```
ByteArrayArray()
```

Syntax 2: Here is the syntax for a constructor that takes a Base 64 binary value as a parameter:

```
ByteArrayArray(byte[][] Base64BinaryVal)
```

getBase64Binary

Returns a two-dimensional array of bytes for an attribute.

Syntax: Here is the method signature:

```
byte[][] getBase64Binary()
```

setBase64Binary

Sets a two-dimensional array of bytes for an attribute.

Syntax: Here is the method signature:

```
void setBase64Binary(byte[][] Base64BinaryVal)
```

DateArray

This section provides reference information for the DateArray class.

DateArray constructors

The DateArray class has two constructors.

Syntax 1: Here is the syntax for a constructor that takes no parameters:

```
DateArray()
```

Syntax 2: Here is the syntax for a constructor that takes a Calendar array as a parameter:

```
DateArray(java.util.Calendar[] DatetimeVal)
```

getDatetime

Returns an array of Calendar objects for an attribute.

Syntax: Here is the method signature:

```
java.util.Calendar[] getDatetime()
```

setDatetime

Sets an array of Calendar objects for an attribute.

Syntax: Here is the method signature:

```
void setDatetime(java.util.Calendar[] DatetimeVal)
```

EntryAttributeMap

The EntryAttributeMap class is a container for an EntryArray object. It is returned by the query method on the stub.

This section provides reference information on the methods associated with the EntryAttributeMap class.

EntryAttributeMap constructors

The EntryAttributeMap class has two constructors.

Syntax 1: Here is the syntax for a constructor that takes no parameters:

```
EntryAttributeMap()
```

Syntax 2: Here is the syntax for a constructor that takes an EntryArray object as a parameter:

```
EntityAttributeMap(EntryArray EntriesVal)
```

getEntries

Returns the EntryArray object contained within this EntryAttributeMap object.

Syntax: Here is the method signature:

```
EntryArray getEntries()
```

setEntries

Sets the EntryArray object for this EntryAttributeMap object.

Syntax: Here is the method signature:

```
void setEntry(EntryArray EntriesVal)
```

Entry

The Entry class represents an entry in an EntryArray object.

This section provides reference information for each method associated with the Entry class.

Entry constructors

The Entry class has two constructors.

Syntax 1: Here is the syntax for a constructor that takes no parameters:

```
Entry()
```

Syntax 2: Here is the syntax for a constructor that takes two parameters, the key value and an array of attribute values:

```
Entry(java.lang.String KeyVal, AttributeArray ValuesVal)
```

getKey

Returns the key defined for the Entry object. The key identifies the attribute.

Syntax: Here is the method signature:

```
java.lang.String getKey()
```

setKey

Sets the key for the Entry object. The key identifies the attribute.

Syntax: Here is the method signature:

```
void setKey(java.lang.String KeyVal)
```

getValues

Returns a AttributeArray object representing the values for the Entry object.

Syntax: Here is the method signature:

```
AttributeArray getValues()
```

setValues

Sets the values for the Entry object.

Syntax: Here is the method signature:

```
void setValues(AttributeArray ValuesVal)
```

EntryArray

The EntryArray class is a container for an array of Entry objects. It is contained by the EntryAttributeMap object.

This section provides reference information on the methods associated with the EntryArray class.

EntryArray constructors

The EntryArray class has two constructors.

Syntax 1: Here is the syntax for a constructor that takes no parameters:

```
EntryArray()
```

Syntax 2: Here is the syntax for a constructor that takes an array of Entry objects as a parameter:

```
EntryArray(Entry[] EntryVal)
```

getEntry

Returns the Entry object contained within this EntryArray object.

Syntax: Here is the method signature:

```
Entry[] getEntry()
```

setEntry

Sets the Entry object for this EntryArray object.

Syntax: Here is the method signature:

```
void setEntry(Entry[] EntryVal)
```

IntegerArray

This section provides reference information for the IntegerArray class.

IntegerArray constructors

The IntegerArray class has two constructors.

Syntax 1: Here is the syntax for a constructor that takes no parameters:

```
IntegerArray()
```

Syntax 2: Here is the syntax for a constructor that takes an int array as a parameter:

```
IntegerArray(int[] IntVal)
```

getInt

Returns an array of integers for an attribute.

Syntax: Here is the method signature:

```
int[] getInt()
```

setInt

Sets an array of integers for an attribute.

Syntax: Here is the method signature:

```
void setInt(int[] IntVal)
```

StringArray

The StringArray class is a container for an array of String objects. When you call the query() and getAttributes() methods, you pass in a StringArray object to specify which attributes you want to retrieve values for.

This section provides reference information for the StringArray class.

StringArray constructors

The StringArray class has two constructors.

Syntax 1: Here is the syntax for a constructor that takes no parameters:

```
StringArray()
```

Syntax 2: Here is the syntax for a constructor that takes an String array as a parameter:

```
StringArray(java.lang.String[] StringVal)
```

getString

Returns the array of String objects associated with the StringArray object.

Syntax: Here is the method signature:

```
java.lang.String[] getString()
```

setString

Sets the array of String objects associated with the StringArray object.

Syntax: Here is the method signature:

```
void setString(java.lang.String[] StringVal)
```

StringEntry

The StringEntry class is contained by the the StringEntryArray class.

This section provides reference information for the StringEntry class.

StringEntry constructors

The StringEntry class has two constructors.

Syntax 1: Here is the syntax for a constructor that takes no parameters:

```
StringEntry()
```

Syntax 2: Here is the syntax for a constructor that takes a key and a String value as parameters:

```
StringEntry(java.lang.String KeyVal, java.lang.String ValuesVal)
```

getKey

Returns the key defined for the StringEntry object.

Syntax: Here is the method signature:

```
java.lang.String getKey()
```

setKey

Sets the key for the StringEntry object.

Syntax: Here is the method signature:

```
void setKey(java.lang.String KeyVal)
```

StringEntryArray

The StringEntryArray class is a container for an array of StringEntry objects. It is contained by the StringMap object.

This section provides reference information for the StringEntryArray class.

StringEntryArray constructors

The StringEntryArray class has two constructors.

Syntax 1: Here is the syntax for a constructor that takes no parameters:

```
StringEntryArray()
```

Syntax 2: Here is the syntax for a constructor that takes a StringEntry array as a parameter:

```
StringEntryArray(StringEntry[] StringentryVal)
```

getStringentry

Returns the key for the StringEntryArray object.

Syntax: Here is the method signature:

```
StringEntry[] getStringentry()
```

setStringentry

Sets the key for the StringEntryArray object.

Syntax: Here is the method signature:

```
void setStringentry(StringEntry[] StringentryVal)
```

StringMap

The StringMap is a container for a StringEntryArray object.

This section provides reference information on the StringMap class.

StringMap constructors

The StringMap class has two constructors.

Syntax 1: Here is the syntax for a constructor that takes no parameters:

```
StringMap()
```

Syntax 2: Here is the syntax for a constructor that takes a StringEntryArray as a parameter:

```
StringMap(StringEntryArray EntriesVal)
```

getEntries

Returns the StringEntryArray object contained by this StringMap object.

Syntax: Here is the method signature:

```
StringEntryArray getEntries()
```

setEntries

Sets the StringEntryArray object for this StringMap object.

Syntax: Here is the method signature:

```
void setEntries(StringEntryArray EntriesVal)
```

VdxService

This section provides reference information for the VdxService interface.

getIRemoteVdxPort

Gets the stub for the remote service. The stub is a port of type IRemoteVdx.

Syntax: Here is the method signature:

```
IRemoteVdx getIRemoteVdxPort() throws javax.xml.rpc.ServiceException;
```

VersionVO

This section provides reference information on the VersionVO class.

getValue

Returns the version number of the service.

Syntax: Here is the method signature:

```
java.lang.String getValue()
```

VDX Example

The following code example shows how one might use the VDX service to access the attributes associated with entities defined in the directory abstraction layer. It demonstrates the use of ad hoc searches, as well as predefined searches called global queries. This code listing includes examples that use the getAttribute(), getAttributes(), query(), and globalQuery() methods on the service.

To get a reference to the SOAP endpoint for the VDX service, it calls a method called getVdxStub(). The implementation for this method is shown at the end of the listing:

NOTE: This example presumes that you have generated client stubs from the WSDL file `IRemoteVdx.wsdl`. Use the SOAP stack provider of your choice (such as AXIS or CFX) to generate client stubs.

With Apache CXF, for example, you should be able to generate the stubs to match the package names in the `import` statement by using the following command:

```
wsdl2java -p com.netiq.ws.client.vdx IRemoteVdx.wsdl
```

```
import java.util.Properties;

import javax.naming.Context;
import javax.naming.InitialContext;
import javax.xml.rpc.Stub;
import java.rmi.RemoteException;
import java.io.File;
import java.io.FileNotFoundException;
import java.io.FileOutputStream;
import java.io.IOException;
import java.rmi.RemoteException;
import java.util.Calendar;
import java.util.Date;
import java.util.Hashtable;
import java.util.Map;
//
// Vdx imports
import com.netiq.ws.client.vdx.IRemoteVdx;
import com.netiq.ws.client.vdx.VdxService;
import com.netiq.ws.client.vdx.VdxServiceException;
import com.netiq.ws.client.vdx.VersionVO;
import com.netiq.ws.client.vdx.Attribute;
import com.netiq.ws.client.vdx.AttributeArray;
import com.netiq.ws.client.vdx.AttributeType;
import com.netiq.ws.client.vdx.ByteArrayArray;
import com.netiq.ws.client.vdx.BooleanArray;
import com.netiq.ws.client.vdx.DateArray;
import com.netiq.ws.client.vdx.StringArray;
import com.netiq.ws.client.vdx.IntegerArray;
import com.netiq.ws.client.vdx.EntryArray;
import com.netiq.ws.client.vdx.Entry;
import com.netiq.ws.client.vdx.EntityAttributeMap;


public class ServiceTest
{
  public static final int VDX           = 0;
  public static final int NOTIFICATION      = 1;
  public static final int RESOURCE         = 2;
  public static final int ENDPOINT_SERVICE  = VDX;

  private static final int LOCALHOST    = 0;  // localhost
  private static final int TESTSERVER      = 1;  // testserver
  private static final int SELECTED_URL     = TESTSERVER;

      private String [] SERVER_URLS = {
    "http://localhost:8080/IDMProv/vdx/service",
    "http://testserver:8080/IDMProv/vdx/service"
  };

  private String url = SERVER_URLS[SELECTED_URL];
  private String username = "cn=admin,ou=idmsample,o=netiq";
  private String password = "test";

      private String [] userAttributes = {
                    //"passwordAllowChange", // boolean
                    "UserPhoto",             // binary
                    //"loginTime",             // time
                    "Department",            // string
                    "Title",
                    "Email",
                    "manager",               // dn = string
                    "TelephoneNumber",
                    "directReports",
                    "FirstName",
                    //"surname",
                    "group",
                    "srvprvHideAttributes",
                    "NotificationPrefs",
                    "srvprvQueryList",
                    "Location",
                    };

  public ServiceTest() { };

  public static void main(String [] args)
  {
           ServiceTest serviceTest = new ServiceTest();
       //
           // Set default if no params are given
       int wService = ENDPOINT_SERVICE;
       if(args.length == 1)
              wService = Integer.parseInt(args[0]);
```

```
        try
        {
            serviceTest.run(wService);
        }
        catch(Exception e)
        {
        System.exit(-1);
        }
  }


  private void waitHere(long _time) { try { Thread.sleep(_time *
1000); } catch(InterruptedException ie) {} }


  public void run(int _service)
  throws Exception
  {
     if(_service == VDX)
     {
    System.out.println("Calling VDX endpoint");
    //
    // Get the version number
    getVersionTestCase();
    waitHere(2);
    //
    // Get attribute data for entity user
    getAttributeTestCase();
    waitHere(2);
    //
    // Get attributes
    getAttributesTestCase();
    waitHere(2);
    //
    // Query attributes
    queryAttributesTestCase();
    waitHere(2);
    //
    // Global query
           // Global query MUST be associated with a defined and
deployed query.
    // This can be done via the Designer.

    globalQueryTestCase();
     }
     else if(_service == NOTIFICATION)
     {
    System.out.println("Calling Notification endpoint");
    NotificationTest notificationTest = new
NotificationTest();
    //
    // Email Notification
    notificationTest.emailNotificationTestCase();
         }
     else if(_service == RESOURCE)
     {
    System.out.println("Calling Resource endpoint");
         }
         else
     {
    System.out.println("Unrecognized service selection");
         }
  }


public void globalQueryTestCase()
    throws Exception
    {

System.out.println("\n<=========queryAttributesTestCase=========>");
        try
        {
            //
            // Get the vdx stub
    IRemoteVdx vdxStub = getVdxStub(url, username, password);
            //
            // Create entry items corresponding to param key in DAL
            StringEntry [] entry = {
                    new StringEntry("titleattribute", "Chief Operating
Officer"),
                    new StringEntry("managerattribute",
"cn=jmiller,ou=users,ou=idmsample-pproto,o=netiq")
            };
            //
            // Create and set the array of entries (key,value pairs)
            StringEntryArray entryArr = new StringEntryArray();
            entryArr.setStringentry(entry);
            //
            // Create and set the map using the entries
            StringMap map = new StringMap();
            map.setEntries(entryArr);
            //
            // Define and execute the global query
            int QUERY_KEY_INDEX = 0;
            String [] queryKeyName = {"TestVdxGlobalQuery2",
"TestVdxGlobalQuery"};
            //
            // Results from global query TestVdxGlobalQuery2 ----->
cn=apalani,ou=users,OU=idmsample-pproto,O=netiq
            //
            // Make the vdx endpoint call
            StringArray array =
vdxStub.globalQuery(queryKeyName[QUERY_KEY_INDEX], map);
            String [] str = array.getString();
            if(str == null)
```

```
                throw new Exception("Global query returns null for key
name " + queryKeyName);
            else
            {
                System.out.println("Results for global query : " +
queryKeyName[QUERY_KEY_INDEX]);

System.out.println("===============================================
===");
                for(int index = 0; index < str.length; index++)
                {
                    System.out.println(str[index]);
                }
            }
        }
        catch(VdxServiceException error)
        {
            System.out.println(error.getReason() );
            throw new Exception(error.getReason() );
        }
        catch(RemoteException error)
        {
            System.out.println(error.getMessage() );
            throw new Exception(error.getMessage() );
        }
    }


    public void queryAttributesTestCase()
    throws Exception
    {
    System.out.println("\nCalling queryAttributesTestCase() test
case");
    try
        {
    IRemoteVdx vdxStub = getVdxStub(url, username, password);

            StringArray attributes = new StringArray();
            attributes.setString(new String[]{"FirstName", "Title",
"UserPhoto", "Department"});
            String expression1 = "FirstName STARTWITH 'J'";
            String expression2 = "Title = 'Controller'";
            String expression3 = "vdxInteger > 0";
            String expression4 = "TelephoneNumber != '(555) 555-1201'";
            //
            // Test Cases
            // expression1 --> Should yield all users whose firstname
starts with J
            // expression1 AND expression2 --> Should yield jkelley who
is the Controller
            // expression1 AND expression3 --> Should yield only jmiller
            // expression1 AND expression4 --> Should yield all users
starting with J EXCEPT jmiller
            String finalExpression = expression1 + " AND " +
expression2;
            //
            // Make the vdx endpoint call
            EntityAttributeMap map = vdxStub.query("user", attributes,
finalExpression);
            EntryArray entryArray = map.getEntries();
            Entry [] entries = entryArray.getEntry();
            if(entries != null)
            {
                for(int index = 0; index < entries.length; index++)
                {
                    String dnKey = entries[index].getKey();
                    System.out.println("DN Key = " + dnKey);
                    AttributeArray attributeArray =
entries[index].getValues();
                    Attribute [] attributeData =
attributeArray.getAttribute();
                    for(int attrIndex = 0; attrIndex <
attributeData.length; attrIndex++)
                    {
                        //
                        // Determine how to handle the return data
                        examineAttributeData(attributeData[attrIndex],
" ");
                    }

                }
            }
        }
        catch(VdxServiceException error)
        {
            System.out.println(error.getReason() );
            throw new Exception(error.getReason() );
        }
        catch(RemoteException error)
        {
            System.out.println(error.getMessage() );
            throw new Exception(error.getMessage() );
        }
    }


    public void getVersionTestCase()
    throws Exception
    {
    System.out.println("\nCalling getVersionTestCase() test
case");

  try
  {
    IRemoteVdx vdxStub = getVdxStub(url, username, password);
            VersionVO version = vdxStub.getVersion();
            System.out.println("Version : " + version.getValue() );
  }
        catch(RemoteException error)
        {
              System.out.println(error.getMessage() );
              throw new Exception(error.getMessage() );
        }
    }


    public void getAttributeTestCase()
    throws Exception
    {
      System.out.println("\nCalling getAttributeTestCase() test
case");

          try
          {
     IRemoteVdx vdxStub = getVdxStub(url, username, password);

            String recipient =
"cn=jmiller,ou=users,ou=idmsample,o=netiq";
            String entity = "user";
            for(int attributeIndex = 0; attributeIndex <
userAttributes.length; attributeIndex++)
            {
                //
                // Now, get the values for each attribute from the VDX
layer
                Attribute attributeData =
vdxStub.getAttribute(recipient,
                            entity, userAttributes[attributeIndex]);
                //
                // Determine how to handle the return data
                examineAttributeData(attributeData,
userAttributes[attributeIndex]);
            }
         }
        catch(VdxServiceException error)
        {
            System.out.println(error.getReason() );
            throw new Exception(error.getReason() );
        }
        catch(RemoteException error)
        {
            System.out.println(error.getMessage() );
            throw new Exception(error.getMessage() );
        }
   }

    public void getAttributesTestCase()
    throws Exception
    {
      System.out.println("\nCalling getAttributesTestCase() test
case");

          try
          {
     IRemoteVdx vdxStub = getVdxStub(url, username, password);

            String recipient =
"cn=jmiller,ou=users,ou=idmsample,o=netiq";
            String entity = "user";
    StringArray userAttributesArray = new
StringArray(userAttributes);
            AttributeArray attributeArray =
vdxStub.getAttributes(recipient,
      entity, userAttributesArray);
            Attribute [] attributeData = attributeArray.getAttribute();
            for(int index = 0; index < attributeData.length; index++)
            {
                //
                // Determine how to handle the return data
                examineAttributeData(attributeData[index],
userAttributes[index]);
            }
    }
        catch(VdxServiceException error)
        {
            System.out.println(error.getReason() );
            throw new Exception(error.getReason() );
        }
        catch(RemoteException error)
        {
            System.out.println(error.getMessage() );
            throw new Exception(error.getMessage() );
        }
   }


    private void examineAttributeData(Attribute _attribute, String _attributeName)
    throws Exception
    {
        AttributeType type = _attribute.getType();
       System.out.println("Attribute type : " + type);
        //
        // What type are we dealing with?
        if(type.getValue().compareTo(AttributeType._Integer) == 0)
        {
            IntegerArray intArray = _attribute.getIntegers();
            int [] intData = intArray.getInt();
            if(intData == null)
                System.out.println(_attributeName + " attribute : " +
"null because no attribute value exists.");
            else
            {
                for(int intIndex = 0; intIndex < intData.length;
intIndex++)
                {
                    System.out.println(_attributeName + " attribute : "
+ intData[intIndex]);
                }
            }
        }
        else if(type.getValue().compareTo(AttributeType._Boolean) == 0)
        {
            BooleanArray boolArray = _attribute.getBooleans();
            boolean [] booleanData = boolArray.getBoolean();
            if(booleanData == null)
                System.out.println(_attributeName + " attribute : " +
"null because no attribute value exists.");
            else
            {
                for(int boolIndex = 0; boolIndex < booleanData.length;
boolIndex++)
                {
                    System.out.println(_attributeName + " attribute : "
+ booleanData[boolIndex]);
                }
            }
        }
        else if( (type.getValue().compareTo(AttributeType._String) ==
0) ||
                 (type.getValue().compareTo(AttributeType._DN) == 0) )
        {
            StringArray dataArray = _attribute.getStrings();
            String [] stringData = dataArray.getString();
            if(stringData == null)
                System.out.println(_attributeName + " attribute : " +
"null because no attribute value exists.");
            else
            {
                for(int strIndex = 0; strIndex < stringData.length;
strIndex++)
                {
                    System.out.println(_attributeName + " attribute : "
+ stringData[strIndex]);
                }
            }
        }
        else if(type.getValue().compareTo(AttributeType._Binary) == 0)
        {
            ByteArrayArray byteArray = _attribute.getBinaries();
            byte [][] byteData = byteArray.getBase64Binary();
            if(byteData == null)
                System.out.println(_attributeName + " attribute : " +
"null because no attribute value exists.");
            else
            {
                for(int byteIndex = 0; byteIndex < byteData.length;
byteIndex++)
                {
                    byte [] data = byteData[byteIndex];
                    //
                    // Save the data to a gif file and view it to
                    // make sure the binary return data is correct.
                    try
                    {
                        File fileObj = new File("C:\\temp\\photo.gif");
                        if(fileObj.exists())
                            fileObj.delete();
                        FileOutputStream fout = new
FileOutputStream(fileObj);
                        fout.write(data);
                        fout.flush();
                    }
                    catch(FileNotFoundException fne)
                    {
                        throw new Exception(fne.getMessage());
                    }
                    catch(IOException ioe)
                    {
                        throw new Exception(ioe.getMessage());
                    }
                }
            }
        }
        else if(type.getValue().compareTo(AttributeType._Time) == 0)
        {
            DateArray dateArray = _attribute.getDates();
            Calendar [] calendar = dateArray.getDatetime();
            if(calendar == null)
                System.out.println(_attributeName + " attribute : " +
"null because no attribute value exists.");
```

```
            else
            {
                for(int calIndex = 0; calIndex < calendar.length;
calIndex++)
                {
                    System.out.println(_attributeName + " attribute : "
+ calendar[calIndex].getTime().toString());
                }
            }
        }

    }


    /**
     * Method to obtain the remote interface to the Vdx endpoint
     * @param _url
     * @param _username
     * @param _password
     * @return IRemoteMetrics interface
     * @throws Exception
     */
    private IRemoteVdx getVdxStub(String _url, String _username, String
_password)
    throws Exception
    {
        Properties properties = new Properties();
        properties.put(Context.INITIAL_CONTEXT_FACTORY,
"org.jnp.interfaces.NamingContextFactory");

        String lookup =
"xmlrpc:soap:com.netiq.ws.client.vdx.VdxService";

        InitialContext ctx = new InitialContext();
        VdxService svc = (VdxService) ctx.lookup(lookup);

        Stub stub = (Stub)svc.getIRemoteVdxPort();

        stub._setProperty(Stub.USERNAME_PROPERTY, _username);
        stub._setProperty(Stub.PASSWORD_PROPERTY, _password);
        stub._setProperty(Stub.SESSION_MAINTAIN_PROPERTY,
Boolean.TRUE);
        stub._setProperty(Stub.ENDPOINT_ADDRESS_PROPERTY, _url);

        return (IRemoteVdx) stub;
    }

}
```

24 Role Web Service

This section describes the Role Web Service, which allows SOAP clients to access the role management and SoD management functions.

About the Role Web Service

To support access by third-party software applications, the Role subsystem includes a Web service endpoint called the Role Web Service. It supports a wide range of role management and SoD management functions.

This Appendix describes the programming interface for the Role Web Service.

Accessing the Test Page

You can access the Role Web Service endpoint using a URL similar to the following:

```
http://server:port/warcontext/role/service?test
```

For example, if your server is named “myserver”, your User Application is listening on port 8080, and your User Application war file is named “IDMPROV”, the URL would be:

```
http://myserver:8080/IDMPROV/role/service?test
```

You can also access the SOAP endpoint by going to the **Administration** within the User Application. To do this, you need to select the **Application Configuration** tab, then select **Web Services** from the left-navigation menu. After selecting **Web Services**, pick the Web Service endpoint you want from the list.

WARNING: The test page is disabled by default. Since some of the methods allow data to be updated, the test page presents a potential security vulnerability and should not be allowed in a production environment.

Servlet Declaration for the Test Page

A SOAP service using WSSDK is deployed by adding the following declarations in the deployment descriptor (i.e. WEB-INF/web.xml):

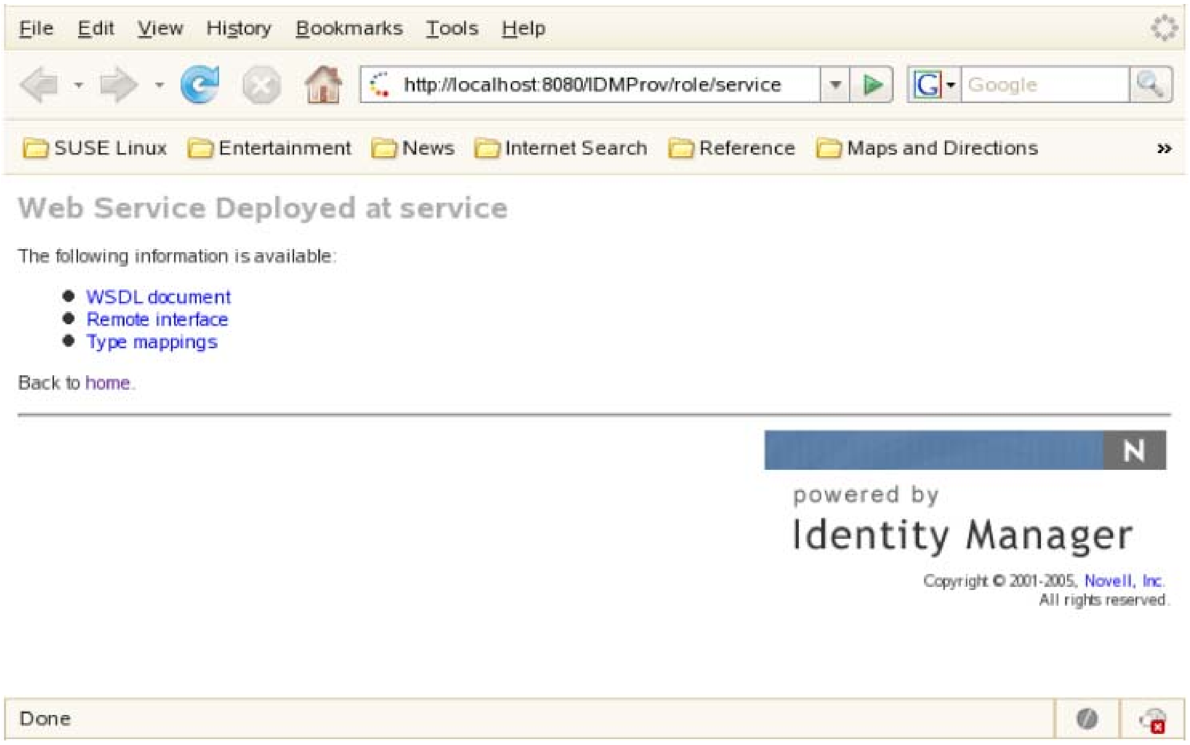
```
<servlet>
  <servlet-name>Role</servlet-name>
  <servlet-class>com.novell.idm.nrf.soap.ws.role.impl.RoleServiceSkeletonImpl</
servlet-class>

<servlet-mapping>
  <servlet-name>Role</servlet-name>
  <url-pattern>/role/service</url-pattern>
</servlet-mapping>
</servlet>
```

This follows the normal servlet declaration pattern. It indicates that the servlet com.novell.idm.nrf.soap.ws.role.impl.RoleServiceSkeletonImpl is deployed at /role/service.

When a user reaches this servlet using a HTTP GET by entering `http://`*`server-name/context/`*`role/service` (for example, `http://localhost:8080/IDMProv/role/service`) in their browser, the WSSDK provides a page that exposes some information about the deployed service. By default the page looks like this:

***Figure 24-1** SOAP Service with Test Page Disabled*


File Edit View History Bookmarks Tools Help
http://localhost:8080/IDMProv/role/service
Google
SUSE Linux
Entertainment
News
Internet Search
Reference
Maps and Directions

Web Service Deployed at service

The following information is available:

- WSDL document
- Remote interface
- Type mappings

Back to home.

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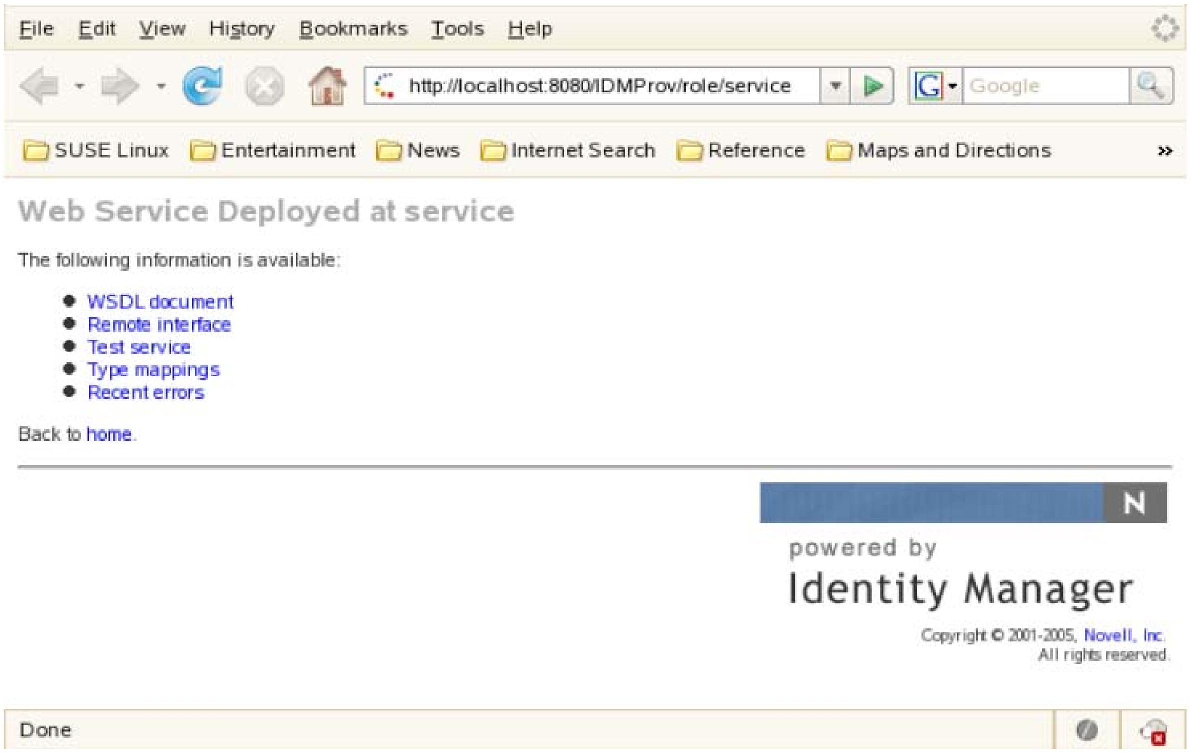
Done

After you enable the test page, the **Test Service** link is available:

Figure 24-2 SOAP Servlet with Test Page Enabled



Web Service Deployed at service

The following information is available:

- WSDL document
- Remote interface
- Test service
- Type mappings
- Recent errors

Back to home.

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On the test page, the user can retrieve the WSDL document that describes the Web Service, see the Java Remote Interface that represents the service, and also see the type mappings from XML to Java. In addition, the user can test the service by invoking individual methods.

Enabling the Test Page

WARNING: The test page is disabled by default. Since some of the methods allow data to be updated, the test page presents a potential security vulnerability and should not be allowed in a production environment.

To enable the test page, you need to update the WEB-INF/web.xml file in the IDMProv.war file. Before you make your changes, the web.xml should look like this:

```
<servlet>
  <servlet-name>Role</servlet-name>
  <servlet-class>com.novell.idm.nrf.soap.ws.role.impl.RoleServiceSkeletonImpl</
servlet-class>
  <init-param>
    <param-name>com.novell.soa.ws.test.disable</param-name>
    <param-value>true</param-value>
  </init-param>
</servlet>
```

Change the servlet declaration, as follows:

```
<servlet>
  <servlet-name>Role</servlet-name>
  <servlet-class>com.novell.idm.nrf.soap.ws.role.impl.RoleServiceSkeletonImpl</
servlet-class>
</servlet>
```

Accessing the WSDL

You can access the WSDL for the Role Web Service using a URL similar to the following:

`http://`*`server`*`:`*`port`*`/`*`warcontext`*`/role/service?wsdl`

For example, if your server is named “myserver”, your User Application is listening on port 8080, and your User Application war file is named “IDMPROV”, the URL would be:

```
http://myserver:8080/IDMPROV/role/service?wsdl
```

Generating the Stub Classes

Before using the Web Service, you need to use the WSSDK tool or another SOAP tool kit to generate the stub classes. To allow your code to find the stub classes, you also need to add the JAR that contains the stub classes to your classpath.

If you want to use the NetIQ WSSDK tool, you can generate the client stubs by extracting the WSDL and running the wsdl2java utility. For example, you could run this command to generate the stubs in a package called com.novell.soa.af.role.soap.impl:

```
"C:\Program Files\Java\jdk1.6.0_31\bin\java" -cp "../lib/wssdk.jar;../lib/jaxrpc-
api.jar";"../lib/mail.jar";"../lib/activation.jar";"c:\Program
Files\Java\jdk1.6.0_31\lib\tools.jar"; com.novell.soa.ws.impl.tools.wsdl2java.Main
-verbose -ds gensrc -d C:\ -noskel -notie -genclient -keep -package
com.novell.soa.af.role.soap.impl -javadoc role.wsdl
```

You can change the wsdl2java parameters to suit your requirements.

Removing Administrator Credential Restrictions

The Role Web Service supports two levels of security, one that restricts access to Role Administrators, and another that restricts access to the authenticated user. The default setting restricts access to all operations to the Role Administrator.

You can modify the settings for security configuration in the `ism-configuration.properties` file, located by default in the `/netiq/idm/apps/tomcat/conf` directory. . Each property can be set to true or false. A value of true locks down the operation, whereas a value of false opens up the operation.

You can open up the Role Web Service to authenticated users by setting the RoleService/Role/soap property to false. To open up a particular operation to authenticated users, you need to set the property for that operation (RoleService/Role/soap/*operation*) to false as well. If you set all of the properties to false, you can open up all operations to authenticated users. The *operation* names are the same as the names of the methods supported by the service.

Example To ensure that the security configuration opens up all operations within the Role Web Service, the `ism-configuration.properties` file must have the following setting:

```
    RoleService/Role/soap = false
```

Role API

This section provides details about the methods available with the Role Web service. This API presumes you're using Java code generated by the WSSDK toolkit. The API will be different if you're using another Web Service toolkit.

IRemoteRole

This section provides reference information for each method associated with the IRemoteRole interface.

createResourceAssociation

Create a resource association and return the resource association object with the newly created resource association DN.

Syntax: Here is the method signature:

```
ResourceAssociation
createResourceAssociation(com.novell.idm.nrf.soap.ws.ResourceAssociation
resourceAssociation)
        throws com.novell.idm.nrf.soap.ws.NrfServiceException,
java.rmi.RemoteException;
```

deleteResourceAssociation

Deletes a resource association object.

Syntax: Here is the method signature:

```
void deleteResourceAssociation(com.novell.idm.nrf.soap.ws.DNString
resourceAssociationDn)
        throws com.novell.idm.nrf.soap.ws.NrfServiceException,
java.rmi.RemoteException;
```

getResourceAssociations

Retrieves resource association objects for a given role DN or resource DN. If the *roleDn* and *resourceDn* parameters are null, the entire list is returned.

Syntax: Here is the method signature:

```
ResourceAssociation[] getResourceAssociations(com.novell.idm.nrf.soap.ws.DNString
roleDn, com.novell.idm.nrf.soap.ws.DNString resourceDn)
        throws com.novell.idm.nrf.soap.ws.NrfServiceException,
java.rmi.RemoteException;
```

Create Role

Creates a new role according to the specified parameters and returns the DN of the created role.

A correlation ID is generated automatically for this method that uses this format:

```
UserApp#RemoteRoleRequest#xxxxxxxx-xxxx-xxxx-xxxx-xxxxxxxxxxxx
```

The correlation ID is used for auditing.

Syntax: Here is the method signature:

```
public DNString createRole(RoleRequest role)
            throws NrfServiceException, RemoteException;
```

createRoleAid

Creates a new role with a correlation ID that you provide. The correlation ID is used for auditing to link a set of related roles. This method returns the DN of the created role.

Syntax: Here is the method signature:

```
public DNString createRoleAid (RoleRequest role, String correlationId)
            throws NrfServiceException, RemoteException;
```

findRoleByExampleWithOperator

Finds an array of Role objects based on the search criteria specified in the given Role object. This method also lets you specify whether to use AND as the operator for multi-value searches.

Syntax: Here is the method signature:

```
RoleArray findRoleByExampleWithOperator(Role searchCriteria, boolean
useAndForMultiValueSearch) throws NrfServiceException, java.rmi.RemoteException
```

This method follows a query by example approach. It allows you to populate a Role object to specify the desired search criteria. An AND operation is always used across multiple attributes within the Role search object. For example, you might provide a value for the `name` and `description` attributes, which indicates that the criteria for both attributes must be satisfied for a successful search.

The second parameter (useAndForMultiValueSearch) allows you to specify which operator should be used for multi-valued attributes (such as when multiple child roles are provided). A value of true indicates that AND should be used for these operations, whereas a value of false indicates that OR should be used.

Not all attributes in the Role object can be used for the search expression. Values found in the non-supported search attributes are ignored.

Table 24-1 Guidelines for Defining Search Criteria in the Role Object

Attribute	Supported?	Description

approvers	Yes	Uses a standard LDAP equal operator for the search. You can enter multiple approvers and use the operator parameter to determine whether an AND or an OR is used for the multi-valued search. You need to provide valid Dns for the approvers. Note that an approver is made up of multiple parts. It is of type TypedNameSyntax. You need to specify the sequence number of the approver to execute a successful search. This is a limitation in LDAP.
		
		Sample SOAP Request:
		
		`<ser:findRoleByExampleWithOperatorRequest>`
		` <ser:role>`
		`  <ser:approvers>`
		`   <!--Zero or more repetitions:-->`
		`   <ser:approver>`
		`    <ser:approverDN>cn=ablake,ou=users,ou=medical-`
		`idmsample,o=netiq</ser:approverDN>`
		`    <ser:sequence>1</ser:sequence>`
		`   </ser:approver>`
		`  </ser:approvers>`
		` </ser:role>`
		` <ser:operator>false</ser:operator>`
		`</ser:findRoleByExampleWithOperatorRequest>`
		
		The example above shows how to find roles that have the specified approver associated with them. An OR search is used since the operator parameter is set to false.

childRoles	Yes	Uses a standard LDAP equal operator for the search. You can enter multiple child roles and use the operator parameter to determine whether an AND or an OR is used for the multi-valued search. You need to provide valid Dns for the child roles.
		
		Sample SOAP Request:
		
		`<ser:findRoleByExampleWithOperatorRequest>`
		` <ser:role>`
		`  <ser:childRoles>`
		`   <!--Zero or more repetitions:-->`
		`   <ser:dnstring>`
		`    <ser:dn>cn=Doctor,cn=Level20,cn=RoleDefs,cn=RoleConfig`
		`,cn=AppConfig,cn=PicassoDriver,cn=TestDrivers,o=netiq</`
		`ser:dn>`
		`    </ser:dnstring>`
		`   <ser:dnstring>`
		`    <ser:dn>cn=Nurse,cn=Level20,cn=RoleDefs,cn=RoleConfig,`
		`cn=AppConfig,cn=PicassoDriver,cn=TestDrivers,o=netiq</`
		`ser:dn>`
		`   </ser:dnstring>`
		`  </ser:childRoles>`
		` </ser:role>`
		` <ser:operator>false</ser:operator>`
		`</ser:findRoleByExampleWithOperatorRequest>`
		
		The example above shows how to find roles with a child role of "Doctor" or "Nurse. An OR search is used since the operator parameter is set to false.

Attribute	Supported?	Description

description	Yes	Uses an LDAP contains search. All entries are prefixed and suffixed with the * (wild card character). Therefore, a search for “Doctor” translates to “*Doctor*”. This is to accommodate searches across any localized language.
		
		Sample SOAP Request:
		
		`<ser:findRoleByExampleWithOperatorRequest>`
		` <ser:role>`
		`  <ser:description>Doctor</ser:description>`
		` </ser:role>`
		` <ser:operator>false</ser:operator>`
		`</ser:findRoleByExampleWithOperatorRequest>`
		
		The example above shows how to find roles with a description of “Doctor”. This description string results in a search string of “*Doctor*”.

entityKey	Yes	If entered, this attribute causes a getRole operation to be performed. All other search criteria are ignored in this case.
		
		Sample SOAP Request:
		
		`<ser:findRoleByExampleWithOperatorRequest>`
		` <ser:role>`
		`  <ser:entityKey>cn=Doctor,cn=Level20,cn=RoleDefs,cn=RoleC`
		`onfig,cn=AppConfig,cn=PicassoDriver,cn=TestDrivers,o=netiq`
		`</ser:entityKey>`
		` </ser:role>`
		` <ser:operator>false</ser:operator>`
		`</ser:findRoleByExampleWithOperatorRequest>`
		
		The example above shows how to retrieve a role with a specific entity key.

implicitContainers	Yes	Uses a standard LDAP equal operator for the search. You can enter multiple implicit containers and use the operator parameter to determine whether an AND or an OR will be used for the multi-valued search. You need to provide valid Dns for the implicit containers.
		
		Sample SOAP Request:
		
		`<ser:findRoleByExampleWithOperatorRequest>`
		` <ser:role>`
		`  <ser:implicitContainers>`
		`   <!--Zero or more repetitions:-->`
		`   <ser:dnstring>`
		`    <ser:dn>ou=medical-idmsample,o=netiq</ser:dn>`
		`   </ser:dnstring>`
		`  </ser:implicitContainers>`
		` </ser:role>`
		` <ser:operator>false</ser:operator>`
		`</ser:findRoleByExampleWithOperatorRequest>`
		
		The example above shows how to find roles that have the specified implicit container associated with them. An OR search is used since the operator parameter is set to false.

Attribute	Supported?	Description

implicitGroups	Yes	Uses a standard LDAP equal operator for the search. You can enter multiple implicit groups and use the operator parameter to determine whether an AND or an OR will be used for the multi-valued search. You need to provide valid Dns for the implicit groups.
		
		Sample SOAP Request:
		
		`<ser:findRoleByExampleWithOperatorRequest>`
		` <ser:role>`
		`  <ser:implicitGroups>`
		`   <!--Zero or more repetitions:-->`
		`   <ser:dnstring>`
		`    <ser:dn>cn=HR,ou=groups,ou=medical-idmsample,o=netiq</`
		`ser:dn>`
		`   </ser:dnstring>`
		`  </ser:implicitGroups>`
		` </ser:role>`
		` <ser:operator>false</ser:operator>`
		`</ser:findRoleByExampleWithOperatorRequest>`
		
		The example above shows how to find roles that have the specified implicit group associated with them. An OR search is used since the operator parameter is set to false.

name	Yes	Uses an LDAP contains search. All entries will be prefixed and suffixed with the * (wild card character). Therefore, a search for “Doctor” translates to “*Doctor*”. This is to accommodate searches across any localized language.
		
		Sample SOAP Request:
		
		`<ser:findRoleByExampleWithOperatorRequest>`
		` <ser:role>`
		`  <ser:name>Doctor</ser:name>`
		` </ser:role>`
		` <ser:operator>false</ser:operator>`
		`</ser:findRoleByExampleWithOperatorRequest>`
		
		The above example shows how to find roles with a name of “Doctor”. The name string results in a search string of “*Doctor*”.

Attribute	Supported?	Description

owners	Yes	Uses a standard LDAP equal operator for the search. You can enter multiple owners and use the operator parameter to determine whether an AND or an OR is used for the multi-valued search. You must provide valid Dns for the owners.
		
		SoapUI Example Request:
		
		`<ser:findRoleByExampleWithOperatorRequest>`
		` <ser:role>`
		`  <ser:owners>`
		`   <!--Zero or more repetitions:-->`
		`   <ser:dnstring>`
		`    <ser:dn>cn=ablake,ou=users,ou=medical-`
		`idmsample,o=netiq</ser:dn>`
		`   </ser:dnstring>`
		`   <ser:dnstring>`
		`    <ser:dn>cn=mmackenzie,ou=users,ou=medical-`
		`idmsample,o=netiq</ser:dn>`
		`   </ser:dnstring>`
		`  </ser:owners>`
		` </ser:role>`
		` <ser:operator>true</ser:operator>`
		`</ser:findRoleByExampleWithOperatorRequest>`
		
		The example above shows how to find roles that have the specified owners. An AND search is used since the operator parameter is set to true.

parentRoles	Yes	Uses a standard LDAP equal operator for the search. You can enter multiple parent roles and use the operator parameter to determine whether an AND or an OR is used for the multi-valued search. You must provide valid Dns for the parent roles.
		
		Sample SOAP Request:
		
		`<ser:findRoleByExampleWithOperatorRequest>`
		` <ser:role>`
		`  <ser:parentRoles>`
		`   <!--Zero or more repetitions:-->`
		`   <ser:dnstring>`
		`    <ser:dn>cn=Doctor-`
		`East,cn=Level30,cn=RoleDefs,cn=RoleConfig,cn=AppConfig,cn=`
		`PicassoDriver,cn=TestDrivers,o=netiq</ser:dn>`
		`   </ser:dnstring>`
		`   <ser:dnstring>`
		`    <ser:dn>cn=Doctor-`
		`West,cn=Level30,cn=RoleDefs,cn=RoleConfig,cn=AppConfig,cn=`
		`PicassoDriver,cn=TestDrivers,o=netiq</ser:dn>`
		`   </ser:dnstring>`
		`  </ser:parentRoles>`
		` </ser:role>`
		` <ser:operator>true</ser:operator>`
		`</ser:findRoleByExampleWithOperatorRequest>`
		
		The example above shows how to find roles that have the specified parent roles. An AND search is used since the operator parameter is set to true.

Attribute	Supported?	Description

quorum	Yes	Uses a standard LDAP equal operator for the search.
		
		Sample SOAP Request:
		
		`<ser:findRoleByExampleWithOperatorRequest>`
		` <ser:role>`
		`  <ser:quorum>50%</ser:quorum>`
		` </ser:role>`
		` <ser:operator>false</ser:operator>`
		`</ser:findRoleByExampleWithOperatorRequest>`
		
		The example above shows how to find roles with the specified quorum search string. The search string can include the wild card character (“*”).

requestDef	Yes	Uses a standard LDAP equal operator for the search. You must provide a valid DN for the request definition.
		
		Sample SOAP Request:
		
		`<ser:findRoleByExampleWithOperatorRequest>`
		` <ser:role>`
		`  <ser:requestDef>cn=Role`
		`Approval,cn=RequestDefs,cn=AppConfig,cn=PicassoDriver,cn=T`
		`estDrivers,o=netiq</ser:requestDef>`
		` </ser:role>`
		` <ser:operator>false</ser:operator>`
		`</ser:findRoleByExampleWithOperatorRequest>`
		
		The example above shows how to find roles with the specified request definition DN.

roleCategoryKeys	Yes	Uses a standard LDAP equal operator for the search. You can enter multiple category keys and use the operator parameter to determine whether an AND or an OR is used for the multi-valued search.
		
		Sample SOAP Request:
		
		`<ser:findRoleByExampleWithOperatorRequest>`
		` <ser:role>`
		`  <ser:roleCategoryKeys>`
		`   <!--Zero or more repetitions:-->`
		`   <ser:categorykey>`
		`    <ser:categoryKey>doctor</ser:categoryKey>`
		`   </ser:categorykey>`
		`   <ser:categorykey>`
		`    <ser:categoryKey>nurse</ser:categoryKey>`
		`   </ser:categorykey>`
		`  </ser:roleCategoryKeys>`
		` </ser:role>`
		` <ser:operator>false</ser:operator>`
		`</ser:findRoleByExampleWithOperatorRequest>`
		
		The example above shows how to find roles with a category of “doctor” or “nurse. An OR search is used since the operator parameter is set to false.

Attribute	Supported?	Description

roleLevel	Yes	Uses a standard LDAP equal operator for the search. You can only enter one level at a time.
		
		Sample SOAP Request:
		
		`<ser:findRoleByExampleWithOperatorRequest>`
		` <ser:role>`
		`  <ser:roleLevel>`
		`   <ser:level>10</ser:level>`
		`  </ser:roleLevel>`
		` </ser:role>`
		`   <ser:operator>false</ser:operator>`
		`</ser:findRoleByExampleWithOperatorRequest>`
		
		The example above shows how to find all level 10 roles.

associatedRoles	No	Not supported.
entitlementRef	No	Not supported.
roleAssignments	No	Not supported.
systemRole	No	Not supported.

findSodByExample

Finds all SoD objects based on the search criteria in the given SOD object.

Syntax: Here is the method signature:

```
SodArray findSodByExample(Sod sod) throws NrfServiceException,
java.rmi.RemoteException
```

findSodByExampleWithOperator

Finds all SoD objects based on the search criteria found in the given SOD object. This method also lets you specify whether to use And as the operator for multi-value searches.

Syntax: Here is the method signature:

```
SodArray findSodByExampleWithOperator(Sod searchCriteria, boolean
useAndForMultiValueSearch) throws NrfServiceException, java.rmi.RemoteException
```

findSodById

Find by key.

Syntax: Here is the method signature:

```
Sod findSodById(java.lang.String entityKey) throws NrfServiceException,
java.rmi.RemoteException
```

getAssignedIdentities

Returns returns the list of identities having a particular role DN.

Syntax: Here is the method signature:

```
RoleAssignment[] getAssignedIdentities(java.lang.String roleDN, IdentityType
identityType, boolean directAssignOnly)
```

getConfigProperty

Retrieves configuration properties stored in the User Application configuration XML files by passing in a configuration property key or macro name.

Syntax: Here is the method signature:

```
public ConfigProperty getConfigProperty(String configPropertyKey) throws
NrfServiceException, RemoteException;
```

The configPropertyKey parameter can accept a fully qualified configuration key name from any of the configuration XML files, such as the following:

```
DirectoryService/realms/jndi/params/USER_ROOT_CONTAINER
```

Alternativelly, the configPropertyKey parameter can accept a macro name that references a fully qualified configuration key name. The following macro names are allowed:

Table 24-2 *Macro Names Allowed*

Configuration Macro Name	Configuration Key Value
USER_CONTAINER	DirectoryService/realms/jndi/params/ USER_ROOT_CONTAINER
GROUP_CONTAINER	DirectoryService/realms/jndi/params/ GROUP_ROOT_CONTAINER
ROOT_CONTAINER	DirectoryService/realms/jndi/params/ROOT_NAME
PROVISIONING_DRIVER	DirectoryService/realms/jndi/params/ PROVISIONING_ROOT

getConfiguration

Returns the role system configuration defined in the Role Catalog root (nrfConfiguration).

Syntax: Here is the method signature:

```
Configuration getConfiguration() throws NrfServiceException,
java.rmi.RemoteException
```

getContainer

Gets container and role information for a given container DN.

Syntax: Here is the method signature:

```
Container getContainer(java.lang.String containerDn)                       throws
NrfServiceException, java.rmi.RemoteException
```

getExceptionList

Returns a list of Sod instances for all SOD violations found for a specific identity and type.

Syntax: Here is the method signature:

```
SodArray getExceptionsList(java.lang.String identity, IdentityType identityType)
throws NrfServiceException, java.rmi.RemoteException
```

getGroup

Gets group and role information for a given group DN.

Syntax: Here is the method signature:

```
Group getGroup(java.lang.String groupDn) throws NrfServiceException,
java.rmi.RemoteException
```

getIdentitiesInViolation

Returns a map of identities which are in violation of a given SoD.

Syntax: Here is the method signature:

```
IdentityTypeDnMapArray getIdentitiesInViolation(java.lang.String sodDn) throws
NrfServiceException, java.rmi.RemoteException
```

getIdentityRoleConflicts

Returns a list of Sod instances for all SOD conflicts found for a given list of roles for a given identity.

Syntax: Here is the method signature:

```
SodArray getIdentityRoleConflicts(java.lang.String identity, IdentityType
identityType, DNStringArray requestedRoles) throws NrfServiceException,
java.rmi.RemoteException
```

getRole

Retrieves a role object defined by a role DN. Returns several role attributes, such as name, dn, description, role level. Returns child roles, assigned containers, and assigned groups. However, this API does not return assigned users. If you want assigned users, use the getAssignedIdentities API with USER for identityType and true for directAssignOnly.

Syntax: Here is the method signature:

```
Role getRole(java.lang.String roleDn) throws NrfServiceException,
java.rmi.RemoteException
```

getRoleAssignmentRequestStatus

Returns a list of role assignment request status instances given a correlation ID.

Syntax: Here is the method signature:

```
RoleAssignmentRequestStatusArray getRoleAssignmentRequestStatus(java.lang.String
correlationId) throws NrfServiceException, java.rmi.RemoteException
```

getRoleAssignmentRequestStatusByIdentityType

Returns a list of role assignment request status instances given an identity and an identity type.

Syntax: Here is the method signature:

```
RoleAssignmentRequestStatusArray
getRoleAssignmentRequestStatusByIdentityType(java.lang.String identityDn,
IdentityType identityType) throws NrfServiceException, java.rmi.RemoteException
```

getRoleAssignmentTypeInfo

Retrieves details about a RoleAssignmentType.

Syntax: Here is the method signature:

```
RoleAssignmentTypeInfo getRoleAssignmentTypeInfo(RoleAssignmentType type) throws
NrfServiceException, java.rmi.RemoteException
```

getRoleCategories

Gets role categories.

Syntax: Here is the method signature:

```
CategoryArray getRoleCategories() throws NrfServiceException,
java.rmi.RemoteException
```

getRoleConflicts

Returns a list of Sod instances found for all given roles. This method always returns a list.

Syntax: Here is the method signature:

```
SodArray getRoleConflicts(DNStringArray roles) throws NrfServiceException,
java.rmi.RemoteException
```

getRoleLevels

Gets the role levels.

Syntax: Here is the method signature:

```
RoleLevelArray getRoleLevels() throws NrfServiceException,
java.rmi.RemoteException
```

getRoleLocalizedStrings

Gets role localized strings, such as names and descriptions. The method takes an integer parameter that allows you to specify the type of the string. The number 1 indicates names; the number 2 indicates descriptions.

Syntax: Here is the method signature:

```
public LocalizedValue[] getRoleLocalizedStrings(DNString roleDn, int type)
            throws NrfServiceException, RemoteException;
```

getRolesInfo

Returns a list of RoleInfo instances given a list of role DNs.

Syntax: Here is the method signature:

```
RoleInfoArray getRolesInfo(DNStringArray roleDns) throws NrfServiceException,
java.rmi.RemoteException
```

getRolesInfoByCategory

Returns a list of RoleInfo instances given a list of role category keys.

Syntax: Here is the method signature:

```
RoleInfoArray getRolesInfoByCategory(CategoryKeyArray roleCategoryKeys) throws
NrfServiceException, java.rmi.RemoteException
```

getRolesInfoByLevel

Returns a list of RoleInfo instances given a list of role levels.

Syntax: Here is the method signature:

```
RoleInfoArray getRolesInfoByLevel(LongArray roleLevels) throws
NrfServiceException, java.rmi.RemoteException
```

getTargetSourceConflicts

Returns a list of Sod instances for all SOD conflicts defined between the target role DN and the source role DN.

Syntax: Here is the method signature:

```
SodArray getTargetSourceConflicts(java.lang.String targetName, java.lang.String
sourceName) throws NrfServiceException, java.rmi.RemoteException
```

getUser

Gets user info including all role assignments for a given user DN stored in a UserIdentity object.

Syntax: Here is the method signature:

```
User getUser(java.lang.String userDn) throws NrfServiceException,
java.rmi.RemoteException
```

getVersion

Returns the version of this Web Service.

Syntax: Here is the method signature:

```
VersionVO getVersion() throws java.rmi.RemoteException
```

isUserInRole

Returns boolean flag; true if role has been assigned to a User identity.

Syntax: Here is the method signature:

```
boolean isUserInRole(java.lang.String userDn, java.lang.String roleDn)
```

modifyRole

Modifies a role definition. This method does not update localized strings. Use the getRoleLocalizedStrings(DNString roleDn, LocalizedString[] locStrings, int strType) method to update localized names or descriptions for a role.

A correlation ID is generated automatically for this method that uses this format:

```
UserApp#RemoteRoleRequest#xxxxxxxx-xxxx-xxxx-xxxx-xxxxxxxxxxxx
```

The correlation ID is used for auditing.

Syntax: Here is the method signature:

```
public Role modifyRole(Role role)
            throws NrfServiceException, RemoteException;
```

modifyRoleAid

Modifies a role definition with a correlation ID that you provide. The correlation ID is used for auditing to link a set of related roles. This method does not update localized strings. Use the getRoleLocalizedStrings(DNString roleDn, LocalizedString[] locStrings, int strType) method to update localized names or descriptions for a role.

Syntax: Here is the method signature:

```
public Role modifyRoleAid(Role role, String correlationId)
            throws NrfServiceException, RemoteException;
```

removeRoles

Deletes specified roles from the Role Catalog and returns an array of DNs for the deleted roles as a confirmation.

A correlation ID is generated automatically for this method that uses this format:

```
UserApp#RemoteRoleRequest#xxxxxxxx-xxxx-xxxx-xxxx-xxxxxxxxxxxx
```

The correlation ID is used for auditing.

Syntax: Here is the method signature:

```
public DNString[] removeRoles(DNString[] roleDns)
            throws NrfServiceException, RemoteException;
```

removeRolesAid

Deletes specified roles from the Role Catalog with a correlation ID that you provide. The correlation ID is used for auditing to link a set of related roles. This method returns an array of DNs for the deleted roles as a confirmation.

Syntax: Here is the method signature:

```
public DNString[] removeRolesAid(DNString[] roleDns, String correlationId)
            throws NrfServiceException, RemoteException;
```

requestRolesAssignment

Returns a list of request DNs created by the role assignment. Be aware that the role assignment expires only if the role is assigned to a user and not when it is assigned to a group or a container.

If you do not want to supply date (effective or expiration) for role assignments with the requestRolesAssignment endpoint, then you must remove these two elements from the SOAP call. They must not be included with empty tags:

```
<ser:effectiveDate/>
<ser:expirationDate/>
```

If you want to omit the effective date or the expiration date, a request similar to the following will work:

```
<soapenv:Envelope xmlns:soapenv="http://schemas.xmlsoap.org/soap/envelope/"
xmlns:ser="http://www.netiq.com/role/service">
   <soapenv:Header/>
   <soapenv:Body>
      <ser:requestRolesAssignmentRequest>
         <!--Optional:-->
         <ser:assignRequest>
            <ser:actionType>grant</ser:actionType>
            <ser:assignmentType>USER_TO_ROLE</ser:assignmentType>
            <ser:correlationID>testpolina</ser:correlationID>
            <ser:identity>cn=uaadmin,ou=sa,o=data</ser:identity>
            <ser:originator/>
            <ser:reason>test without expiration date</ser:reason>
            <ser:roles>
               <!--Zero or more repetitions:-->
               <ser:dnstring>
                  <ser:dn>cn=test2
id,cn=Level10,cn=RoleDefs,cn=RoleConfig,cn=AppConfig,cn=User Application
Driver,cn=driverset1,o=system</ser:dn>
               </ser:dnstring>
            </ser:roles>
            <ser:sodOveridesRequested/>
         </ser:assignRequest>
      </ser:requestRolesAssignmentRequest>
   </soapenv:Body>
</soapenv:Envelope>
```

With that said, without the these two elements in the soap request, the request will not validate. It will work, but will not validate.

Syntax: Here is the method signature:

```
DNStringArray requestRolesAssignment(RoleAssignmentRequest roleAssignmentRequest)
throws NrfServiceException, java.rmi.RemoteException
```

setRoleLocalizedStrings

Sets role localized strings, such as names and descriptions.

A correlation ID is generated automatically for this method that uses this format:

```
UserApp#RemoteRoleRequest#xxxxxxxx-xxxx-xxxx-xxxx-xxxxxxxxxxxx
```

The correlation ID is used for auditing.

Syntax: Here is the method signature:

```
public LocalizedValue[] setRoleLocalizedStrings(DNString roleDn, LocalizedValue[]
locStrings, int type)
            throws NrfServiceException, RemoteException;
```

setRoleLocalizedStringsAid

Sets role localized strings, such as name and description, with a correlation ID that you provide. The correlation ID is used for auditing to link a set of related roles.

Syntax: Here is the method signature:

```
public LocalizedValue[] setRoleLocalizedStringsAid(DNString roleDn, String
correlationId, LocalizedValue[] locStrings, int type)
            throws NrfServiceException, RemoteException;
```

Approver

Class to hold the approver information for SOD or normal request approvals.

Approver constructors

The Approver class supports a single constructor.

Syntax: Here is the syntax for the constructor:

```
Approver()
```

getApproverDN

Gets the approver DN.

Syntax: Here is the method signature:

```
public java.lang.String getApproverDN()
```

getSequence

Gets the approver sequence.

Syntax: Here is the method signature:

```
public long getSequence()
```

setApproverDN

Sets the approver DN.

Syntax: Here is the method signature:

```
public void setApproverDN(java.lang.String approverDN)
```

setSequence

Sets the approver sequence.

Syntax: Here is the method signature:

```
public void setSequence(long sequence)
```

ApproverArray

This section provides reference information on the ApproverArray class.

ApproverArray constructors

The ApproverArray class has two constructors.

Syntax 1: Here is the syntax for a constructor that takes no parameters:

```
ApproverArray()
```

Syntax 2: Here is the syntax for a constructor that takes an array of Attribute objects as a parameter:

```
ApproverArray(Approver[] ApproverVal)
```

getApprover

Returns an array of Approver objects.

Syntax: Here is the method signature:

```
Approver[] getApprover()
```

setApprover

Sets the array of Approver objects associated with the ApproverArray class.

Syntax: Here is the method signature:

```
void setApprover (Approver[] ApproverVal)
```

Category

Class to represent a role category.

Category constructors

The Category class supports a single constructor.

Syntax: Here is the syntax for the constructor:

```
Category()
```

getCategoryKey

Gets the category key.

Syntax: Here is the method signature:

```
public java.lang.String getCategoryKey()
```

getCategoryLabel

Gets the category label.

Syntax: Here is the method signature:

```
public java.lang.String getCategoryLabel()
```

setCategoryKey

Sets the category key.

Syntax: Here is the method signature:

```
public void setCategoryKey(java.lang.String categoryKey)
```

setCategoryLabel

Sets the category label.

Syntax: Here is the method signature:

```
public void setCategoryLabel(java.lang.String categoryLabel)
```

CategoryArray

This section provides reference information on the CategoryArray class.

CategoryArray constructors

The CategoryArray class has two constructors.

Syntax 1: Here is the syntax for a constructor that takes no parameters:

```
CategoryArray()
```

Syntax 2: Here is the syntax for a constructor that takes an array of Category objects as a parameter:

```
CategoryArray(Category[] CategoryVal)
```

getCategory

Returns an array of Category objects.

Syntax: Here is the method signature:

```
Category[] getCategory()
```

setCategory

Sets the array of Category objects associated with the CategoryArray class.

Syntax: Here is the method signature:

```
void setCategory(Category[] CategoryVal)
```

CategoryKey

Class to hold a Category Key.

CategoryKey constructors

The CategoryKey class has two constructors.

Syntax 1: Here is the syntax for a constructor that takes no parameters:

```
CategoryKey()
```

Syntax 2: Here is the syntax for a constructor that takes a String as a parameter:

```
CategoryKey(java.lang.String categoryKey)
```

getCategoryKey()

Gets the categoryKey.

Syntax: Here is the method signature:

```
public java.lang.String getCategoryKey()
```

setCategoryKey

Sets the category key.

Syntax: Here is the method signature:

```
public void setCategoryKey(java.lang.String categoryKey)
```

CategoryKeyArray

This section provides reference information on the CategoryKeyArray class.

CategoryKeyArray constructors

The CategoryKeyArray class has two constructors.

Syntax 1: Here is the syntax for a constructor that takes no parameters:

```
CategoryKeyArray()
```

Syntax 2: Here is the syntax for a constructor that takes an array of CategoryKey objects as a parameter:

```
CategoryKeyArray(CategoryKey[] CategoryVal)
```

getCategorykey

Returns an array of Category objects.

Syntax: Here is the method signature:

```
CategoryKey[] getCategorykey()
```

setCategorykey

Sets the array of CategoryKey objects associated with the CategoryKeyArray class.

Syntax: Here is the method signature:

```
void setCategorykey(CategoryKey[] CategoryKeyVal)
```

Configuration

Class to represent the configuration object.

Configuration constructors

The Configuration class supports a single constructor.

Syntax: Here is the syntax for the constructor:

```
Configuration()
```

getDefaultRequestDef

Gets the default request definition.

Syntax: Here is the method signature:

```
public java.lang.String getDefaultRequestDef()
```

getDefaultSODRequestDef

Gets the default SOD request definition.

Syntax: Here is the method signature:

```
public java.lang.String getDefaultSODRequestDef()
```

getRemovalGracePeriod

Gets the removal grace period.

Syntax: Here is the method signature:

```
public int getRemovalGracePeriod()
```

getReportContainer

Gets the report container.

Syntax: Here is the method signature:

```
public java.lang.String getReportContainer()
```

getRoleLevels

Gets the role levels.

Syntax: Here is the method signature:

```
public RoleLevelArray getRoleLevels()
```

getRoleRequestContainer

Gets the role request container.

Syntax: Here is the method signature:

```
public java.lang.String getRoleRequestContainer()
```

getRolesContainer

Gets the role container.

Syntax: Here is the method signature:

```
public java.lang.String getRolesContainer()
```

getSODApprovers

Gets SOD approvers.

Syntax: Here is the method signature:

```
public ApproverArray getSODApprovers()
```

getSODContainer

Gets the SOD container.

Syntax: Here is the method signature:

```
public java.lang.String getSODContainer()
```

getSODQuorum

Gets the SOD quorum amount.

Syntax: Here is the method signature:

```
public java.lang.String getSODContainer()
```

getSODRequestDef

Gets the SOD request definition.

Syntax: Here is the method signature:

```
public java.lang.String getSODRequestDef()
```

setDefaultRequestDef

Sets the default request definition.

Syntax: Here is the method signature:

```
public void setDefaultRequestDef(java.lang.String defaultRequestDef)
```

setDefaultSODRequestDef

Sets the default SOD request definition.

Syntax: Here is the method signature:

```
public void setDefaultSODRequestDef(java.lang.String defaultSODRequestDef)
```

setRemovalGracePeriod

Sets the removal grace period.

Syntax: Here is the method signature:

```
public void setRemovalGracePeriod(int removalGracePeriod)
```

setReportContainer

Sets the report container.

Syntax: Here is the method signature:

```
public void setReportContainer(java.lang.String reportContainer)
```

setRoleLevels

Sets the role levels.

Syntax: Here is the method signature:

```
public void setRoleLevels(RoleLevelArray roleLevels)
```

setRoleRequestContainer

Sets the role request container.

Syntax: Here is the method signature:

```
public void setRoleRequestContainer(java.lang.String roleRequestContainer)
```

setRolesContainer

Sets the role container.

Syntax: Here is the method signature:

```
public void setRolesContainer(java.lang.String rolesContainer)
```

setSODApprovers

Sets the SoD approvers.

Syntax: Here is the method signature:

```
public void setSODApprovers(ApproverArray sODApprovers)
```

setSODContainer

Sets the SoD container.

Syntax: Here is the method signature:

```
public void setSODContainer(java.lang.String sODContainer)
```

Container

Class to represent a Container object.

Container constructors

The Container class supports a single constructor.

Syntax: Here is the syntax for the constructor:

```
Container()
```

getAssociatedRoles

Gets associated roles for this identity.

Syntax: Here is the method signature:

```
public DNStringArray getAssociatedRoles()
```

getEntityKey

Gets identity entity key.

Syntax: Here is the method signature:

```
public java.lang.String getEntityKey()
```

getIdentityType

Gets identity type.

Syntax: Here is the method signature:

```
public IdentityType getIdentityType()
```

getRoleAssignments

Gets role assignments for this identity.

Syntax: Here is the method signature:

```
public RoleAssignmentArray getRoleAssignments()
```

setAssociatedRoles

Sets the associated roles for this identity.

Syntax: Here is the method signature:

```
public void setAssociatedRoles(DNStringArray associatedRoles)
```

setEntityKey

Sets the identity entity key.

Syntax: Here is the method signature:

```
public void setEntityKey(java.lang.String entityKey)
```

setIdentityType

Sets the identity type.

Syntax: Here is the method signature:

```
public void setIdentityType(IdentityType identityType)
```

setRoleAssignments

Sets the role assignments for this identity.

Syntax: Here is the method signature:

```
public void setRoleAssignments(RoleAssignmentArray roleAssignments)
```

DNString

Class to hold a DN.

DNString constructors

The DNString class has two constructors.

Syntax 1: Here is the syntax for a constructor that takes no parameters:

```
DNString()
```

Syntax 2: Here is the syntax for a constructor that takes a String as a parameter:

```
DNString(java.lang.String dn)
```

getDn

Gets the DN.

Syntax: Here is the method signature:

```
public java.lang.String getDn()
```

setDn

Sets the DN.

Syntax: Here is the method signature:

```
public void setDn(java.lang.String dn)
```

DNStringArray

This section provides reference information on the DNStringArray class.

DNStringArray constructors

The DNStringArray class has two constructors.

Syntax 1: Here is the syntax for a constructor that takes no parameters:

```
DNStringArray()
```

Syntax 2: Here is the syntax for a constructor that takes an array of DNString objects as a parameter:

```
DNStringArray(DNString[] DNStringVal)
```

getDnstring

Returns an array of DNString objects.

Syntax: Here is the method signature:

```
DNString[] getDnstring()
```

setDnstring

Sets the array of DNString objects associated with the DNStringArray class.

Syntax: Here is the method signature:

```
void setDnstring(DNString[] DnstringVal)
```

Entitlement

Class to hold Entitlement information.

Entitlement constructors

The Entitlement class supports a single constructor.

Syntax: Here is the syntax for the constructor:

```
Entitlement()
```

getEntitlementDn

Gets the entitlement DN.

Syntax: Here is the method signature:

```
public java.lang.String getEntitlementDn()
```

getEntitlementParameters

Gets the entitlement parameters.

Syntax: Here is the method signature:

```
public java.lang.String getEntitlementParameters()
```

setEntitlementDn

Sets the entitlement DN.

Syntax: Here is the method signature:

```
public void setEntitlementDn(java.lang.String entitlementDn)
```

setEntitlementParameters

Sets the entitlement parameters.

Syntax: Here is the method signature:

```
public void setEntitlementParameters(java.lang.String entitlementParameters)
```

EntitlementArray

This section provides reference information on the EntitlementArray class.

EntitlementArray constructors

The EntitlementArray class has two constructors.

Syntax 1: Here is the syntax for a constructor that takes no parameters:

```
EntitlementArray()
```

Syntax 2: Here is the syntax for a constructor that takes an array of Entitlement objects as a parameter:

```
EntitlementArray(Entitlement[] EntitlementVal)
```

getEntitlement

Returns an array of Entitlement objects.

Syntax: Here is the method signature:

```
Entitlement[] getEntitlement()
```

setEntitlement

Sets the array of Entitlement objects associated with the EntitlementArray class.

Syntax: Here is the method signature:

```
void setEntitlement(EntitlementArray EntitlementVal)
```

Group

Class to represent a Group object.

Group constructors

The Group class supports a single constructor.

Syntax: Here is the syntax for the constructor:

```
Group()
```

getAssociatedRoles

Gets associated roles for this identity.

Syntax: Here is the method signature:

```
public DNStringArray getAssociatedRoles()
```

getDescription

Gets group description.

Syntax: Here is the method signature:

```
public java.lang.String getDescription()
```

getEntityKey

Gets identity entity key.

Syntax: Here is the method signature:

```
public java.lang.String getEntityKey()
```

getIdentityType

Gets identity type.

Syntax: Here is the method signature:

```
public IdentityType getIdentityType()
```

getRoleAssignments

Gets role assignments for this identity.

Syntax: Here is the method signature:

```
public RoleAssignmentArray getRoleAssignments()
```

setAssociatedRoles

Sets the associated roles for this identity.

Syntax: Here is the method signature:

```
public void setAssociatedRoles(DNStringArray associatedRoles)
```

setDescription

Sets the group description.

Syntax: Here is the method signature:

```
public void setDescription(java.lang.String description)
```

setEntityKey

Sets the identity entity key.

Syntax: Here is the method signature:

```
public void setEntityKey(java.lang.String entityKey)
```

setIdentityType

Sets the identity type.

Syntax: Here is the method signature:

```
public void setIdentityType(IdentityType identityType)
```

setRoleAssignments

Sets the role assignments for this identity.

Syntax: Here is the method signature:

```
public void setRoleAssignments(RoleAssignmentArray roleAssignments)
```

IdentityType

An JAX-RPC friendly representation of com.novell.idm.nrf.api.IdentityType.

Table 24-3 *Field summary*

Type	Name
static IdentityType	CONTAINER
static IdentityType	GROUP
static IdentityType	ROLE
static IdentityType	USER

IdentityType constructors

The IdentityType class has two constructors.

Syntax 1: Here is the syntax for a constructor that takes no parameters:

```
IdentityType()
```

Syntax 2: Here is the syntax for a constructor that takes a String as a parameter:

```
IdentityType(java.lang.String value)
```

convertToAPI

Reconstructs an API representation object from an RPC representation.

Syntax: Here is the method signature:

```
public com.novell.idm.nrf.api.IdentityType convertToAPI()
```

convertToRPC

Contructs an RPC friendly representation from an API object.

Syntax: Here is the method signature:

```
public static IdentityType convertToRPC(com.novell.idm.nrf.api.IdentityType type)
```

equals

This is an implementation of equals(). This implementation overrides the equals() method in java.lang.Object.

Syntax: Here is the method signature:

```
public boolean equals(java.lang.Object obj)
```

fromValue

This method is for WSSDK serialization.

Syntax: Here is the method signature:

```
public static IdentityType fromValue(java.lang.String value)
```

getValue

Gets the type.

Syntax: Here is the method signature:

```
public java.lang.String getValue()
```

hashCode

This is an implementation of hashCode(). This implementation overrides the hashCode() method in java.lang.Object.

Syntax: Here is the method signature:

```
public int hashCode()
```

setValue

Sets the type.

Syntax: Here is the method signature:

```
public void setValue(java.lang.String type)
```

toString

Implementation of toString() that returns a string representation of the class.

Syntax: Here is the method signature:

```
public java.lang.String toString()
```

IdentityTypeDnMap

Class to represent DNs grouped by identity type. Used for SOD violations.

IdentityTypeDnMap

The IdentityTypeDnMap class has two constructors.

Syntax 1: Here is the syntax for a constructor that takes no parameters:

```
IdentityTypeDnMap()
```

Syntax 2: Here is the syntax for a constructor that takes a String as a parameter:

```
IdentityTypeDnMap(IdentityType identityType, DNStringArray dns)
```

getDns

Gets the DNs associated with the identity type.

Syntax: Here is the method signature:

```
public DNStringArray getDns()
```

getIdentityType

Gets identity type (USER, ROLE, GROUP, CONTAINER).

Syntax: Here is the method signature:

```
public IdentityType getIdentityType()
```

setDns

Sets the DNs to associate with the identity type.

Syntax: Here is the method signature:

```
public void setDns(DNStringArray dns)
```

setIdentityType

Sets the identity type (USER, ROLE, GROUP, or CONTAINER).

Syntax: Here is the method signature:

```
public void setIdentityType(IdentityType identityType)
```

IdentityTypeDnMapArray

This section provides reference information on the IdentityTypeDnMapArray class.

IdentityTypeDnMapArray constructors

The IdentityTypeDnMapArray class has two constructors.

Syntax 1: Here is the syntax for a constructor that takes no parameters:

```
IdentityTypeDnMapArray()
```

Syntax 2: Here is the syntax for a constructor that takes an array of IdentityTypeDnMap objects as a parameter:

```
IdentityTypeDnMapArray(IdentityTypeDnMap[] IdentityTypeDnMapVal)
```

getIdentitytypednmap

Returns an array of IdentityTypeDnMap objects.

Syntax: Here is the method signature:

```
IdentityTypeDnMap[] getIdentitytypednmap()
```

setIdentitytypednmap

Sets the array of IdentityTypeDnMap objects associated with the IdentityTypeDnMapArray class.

Syntax: Here is the method signature:

```
void setIdentitytypednmap(IdentityTypeDnMap[] IdentityTypeDnMapVal)
```

LocalizedValue

The LocalizedValue class has been added to support management of localized strings for role definitions.

getValue

Returns a localized string value.

Syntax: Here is the method signature:

```
public String getValue()
```

setValue

Sets a localized string value.

Syntax: Here is the method signature:

```
public void setValue(final String value)
```

getLocale

Returns a string representaton of the Locale object.

Syntax: Here is the method signature:

```
public String getLocale()
```

setLocale

Sets a string representation of the Locale object.

Syntax: Here is the method signature:

```
public void setLocale()
```

LongArray

This section provides reference information on the LongArray class.

LongArray constructors

The LongArray class has two constructors.

Syntax 1: Here is the syntax for a constructor that takes no parameters:

```
LongArray()
```

Syntax 2: Here is the syntax for a constructor that takes an array of Long objects as a parameter:

```
LongArray(long[] LongVal)
```

getLong

Returns an array of Long objects.

Syntax: Here is the method signature:

```
long[] getLong()
```

setLong

Sets the array of long objects associated with the LongArray class.

Syntax: Here is the method signature:

```
void setLong(LongArray LongVal)
```

NrfServiceException

This is the exception thrown by the remote Roles Web Service.

NrfServiceException constructors

The NrfServiceException class has two constructors.

Syntax 1: Here is the syntax for a constructor that takes no parameters:

```
NrfServiceException()
```

Syntax 2: Here is the syntax for a constructor that takes a String as a parameter:

```
NrfServiceException(java.lang.String reason)
```

getReason

Returns the reason for the exception.

Syntax: Here is the method signature:

```
public java.lang.String getReason()
```

setReason

Sets the reason for the exception.

Syntax: Here is the method signature:

```
public void setReason(java.lang.String reason)
```

RequestCategoryType

An JAX-RPC friendly representation of com.novell.idm.nrf.persist.RequestCategoryType.

Table 24-4 *Field Summary*

Type	Name
static RequestCategoryType	ROLE_TO_CONTAINER_ADD
static RequestCategoryType	ROLE_TO_CONTAINER_ADD_SUBTREE
static RequestCategoryType	ROLE_TO_CONTAINER_REMOVE
static RequestCategoryType	ROLE_TO_GROUP_ADD
static RequestCategoryType	ROLE_TO_GROUP_REMOVE
static RequestCategoryType	ROLE_TO_ROLE_ADD
static RequestCategoryType	ROLE_TO_ROLE_REMOVE
static RequestCategoryType	ROLE_TO_USER_ADD
static RequestCategoryType	ROLE_TO_USER_REMOVE

RequestCategoryType constructors

The RequestCategoryType class has two constructors.

Syntax 1: Here is the syntax for a constructor that takes no parameters:

```
RequestCategoryType()
```

Syntax 2: Here is the syntax for a constructor that takes a String as a parameter:

```
RequestCategoryType(java.lang.String value)
```

equals

Implementation of equals(). This implementation overrides the equals() method in java.lang.Object.

Syntax: Here is the method signature:

```
public boolean equals(java.lang.Object obj)
```

fromRPC

Reconstructs an API representation object from an RPC representation.

Syntax: Here is the method signature:

```
public com.novell.idm.nrf.persist.RequestCategoryType fromRPC() throws
com.novell.idm.nrf.exception.NrfException
```

fromValue

This method is for WSSDK serialization.

Syntax: Here is the method signature:

```
public static RequestCategoryType fromValue(java.lang.String value)
```

getValue

Gets the type.

Syntax: Here is the method signature:

```
public java.lang.String getValue()
```

hashCode

This implementation overrides the hashCode() method in java.lang.Object.

Syntax: Here is the method signature:

```
public int hashCode()
```

setValue

Sets the type.

Syntax: Here is the method signature:

```
public void setValue(java.lang.String type)
```

toRPC

Constructs an RPC friendly representation off of an API object.

Syntax: Here is the method signature:

```
public static RequestCategoryType
toRPC(com.novell.idm.nrf.persist.RequestCategoryType type)
```

toString

Implementation of toString() that returns a string representation of the class.

Syntax: Here is the method signature:

```
public java.lang.String toString()
```

RequestStatus

An JAX-RPC friendly representation of com.novell.idm.nrf.persist.RequestStatus.

Table 24-5 *Field Summary*

Type	Name
static RequestStatus	ACTIVATION_TIME_PENDING
static RequestStatus	APPROVAL_PENDING
static RequestStatus	APPROVAL_START_PENDING
static RequestStatus	APPROVAL_START_SUSPENDED
static RequestStatus	APPROVED
static RequestStatus	CLEANUP
static RequestStatus	DENIED
static RequestStatus	NEW_REQUEST
static RequestStatus	PROVISION
static RequestStatus	PROVISIONED
static RequestStatus	PROVISIONING_ERROR
static RequestStatus	SOD_APPROVAL_START_PENDING
static RequestStatus	SOD_APPROVAL_START_SUSPENDED
static RequestStatus	SOD_EXCEPTION_APPROVAL_PENDING
static RequestStatus	SOD_EXCEPTION_APPROVED
static RequestStatus	SOD_EXCEPTION_DENIED

RequestStatus constructors

The RequestStatus class has two constructors.

Syntax 1: Here is the syntax for a constructor that takes no parameters:

```
RequestStatus()
```

Syntax 2: Here is the syntax for a constructor that takes a String as a parameter:

```
RequestStatus(java.lang.String value)
```

equals

Implementation of equals().

Syntax: Here is the method signature:

```
public boolean equals(java.lang.Object obj)
```

fromRPC

Reconstructs an API representation object from an RPC representation.

Syntax: Here is the method signature:

```
public com.novell.idm.nrf.persist.RequestStatus fromRPC() throws
com.novell.idm.nrf.exception.NrfException
```

fromValue

This method is for WSSDK serialization.

Syntax: Here is the method signature:

```
public static RequestStatus fromValue(java.lang.String value)
```

getValue

Gets the type.

Syntax: Here is the method signature:

```
public java.lang.String getValue()
```

hashCode

This implementation overrides the hashCode() method in java.lang.Object.

Syntax: Here is the method signature:

```
public int hashCode()
```

setValue

Sets the type.

Syntax: Here is the method signature:

```
public void setValue(java.lang.String type)
```

toRPC

Constructs an RPC friendly representation off of an API object.

Syntax: Here is the method signature:

```
public static RequestStatus toRPC(com.novell.idm.nrf.persist.RequestStatus type)
```

toString

Implementation of toString() that returns a string representation of the class.

Syntax: Here is the method signature:

```
public java.lang.String toString()
```

ResourceAssociation

Supporting class that holds information about resource associations for a role.

getRole

Returns the DN for the role involved in the association.

```
public String getRole()
```

setRole

Sets the DN for the role involved in the association.

```
public void setRole(String role)
```

getEntityKey

Returns the entity key for the association.

```
public String getEntityKey()
```

setEntityKey

Sets the entity key for the association.

```
public void setEntityKey(String entityKey)
```

getResource

Returns the DN for the resource involved in the association.

```
public String getResource()
```

setResource

Sets the DN for the resource involved in the association.

```
public void setResource(String resource)
```

getDynamicParameters

Returns the list of dynamic parameters for the resource.

```
public DynamicParameter[] getDynamicParameters()
```

setDynamicParameters

Sets the list of dynamic parameters for the resource.

```
public void setDynamicParameters(DynamicParameter[] parameterValues)
```

getLocalizedDescriptions

Returns the list of localized descriptions.

```
public LocalizedValue[] getLocalizedDescriptions()
```

setLocalizedDescriptions

Sets the list of localized descriptions.

```
public void setLocalizedDescriptions(LocalizedValue[] descriptions)
```

getApprovalOverride

Returns the boolean flag indicating whether the role approval process overrides the resource approval process.

```
public boolean getApprovalOverride()
```

setApprovalOverride

Sets the boolean flag indicating whether the role approval process overrides the resource approval process.

```
public void setApprovalOverride(boolean override)
```

getStatus

Returns the status of the association.

```
public int getStatus()
```

setStatus

Sets the status of the association.

```
public void setStatus(int status)
```

toString

Converts the resource association to a string.

```
public String toString()
```

Role

Value class to hold the role information.

Role constructors

The Role class supports a single constructor.

Syntax: Here is the syntax for the constructor:

```
Role()
```

getApprovers

Gets the approvers of the role approval.

Syntax: Here is the method signature:

```
public ApproverArray getApprovers()
```

getAssociatedRoles

Gets the associated roles.

Syntax: Here is the method signature:

```
public DNStringArray getAssociatedRoles()
```

getChildRoles

Gets the children roles.

Syntax: Here is the method signature:

```
public DNStringArray getChildRoles()
```

getDescription

Gets the role description.

Syntax: Here is the method signature:

```
public java.lang.String getDescription()
```

getEntitlementRef

Gets the entitlement references.

Syntax: Here is the method signature:

```
public EntitlementArray getEntitlementRef()
```

getEntityKey

Gets the role entity key.

Syntax: Here is the method signature:

```
public java.lang.String getEntityKey()
```

getImplicitContainers

Gets the implicit container DNs.

Syntax: Here is the method signature:

```
public DNStringArray getImplicitContainers()
```

getImplicitGroups

Gets implicit group DNs.

Syntax: Here is the method signature:

```
public DNStringArray getImplicitGroups()
```

getName

Gets the role name.

Syntax: Here is the method signature:

```
public java.lang.String getName()
```

getOwners

Gets the owner DNs.

Syntax: Here is the method signature:

```
public DNStringArray getOwners()
```

getParentRoles

Gets the parent roles.

Syntax: Here is the method signature:

```
public DNStringArray getParentRoles()
```

getQuorum

Gets the quorum amount.

Syntax: Here is the method signature:

```
public java.lang.String getQuorum()
```

getRequestDef

Gets the request definition for approval processing.

Syntax: Here is the method signature:

```
public java.lang.String getRequestDef()
```

getRoleAssignments

Gets the role assignments.

Syntax: Here is the method signature:

```
public RoleAssignmentArray getRoleAssignments()
```

getRoleCategoryKeys

Gets the role category keys.

Syntax: Here is the method signature:

```
public CategoryKeyArray getRoleCategoryKeys()
```

getRoleLevel

Gets the role level object.

Syntax: Here is the method signature:

```
public RoleLevel getRoleLevel()
```

getSystemRole

Gets the system role flag.

Syntax: Here is the method signature:

```
public boolean getSystemRole()
```

setApprovers

Sets the approvers for role approval processing.

Syntax: Here is the method signature:

```
public void setApprovers(ApproverArray approvers)
```

setAssociatedRoles

Sets the associated roles.

Syntax: Here is the method signature:

```
public void setAssociatedRoles(DNStringArray associatedRoles)
```

setChildRoles

Sets the children roles.

Syntax: Here is the method signature:

```
public void setChildRoles(DNStringArray childRoles)
```

setDescription

Sets the role description.

Syntax: Here is the method signature:

```
public void setDescription(java.lang.String description)
```

setEntitlementRef

Sets the entitlement references.

Syntax: Here is the method signature:

```
public void setEntitlementRef(EntitlementArray entitlementRef)
```

setEntityKey

Sets the role entity key.

Syntax: Here is the method signature:

```
public void setEntityKey(java.lang.String entityKey)
```

setImplicitContainers

Sets the implicit container DNs.

Syntax: Here is the method signature:

```
public void setImplicitContainers(DNStringArray implicitContainers)
```

setImplicitGroups

Sets the implicit group DNs.

Syntax: Here is the method signature:

```
public void setImplicitGroups(DNStringArray implicitGroups)
```

setName

Sets the role name.

Syntax: Here is the method signature:

```
public void setName(java.lang.String name)
```

setOwners

Sets the owner DNs.

Syntax: Here is the method signature:

```
public void setOwners(DNStringArray owners)
```

setParentRoles

Sets the parent roles.

Syntax: Here is the method signature:

```
public void setParentRoles(DNStringArray parentRoles)
```

setQuorum

Sets the quorum amount.

Syntax: Here is the method signature:

```
public void setQuorum(java.lang.String quorum)
```

setRequestDef

Sets the request definition for approval processing.

Syntax: Here is the method signature:

```
public void setRequestDef(java.lang.String requestDef)
```

setRoleAssignments

Sets the role assignments.

Syntax: Here is the method signature:

```
public void setRoleAssignments(RoleAssignmentArray roleAssignments)
```

setRoleCategoryKeys

Sets the role category keys.

Syntax: Here is the method signature:

```
public void setRoleCategoryKeys(CategoryKeyArray roleCategoryKeys)
```

setRoleLevel

Sets the role level object.

Syntax: Here is the method signature:

```
public void setRoleLevel(RoleLevel roleLevel)
```

setSystemRole

Sets the system role flag.

Syntax: Here is the method signature:

```
public void setSystemRole(boolean systemRole)
```

RoleAssignment

Value class to hold role assignment information.

RoleAssignment

The RoleAssignment class supports a single constructor.

Syntax: Here is the syntax for the constructor:

```
RoleAssignment()
```

getAssignmentType

Gets the role assignment type.

Syntax: Here is the method signature:

```
public RoleAssignmentType getAssignmentType()
```

getCauseIdentities

Gets the cause identities DNs.

Syntax: Here is the method signature:

```
public IdentityTypeDnMapArray getCauseIdentities()
```

getEffectiveDate

Gets the effective date.

Syntax: Here is the method signature:

```
public java.util.Date getEffectiveDate()
```

getExpirationDate

Gets the expiration date.

Syntax: Here is the method signature:

```
public java.util.Date getExpirationDate()
```

getExplicitIdentities

Gets the explicit identities DNs.

Syntax: Here is the method signature:

```
public DNStringArray getExplicitIdentities()
```

getRole

Gets the role associated with the assignment.

Syntax: Here is the method signature:

```
public java.lang.String getRole()
```

setAssignmentType

Sets the role assignment type.

Syntax: Here is the method signature:

```
public void setAssignmentType(RoleAssignmentType assignmentType)
```

setCauseIdentities

Sets the cause identities DNs.

Syntax: Here is the method signature:

```
public void setCauseIdentities(IdentityTypeDnMapArray causeIdentities)
```

setEffectiveDate

Sets the effective date.

Syntax: Here is the method signature:

```
public void setEffectiveDate(java.util.Date effectiveDate)
```

setExpirationDate

Sets the expiration date.

Syntax: Here is the method signature:

```
public void setExpirationDate(java.util.Date expirationDate)
```

setExplicitIdentities

Sets the explicit identities DNs.

Syntax: Here is the method signature:

```
public void setExplicitIdentities(DNStringArray explicitIdentities)
```

setRole

Sets role associated with this assignment.

Syntax: Here is the method signature:

```
public void setRole(java.lang.String role)
```

RoleAssignmentArray

This section provides reference information on the RoleAssignmentArray class.

RoleAssignmentArray constructors

The RoleAssignmentArray class has two constructors.

Syntax 1: Here is the syntax for a constructor that takes no parameters:

```
RoleAssignmentArray()
```

Syntax 2: Here is the syntax for a constructor that takes an array of Attribute objects as a parameter:

```
RoleAssignmentArray(RoleAssignment[] RoleAssignmentVal)
```

getRoleassignment

Returns an array of RoleAssignment objects.

Syntax: Here is the method signature:

```
RoleAssignment[] getRoleassignment()
```

setRoleassignment

Sets the array of RoleAssignment objects associated with the RoleAssignmentArray class.

Syntax: Here is the method signature:

```
void setRoleassignment (RoleAssignment[] RoleAssignmentVal)
```

RoleAssignmentActionType

An JAX-RPC friendly representation of com.novell.idm.nrf.RoleAssignmentActionType.

Table 24-6 *Field Summary*

Type	Name
static RoleAssignmentActionType	EXTEND
static RoleAssignmentActionType	GRANT
static RoleAssignmentActionType	REVOKE

RoleAssignmentActionType constructors

The RoleAssignmentActionType class has two constructors.

Syntax 1: Here is the syntax for a constructor that takes no parameters:

```
RoleAssignmentActionType()
```

Syntax 2: Here is the syntax for a constructor that takes a String as a parameter:

```
RoleAssignmentActionType(java.lang.String value)
```

equals

Implementation of equals().

Syntax: Here is the method signature:

```
public boolean equals(java.lang.Object obj)
```

fromRPC

Reconstructs an API representation object from an RPC representation.

Syntax: Here is the method signature:

```
public com.novell.idm.nrf.RoleAssignmentActionType fromRPC()
```

fromValue

This method is for WSSDK serialization.

Syntax: Here is the method signature:

```
public static RoleAssignmentActionType fromValue(java.lang.String value)
```

getValue

Gets the type.

Syntax: Here is the method signature:

```
public java.lang.String getValue()
```

hashCode

This is an implementation of hashCode(). This implementation overrides the hashCode() method in java.lang.Object.

Syntax: Here is the method signature:

```
public int hashCode()
```

setValue

Sets the type.

Syntax: Here is the method signature:

```
public void setValue(java.lang.String type)
```

toRPC

Constructs an RPC friendly representation off of an API object.

Syntax: Here is the method signature:

```
public static RoleAssignmentActionType
toRPC(com.novell.idm.nrf.RoleAssignmentActionType type)
```

toString

Implementation of toString() that returns a string representation of the class.

Syntax: Here is the method signature:

```
public java.lang.String toString()
```

RoleAssignmentRequest

Class to represent a role assignment request.

RoleAssignmentRequest

The RoleAssignmentRequest class supports a single constructor.

Syntax: Here is the syntax for the constructor:

```
RoleAssignmentRequest()
```

getActionType

Gets role assignment type (grant, revoke, extend).

Syntax: Here is the method signature:

```
public RoleAssignmentActionType getActionType()
```

getAssignmentType

Gets the role assignment type.

Syntax: Here is the method signature:

```
public RoleAssignmentType getAssignmentType()
```

getCorrelationID

Gets the correlation ID.

Syntax: Here is the method signature:

```
public java.lang.String getCorrelationID()
```

getEffectiveDate

Gets the effective date.

Syntax: Here is the method signature:

```
public java.util.Date getEffectiveDate()
```

getExpirationDate

Gets the expiration date.

Syntax: Here is the method signature:

```
public java.util.Date getExpirationDate()
```

getIdentity

Gets the identity to assign roles to.

Syntax: Here is the method signature:

```
public java.lang.String getIdentity()
```

getReason

Gets the reason for the role assignment.

Syntax: Here is the method signature:

```
public java.lang.String getReason()
```

getRoles

Gets the roles to assign to the identity.

Syntax: Here is the method signature:

```
public DNStringArray getRoles()
```

getSodOveridesRequested

Gets the SOD DNs and justification to override.

Syntax: Here is the method signature:

```
public SodJustificationArray getSodOveridesRequested()
```

setActionType

Sets the action type (grant, revoke, extend).

Syntax: Here is the method signature:

```
public void setActionType(RoleAssignmentActionType actionType)
```

setAssignmentType

Sets the role assignment type.

Syntax: Here is the method signature:

```
public void setAssignmentType(RoleAssignmentType assignmentType)
```

setCorrelationID

Sets the correlation ID.

Syntax: Here is the method signature:

```
public void setCorrelationID(java.lang.String correlationID)
```

setEffectiveDate

Sets the effective date.

Syntax: Here is the method signature:

```
public void setEffectiveDate(java.util.Date effectiveDate)
```

setExpirationDate

Sets the expiration date.

Syntax: Here is the method signature:

```
public void setExpirationDate(java.util.Date expirationDate)
```

setIdentity

Sets the identity to assign roles to.

Syntax: Here is the method signature:

```
public void setIdentity(java.lang.String identity)
```

setReason

Sets the reason for the role assignment.

Syntax: Here is the method signature:

```
public void setReason(java.lang.String reason)
```

setRoles

Sets the roles to assign to the identity.

Syntax: Here is the method signature:

```
public void setRoles(DNStringArray roles)
```

setSodOveridesRequested

Sets the SOD DNs and justification to override.

Syntax: Here is the method signature:

```
public void setSodOveridesRequested(SodJustificationArray sodOveridesRequested)
```

RoleAssignmentRequestStatus

This class represents the status of a role assignment.

RoleAssignmentRequestStatus

The RoleAssignmentRequestStatus class supports a single constructor.

Syntax: Here is the syntax for the constructor:

```
RoleAssignmentRequestStatus()
```

getCategory

Gets the request category.

Syntax: Here is the method signature:

```
public RequestCategoryType getCategory()
```

getCorrelationId

Gets the correlation ID.

Syntax: Here is the method signature:

```
public java.lang.String getCorrelationId()
```

getEffectiveDate

Gets the effective date.

Syntax: Here is the method signature:

```
public java.util.Date getEffectiveDate()
```

getEntityKey

Gets the entity key.

Syntax: Here is the method signature:

```
public java.lang.String getEntityKey()
```

getExpirationDate

Gets the expiration date.

Syntax: Here is the method signature:

```
public java.util.Date getExpirationDate()
```

getReason

Gets the reason for the role assignment.

Syntax: Here is the method signature:

```
public java.lang.String getReason()
```

getRequestDate

Gets the request date.

Syntax: Here is the method signature:

```
public java.util.Date getRequestDate()
```

getRequester

Gets the request DN.

Syntax: Here is the method signature:

```
public java.lang.String getRequester()
```

getSource

Gets the source Role DN.

Syntax: Here is the method signature:

```
public java.lang.String getSource()
```

getStatus

Gets the request status.

Syntax: Here is the method signature:

```
public RequestStatus getStatus()
```

getTarget

Gets the targeted identity DN.

Syntax: Here is the method signature:

```
public java.lang.String getTarget()
```

setCategory

Sets the request category.

Syntax: Here is the method signature:

```
public void setCategory(RequestCategoryType category)
```

setCorrelationId

Sets the correlation ID.

Syntax: Here is the method signature:

```
public void setCorrelationId(java.lang.String correlationId)
```

setEffectiveDate

Sets the effective date.

Syntax: Here is the method signature:

```
public void setEffectiveDate(java.util.Date effectiveDate)
```

setEntityKey

Sets the entity key.

Syntax: Here is the method signature:

```
public void setEntityKey(java.lang.String entityKey)
```

setExpirationDate

Sets the expiration date.

Syntax: Here is the method signature:

```
public void setExpirationDate(java.util.Date expirationDate)
```

setReason

Sets the reason for the role assignment.

Syntax: Here is the method signature:

```
public void setReason(java.lang.String reason)
```

setRequestDate

Sets the request date.

Syntax: Here is the method signature:

```
public void setRequestDate(java.util.Date requestDate)
```

setRequester

Sets the requester DN.

Syntax: Here is the method signature:

```
public void setRequester(java.lang.String requester)
```

setSource

Sets the source Role DN.

Syntax: Here is the method signature:

```
public void setSource(java.lang.String source)
```

setStatus

Sets the request status.

Syntax: Here is the method signature:

```
public void setStatus(RequestStatus status)
```

setTarget

Sets the identity targeted DN.

Syntax: Here is the method signature:

```
public void setTarget(java.lang.String target)
```

RoleAssignmentType

An JAX-RPC friendly representation of com.novell.idm.nrf.RoleAssignmentType.

***Table 24-7** Field Summary*

Type	Name
static RoleAssignmentType	CONTAINER_TO_ROLE
static RoleAssignmentType	CONTAINER_WITH_SUBTREE_TO_ROLE
static RoleAssignmentType	GROUP_TO_ROLE
static RoleAssignmentType	ROLE_TO_ROLE
static RoleAssignmentType	USER_TO_ROLE

RoleAssignmentType constructors

The CategoryKey class has two constructors.

Syntax 1: Here is the syntax for a constructor that takes no parameters:

```
CategoryKey()
```

Syntax 2: Here is the syntax for a constructor that takes a String as a parameter:

```
CategoryKey(java.lang.String categoryKey)
```

convertToAPI

Reconstructs an API representation object from an RPC representation.

Syntax: Here is the method signature:

```
public com.novell.idm.nrf.RoleAssignmentType convertToAPI()
```

convertToRPC

Constructs an RPC friendly representation off of an API object.

Syntax: Here is the method signature:

```
public static RoleAssignmentType
convertToRPC(com.novell.idm.nrf.RoleAssignmentType type)
```

equals

Implementation of equals().

Syntax: Here is the method signature:

```
public boolean equals(java.lang.Object obj)
```

fromValue

This method is for WSSDK serialization.

Syntax: Here is the method signature:

```
public static RoleAssignmentType fromValue(java.lang.String value)
```

getValue

Gets the type.

Syntax: Here is the method signature:

```
public java.lang.String getValue()
```

hashCode

This is an implementation of hashCode(). This implementation overrides the hashCode() method in java.lang.Object.

Syntax: Here is the method signature:

```
public int hashCode()
```

setValue

Sets the type.

Syntax: Here is the method signature:

```
public void setValue(java.lang.String type)
```

toString

Implementation of toString() that returns a string representation of the class.

Syntax: Here is the method signature:

```
public java.lang.String toString()
```

RoleAssignmentTypeInfo

An JAX-RPC friendly representation of the details of the com.novell.idm.nrf.RoleAssignmentType enumeration.

RoleAssignmentTypeInfo

The RoleAssignmentTypeInfo class supports a single constructor.

Syntax: Here is the syntax for the constructor:

```
RoleAssignmentTypeInfo()
```

convertToRPC

Constructs an RPC friendly representation from an API object.

Syntax: Here is the method signature:

```
public static RoleAssignmentTypeInfo
convertToRPC(com.novell.idm.nrf.RoleAssignmentType type)
```

getIdentityType

Returns the JAX-RPC friendly identity type.

Syntax: Here is the method signature:

```
public IdentityType getIdentityType()
```

getSubtreeIncluded

Determines whether the sub tree is included.

Syntax: Here is the method signature:

```
public boolean getSubtreeIncluded()
```

getSupportsApproval

Determines whether the assignment supports approval.

Syntax: Here is the method signature:

```
public boolean getSupportsApproval()
```

getSupportsEffectiveDate

Determines whether the assignment supports an effective date.

Syntax: Here is the method signature:

```
public boolean getSupportsEffectiveDate()
```

getSupportsExpiration

Determines whether the assignment supports expiration.

Syntax: Here is the method signature:

```
public boolean getSupportsExpiration()
```

getSupportsSODApproval

Determines whether the assignment supports SOD approval.

Syntax: Here is the method signature:

```
public boolean getSupportsSODApproval()
```

setIdentityType

Sets the JAX-RPC friendly identity type.

Syntax: Here is the method signature:

```
public void setIdentityType(IdentityType type)
```

setSubtreeIncluded

Sets whether the sub tree is included.

Syntax: Here is the method signature:

```
public void setSubtreeIncluded(boolean bool)
```

setSupportsApproval

Sets whether the assignment supports approval.

Syntax: Here is the method signature:

```
public void setSupportsApproval(boolean bool)
```

setSupportsEffectiveDate

Sets whether the assignment supports effective date.

Syntax: Here is the method signature:

```
public void setSupportsEffectiveDate(boolean bool)
```

setSupportsExpiration

Sets whethers the assignment supports expiration.

Syntax: Here is the method signature:

```
public void setSupportsExpiration(boolean bool)
```

setSupportsSODApproval

Sets whether the assignment supports SOD approval.

Syntax: Here is the method signature:

```
public void setSupportsSODApproval(boolean bool)
```

RoleInfo

Value class to hold main role information. This is a small subset of the role value class.

RoleInfo constructors

The RoleInfo class supports a single constructor.

Syntax: Here is the syntax for the constructor:

```
RoleInfo()
```

getDescription

Gets the role description.

Syntax: Here is the method signature:

```
public java.lang.String getDescription()
```

getEntityKey

Gets the role entity key.

Syntax: Here is the method signature:

```
public java.lang.String getEntityKey()
```

getName

Gets the role name.

Syntax: Here is the method signature:

```
public java.lang.String getName()
```

getRoleCategoryKeys

Gets the role category keys.

Syntax: Here is the method signature:

```
public CategoryKeyArray getRoleCategoryKeys()
```

getRoleLevel

Gets the role level object.

Syntax: Here is the method signature:

```
public RoleLevel getRoleLevel()
```

setDescription

Sets the role description.

Syntax: Here is the method signature:

```
public void setDescription(java.lang.String description)
```

setEntityKey

Sets the role entity key.

Syntax: Here is the method signature:

```
public void setEntityKey(java.lang.String entityKey)
```

setName

Sets the role name.

Syntax: Here is the method signature:

```
public void setName(java.lang.String name)
```

setRoleCategoryKeys

Sets the role category keys.

Syntax: Here is the method signature:

```
public void setRoleCategoryKeys(CategoryKeyArray roleCategoryKeys)
```

setRoleLevel

Sets role level object.

Syntax: Here is the method signature:

```
public void setRoleLevel(RoleLevel roleLevel)
```

RoleInfoArray

This section provides reference information on the RoleInfoArray class.

RoleInfoArray constructors

The RoleInfoArray class has two constructors.

Syntax 1: Here is the syntax for a constructor that takes no parameters:

```
RoleInfoArray()
```

Syntax 2: Here is the syntax for a constructor that takes an array of Attribute objects as a parameter:

```
RoleInfoArray(RoleInfo[] RoleInfoVal)
```

getRoleinfo

Returns an array of RoleInfo objects.

Syntax: Here is the method signature:

```
RoleInfo[] getRoleinfo()
```

setRoleinfo

Sets the array of RoleInfo objects associated with the RoleInfoArray class.

Syntax: Here is the method signature:

```
void setRoleinfo (RoleInfo[] RoleInfoVal)
```

RoleLevel

This class represent a role level.

RoleLevel constructors

The RoleLevel class supports a single constructor.

Syntax: Here is the syntax for the constructor:

```
RoleLevel()
```

getContainer

Gets the role level container.

Syntax: Here is the method signature:

```
public java.lang.String getContainer()
```

getDescription

Gets the role level description.

Syntax: Here is the method signature:

```
public java.lang.String getDescription()
```

getLevel

Gets the role level.

Syntax: Here is the method signature:

```
public long getLevel()
```

getName

Gets the role level name.

Syntax: Here is the method signature:

```
public java.lang.String getName()
```

setContainer

Sets the role level container.

Syntax: Here is the method signature:

```
public void setContainer(java.lang.String container)
```

setDescription

Sets the role level description.

Syntax: Here is the method signature:

```
public void setDescription(java.lang.String description)
```

setLevel

Sets the role level.

Syntax: Here is the method signature:

```
public void setLevel(long level)
```

setName

Sets the role level name.

Syntax: Here is the method signature:

```
public void setName(java.lang.String name)
```

RoleLevelArray

This section provides reference information on the RoleLevelArray class.

RoleLevelArray constructors

The RoleLevelArray class has two constructors.

Syntax 1: Here is the syntax for a constructor that takes no parameters:

```
RoleLevelArray()
```

Syntax 2: Here is the syntax for a constructor that takes an array of Attribute objects as a parameter:

```
RoleLevelArray(RoleLevel[] RoleLevelVal)
```

getRolelevel

Returns an array of RoleLevel objects.

Syntax: Here is the method signature:

```
RoleLevel[] getRolelevel()
```

setRolelevel

Sets the array of RoleLevel objects associated with the RoleLevelArray class.

Syntax: Here is the method signature:

```
void setRolelevel (RoleLevel[] RoleLevelVal)
```

RoleRequest

The Role Request class has been added to support the creation of roles. The Role Request class is a value class used to hold information about a request to create a role.

getName

Gets the role name.

Syntax: Here is the method signature:

```
public String getName()
```

getDescription

Gets the role description.

Syntax: Here is the method signature:

```
public String getDescription()
```

getEntityKey

Gets the entity key for the role.

Syntax: Here is the method signature:

```
public String getEntityKey()
```

getRoleLevel

Gets the role level object.

Syntax: Here is the method signature:

```
public long getRoleLevel()
```

getRoleCategoryKeys

Gets the role category keys.

Syntax: Here is the method signature:

```
public CategoryKey[] getRoleCategoryKeys()
```

getQuorum

Gets the quorum amount.

Syntax: Here is the method signature:

```
public String getQuorum()
```

getRequestDef

Gets the provisioning request definition for approval processing.

Syntax: Here is the method signature:

```
public String getRequestDef()
```

getApprovers

Gets the approvers for the role definition.

Syntax: Here is the method signature:

```
public Approver[] getApprovers()
```

getOwners

Gets the owner DNs.

Syntax: Here is the method signature:

```
public DNString[] getOwners()
```

getRoleAssignments

Gets the associated roles.

Syntax: Here is the method signature:

```
public String getRoleAssignments()
```

getSystemRole

Gets the system role flag, which indicates whether this is a system role.

Syntax: Here is the method signature:

```
public boolean getSystemRole()
```

getContainer

Gets the name of the role container.

Syntax: Here is the method signature:

```
public String getContainer()
```

setName

Sets the role name.

Syntax: Here is the method signature:

```
public void setName()
```

setDescription

Sets the role description.

Syntax: Here is the method signature:

```
public void setDescription()
```

setEntityKey

Sets the entity key for the role.

Syntax: Here is the method signature:

```
public void setEntityKey()
```

setRoleLevel

Sets the role level object.

Syntax: Here is the method signature:

```
public void setRoleLevel()
```

setRoleCategoryKeys

Sets the role category keys.

Syntax: Here is the method signature:

```
public void setRoleCategoryKeys()
```

setQuorum

Sets the quorum amount.

Syntax: Here is the method signature:

```
public void setQuorum()
```

setRequestDef

Sets the provisioning request definition for approval processing.

Syntax: Here is the method signature:

```
public void setRequestDef()
```

setApprovers

Sets the approvers for role approval processing.

Syntax: Here is the method signature:

```
public void setApprovers()
```

setOwners

Sets the owner DNs.

Syntax: Here is the method signature:

```
public void setOwners()
```

setSystemRole

Sets the system role flag, which determines whether this is a system role.

Syntax: Here is the method signature:

```
public void setSystemRole()
```

setContainer

Sets the role container.

Syntax: Here is the method signature:

```
public void setContainer()
```

RoleServiceDelegate

Delegate class to perform the actual call to the API layer. Should be used by all skeleton classes.

RoleServiceDelegate constructors

The RoleServiceDelegate class supports a single constructor.

Syntax: Here is the syntax for the constructor:

```
RoleServiceDelegate(com.novell.srvprv.spi.security.ISecurityContext ctx,
java.util.Locale locale)
```

findSodByExample

Finds all SoD objects based on the search criteria in the given SOD object.

Syntax: Here is the method signature:

```
SodArray findSodByExample(Sod sod) throws NrfServiceException,
java.rmi.RemoteException
```

findSodByExampleWithOperator

Finds all SoD objects based on the search criteria found in the given SOD object

Syntax: Here is the method signature:

```
SodArray findSodByExampleWithOperator(Sod searchCriteria, boolean
useAndForMultiValueSearch) throws NrfServiceException, java.rmi.RemoteException
```

findSodById

Find by key.

Syntax: Here is the method signature:

```
Sod findSodById(java.lang.String entityKey) throws NrfServiceException,
java.rmi.RemoteException
```

getAssignedIdentities

Returns a list of role assignments for a specified identity.

Syntax: Here is the method signature:

```
RoleAssignmentArray   getAssignedIdentities(java.lang.String identityDn,
IdentityType type, boolean direct) throws NrfServiceException,
java.rmi.RemoteException
```

getConfiguration

Returns the role system configuration defined in the role vault root (nrfConfiguration)

Syntax: Here is the method signature:

```
Configuration getConfiguration() throws NrfServiceException,
java.rmi.RemoteException
```

getContainer

Gets container and role information for a given container DN.

Syntax: Here is the method signature:

```
Container getContainer(java.lang.String containerDn)                       throws
NrfServiceException, java.rmi.RemoteException
```

getExceptionList

Returns a list of Sod instances for all SOD violations found for a specific identity and type.

Syntax: Here is the method signature:

```
SodArray getExceptionsList(java.lang.String identity, IdentityType identityType)
throws NrfServiceException, java.rmi.RemoteException
```

getGroup

Gets group and role information for a given group DN.

Syntax: Here is the method signature:

```
Group getGroup(java.lang.String groupDn) throws NrfServiceException,
java.rmi.RemoteException
```

getIdentitiesInViolation

Returns a map of identities which are in violation of a given SoD.

Syntax: Here is the method signature:

```
IdentityTypeDnMapArray getIdentitiesInViolation(java.lang.String sodDn) throws
NrfServiceException, java.rmi.RemoteException
```

getIdentityRoleConflicts

Returns a list of Sod instances for all SOD conflicts found for a given list of roles for a given identity.

Syntax: Here is the method signature:

```
SodArray getIdentityRoleConflicts(java.lang.String identity, IdentityType
identityType, DNStringArray requestedRoles) throws NrfServiceException,
java.rmi.RemoteException
```

getRole

Retrieves a role object defined by a role DN

Syntax: Here is the method signature:

```
Role getRole(java.lang.String roleDn) throws NrfServiceException,
java.rmi.RemoteException
```

getRoleAssignmentRequestStatus

Returns a list of role assignment request status instances given a correlation ID.

Syntax: Here is the method signature:

```
RoleAssignmentRequestStatusArray getRoleAssignmentRequestStatus(java.lang.String
correlationId) throws NrfServiceException, java.rmi.RemoteException
```

getRoleAssignmentRequestStatusByIdentityType

Returns a list of role assignment request status instances given an identity and an identity type.

Syntax: Here is the method signature:

```
RoleAssignmentRequestStatusArray
getRoleAssignmentRequestStatusByIdentityType(java.lang.String identityDn,
IdentityType identityType) throws NrfServiceException, java.rmi.RemoteException
```

getRoleAssignmentTypeInfo

Retrieves details about a RoleAssignmentType.

Syntax: Here is the method signature:

```
RoleAssignmentTypeInfo getRoleAssignmentTypeInfo(RoleAssignmentType type) throws
NrfServiceException, java.rmi.RemoteException
```

getRoleCategories

Gets role categories.

Syntax: Here is the method signature:

```
CategoryArray getRoleCategories() throws NrfServiceException,
java.rmi.RemoteException
```

getRoleConflicts

Returns a list of Sod instances found for all given roles. This method always returns a list.

Syntax: Here is the method signature:

```
SodArray getRoleConflicts(DNStringArray roles) throws NrfServiceException,
java.rmi.RemoteException
```

getRoleLevels

Gets role levels.

Syntax: Here is the method signature:

```
RoleLevelArray getRoleLevels() throws NrfServiceException,
java.rmi.RemoteException
```

getRolesInfo

Returns a list of RoleInfo instances given a list of role DNs.

Syntax: Here is the method signature:

```
RoleInfoArray getRolesInfo(DNStringArray roleDns) throws NrfServiceException,
java.rmi.RemoteException
```

getRolesInfoByCategory

Returns a list of RoleInfo instances given a list of role category keys.

Syntax: Here is the method signature:

```
RoleInfoArray getRolesInfoByCategory(CategoryKeyArray roleCategoryKeys) throws
NrfServiceException, java.rmi.RemoteException
```

getRolesInfoByLevel

Returns a list of RoleInfo instances given a list of role levels.

Syntax: Here is the method signature:

```
RoleInfoArray getRolesInfoByLevel(LongArray roleLevels) throws
NrfServiceException, java.rmi.RemoteException
```

getTargetSourceConflicts

Returns a list of Sod instances for all SOD conflicts defined between the target role DN and the source role DN.

Syntax: Here is the method signature:

```
SodArray getTargetSourceConflicts(java.lang.String targetName, java.lang.String
sourceName) throws NrfServiceException, java.rmi.RemoteException
```

getUser

Gets user info including all role assignments for a given user DN stored in a UserIdentity object.

Syntax: Here is the method signature:

```
User getUser(java.lang.String userDn) throws NrfServiceException,
java.rmi.RemoteException
```

getVersion

Returns the version of this Web Service.

Syntax: Here is the method signature:

```
VersionVO getVersion() throws java.rmi.RemoteException
```

isUserInRole

Returns boolean flag; true if role has been assigned to a User identity

Syntax: Here is the method signature:

```
boolean isUserInRole(java.lang.String userDn, java.lang.String roleDn)
```

requestRoleAssignment

Returns a list of request DNs created by the role assignment

Syntax: Here is the method signature:

```
DNStringArray requestRolesAssignment(RoleAssignmentRequest roleAssignmentRequest)
throws NrfServiceException, java.rmi.RemoteException
```

RoleServiceSkeletonImpl

Class to represent the skeleton server side implementation of the Role Based offered services.

RoleServiceSkeletonImpl

The RoleServiceSkeletonImpl class supports a single constructor.

Syntax: Here is the syntax for the constructor:

```
RoleServiceSkeletonImpl()
```

findSodByExample

Finds all SoD objects based on the search criteria in the given SOD object.

Syntax: Here is the method signature:

```
SodArray findSodByExample(Sod sod) throws NrfServiceException,
java.rmi.RemoteException
```

findSodByExampleWithOperator

Finds all SoD objects based on the search criteria found in the given SOD object

Syntax: Here is the method signature:

```
SodArray findSodByExampleWithOperator(Sod searchCriteria, boolean
useAndForMultiValueSearch) throws NrfServiceException, java.rmi.RemoteException
```

findSodById

Find by key.

Syntax: Here is the method signature:

```
Sod findSodById(java.lang.String entityKey) throws NrfServiceException,
java.rmi.RemoteException
```

getAssignedIdentities

Returns a list of role assignments for a specified identity.

Syntax: Here is the method signature:

```
RoleAssignmentArray   getAssignedIdentities(java.lang.String identityDn,
IdentityType type, boolean direct) throws NrfServiceException,
java.rmi.RemoteException
```

getConfiguration

Returns the role system configuration defined in the role vault root (nrfConfiguration)

Syntax: Here is the method signature:

```
Configuration getConfiguration() throws NrfServiceException,
java.rmi.RemoteException
```

getContainer

Gets container and role information for a given container DN.

Syntax: Here is the method signature:

```
Container getContainer(java.lang.String containerDn)                      throws
NrfServiceException, java.rmi.RemoteException
```

getExceptionList

Returns a list of Sod instances for all SOD violations found for a specific identity and type.

Syntax: Here is the method signature:

```
SodArray getExceptionsList(java.lang.String identity, IdentityType identityType)
throws NrfServiceException, java.rmi.RemoteException
```

getGroup

Gets group and role information for a given group DN.

Syntax: Here is the method signature:

```
Group getGroup(java.lang.String groupDn) throws NrfServiceException,
java.rmi.RemoteException
```

getIdentitiesInViolation

Returns a map of identities which are in violation of a given SoD.

Syntax: Here is the method signature:

```
IdentityTypeDnMapArray getIdentitiesInViolation(java.lang.String sodDn) throws
NrfServiceException, java.rmi.RemoteException
```

getIdentityRoleConflicts

Returns a list of Sod instances for all SOD conflicts found for a given list of roles for a given identity.

Syntax: Here is the method signature:

```
SodArray getIdentityRoleConflicts(java.lang.String identity, IdentityType
identityType, DNStringArray requestedRoles) throws NrfServiceException,
java.rmi.RemoteException
```

getRole

Retrieves a role object defined by a role DN

Syntax: Here is the method signature:

```
Role getRole(java.lang.String roleDn) throws NrfServiceException,
java.rmi.RemoteException
```

getRoleAssignmentRequestStatus

Returns a list of role assignment request status instances given a correlation ID.

Syntax: Here is the method signature:

```
RoleAssignmentRequestStatusArray getRoleAssignmentRequestStatus(java.lang.String
correlationId) throws NrfServiceException, java.rmi.RemoteException
```

getRoleAssignmentRequestStatusByIdentityType

Returns a list of role assignment request status instances given an identity and an identity type.

Syntax: Here is the method signature:

```
RoleAssignmentRequestStatusArray
getRoleAssignmentRequestStatusByIdentityType(java.lang.String identityDn,
IdentityType identityType) throws NrfServiceException, java.rmi.RemoteException
```

getRoleAssignmentTypeInfo

Retrieves details about a RoleAssignmentType.

Syntax: Here is the method signature:

```
RoleAssignmentTypeInfo getRoleAssignmentTypeInfo(RoleAssignmentType type) throws
NrfServiceException, java.rmi.RemoteException
```

getRoleCategories

Gets role categories.

Syntax: Here is the method signature:

```
CategoryArray getRoleCategories() throws NrfServiceException,
java.rmi.RemoteException
```

getRoleConflicts

Returns a list of Sod instances found for all given roles. This method always returns a list.

Syntax: Here is the method signature:

```
SodArray getRoleConflicts(DNStringArray roles) throws NrfServiceException,
java.rmi.RemoteException
```

getRoleLevels

Gets role levels.

Syntax: Here is the method signature:

```
RoleLevelArray getRoleLevels() throws NrfServiceException,
java.rmi.RemoteException
```

getRolesInfo

Returns a list of RoleInfo instances given a list of role DNs.

Syntax: Here is the method signature:

```
RoleInfoArray getRolesInfo(DNStringArray roleDns) throws NrfServiceException,
java.rmi.RemoteException
```

getRolesInfoByCategory

Returns a list of RoleInfo instances given a list of role category keys.

Syntax: Here is the method signature:

```
RoleInfoArray getRolesInfoByCategory(CategoryKeyArray roleCategoryKeys) throws
NrfServiceException, java.rmi.RemoteException
```

getRolesInfoByLevel

Returns a list of RoleInfo instances given a list of role levels.

Syntax: Here is the method signature:

```
RoleInfoArray getRolesInfoByLevel(LongArray roleLevels) throws
NrfServiceException, java.rmi.RemoteException
```

getTargetSourceConflicts

Returns a list of Sod instances for all SOD conflicts defined between the target role DN and the source role DN.

Syntax: Here is the method signature:

```
SodArray getTargetSourceConflicts(java.lang.String targetName, java.lang.String
sourceName) throws NrfServiceException, java.rmi.RemoteException
```

getUser

Gets user info including all role assignments for a given user DN stored in a UserIdentity object.

Syntax: Here is the method signature:

```
User getUser(java.lang.String userDn) throws NrfServiceException,
java.rmi.RemoteException
```

getVersion

Returns the version of this Web Service.

Syntax: Here is the method signature:

```
VersionVO getVersion() throws java.rmi.RemoteException
```

isUserInRole

Returns boolean flag; true if role has been assigned to a User identity

Syntax: Here is the method signature:

```
boolean isUserInRole(java.lang.String userDn, java.lang.String roleDn)
```

requestRoleAssignment

Returns a list of request DNs created by the role assignment

Syntax: Here is the method signature:

```
DNStringArray requestRolesAssignment(RoleAssignmentRequest roleAssignmentRequest)
throws NrfServiceException, java.rmi.RemoteException
```

Sod

Value object to hold SOD information.

Sod constructors

The Sod class supports a single constructor.

Syntax: Here is the syntax for the constructor:

```
Sod()
```

getApprovalType

Gets the SOD approval type.

Syntax: Here is the method signature:

```
public SodApprovalType getApprovalType()
```

getApprovers

Gets SOD approvers.

Syntax: Here is the method signature:

```
public ApproverArray getApprovers()
```

getDescription

Gets the SOD description.

Syntax: Here is the method signature:

```
public java.lang.String getDescription()
```

getEntityKey

Gets the SOD entity key.

Syntax: Here is the method signature:

```
public java.lang.String getEntityKey()
```

getName

Gets the SOD name.

Syntax: Here is the method signature:

```
public java.lang.String getName()
```

getQuorum

Gets the SOD quorum amount.

Syntax: Here is the method signature:

```
public java.lang.String getQuorum()
```

getRequestDef

Gets the request definition for approval processing.

Syntax: Here is the method signature:

```
public java.lang.String getRequestDef()
```

getRoles

Gets the SOD roles.

Syntax: Here is the method signature:

```
public DNStringArray getRoles()
```

setApprovalType

Sets the SOD approval type.

Syntax: Here is the method signature:

```
public void setApprovalType(SodApprovalType approvalType)
```

setApprovers

Sets the SOD approvers.

Syntax: Here is the method signature:

```
public void setApprovers(ApproverArray approvers)
```

setDescription

Sets the SOD description.

Syntax: Here is the method signature:

```
public void setDescription(java.lang.String description)
```

setEntityKey

Sets the SOD entity key.

Syntax: Here is the method signature:

```
public void setEntityKey(java.lang.String entityKey)
```

setName

Sets the SOD name.

Syntax: Here is the method signature:

```
public void setName(java.lang.String name)
```

setQuorum

Sets the SOD quorum amount.

Syntax: Here is the method signature:

```
public void setQuorum(java.lang.String quorum)
```

setRequestDef

Sets the request definition for approval processing.

Syntax: Here is the method signature:

```
public void setRequestDef(java.lang.String requestDef)
```

setRoles

Sets the SOD roles.

Syntax: Here is the method signature:

```
public void setRoles(DNStringArray roles)
```

SodArray

This section provides reference information on the SodArray class.

SodArray constructors

The SodArray class has two constructors.

Syntax 1: Here is the syntax for a constructor that takes no parameters:

```
SodArray()
```

Syntax 2: Here is the syntax for a constructor that takes an array of Attribute objects as a parameter:

```
SodArray(Sod[] SodVal)
```

getSod

Returns an array of Sod objects.

Syntax: Here is the method signature:

```
Sod[] getSod()
```

setSod

Sets the array of Sod objects associated with the SodArray class.

Syntax: Here is the method signature:

```
void setSod (Sod[] SodVal)
```

SodApprovalType

An JAX-RPC friendly representation of com.novell.idm.nrf.api.SodApprovalType.

Table 24-8 *Field Summary*

Type	Name
static SodApprovalType	ALLOW_WITH_WORKFLOW
static SodApprovalType	ALWAYS_ALLOW

SodApprovalType constructors

The SodApprovalType class has two constructors.

Syntax 1: Here is the syntax for a constructor that takes no parameters:

```
SodApprovalType()
```

Syntax 2: Here is the syntax for a constructor that takes a String as a parameter:

```
SodApprovalType(java.lang.String value)
```

equals

Implementation of equals().

Syntax: Here is the method signature:

```
public boolean equals(java.lang.Object obj)
```

fromRPC

Reconstructs an API representation object from an RPC representation.

Syntax: Here is the method signature:

```
public com.novell.idm.nrf.api.SodApprovalType fromRPC() throws
com.novell.idm.nrf.exception.NrfException
```

fromValue

This method is for WSSDK serialization.

Syntax: Here is the method signature:

```
public static SodApprovalType fromValue(java.lang.String value)
```

getValue

Gets the type.

Syntax: Here is the method signature:

```
public java.lang.String getValue()
```

hashCode

This is an implementation of hashCode(). This implementation overrides the hashCode() method in java.lang.Object.

Syntax: Here is the method signature:

```
public int hashCode()
```

setValue

Sets the type.

Syntax: Here is the method signature:

```
public void setValue(java.lang.String type)
```

toRPC

Reconstructs an API representation object from an RPC representation.

Syntax: Here is the method signature:

```
public com.novell.idm.nrf.api.SodApprovalType fromRPC() throws
com.novell.idm.nrf.exception.NrfException
```

toString

Implementation of toString() that returns a string representation of the class.

Syntax: Here is the method signature:

```
public java.lang.String toString()
```

SodJustification

Class to represent an SOD DN to override with a justification. Used for assignment of roles to be able to pass in a justification for overrides of SODs.

SodJustification constructors

The SodJustification class has two constructors.

Syntax 1: Here is the syntax for a constructor that takes no parameters:

```
SodJustification()
```

Syntax 2: Here is the syntax for a constructor that takes two String values as parameters:

```
SodJustification(java.lang.String sodDN, java.lang.String justification)
```

getJustification

Gets the SOD justification for override.

Syntax: Here is the method signature:

```
public java.lang.String getJustification()
```

getSodDN

Gets the SOD DN for override.

Syntax: Here is the method signature:

```
public java.lang.String getSodDN()
```

setJustification

Sets the justification for override.

Syntax: Here is the method signature:

```
public void setJustification(java.lang.String justification)
```

setSodDN

Sets the SOD DN for override.

Syntax: Here is the method signature:

```
public void setSodDN(java.lang.String sodDN)
```

SodJustificationArray

This section provides reference information on the SodJustificationArray class.

SodJustificationArray constructors

The SodJustificationArray class has two constructors.

Syntax 1: Here is the syntax for a constructor that takes no parameters:

```
SodJustificationArray()
```

Syntax 2: Here is the syntax for a constructor that takes an array of Attribute objects as a parameter:

```
SodJustificationArray(SodJustification[] SodJustificationVal)
```

getSodjustification

Returns an array of SodJustification objects.

Syntax: Here is the method signature:

```
SodJustification[] getSodjustification()
```

setSodjustification

Sets the array of SodJustification objects associated with the SodJustificationArray class.

Syntax: Here is the method signature:

```
void setSodjustification (SodJustification[] SodJustificationVal)
```

User

Value class to hold user identity information.

User constructors

The User class supports a single constructor.

Syntax: Here is the syntax for the constructor:

```
User()
```

getAssociatedRoles

Gets the associated roles for this identity.

Syntax: Here is the method signature:

```
public DNStringArray getAssociatedRoles()
```

getCn

Gets the cn.

Syntax: Here is the method signature:

```
public java.lang.String getCn()
```

getContainerRoles

Gets the container roles.

Syntax: Here is the method signature:

```
public DNStringArray getContainerRoles()
```

getEmail

Gets the email address.

Syntax: Here is the method signature:

```
public java.lang.String getEmail()
```

getEntityKey

Gets the identity entity key.

Syntax: Here is the method signature:

```
public java.lang.String getEntityKey()
```

getExplicitAssignments

Gets the explicit role assignments.

Syntax: Here is the method signature:

```
public RoleAssignmentArray getExplicitAssignments()
```

getFirstName

Gets the first name.

Syntax: Here is the method signature:

```
public java.lang.String getFirstName()
```

getGroupRoles

Gets the group roles.

Syntax: Here is the method signature:

```
public DNStringArray getGroupRoles()
```

getIdentityType

Gets identity type.

Syntax: Here is the method signature:

```
public IdentityType getIdentityType()
```

getImplicitAssignments

Gets the implicit role assignments.

Syntax: Here is the method signature:

```
public RoleAssignmentArray getImplicitAssignments()
```

getInheritedAssignments

Gets the inherited role assignments.

Syntax: Here is the method signature:

```
public RoleAssignmentArray getInheritedAssignments()
```

getInheritedRoles

Gets the inherited roles.

Syntax: Here is the method signature:

```
public DNStringArray getInheritedRoles()
```

getLastName

Gets the last name.

Syntax: Here is the method signature:

```
public java.lang.String getLastName()
```

getRoleAssignments

Gets the role assignments for this identity.

Syntax: Here is the method signature:

```
public RoleAssignmentArray getRoleAssignments()
```

setAssociatedRoles

Sets the associated roles for this identity.

Syntax: Here is the method signature:

```
public void setAssociatedRoles(DNStringArray associatedRoles)
```

setCn

Sets the CN.

Syntax: Here is the method signature:

```
public void setCn(java.lang.String cn)
```

setContainerRoles

Sets the container roles.

Syntax: Here is the method signature:

```
public void setContainerRoles(DNStringArray containerRoles)
```

setEmail

Sets the email address.

Syntax: Here is the method signature:

```
public void setEmail(java.lang.String email)
```

setEntityKey

Sets the identity entity key.

Syntax: Here is the method signature:

```
public void setEntityKey(java.lang.String entityKey)
```

setExplicitAssignments

Sets the explicit role assignments.

Syntax: Here is the method signature:

```
public void setExplicitAssignments(RoleAssignmentArray explicitAssignments)
```

setFirstName

Sets the first name.

Syntax: Here is the method signature:

```
public void setFirstName(java.lang.String firstName)
```

setGroupRoles

Sets the group roles.

Syntax: Here is the method signature:

```
public void setGroupRoles(DNStringArray groupRoles)
```

setIdentityType

Sets the identity type.

Syntax: Here is the method signature:

```
public void setIdentityType(IdentityType identityType)
```

setImplicitAssignments

Sets the implicit role assignments.

Syntax: Here is the method signature:

```
public void setImplicitAssignments(RoleAssignmentArray implicitAssignments)
```

setInheritedAssignments

Sets the inherited role assignments.

Syntax: Here is the method signature:

```
public void setInheritedAssignments(RoleAssignmentArray inheritedAssignments)
```

setInheritedRoles

Sets the inherited roles.

Syntax: Here is the method signature:

```
public void setInheritedRoles(DNStringArray inheritedRoles)
```

setLastName

Sets the last name.

Syntax: Here is the method signature:

```
public void setLastName(java.lang.String lastName)
```

setRoleAssignments

Sets the role assignments for this identity.

Syntax: Here is the method signature:

```
public void setRoleAssignments(RoleAssignmentArray roleAssignments)
```

VersionVO

A value object for Version.

VersionVO constructors

The VersionVO class has two constructors.

Syntax 1: Here is the syntax for a constructor that takes no parameters:

```
VersionVO()
```

Syntax 2: Here is the syntax for a constructor that takes a String as a parameter:

```
VersionVO(java.lang.String version)
```

getValue

Gets the version.

Syntax: Here is the method signature:

```
public java.lang.String getValue()
```

setValue

Sets the version.

Syntax: Here is the method signature:

```
public void setValue(java.lang.String version)
```

Role Web Service Examples

This section provides examples that demonstrate how you might use the Role service.

Retrieving Roles for a Group

This example shows how to retrieve the role assignments for a given group:

```
public void getGroupTestCase()
    throws Exception
  {
    System.out.println("\n***************Calling
getGroupTestCase()*******************************");
    String groupDN = "cn=HR,ou=groups,ou=medical-idmsample,o=netiq";
    try
    {
      IRemoteRole stub = getRolesStub(username, password, acceptlanguage);
      Group group = stub.getGroup(groupDN);
      //Assert.assertNotNull("Group not found", group);
      if (group != null)
      {
        System.out.println("Group Found:");
        System.out.println("   entityKey          : " + group.getEntityKey());
        System.out.println("   identityType       : " +
group.getIdentityType().getValue());
        System.out.println("   description        : " + group.getDescription());

        DNString[] roles = group.getAssociatedRoles().getDnstring();
        if (roles != null)
        {
          System.out.println("no of associated roles: " + roles.length);
          for (int rIndex = 0; rIndex < roles.length; rIndex++)
          {
            System.out.println("      role: " + rIndex);
          }
        }
        else
        {
          System.out.println("no of associated roles:0");
        }

        RoleAssignment[] assignments =
group.getRoleAssignments().getRoleassignment();
        PrintRoleUtils.getAssignments(assignments);
      }
      else
        System.out.println("Group not found");
    }
    catch (NrfServiceException nrf)
    {
      throw new Exception(nrf.getMessage());
    }
    catch (RemoteException re)
    {
      throw new Exception(re.getMessage());
    }
  }
```

```
...
 /**
     * Returns the Roles remote stub
     * @param username - user name
     * @param password - password
     * @param acceptLanguage - HTTP header Accept-Language
     * @return the Roles remote stub
     * @throws Exception - catch all exceptions
     */
    public static IRemoteRole getRolesStub(String username,
                                    String password,
                                    String acceptLanguage)
        throws Exception
    {
        Stub stub = null;
        String stubCacheKey = username + ":" + password;
        if (g_rolesStubCache.containsKey(stubCacheKey)) {
            g_log.debug("Using Cached Roles stub for [" + username + "]");
            stub = (Stub) g_rolesStubCache.get(stubCacheKey);
        } else {
            g_log.debug("Using New Roles stub");
            RoleService service = new RoleServiceImpl();
            stub = (Stub) service.getIRemoteRolePort();

            if (username != null && password != null) {
                stub._setProperty(Stub.USERNAME_PROPERTY, username);
                stub._setProperty(Stub.PASSWORD_PROPERTY, password);
            }

            stub._setProperty(Stub.ENDPOINT_ADDRESS_PROPERTY,
ServletParameters.getInstance().getUserAppUrl() + ROLES_SERVICE);
            stub._setProperty(Stub.SESSION_MAINTAIN_PROPERTY, Boolean.TRUE);

            g_rolesStubCache.put(stubCacheKey, stub);
        }

        Properties props = new Properties();
        props.setProperty("Accept-Language", acceptLanguage);
        stub._setProperty(Stub.HTTP_HEADERS, props);

        return (IRemoteRole) stub;
    }
```

Retrieving Role Assignment Request Status

Returns a list of role assignment request status instances given a correlation ID.

```
  public void getRoleAssignmentRequestStatusTestCase()
    throws Exception
  {
    System.out.println("\n***************Calling


getRoleAssignmentRequestStatusTestCase()********************************");
    String correlationId = "9a5feec728864b55ac443724a915e831";
    try
    {
      IRemoteRole stub = getRoleStub(url, username, password);
      RoleAssignmentRequestStatusArray reqArray =
stub.getRoleAssignmentRequestStatus(correlationId);
      RoleAssignmentRequestStatus[] reqStatus =
reqArray.getRoleassignmentrequeststatus();
      //Assert.assertNotNull("RoleAssignmentRequestStatus object is null for


getRoleAssignmentRequestStatus", reqStatus);
      if (reqStatus != null)
        System.out.println(PrintRoleUtils.getRequestStatus(reqStatus));
      else
        System.out.println("RoleAssignmentRequestStatus object is null for


getRoleAssignmentRequestStatus");

      //result += Util.getRequestStatus(reqStatus);
    }
    catch (NrfServiceException nrf)
    {
      throw new Exception(nrf.getMessage());
    }
    catch (RemoteException re)
    {
      throw new Exception(re.getMessage());
    }

  }
```

Retrieving Type Information for a Role Assignment

This example shows how to retrieve the type for a role assignment:

```
  public void getRoleAssignmentTypeInfoTestCase()
    throws Exception
  {
    System.out.println("\n***************Calling


getRoleAssignmentTypeInfoTestCase()********************************");
    try
    {
      IRemoteRole stub = getRoleStub(url, username, password);

      RoleAssignmentTypeInfo info =

stub.getRoleAssignmentTypeInfo(RoleAssignmentType.fromValue("ROLE_TO_ROLE"));
      //Assert.assertNotNull("Role Assignment Type Info Not Found for
getRoleAssignmentTypeInfo", info);
      if (info != null)
      {
        System.out.println("Role Assignment Type Info:");
        System.out.println("           identity type: " +
info.getIdentityType().getValue());
        System.out.println("        subtree included: " +
info.getSubtreeIncluded());
        System.out.println("       suports approvals: " +
info.getSupportsApproval());
        System.out.println("  supports effective date: " +
info.getSupportsEffectiveDate());
        System.out.println("      supports expiration: " +
info.getSupportsExpiration());
        System.out.println("    supports SOD Approval: " +
info.getSupportsSODApproval());
      }
      else
        System.out.println("Role Assignment Type Info Not Found for
getRoleAssignmentTypeInfo");
    }
    catch (NrfServiceException nrf)
    {
      throw new Exception(nrf.getMessage());
    }
    catch (RemoteException re)
    {
      throw new Exception(re.getMessage());
    }

  }
```

Retrieving Role Categories

This example shows how to retrieve the defined role categories:

```
  public void getRoleCategoriesTestCase()
    throws Exception
  {
    System.out.println("\n****************Calling
getRoleCategoriesTestCase()********************************");
    try
    {
      IRemoteRole stub = getRoleStub(url, username, password);
      CategoryArray entriesArray = stub.getRoleCategories();
      Category[] entries = entriesArray.getCategory();
      Assert.assertNotNull("No categories found.", entries);
      if (entries != null)
      {
        System.out.println("no of categories:" + entries.length);

        for (int i = 0; i < entries.length; i++)
        {
          System.out.println("   category key  : " + entries[i].getCategoryKey());
         System.out.println("   category label: " + entries[i].getCategoryLabel());
        }
      }
      else
        System.out.println("No categories found.");
    }
    catch (NrfServiceException nrf)
    {
      throw new Exception(nrf.getMessage());
    }
    catch (RemoteException re)
    {
      throw new Exception(re.getMessage());
    }

  }
```

Retrieving Role Levels

This example shows how to retrieve the defined role levels:

```
  public void getRoleLevelsTestCase()
    throws Exception
  {
    System.out.println("\n***************Calling
getRoleLevelsTestCase()*******************************");
    try
    {
      IRemoteRole stub = getRoleStub(url, username, password);
      RoleLevelArray roleLevelArray = stub.getRoleLevels();
      RoleLevel[] entries = roleLevelArray.getRolelevel();
      //Assert.assertNotNull("No role levels found.", entries);
      if (entries != null)
      {
        System.out.println("no of levels:" + entries.length);

        for (int index = 0; index < entries.length; index++)
        {
          System.out.println("   Level      : " + entries[index].getLevel());
          System.out.println("   Name       : " + entries[index].getName());
          System.out.println("   Description: " + entries[index].getDescription());
          System.out.println("   Container  : " + entries[index].getContainer());
        }
      }
      else
        System.out.println("No role levels found.");
    }
    catch (NrfServiceException nrf)
    {
      throw new Exception(nrf.getMessage());
    }
    catch (RemoteException re)
    {
      throw new Exception(re.getMessage());
    }

  }
```

Verifying Whether a User Is In a Role

This example shows how to determine whether a user has been assigned to a role:

```
  public void isUserInRoleTestCase()
    throws Exception
  {
    System.out.println("\n****************Calling
isUserInRoleTestCase()*******************************");
    String[] DNs = {
                "cn=ablake,ou=users,ou=medical-idmsample,o=netiq",

"cn=Doctor,cn=Level20,cn=RoleDefs,cn=RoleConfig,cn=AppConfig,cn=HajenDriver,cn=Tes
tDrivers,o=netiq"
                };
    try
    {
      IRemoteRole stub = getRoleStub(url, username, password);
      boolean inRole = stub.isUserInRole(DNs[0], DNs[1]);

      String sInRole = "User Not In Role";
      if (inRole)
        sInRole = new String("User In Role");

      System.out.println(sInRole);
    }
    catch (NrfServiceException nrf)
    {
      throw new Exception(nrf.getMessage());
    }
    catch (RemoteException re)
    {
      throw new Exception(re.getMessage());
    }

  }
```

25 Resource Web Service

This section describes the Resource Web Service, which allows SOAP clients to invoke a subset of actions that apply to resources.

About the Resource Web Service

The Resource Web Service exposes a small set of actions for the resource model. The service allows remote clients to request that a resource be granted or revoked, and also to check on the status of resource requests. By exposing these actions, the service makes it possible for a provisioning workflow to invoke resource requests through the Integration activity.

Calls to the Resource Web Service calls require HTTP authentication. By default, access to the resource service methods is restricted to Resource Administrators.

Accessing the Test Page

You can access the Resource Web Service endpoint using a URL similar to the following:

`http://`*`server`*`:`*`port`*`/`*`warcontext`*`/resource/service?test`

For example, if your server is named “myserver”, your User Application is listening on port 8080, and your User Application war file is named “IDMPROV”, the URL would be:

```
http://myserver:8080/IDMPROV/resource/service?test
```

WARNING: The test page is disabled by default. Since some of the methods allow data to be updated, the test page presents a potential security vulnerability and should not be allowed in a production environment.

Servlet declaration for the Resource Service

A SOAP service using WSSDK is deployed by adding the following declarations in the deployment descriptor (i.e. WEB-INF/web.xml):

```
<servlet>
  <servlet-name>Resource</servlet-name>
  <servlet-
class>com.novell.idm.nrf.soap.ws.role.impl.ResourceServiceSkeletonImpl</servlet-
class>

<servlet-mapping>
  <servlet-name>Resource</servlet-name>
  <url-pattern>/resource/service</url-pattern>
</servlet-mapping>
</servlet>
```

This follows the normal servlet declaration pattern. It indicates that the servlet com.novell.idm.nrf.soap.ws.resource.impl.ResourceServiceSkeletonImpl is deployed at /resource/service.

When a user reaches this servlet using a HTTP GET by entering `http://`*`server-name/context/`*`resource/service` (for example, `http://localhost:8080/IDMProv/resource/service`) in their browser, the WSSDK provides a page that exposes some information about the deployed service.

Enabling the Test Page

WARNING: The test page is disabled by default. Since some of the methods allow data to be updated, the test page presents a potential security vulnerability and should not be allowed in a production environment.

To enable the test page, you need to update the WEB-INF/web.xml file in the IDMProv.war file. Before you make your changes, the web.xml should look like this:

```
<servlet>
  <servlet-name>Resource</servlet-name>
  <servlet-
class>com.novell.idm.nrf.soap.ws.resource.impl.ResourceServiceSkeletonImpl</
servlet-class>
  <init-param>
    <param-name>com.novell.soa.ws.test.disable</param-name>
    <param-value>true</param-value>
  </init-param>
</servlet>
```

Change the servlet declaration, as follows:

```
<servlet>
  <servlet-name>Resource</servlet-name>
  <servlet-
class>com.novell.idm.nrf.soap.ws.resource.impl.ResourceServiceSkeletonImpl</
servlet-class>
  <init-param>
    <param-name>com.novell.soa.ws.test.disable</param-name>
    <param-value>false</param-value>
  </init-param>
</servlet>
```

Accessing the WSDL

You can access the WSDL for the Resource Web Service using a URL similar to the following:

`http://`*`server`*`:`*`port`*`/`*`warcontext`*`/resource/service?wsdl`

For example, if your server is named “myserver”, your User Application is listening on port 8080, and your User Application war file is named “IDMPROV”, the URL would be:

```
http://myserver:8080/IDMPROV/resource/service?wsdl
```

Generating the Stub Classes

Before using the Web Service, you need to use the WSSDK tool or another SOAP tool kit to generate the stub classes. To allow your code to find the stub classes, you also need to add the JAR that contains the stub classes to your classpath.

If you want to use the NetIQ WSSDK tool, you can generate the client stubs by extracting the WSDL and running the wsdl2java utility. For example, you could run this command to generate the stubs in a package called com.novell.soa.af.resource.soap.impl:

```
"C:\Program Files\Java\jdk1.6.0_31\bin\java" -cp "../lib/wssdk.jar;../lib/jaxrpc-
api.jar";"../lib/mail.jar";"../lib/activation.jar";"c:\Program
Files\Java\jdk1.6.0_31\lib\tools.jar"; com.novell.soa.ws.impl.tools.wsdl2java.Main
-verbose -ds gensrc -d C:\ -noskel -notie -genclient -keep -package
com.novell.soa.af.resource.soap.impl -javadoc resource.wsdl
```

You can change the wsdl2java parameters to suit your requirements.

Removing Administrator Credential Restrictions

The Resource Web Service supports two levels of security, one that restricts access to Resource Administrators, and another that restricts access to the authenticated user. The default setting restricts access to all operations to the Resource Administrator.

You can modify the settings for security configuration in the `ism-configuration.properties` file, located by default in the `/netiq/idm/apps/tomcat/conf` directory. Each property can be set to true or false. A value of true locks down the operation, whereas a value of false opens up the operation.

You can open up the Resource Web Service to authenticated users by setting the ResourceService/Resource/soap property to false. To open up a particular operation to authenticated users, you need to set the property for that operation (ResourceService/Resource/soap/*operation*) to false as well. If you set all of the properties to false, you can open up all operations to authenticated users. The *operation* names are the same as the names of the methods supported by the service.

The following methods can be invoked by users without Resource Administrator credentials if the property ResourceService/Resource/soap property is set to false:

- requestResourceGrant
- requestResourceRevoke
- getResourceRequestStatusByCorrelationId
- getResourceRequestStatusForCurrentUser
- getResourceAssignmentsForCurrentUser

If you wish to change the restriction for a particular operation, you can modify the property ResourceService/Resource/soap/operation for the method, setting its value to true to restrict access to administrators for the operation and false to remove the restriction. If the ResourceService/Resource/soap property is true, all methods are restricted to Resource Administrator credentials.

Example To ensure that the security configuration opens up all operations within the Resource Web Service, except for the getResourceRequestStatusByIdentity operation, which would only be accessible to the Resource Administrator, the `ism-configuration.properties` must have the following settings:

```
ResourceService/Resource/soap = false
 ResourceService/Resource/soap/requestResourceGrant = false
 ResourceService/Resource/soap/requestResourceRevoke = false
 ResourceService/Resource/soap/getResourceRequestStatusByCorrelationId = false
 ResourceService/Resource/soap/getResourceRequestStatusForCurrentUser = false
 ResourceService/Resource/soap/getResourceRequestStatusByIdentity = true
```

Resource Web Service Interface

This section provides details about the methods available with the Resource Web service. This programming interface presumes you're using Java code generated by the WSSDK toolkit. The interface will be different if you're using another Web Service toolkit.

IRemoteResource

This section provides reference information for each method associated with the IRemoteResource interface.

checkCodeMapValueStatus

Checks to see if a particular value exists in the code map table for a specified entitlement and logical system. The method returns the status for the code map value as a CodeMapValueStatus object.

This method is one of three SOAP endpoints to help you keep the code map tables for the Roles Based Provisioning Module synchronized with the code map tables for the Role Mapping Administrator. The user interface for the Role Mapping Administrator can trigger a code map refresh if a mismatch is discovered while a user is creating mappings. In addition, the Roles Based Provisioning Module allows you to use the three SOAP endpoints to refresh selected entitlements within its code map tables.

In addition to checkCodeMapValueStatus, the Roles Based Provisioning Module includes the following endpoints to help with code map synchronization:

- getRefreshStatus
- refreshCodeMap

The **Entitlement Query Settings** section of the **Configure Roles and Resources Settings** page in the User Application allows you to specify how often the Roles Based Provisioning Module code map tables are refreshed and also start a manual refresh. However, this page does not allow to refresh selected entitlements. To control which entitlements are refreshed, you need to use the SOAP endpoints.

For additional information on the getRefreshStatus endpoint, see "getRefreshStatus" on page 481. For additional information on the refreshCodeMap endpoint, see "refreshCodeMap" on page 486.

For code samples that use the new methods for code map synchronization, see "Code Map Synchronization Code Samples" on page 506.

Syntax: Here is the method signature:

```
public CodeMapValueStatus checkCodeMapValueStatus(String entitilementDN, String
connectionName, String codeMapValue)
       throws NrfServiceException, RemoteException;
```

The parameters are described below:

- *entitlementDN* entitlement DN as a string.

  For example:

  ```
  cn=groups,cn=groupentitlementloopback,cn=driverset1,o=system
  ```

- *connectionName* connection (logical system) name. This is an optional parameter. Only fanout drivers need to specify the connection name.
- *codeMapValue* code map value to verify.

  For example:

  ```
  \TEST1\data\groups\netiq\cambridge\rbpm\4AlphaGroup
  ```

SOAP Request: Here is the SOAP request:

```
<soapenv:Envelope xmlns:soapenv="http://schemas.xmlsoap.org/soap/envelope/"
xmlns:ser="http://www.netiq.com/resource/service">
<soapenv:Header/>
<soapenv:Body>
<ser:checkCodeMapValueStatusRequest>
<!--Optional:-->
<ser:entitilementDN>cn=groups,cn=groupentitlementloopback,cn=driverset1,o=system</
ser:entitilementDN>
<!--Optional:-->
<ser:connectionName/>
<!--Optional:-->
<ser:codeMapValue>\WILLIAMS1\data\groups\netiq\cambridge\rbpm\4AlphaGroup</
ser:codeMapValue>
</ser:checkCodeMapValueStatusRequest>
</soapenv:Body>
</soapenv:Envelope>
```

SOAP Response: Here is the SOAP response:

```
<SOAP-ENV:Envelope xmlns:SOAP-ENV="http://schemas.xmlsoap.org/soap/envelope/"
xmlns:xsd="http://www.w3.org/2001/XMLSchema" xmlns:xsi="http://www.w3.org/2001/
XMLSchema-instance">
<SOAP-ENV:Body>
<ns1:checkCodeMapValueStatusResponse xmlns="http://www.netiq.com/resource/service"
xmlns:ns1="http://www.netiq.com/resource/service">
<result>
<refreshStatus>
<connectionName xsi:nil="1"/>
<entitlementDN>cn=groups,cn=groupentitlementloopback,cn=driverset1,o=system</
entitlementDN>
<guid>\2d\13\d1\a4\7b\99\d6\4c\03\9a\2d\13\d1\a4\7b\99</guid>
<lastRefresh>1329431650891</lastRefresh>
<status>SUCCESS</status>
</refreshStatus>
<upToDate>true</upToDate>
<value>\WILLIAMS1\data\groups\netiq\cambridge\rbpm\4AlphaGroup</value>
</result>
</ns1:checkCodeMapValueStatusResponse>
</SOAP-ENV:Body>
</SOAP-ENV:Envelope>
```

createResource

Creates a new resource according to the specified parameters, and returns a DN of the created resource.

A correlation ID is generated automatically for this method that uses this format:

```
UserApp#RemoteResourceRequest#xxxxxxxx-xxxx-xxxx-xxxx-xxxxxxxxxxxx
```

The correlation ID is used for auditing.

Syntax: Here is the method signature:

```
public String createResource(Resource resource)
            throws NrfServiceException, RemoteException;
```

The parameters are described below:

- *resource* specifies the resource object to create.

createResourceAid

Creates a new resource, with a correlation ID that you provide. The correlation ID is used for auditing to link a set of related resources. This method creates the resource according to the specified parameters, and returns a DN of the created resource.

Syntax: Here is the method signature:

```
public String createResourceAid(Resource resource, String correlationId)
            throws NrfServiceException, RemoteException;
```

findResourceByExampleWithOperator

Finds all Resource objects based on the search criteria specified in the given Resource object.

Syntax: Here is the method signature:

```
public Resource[] findResourceByExampleWithOperator(Resource searchCriteria,
boolean useAndForMultiValueSearch)
            throws NrfServiceException, RemoteException;
```

The parameters are described below:

- *searchCriteria* specifies Query by Example (QBE) search criteria within a Resource object.
- *useAndForMultiValueSearch* determines whether AND or OR will be used for multi-value search expressions. If you specify a value of true, AND will be used for multi-value searches; if you specify a value of false, OR will be used.

getEntitlementCodeMap

Returns an array of ProvisioningCodeMap objects, which include code map information from the code map and code map label tables.

Syntax: Here is the method signature:

```
ProvisioningCodeMap[] getEntitlementCodeMap(java.lang.String codeMapKey, int type)
        throws com.novell.idm.nrf.soap.ws.resource.NrfServiceException,
java.rmi.RemoteException;
```

The parameters are described below:

- *codeMapKey* specifies the code map key to retrieve values from. The codeMapKey is a GUID that acts as a unique identifier for the code map. For example:

  ```
  \2d\13\d1\a4\7b\99\d6\4c\03\9a\2d\13\d1\a4\7b\99
  ```

- *type* specifies the code map type. A value of 0 filters the list to include entitlement code maps only.

getRefreshStatus

Gets the refresh status of a code map based on a specified entitlement DN. This method returns the status as an array of CodeMapRefreshStatus objects. The structure returned contains the DN, GUID, connection name status, and last refresh time.

This method is one of three SOAP endpoints to help you keep the code map tables for the Roles Based Provisioning Module synchronized with the code map tables for the Role Mapping Administrator. The user interface for the Role Mapping Administrator can trigger a code map refresh if a mismatch is discovered while a user is creating mappings. In addition, the Roles Based Provisioning Module allows you to use the three SOAP endpoints to refresh selected entitlements within its code map tables.

In addition to getRefreshStatus, the Roles Based Provisioning Module includes the following endpoints to help with code map synchronization:

- checkCodeMapValueStatus
- refreshCodeMap

The **Entitlement Query Settings** section of the **Configure Roles and Resources Settings** page in the User Application allows you to specify how often the Roles Based Provisioning Module code map tables are refreshed and also start a manual refresh. However, this page does not allow to refresh selected entitlements. To control which entitlements are refreshed, you need to use the SOAP endpoints.

For additional information on the checkCodeMapValueStatus endpoint, see "checkCodeMapValueStatus" on page 478. For additional information on the refreshCodeMap endpoint, see "refreshCodeMap" on page 486.

For code samples that use the new methods for code map synchronization, see "Code Map Synchronization Code Samples" on page 506.

Syntax: Here is the method signature:

```
 public CodeMapRefreshStatus[] getRefreshStatus(String entitlementDN)
           throws NrfServiceException, RemoteException;
```

The parameters are described below:

- *entitlementDN* entitlement DN as a string

  For example:

  ```
  cn=groups,cn=groupentitlementloopback,cn=driverset1,o=system
  ```

SOAP Request: Here is the SOAP request:

```
<soapenv:Envelope xmlns:soapenv="http://schemas.xmlsoap.org/soap/envelope/"
xmlns:ser="http://www.netiq.com/resource/service">
<soapenv:Header/>
<soapenv:Body>
<ser:getRefreshStatusRequest>
<!--Optional:-->
<ser:entitlementDN>cn=groups,cn=groupentitlementloopback,cn=driverset1,o=system</
ser:entitlementDN>
</ser:getRefreshStatusRequest>
</soapenv:Body>
</soapenv:Envelope>
```

SOAP Response: Here is the SOAP response:

```
<SOAP-ENV:Envelope xmlns:SOAP-ENV="http://schemas.xmlsoap.org/soap/envelope/"
xmlns:xsd="http://www.w3.org/2001/XMLSchema" xmlns:xsi="http://www.w3.org/2001/
XMLSchema-instance">
<SOAP-ENV:Body>
<ns1:getRefreshStatusResponse xmlns="http://www.netiq.com/resource/service"
xmlns:ns1="http://www.netiq.com/resource/service">
<result>
<codemaprefreshstatus>
<connectionName xsi:nil="1"/>
<entitlementDN>cn=groups,cn=groupentitlementloopback,cn=driverset1,o=system</
entitlementDN>
<guid>\2d\13\d1\a4\7b\99\d6\4c\03\9a\2d\13\d1\a4\7b\99</guid>
<lastRefresh>1329100366090</lastRefresh>
<status>SUCCESS</status>
</codemaprefreshstatus>
</result>
</ns1:getRefreshStatusResponse>
</SOAP-ENV:Body>
</SOAP-ENV:Envelope>
```

getResourceAssignmentsForCurrentUser

Returns the resource assignments for the current user.

Syntax: Here is the method signature:

```
ResourceAssignment[] getResourceAssignmentsForCurrentUser()
        throws com.novell.idm.nrf.soap.ws.resource.NrfServiceException,
java.rmi.RemoteException;
```

getResourceAssignmentsForUser

Returns the resource assignments for a particular user.

Syntax: Here is the method signature:

```
ResourceAssignment[] getResourceAssignmentsForUser(java.lang.String userDn)
        throws com.novell.idm.nrf.soap.ws.resource.NrfServiceException,
java.rmi.RemoteException;
```

The parameters are described below:

- *userDn* DN of the target user

getAssignmentsForResource

Returns the resource assignments for a particular resource.

Syntax: Here is the method signature:

```
ResourceAssignment[] getAssignmentsForResource(java.lang.String resourceDn)
        throws com.novell.idm.nrf.soap.ws.resource.NrfServiceException,
java.rmi.RemoteException;
```

The parameters are described below:

- *resourceDn* DN of the target resource

getResourceRequestStatusByCorrelationId

Returns all resource request status items for a given correlation ID.

Syntax: Here is the method signature:

```
public ResourceAssignmentRequestStatus[]
           getResourceRequestStatusByCorrelationId
                   (String correlationId, String locale)
               throws NrfServiceException, RemoteException;
```

The parameters are described below:

- *correlationId* specifies a resource assignment request correlation ID.
- *locale* supplies an iso639 language code to format localized string values; if the parameter is null, the language defaults to the servlet request locale.

This method returns all resource request status instances for the specified *correlationId* parameter value. For more information on the ResourceAssignmentRequestStatus class, see "ResourceAssignmentRequestStatus" on page 503.

getResourceRequestsStatusForCurrentUser

Returns all resource request status items for the authenticated user.

Syntax: Here is the method signature:

```
 public ResourceAssignmentRequestStatus[]
                  getResourceRequestStatusForCurrentUser(String locale)
               throws NrfServiceException, RemoteException;
```

The parameters are described below:

- *locale* supplies an iso639 language code to format localized string values; if the parameter is null, the language defaults to the servlet request locale.

This method returns all resource request status instances for the specified *correlationId* parameter value. For more information on the ResourceAssignmentRequestStatus class, see "ResourceAssignmentRequestStatus" on page 503.

getResourceRequestStatusByIdentity

Returns all resource assignment request status items for a particular user identity.

Syntax: Here is the method signature:

```
public ResourceAssignmentRequestStatus[]
           getResourceRequestStatusByIdentity(String identity, String locale)
        throws NrfServiceException, RemoteException;
```

The parameters are described below:

- *identity* specifies the DN for a user.
- *locale* supplies an iso639 language code to format localized string values; if the parameter is null, the language defaults to the servlet request locale.

This method returns all resource request status instances for the specified *correlationId* parameter value. For more information on the ResourceAssignmentRequestStatus class, see "ResourceAssignmentRequestStatus" on page 503.

getCodeMapValues

Returns a list of code map values for a specified code map.

Syntax: Here is the method signature:

```
public CodeMapValue[] getCodeMapValues(String codeMapKey, String locale)
            throws NrfServiceException, RemoteException;
```

The parameters are described below:

- *codeMapKey* specifies the code map key to retrieve values from. The codeMapKey is a GUID that acts as a unique identifier for the code map. For example:

  ```
  \2d\13\d1\a4\7b\99\d6\4c\03\9a\2d\13\d1\a4\7b\99
  ```

- *locale* supplies an iso639 language code to format localized string values; if the parameter is null, the language defaults to the servlet request locale.

getResource

Returns a resource object.

Syntax: Here is the method signature:

```
 public Resource getResource(String dn, String locale)
            throws NrfServiceException, RemoteException;
```

The parameters are described below:

- *dn* specifies the DN of the resource you want to retrieve.
- *locale* supplies an iso639 language code to format localized string values; if the parameter is null, the language defaults to the servlet request locale.

getResourceLocalizedStrings

Gets the localized strings for a resource, such as the names and descriptions. The type parameter lets you specify whether the names or descriptions should be retrieved.

Syntax: Here is the method syntax:

```
public LocalizedValue[] getResourceLocalizedStrings(String resourceDn, int
type)throws NrfServiceException, RemoteException;
```

The parameters are described below:

- *resourceDn* specifies the DN of the resource for which you want to get the localized strings.
- *type* specifies the type of localized strings you want to retrieve. A type value of 1 retrieves a list of names for the resource, whereas a type value of 2 retrieves a list of descriptions.

getResourcessInfoByCategory

Returns a list of ResourceInfo instances given a list of category keys.

Syntax: Here is the method signature:

```
public ResourceInfo[] getResourcessInfoByCategory(CategoryKey[]
resourceCategoryKeys)
            throws NrfServiceException, RemoteException;
```

The parameters are described below:

- *resourceCategoryKeys* specifies the list of resource category keys to retrieve resource information objects for.

getResourcessInfo

Returns a list of ResourceInfo instances given a list of resource DNs.

Syntax: Here is the method signature:

```
public ResourceInfo[] getResourcessInfo(DNString[] resDns)
            throws NrfServiceException, RemoteException;
```

The parameters are described below:

- *resDns* provides a list of resource DNs for which you want to retrieve resource information objects.

modifyResource

Modifies a resource definition. This method does not perform a localized string modification update. To update the localized names or descriptions for a resource, you need to use the setResourceLocalizedStrings method.

A correlation ID is generated automatically for this method that uses this format:

```
UserApp#RemoteResourceRequest#xxxxxxxx-xxxx-xxxx-xxxx-xxxxxxxxxxxx
```

Syntax: Here is the method signature:

```
public Resource modifyResource(Resource resource)
            throws NrfServiceException, RemoteException;
```

The parameters are described below:

- *resource* specifies the resource object to modify.

modifyResourceAid

Modifies a resource definition, with a correlation ID that you provide. The correlation ID is used for auditing to link a set of related resources. This method does not perform a localized string modification update. To update the localized names or descriptions for a resource, you need to use the setResourceLocalizedStrings method.

Syntax: Here is the method signature:

```
public Resource modifyResourceAid(Resource resource, String correlationId)
            throws NrfServiceException, RemoteException;
```

refreshCodeMap

Refreshes the code map based on a specified entitlement DN. The method returns the status of the refresh operation in the form of an EntitlementRefreshInfo object. This structure includes the detailed status as an array of CodeMapRefreshStatus objects.

This method is one of three SOAP endpoints to help you keep the code map tables for the Roles Based Provisioning Module synchronized with the code map tables for the Role Mapping Administrator. The user interface for the Role Mapping Administrator can trigger a code map refresh if a mismatch is discovered while a user is creating mappings. In addition, the Roles Based Provisioning Module allows you to use the three SOAP endpoints to refresh selected entitlements within its code map tables.

In addition to refreshCodeMap, the Roles Based Provisioning Module includes the following endpoints to help with code map synchronization:

- checkCodeMapValueStatus
- getRefreshStatus

The **Entitlement Query Settings** section of the **Configure Roles and Resources Settings** page in the User Application allows you to specify how often the Roles Based Provisioning Module code map tables are refreshed and also start a manual refresh. However, this page does not allow you to refresh selected entitlements. To control which entitlements are refreshed, use the SOAP endpoints.

For additional information on the checkCodeMapValueStatus endpoint, see "checkCodeMapValueStatus" on page 478. For additional information on the getRefreshStatus endpoint, see "getRefreshStatus" on page 481.

For code samples that use the new methods for code map synchronization, see "Code Map Synchronization Code Samples" on page 506.

Syntax: Here is the method signature:

```
public EntitlementRefreshInfo refreshCodeMap(String entitlementDN rbpm-refresh-
rate="value" freeform-param="value")
           throws NrfServiceException, RemoteException;
```

The parameters are described below:

- *entitlementDN* entitlement DN to refresh the code map

  For example:

  ```
  cn=groups,cn=groupentitlementloopback,cn=driverset1,o=system
  ```

- `rbpm-refresh-rate` allows you to control the automatic or manual rate at which the entitlement is refreshed. Specify `0` to disable automatic refreshing. Specify `-111111` to disable both automatic and manual refreshing.
- `freeform-param` allows you to control whether the code map refresh removes entries from the database when the entitlement type is valued and the values were loaded directly into the database. Specify `false` if you do not want the refresh to remove the values from the database. Specify `true` if you want the refresh to remove the values from the database. The default value is `true`.

SOAP Request: Here is the SOAP request:

```
<soapenv:Envelope xmlns:soapenv="http://schemas.xmlsoap.org/soap/envelope/"
xmlns:ser="http://www.netiq.com/resource/service">
<soapenv:Header/>
<soapenv:Body>
<ser:refreshCodeMapRequest>
<!--Optional:-->
<ser:entitlementDN>cn=groups,cn=groupentitlementloopback,cn=driverset1,o=system</
ser:entitlementDN>
</ser:refreshCodeMapRequest>
</soapenv:Body>
</soapenv:Envelope>
```

SOAP Response: Here is the SOAP request:

```
<SOAP-ENV:Envelope xmlns:soapenv="http://schemas.xmlsoap.org/soap/envelope/"
xmlns:xsd="http://www.w3.org/2001/XMLSchema" xmlns:xsi="http://www.w3.org/2001/
XMLSchema-instance">
   <SOAP-ENV:Body>
      <ns1:refreshCodeMapResponse xmlns="http://www.netiq.com/resource/service"
xmlns:ns1="http://www.netiq.com/resource/service">
         <result>
            <detailedStatus>
               <codemaprefreshstatus>
                  <connectionName xsi:nil="1"/>

<entitlementDN>cn=groups,cn=groupentitlementloopback,cn=driverset1,o=system</
entitlementDN>
                  <guid>\2d\13\d1\a4\7b\99\d6\4c\03\9a\2d\13\d1\a4\7b\99</guid>
                  <lastRefresh>1329244784180</lastRefresh>
                  <status>SUCCESS</status>
               </codemaprefreshstatus>
            </detailedStatus>

<entitlementDN>cn=groups,cn=groupentitlementloopback,cn=driverset1,o=system</
entitlementDN>
            <guid>\2d\13\d1\a4\7b\99\d6\4c\03\9a\2d\13\d1\a4\7b\99</guid>
            <status>true</status>
         </result>
      </ns1:refreshCodeMapResponse>
   </SOAP-ENV:Body>
</SOAP-ENV:Envelope>
```

removeResource

Deletes a specified resource from the Resource Catalog. Returns the DN for the deleted resource as a confirmation.

A correlation ID is generated automatically for this method that uses this format:

```
UserApp#RemoteResourceRequest#xxxxxxxx-xxxx-xxxx-xxxx-xxxxxxxxxxxx
```

The correlation ID is used for auditing.

Syntax: Here is the method signature:

```
 public DNString removeResource(DNString resourceDn)
            throws NrfServiceException, RemoteException;
```

The parameters are described below:

- *resourceDn* specifies the DN of the resource to delete.

removeResourceAid

Deletes a specified resource from the Resource Catalog, with a correlation ID that you provide. The correlation ID is used for auditing to link a set of related resources. This method returns the DN for the deleted resource as a confirmation.

Syntax: Here is the method signature:

```
 public DNString removeResourceAid(DNString resourceDn, String correlation Id)
            throws NrfServiceException, RemoteException;
```

requestResourceGrant

Makes a grant resource request and returns a resource request correlation ID.

Syntax: Here is the method signature:

```
public String requestResourceGrant(String resourceTarget, String requester, String
userTarget, String reasonForRequest,
        ResourceRequestParam[] requestParams, String correlationId)
            throws NrfServiceException, RemoteException;
```

The parameters are described below:

- *resourceTarget* specifies the target resource DN.
- *requester* supplies an identifier for the remote client application making the request to grant the resource.

  The *requester* parameter on this SOAP endpoint identifies the originator of the request. This value is set in the resource request object nrfOriginator attribute, following this convention:
  - For a SOAP call: “REMOTE_CLIENT:<*requester param value*>”
  - For a workflow action: “WF:<*wf process id*>”
  - For the user application user interface: “USER_APP”
- *userTarget* specifies the DN for the being granted the resource.
- *reasonForRequest* provides a reason for the request.
- *requestParams* provides the parameter values for the request.
- *correlationId* specifies a resource assignment request correlation ID; if the parameter is null, a correlation ID is generated.

The *requester* parameter is a client-supplied identifier for the agent making the request. For example, an identifier such as *IRemote-MyApplicationName* might be used to identify a request from MyApplicationName. The *requestParams* are the dynamic parameter values required by the resource to make a request. If no values are required, the parameter value can be null or an empty array. The *correlationId* allows a client to group request for the purpose of checking the staus. If the parameter value is null, the service generates a unique correlation id. The correlation id is returned to the caller.

requestResourceRevoke

Makes a revoke resource request and returns a resource request correlation ID.

The revoke invocation behavior mirrors the behavior for a grant opeation, except that a revoke request for the resource is posted on the server.

Syntax: Here is the method signature:

```
public String requestResourceRevoke(String resourceTarget,
           String requester, String userTarget, String reasonForRequest,
           ResourceRequestParam[] requestParams, String instanceGuid, String
correlationId)
        throws NrfServiceException, RemoteException;
```

The parameters are described below:

- *resourceTarget* specifies the target resource DN.
- *requester* supplies an identifier for the remote client application making the request to revoke the resource.

  The *requester* parameter on this SOAP endpoint identifies the originator of the request. This value is set in the resource request object nrfOriginator attribute, following this convention:

  - For a SOAP call: “REMOTE_CLIENT:<*requester param value*>”
  - For a workflow action: “WF:<*wf process id*>”
  - For the user application user interface: “USER_APP”
- *userTarget* specifies the DN for the user being granted the resource.
- *reasonForRequest* provides a reason for the request.
- *requestParams* provides the parameter values for the request.
- *instanceGuid* provides a GUID identifier for the resource assignment instance. The resource assignment instance GUID supports revoking a single instance of a multi-value resource assignment, if not all instances are to be revoked.

  IMPORTANT: If you do not specify the instanceGuid value, and the user has more than one value of that resource assigned, all instances of the resource assignment will be removed.

  When you create a new resource assignment request, the instanceGuid is included just above the correlationid field:

  ```
  <ser:instanceGuid></ser:instanceGuid>
  ```

  You need to specify the instance of the resource you want to revoke by supplying the value in the *instanceGuid* parameter.

  To find out which resources are assigned to a user, you need to use the getResourceAssignmentsForUser method. This method returns the following data structure, which also includes the instanceGuid:

```
<resourceassignment>
               <instanceGuid>1b335aa9f4a14bd4a2a802eb4ba092da</instanceGuid>
               <reason>3b-Test</reason>
               <recipientDn>cn=ablake,ou=users,o=data</recipientDn>
               <requestDate>2011-08-18T14:25:21</requestDate>
               <requestParams>
                  <resourcerequestparam>
                     <name>param1</name>
                     <value>3a3a</value>
                  </resourcerequestparam>
               </requestParams>
               <requesterDn>cn=uaadmin,ou=sa,o=data</requesterDn>

<resourceDn>cn=Vodacom,cn=ResourceDefs,cn=RoleConfig,cn=AppConfig,cn=User
Application Driver,cn=driverset1,o=system</resourceDn>
 </resourceassignment>
```

- *correlationId* specifies a resource assignment request correlation ID; if the parameter is null, a correlation ID is generated.

setResourceLocalizedStrings

Sets the localized strings for a resource, such as the names and descriptions.

A correlation ID is generated automatically for this method that uses this format:

```
UserApp#RemoteResourceRequest#xxxxxxxx-xxxx-xxxx-xxxx-xxxxxxxxxxxx
```

Syntax: Here is the method signature:

```
public LocalizedValue[] setResourceLocalizedStrings(String resourceDn,
LocalizedValue[] locStrings, int type)
            throws NrfServiceException, RemoteException;
```

The parameters are described below:

- *resourceDn* specifies the DN of the resource for which you want to set the localized strings.
- *locStrings* provides an array of localized strings you want to define.
- *type* specifies the type of localized strings you want to retrieve. A type value of 1 retrieves a list of names for the resource, whereas a type value of 2 retrieves a list of descriptions.

setResourceLocalizedStringsAid

Sets the localized strings for a resource, such as the names and descriptions, with a correlation ID that you provide. The correlation ID is used for auditing to link a set of related resources.

Syntax: Here is the method signature:

```
public LocalizedValue[] setResourceLocalizedStringsAid(String resourceDn,
LocalizedValue[] locStrings, int type, String correlationId)
            throws NrfServiceException, RemoteException;
```

CodeMapRefreshStatus

Supporting class that provides details about the status of a code map refresh.

getConnectionName

Returns the name of the connected system.

Syntax: Here is the method signature:

```
public String getConnectionName()
```

getEntitlementDN

Returns the DN for the entitlement.

Syntax: Here is the method signature:

```
public String getEntitlementDN()
```

getGuid

Returns the GUID for the entitlement.

Syntax: Here is the method signature:

```
public String getGuid()
```

getLastRefresh

Returns the timestamp for the last refresh.

Syntax: Here is the method signature:

```
public long getLastRefresh()
```

getStatus

Returns the refresh status as a string indicating whether the refresh was successful.

Syntax: Here is the method signature:

```
public String getStatus()
```

setConnectionName

Sets the name of the connection system.

Syntax: Here is the method signature:

```
public void setConnectionName(final String connectionName)
```

setEntitlementDN

Sets the entitlement DN.

Syntax: Here is the method signature:

```
public void setEntitlementDN(String entitlementDN)
```

setGuid

Sets the GUID for the entitlement.

Syntax: Here is the method signature:

```
public void setGuid(String guid)
```

setLastRefresh

Sets the last refresh timestamp.

Syntax: Here is the method signature:

```
public void setLastRefresh(final long lastRefresh)
```

setStatus

Sets the refresh status.

Syntax: Here is the method signature:

```
public void setStatus(String status)
```

CodeMapValueStatus

Supporting class that provides details about the status of a refresh for a code map value.

getUpToDate

Returns true or false to indicate whether the status is up-to-date.

Syntax: Here is the method signature:

```
public boolean getUpToDate()
```

getRefreshStatus

Returns the refresh status as a CodeMapRefreshStatus object.

Syntax: Here is the method signature:

```
public CodeMapRefreshStatus getRefreshStatus()
```

getValue

Gets the code map value.

Syntax: Here is the method signature:

```
public String getValue()
```

setRefreshStatus

Sets the refresh as a CodeMapRefreshStatus object.

Syntax: Here is the method signature:

```
public void setRefreshStatus(final CodeMapRefreshStatus refreshStatus)
```

setUpToDate

Sets a boolean indicating whether the status is up-to-date.

Syntax: Here is the method signature:

```
public void setUpToDate(final boolean upToDate)
```

setValue

Sets the code map value.

Syntax: Here is the method signature:

```
public void setValue(final String value)
```

EntitlementRefreshInfo

Supporting class that provides refresh information for an entitlement after a code map refresh has been performed.

getDetailedStatus

Returns the detailed status as an array of CodeMapRefreshStatus objects.

Syntax: Here is the method signature:

```
public CodeMapRefreshStatus[] getDetailedStatus()
```

getEntitlementDN

Returns the DN for the entitlement.

Syntax: Here is the method signature:

```
public String getEntitlementDN()
```

getGuid

Returns the GUID for the entitlement.

Syntax: Here is the method signature:

```
public String getGuid()
```

getStatus

Returns the status of the refresh as a boolean flag.

Syntax: Here is the method signature:

```
public boolean getStatus()
```

setDetailedStatus

Sets the detailed status as an array of CodeMapRefreshStatus objects.

Syntax: Here is the method signature:

```
public void setDetailedStatus(final CodeMapRefreshStatus[] detailedStatus)
```

setEntitlementDN

Sets the DN for the entitlement.

Syntax: Here is the method signature:

```
public void setEntitlementDN(String entitlementDN)
```

setGuid

Sets the GUID for the entitlement.

Syntax: Here is the method signature:

```
public void setGuid(String m_guid)
```

setStatus

Sets the status as a boolean flag.

Syntax: Here is the method signature:

```
public void setStatus(boolean m_status)
```

ProvisioningCodeMap

Value class to hold code map information from the code map and code map label tables.

getDescription

Returns the description

```
public String getDescription()
```

getName

Returns the name.

```
public String getName()
```

getEntityKey

Returns the entity key.

```
public String getEntityKey()
```

getEntityType

Returns the entity type.

```
public int getEntityType()
```

getQueryKey

Returns the query key.

```
public String getQueryKey()
```

getViewId

Returns the view ID.

```
public String getViewId()
```

getLastRefreshed

Returns the timestamp for the last refresh.

```
public long getLastRefreshed()
```

setDescription

Sets the description.

```
public void setDescription(String description)
```

setName

Sets the name.

```
public void setName(String name)
```

setEntityKey

Sets the entity key.

```
public void setEntityKey(String entityKey)
```

setEntityType

Sets the entity type.

```
public void setEntityType(int entityType)
```

setQueryKey

Sets the query key.

```
public void setQueryKey(String queryKey)
```

setViewId

Sets the view ID.

```
public void setViewId(String viewId)
```

setLastRefreshed

Sets the timestamp for the last refresh.

```
public void setLastRefreshed(long lastRefreshed)
```

getLabels

Returns the code map labels.

```
public ProvisioningCodeMapLabel[] getLabels()
```

setLabels

Sets the code map labels.

```
public void setLabels(ProvisioningCodeMapLabel[] labels)
```

getEntitlementDn

Returns the DN for the entitlement.

```
public String getEntitlementDn()
```

setEntitlementDn

Sets the DN for the entitlement.

```
public void setEntitlementDn(String entitlementDn)
```

getDriverDn

Returns the DN for the driver.

```
public String getDriverDn()
```

setDriverDn

Sets the DN for the driver.

```
public void setDriverDn(String driverDn)
```

getDriverDisplayName

Returns the display name for the driver.

```
public String getDriverDisplayName()
```

setDriverDisplayName

Sets the display name for the driver.

```
public void setDriverDisplayName(String driverDisplayName)
```

Resource

Supporting class that provides information about resources.

getName

Returns the name of the resource.

```
public String getName()
```

setName

Sets the name of the resource.

```
public void setName(String name)
```

getDescription

Returns the description of the resource.

```
public String getDescription()
```

setDescription

Sets the description of the resource.

```
public void setDescription(String description)
```

getEntityKey

Returns the entity key for the resource.

```
public String getEntityKey()
```

setEntityKey

Sets the entity key for the resource.

```
public void setEntityKey(String entityKey)
```

getResourceCategoryKeys

Returns the keys for the resource categories.

```
public CategoryKey[] getResourceCategoryKeys()
```

setResourceCategoryKeys

Sets the keys for the resource categories.

```
public void setResourceCategoryKeys(CategoryKey[] resourceCategoryKeys)
```

getEntitlementRef

Returns the entitlement reference for the resource.

```
public NrfEntitlementRef[] getEntitlementRef()
```

setEntitlementRef

Sets the entitlement reference for the resource.

```
public void setEntitlementRef(NrfEntitlementRef[] entitlementRef)
```

getGrantApprovers

Returns the list of approvers for resource grant operations.

```
public Approver[] getGrantApprovers()
```

setGrantApprovers

Sets the list of approvers for resource grant operations.

```
public void setGrantApprovers(Approver[] grantApprovers)
```

getGrantQuorum

Returns the quorum condition for grant operations.

```
public String getGrantQuorum()
```

setGrantQuorum

Sets the quorum condition for grant operations.

```
public void setGrantQuorum(String grantQuorum)
```

getGrantRequestDef

Returns the provisioning request definition for grant operations.

```
public String getGrantRequestDef()
```

setGrantRequestDef

Sets the provisioning request definition for grant operations.

```
public void setGrantRequestDef(String grantRequestDef)
```

getRevokeQuorom

Returns the quorum condition for revoke operations.

```
public String getRevokeQuorum()
```

setRevokeQuorom

Sets the quorum condition for revoke operations.

```
public void setRevokeQuorum(String revokeQuorum)
```

getRevokeRequestDef

Returns the provisioning request definition for revoke operations.

```
public String getRevokeRequestDef()
```

setRevokeRequestDef

Sets the provisioning request definition for revoke operations.

```
public void setRevokeRequestDef(String revokeRequestDef)
```

getRevokeApprovers

Returns the list of approvers for revoke operations.

```
public Approver[] getRevokeApprovers()
```

setRevokeApprovers

Sets the list of approvers for revoke operations.

```
public void setRevokeApprovers(Approver[] revokeApprovers)
```

getOwners

Returns the list of owners for the resource.

```
public DNString[] getOwners()
```

setOwners

Sets the list of owners for the resource.

```
public void setOwners(DNString[] owners)
```

getParameters

Returns the list of entitlement parameters defined for the resource.

```
public ResourceParameter[] getParameters()
```

setParameters

Sets the list of entitlement parameters for the resource.

```
public void setParameters(ResourceParameter[] parameters)
```

getActive

Returns a boolean flag indicating whether the resource is still active, or has been approved or denied.

```
public boolean getActive()
```

setActive

Sets the boolean flag indicating whether the resource is still active.

```
public void setActive(final boolean active)
```

getAllowOverride

Returns a boolean flag indicating whether the approval process for the resource can be overridden by the approval process for a role.

```
public boolean getAllowOverride()
```

setAllowOverride

Sets the boolean flag indicating whether the approval process for the resource can be overridden by the approval process for a role.

```
public void setAllowOverride(final boolean allowOverride)
```

getAllowMulty

Returns a boolean indicating whether the resource allows a user to request multiple resource values.

```
public boolean getAllowedMulty()
```

setAllowMulty

Sets the boolean indicating whether the resource allows a user to request multiple resource values.

```
public void setAllowedMulty(final boolean allowedMulty)
```

ResourceAssignment

Supporting class that holds resource assignment information.

setResourceDn

Sets the DN for the resource.

```
public void setResourceDn(String resourceDn)
```

getResourceDn

Returns the DN for the resource.

```
public String getResourceDn()
```

setRequesterDn

Sets the DN for the requester.

```
public void setRequesterDn(String requesterDn)
```

getRequesterDn

Returns the DN for the requester.

```
public String getRequesterDn()
```

getRecipientDn

Returns the DN for the recipient of the assignment.

```
public String getRecipientDn()
```

setRecipientDn

Sets the DN for the recipient of the assignment.

```
public void setRecipientDn(String recipientDn)
```

getReason

Returns the reason for the assignment.

```
public String getReason()
```

setReason

Sets the reason for the assignment.

```
public void setReason(String reason)
```

getRequestDate

Returns the date of the assignment request.

```
public Date getRequestDate()
```

setRequestDate

Sets the date of the assignment request.

```
public void setRequestDate(Date requestDate)
```

setRequestParams

Sets the parameters for the request.

```
public void setRequestParams(ResourceRequestParam[] params)
```

getRequestParams

Returns the parameters for the request.

```
public ResourceRequestParam[] getRequestParams()
```

setInstanceGuid

Sets the instanceGuid for the resource assignment.

```
public void setInstanceGuid(String instanceGuid)
```

getInstanceGuid

Returns the instanceGuid for the resource assignment.

```
public String getInstanceGuid()
```

ResourceRequestParam

Supporting class that holds the name and value for a resource request parameter value.

ResourceRequestParam Constructors

The ResourceRequestParam class has two constructors.

Syntax 1: Here is the syntax for a constructor that takes no parameters:

```
public ResourceRequestParam()
    {
    }
```

Syntax 2: Here is the syntax for a constructor that takes two String parameters:

```
public ResourceRequestParam(String name, String value)
    {
        m_name = name;
        m_value = value;
    }
```

setName

Sets a parameter name.

Syntax: Here is the method signature:

```
public void setName(String name)
```

getName

Returns a parameter name.

Syntax: Here is the method signature:

```
public String getName()
```

setValue

Sets the value of a parameter.

Syntax: Here is the method signature:

```
public void setValue(String value)
```

getValue

Returns the value of a parameter.

Syntax: Here is the method signature:

```
public String getValue()
```

ResourceAssignmentRequestStatus

Supporting class that holds a resource request status item. The interface includes methods for getting and setting various request status properties. However, you will not need to call the methods for setting property values, since you are using this class to retrieve information about the request status. After calling the requestResourceGrant() or the requestResourceRevoke() methods, you can use the get methods to get the properties for each status object returned in the ResourceAssignmentRequestStatus array.

setEntityKey

Sets the entity key.

Syntax: Here is the method signature:

```
public void setEntityKey(String entityKey)
```

getEntityKey

Gets the entity key.

Syntax: Here is the method signature:

```
public String getEntityKey()
```

setReason

Sets the reason for the role assignment.

Syntax: Here is the method signature:

```
public void setReason(String reason)
```

getReason

Gets the reason for the role assignment.

Syntax: Here is the method signature:

```
public String getReason()
```

setStatusValue

Sets the status value for the request.

Syntax: Here is the method signature:

```
public void setStatusValue(int value)
```

setStatusDescription

Sets the status description for the request.

Syntax: Here is the method signature:

```
public void setStatusDescription(String description)
```

getStatusValue

Gets the status value for the request.

Syntax: Here is the method signature:

```
public int getStatusValue()
```

getStatusDescription

Gets the localized description for the request.

Syntax: Here is the method signature:

```
public String getStatusDescription()
```

setCorrelationId

Sets the correlation ID.

Syntax: Here is the method signature:

```
public void setCorrelationId(String correlationId)
```

getCorrelationId

Gets the correlation ID.

Syntax: Here is the method signature:

```
public String getCorrelationId()
```

setRequester

Sets the requester DN.

Syntax: Here is the method signature:

```
public void setRequester(String requester)
```

getRequester

Gets the requester DN.

Syntax: Here is the method signature:

```
public String getRequester()
```

setRequestDate

Sets the request date.

Syntax: Here is the method signature:

```
public void setRequestDate(Date requestDate)
```

getRequestDate

Gets the request date.

Syntax: Here is the method signature:

```
public Date getRequestDate()
```

setSource

Sets the source resource DN.

Syntax: Here is the method signature:

```
public void setSource(String source)
```

getSource

Gets the source resource DN.

Syntax: Here is the method signature:

```
public String getSource()
```

setTarget

Sets the DN for the target identity.

Syntax: Here is the method signature:

```
public void setTarget(String target)
```

getTarget

Gets the DN for the target identity.

Syntax: Here is the method signature:

```
public String getTarget()
```

setRequestParams

Sets the dynamic request parameters.

Syntax: Here is the method signature:

```
public void setRequestParams(ResourceRequestParam[] params)
```

getRequestParams

Gets the dynamic request parameters.

Syntax: Here is the method signature:

```
public ResourceRequestParam[] getRequestParams()
```

Resource Web Service Examples

This section provides examples of using the Resource Web Service.

Code Map Synchronization Code Samples

This section provides code samples for using the SOAP endpoints for code map synchronization.

```
public IRemoteResource stub;
stub=getResourcesStub(url,adminname,password);


//refreshCodeMap
EntitlementRefreshInfo refreshResult =
stub.refreshCodeMap("cn=Devices,cn=DevicesLoopback,cn=driverset1,o=system");
System.out.println(refreshResult .getDetailedStatus());
System.out.println(refreshResult .getEntitlementDN());
System.out.println(refreshResult .getGuid());
System.out.println(refreshResult .getStatus());


//getRefreshStatus
CodeMapRefreshStatus[] refreshStatus
=stub.getRefreshStatus("cn=Devices,cn=DevicesLoopback,cn=driverset1,o=system");
for (CodeMapRefreshStatus item : refreshStatus) {
           System.out.println("Connection Name is: " + item.getConnectionName());
               System.out.println("Entitlement DN is: " + item.getEntitlementDN());
                System.out.println("Entitlement GUID is: " + item.getGuid());
                System.out.println("Last Refresh of this Entitlement is: " +
item.getLastRefresh());
                System.out.println("Status is: " + item.getStatus());
           }
```

```
//checkCodeMapValueStatus
String connectionName="SAP123";
CodeMapValueStatus checkStatus =
String codeMapValue=null;

stub.checkCodeMapValueStatus("cn=Devices,cn=DevicesLoopback,cn=driverset1,o=system
",connectionName, codeMapValue);

     System.out.println("Connection Name is: " +
checkStatus.getRefreshStatus().getConnectionName());
            System.out.println("Entitlement DN is: " +
checkStatus.getRefreshStatus().getEntitlementDN());
            System.out.println("Entitlement GUID is: " +
checkStatus.getRefreshStatus().getGuid());
            System.out.println("Last Refresh of this Entitlement is: " +
checkStatus.getRefreshStatus().getLastRefresh());
            System.out.println("Status is: " +
checkStatus.getRefreshStatus().getStatus());

            System.out.println(checkStatus.getUpToDate());
            System.out.println(checkStatus.getValue());




private static IRemoteResource getResourcesStub(String url,
    String username, String password) throws ServiceException {
         Stub stub = null;


         ResourceService service = new ResourceServiceImpl();
         stub = (Stub) service.getIRemoteResourcePort();
         stub._setProperty(Stub.USERNAME_PROPERTY, username);
         stub._setProperty(Stub.PASSWORD_PROPERTY, password);

         stub._setProperty(Stub.ENDPOINT_ADDRESS_PROPERTY,url +"/resource/
service");
        stub._setProperty(Stub.SESSION_MAINTAIN_PROPERTY, Boolean.TRUE);

         return (IRemoteResource) stub;
 }
```

26 Forgot Password Web Service

This section describes the Forgot Password Web Service, which allows SOAP clients to invoke a subset of the actions available through the Password Management system.

About the Forgot Password Web Service

The Forgot Password Web Service exposes a small set of actions from the Password Management system. The service allows remote clients to retrieve information about the forgot password configuration. In addition, it allows clients to retrieve information about the forgot password settings for a particular user, and perform challenge response and change password operations for a user.

The Forgot Password Web Service does not support the full range of password self-service operations. The Forgot Password Web Service is only for forgot password operations. If you want to create a custom user interface for performing password self service functions, such as answering or updating the user's hint or answer, or updating the challenge response questions, or checking on the password policy status, you need to use the REST endpoints that have been added to RBPM.

Calls to the Forgot Password Web Service require HTTP authentication.

Accessing the Service

You can access the Forgot Password Web Service endpoint using a URL similar to the following:

`http://`*`server`*`:`*`port`*`/`*`warcontext`*`/pwdmgt/service`

For example, if your server is named "myserver", your User Application is listening on port 8080, and your User Application war file is named "IDMPROV", the URL would be:

```
http://myserver:8080/IDMPROV/pwdmgmt/service
```

NOTE: The URL for the Forgot Password Web Service can be changed on the **Forgot Password Settings** page on the Administration tab in the User Application. To change the URL, enter the new URL in the **Forgot Password Web Service URL** field at the bottom of the page.

Accessing the WSDL

You can access the WSDL for the Forgot Password Web Service using a URL similar to the following:

`http://`*`server`*`:`*`port`*`/`*`warcontext`*`/pwdmgt/service?wsdl`

For example, if your server is named "myserver", your User Application is listening on port 8080, and your User Application war file is named "IDMPROV", the URL would be:

```
http://myserver:8080/IDMPROV/pwdmgt/service?wsdl
```

Generating the Stub Classes

Before using the Web Service, you need to use the WSSDK tool or another SOAP tool kit to generate the stub classes. To allow your code to find the stub classes, you also need to add the JAR that contains the stub classes to your classpath.

If you want to use the NetIQ WSSDK tool, you can generate the client stubs by extracting the WSDL and running the wsdl2java utility. For example, you could run this command to generate the stubs in a package called com.novell.soa.af.pwdmgt.soap.impl:

```
"C:\Program Files\Java\jdk1.6.0_31\bin\java" -cp "../lib/wssdk.jar;../lib/jaxrpc-
api.jar";"../lib/mail.jar";"../lib/activation.jar";"c:\Program
Files\Java\jdk1.6.0_31\lib\tools.jar"; com.novell.soa.ws.impl.tools.wsdl2java.Main
-verbose -ds gensrc -d C:\ -noskel -notie -genclient -keep -package
com.novell.soa.af.pwdmgt.soap.impl -javadoc pwdmgt.wsdl
```

You can change the wsdl2java parameters to suit your requirements.

Password Management Web Service Interface

This section provides reference information for each forgot password operation available through the Password Management interface.

processForgotConf

Gets the forgot password configuration parameters.

This method returns an object of type ForgotPasswordConfWSBean. This object contains the following information about the configuration:

Table 26-1 *ForgotPasswordConfWSBean Data*

Field	Description
Configured Return Link	Provides the forgot password return link.
Show Return Link	Indicates whether to show the forgot password return link.

Syntax: Here is the method signature:

```
public ForgotPasswordConfWSBean processForgotConf()
            throws RemoteException;
```

processUser

Retrieves forgot password configuration information for a user.

This method returns an object of type ForgotPasswordWSBean. If no match is found for the the user name specified, an error message is returned in the getUsers() method of ForgotPasswordWSBean. If multiple matches are found, the getUsers() method is returned with a String array of users. If a single match is found, the getUsers() method has a length of 1, and the following methods in ForgotPasswordWSBean are set:

- getConfiguredRtnLink()

- getShowReturnLink()
- getShowHint()
- getHint()
- getShowFullDN()
- getUserDisplayDN()
- getUserDN()
- getUser()
- getMessage()
- getAction()
- getChallengeQuestions()
- getChaResInUser()
- getMessage()

When a single user match is found, the user should be presented with the Challenge Response screen. If getChaResInUse() returns false, then call processChaRes() and show the Forgot Success screen directly without presenting the Challenge Response screen.

Syntax: Here is the method signature:

```
public ForgotPasswordWSBean processUser(final String userName)
            throws RemoteException;
```

The parameters are described below:

- *userName* specifies the name of a user.

processChaRes

Processes one or more challenge response answers for a particular user.

If the challenge response operation is authenticated, the following events may occur:

- If the password policy action is EmailHint, the operation will send an email with the hint to the user, and set the message to indicate that the operation succeeded. Therefore, the caller of this method should go to the Forgot Password Change Success screen, and display the message.
- If the password policy action is ShowHint, the operation will set the message to the user's hint. Therefore, the caller of this method should go to the Forgot Password Change Success screen, and display the message with the hint on the page.
- If the password policy action is EmailPassword, the operation will set send the password to the user. Therefore, the caller of this method should go to the Forgot Password Change Success screen, and display the message.
- If the password policy action is ChangePassword, the operation will set the password rules and the password hint. Therefore, the caller of this method should go to the Forgot Password Change screen.

This method returns an object of type ForgotPasswordWSBean. After the processCharRes operation is called, the following methods are populated with values:

- getTimeout()
- getRules()
- getLocked()

- getError()
- getMessage()

If the getAction() method returned by the processUser() operation is ChangePassword, then present the user with the Password Change screen. Otherwise, go to the Forgot Success screen and present the user with the message returned from the getMessage() method.

Syntax: Here is the method signature:

```
public ForgotPasswordWSBean processChaRes(final String userDN, final String[]
chaAnswers) throws RemoteException;
```

The parameters are described below:

- *userDN* specifies the DN for a particular user.
- *chaAnswers* provides an array of challenge response answers. The answers are processed in the order in which they are presented.

processChgPwd

Resets the password for a particular user.

After the processChgPwd operation is called, the following events may occur:

- If the change password operation succeeds, the caller of this method should go to the Forgot Password Success screen, and display the success message.
- If the change password operation fails, the error field on the ForgotPasswordWSBean object is set to true, and the message field is populated with the corresponding error message. Therefore, the caller of this method should stay on the password screen and display the error message.

This method returns an object of type ForgotPasswordWSBean. After the processChgPwd operation is called, the following methods are populated with values:

- getTimeout()
- getError()

If the getError() method returns false, you need to present the user with the Password Change Success screen.

Syntax: Here is the method signature:

```
public ForgotPasswordWSBean processChgPwd(final String userDN, final String
newPassword, final String confirmPassword )
            throws RemoteException;
```

The parameters are described below:

- *userDN* specifies the DN for a particular user.
- *newPassword* supplies a password for the user.
- *confirmPassword* repeats the password for confirmation.

ForgotPasswordWSBean

Here is the complete structure of the ForgotPasswordWSBean object:

***Table 26-2** ForgotPasswordWSBean Structure*

Field	Description
Users	Provides a list of the users that match the search criteria specified. When the wildcard feature is enabled, multiple matches may be found.
Challenge Questions	Supplies the challenge questions associated with the user.
Configured Return Link	Shows the Return link to be used after the user performs a forgot password operation.
Show Return Link	Indicates whether to show the Return link after the user performs a forgot password operation.
Show Hint	Indicates whether to show the user's password hint on the Forgot Password Change screen.
Show Full DN	Indicates whether to show the user's full DN or just the CN name after the user performs a forgot password operation.
User DN	Shows the user's DN.
User Display DN	Shows the user's display DN. For example, `cn=ablake,ou=users,o=netiq` or `workforceID=ablake,ou=users,o=netiq`.
User	Provides the user's display name.
Error	Returns true if an error occurs.
Message	Returns a message in the event that there is an application-specific error.
Action	Specifies the policy action, which is one of the following values: ShowHint, EmailHint, EmailPassword, ChangePassword.
Hint	Specifies the user's password hint.
Rules	Lists the password policy rules.
Is Challenge Response in User	Indicates whether the challenge response feature is enabled for this user. If challenge response in use is false, then the user can only perform the email hint and show hint functions.
Locked	Indicates whether the user account is locked.
Timeout	Indicates whether a session timeout occurred.
Login Attribute	Specifies the user's Login Attribute.

VII REST Services

The identity applications components incorporate several REST APIs that enable different features within the User Application functionality. The APIs are included in the `IDMProv.war` file. The `war` is automatically deployed when Identity Applications are installed. The REST API documentation is available from Identity Manager 4.6 Service Pack 1. You can access the documentation by pointing to the URL, `https://identity applications servername:8180/idmappsdoc`.

This section describes how to use the REST services by using the Resource Information Services (RIS) facility. Be aware that RIS will be deprecated in the next major release.

27 Introduction to Resource Information Services

This section describes the Work Items Service.

About RIS

This section describes the Resource Information Services (RIS) facility, which is a standalone component that interacts with the Identity Manager User Application. RIS is built on a Resource Oriented Architecture (ROA). The RIS implementation resides in a WAR file called RIS.WAR, where RIS refers to Resource Information Services. The REST resources exposed through RIS make SOAP calls to gather information from various RBPM systems.

The methodology used to define these ROA services is based on the steps described by Leonard Richardson & Sam Ruby in the RESTful Web Services by O'Reilly.

How it Works

The code for RIS is contained in a WAR outside of the User Application. This is a standalone WAR (RIS.war) that uses SOAP calls to extract the necessary work item data.

Language support is determined by the "Accept-Language" header parameter.

The media type is determined by the "Accept" header parameter and must be equal to "application/json".

The implementation does not support the use of extensions. It does not support the ability to enter a language or media extension at the end of a URI.

This implementation is based on the JSR-311 specification implemented by Sun's Jersey product.

You may see this error on the console:

```
09:52:52,684 ERROR [STDERR] Sep 30, 2008 9:52:52 AM
com.sun.jersey.api.core.ClasspathResourceConfig init
INFO: Root resource classes found:
  class com.novell.ris.spi.impl.Root
```

This is a Jersey message that is simply informational. The application should function normally. You can ignore the message.

Caching the SOAP stubs The web.xml file in the RIS.war includes an element that allows you to control the size of the stub connection pool.

```
<init-param>
   <param-name>STUB_CONNECTION_POOL</param-name>
   <param-value>100</param-value>
</init-param>
```

The STUB_CONNECTION_POOL element defines the size of a pool for caching the SOAP stubs created by each user. The cache uses a Least Recently Used (LRU) eviction policy and defaults to a size of 10 if the element is not defined in web.xml.

Removing the administrator credential restrictions By default, the requirement for invoking the REST and SOAP services is that the HTTP session logged in user must have administrator credentials. The Provisioning and Directory Web Services require Provisioning Administrator credentials. The Roles Web Service requires Role Administrator credentials. The restrictions can be removed to allow a session with a logged in user who does not have administrator credentials to invoke the methods for the services by changing the configuration settings for the service. In order to do this, you must extract the configuration files from the User Application war, make the appropriate changes, and import the files back into the User Application WAR. The details for removing the restrictions is included with the documentation for each of the underlying SOAP services. For example, to remove the credential restriction for the Role Service, see "Removing Administrator Credential Restrictions" on page 384.

Media Type Supported

The only media type supported is JSON (application/json). The service uses a JSON Array format for list of items and a single JSON object for detail information. The media type is determined by the "Accept" header parameter. The implementation uses the Jettison JSON APIs to create the JSON structures.

Digital Signatures Not Supported

The REST interfaces do not support digital signatures. If you attempt to process a digital signature workflow through REST, an internal server error message will appear.

API Version Optional in URIs

The REST URIs work with or without the API version. For example, to access the roles service, you could specify either of the following URIs:

```
/RIS/v1/roles
/RIS/roles
```

Configuring the RIS WAR

This section provides manual instructions for setting up the RIS WAR. In this release, the RIS WAR is configured automatically, so these steps are not required in most environments.

1 Modify the host, port, and WAR context information for the identity applications deployment on Tomcat in the web.xml of the RIS WAR.

   1a Copy the RIS.war file to a test folder.

      For example: `/home/lab/RIS`

   1b Extract the web.xml from the RIS war, maintaining the folder structure.

This will create the following structure: `/home/lab/RIS/WEB-INF/web.xml`

1b1 Open the web.xml in a text editor.

1b2 Locate the following entry:

```
<init-param>
            <param-name>USER_APP_URL</param-name>
            <param-value>http://localhost:8080/IDMProv</param-value>
</init-param>
```

1b3 Modify the param-value as necessary. You need to use either the DNS name or the IP address of the server on which the RBPM war is deployed.

IMPORTANT: Do not use localhost if you plan to use the REST identity services to access user photos. The photo URL is dependent on this entry. The photo URL must point to the User Application to retrieve the photo. The REST identity service does not provide the binaries for the photo, but does provide a link, which is based on this entry.

1b4 Save the file.

1c Add the web.xml file back to the RIS war using the jar command from the SUN JDK.

For example: `/home/lab/jdk`*`version`*`/bin/jar -uf RIS.war WEB-INF/web.xml`

2 Copy the RIS war to the deployment directory of the Tomcat server.

3 Extract the commons-codec.jar from the RBPM war into the *%context%*/lib directory of the Tomcat server where the RIS WAR will be deployed. Make sure to not maintain folder structure when extracting the file.

For example: `/home/lab/IDM46/idm/tomcat/server/IDMProv/lib`

4 Start Tomcat.

Security

This section describes the security model used for the REST services.

The security model attempts to satisfy these objectives:

- Protects against CSRF attacks
- Allows the client to pass in user credentials
- Uses an HTTP Authorization or an HTTP Session Secret header for the REST requests

Architecture

The security model supports two options for making requests. The first one (Option 1) consists of passing in the user credentials in an HTTP header (default: RESTAuthorization). The second approach (Option 2) consists of a two request approach. In the second option, an authorization request is required first and all subsequent requests pass in the session secret token in an HTTP header. The header defaults to RESTSessionSecret.

Both options require the passing of sensitive data on the wire. Therefore, NetIQ highly recommends that you run this application in a TLS/SSL environment (HTTPS). Otherwise the user credentials could be exposed to a man-in-the-middle attack.

Either approach will work. However, NetIQ recommends using Option 2 (the Session Secret Security Model approach) rather than Option 1 (the Authorization Security Model approach). Option 2 offers more protection against discovering the actual user credentials. The credentials are maintained by the RIS server and are discovered using a unique access token through the RESTSessionSecret HTTP header.

Option 1: Authorization Security Model

This model is the same as the Basic authorization model. This model is recommended for developers who do not use JavaScript for their client application.

Here is the flow of control used with this option:

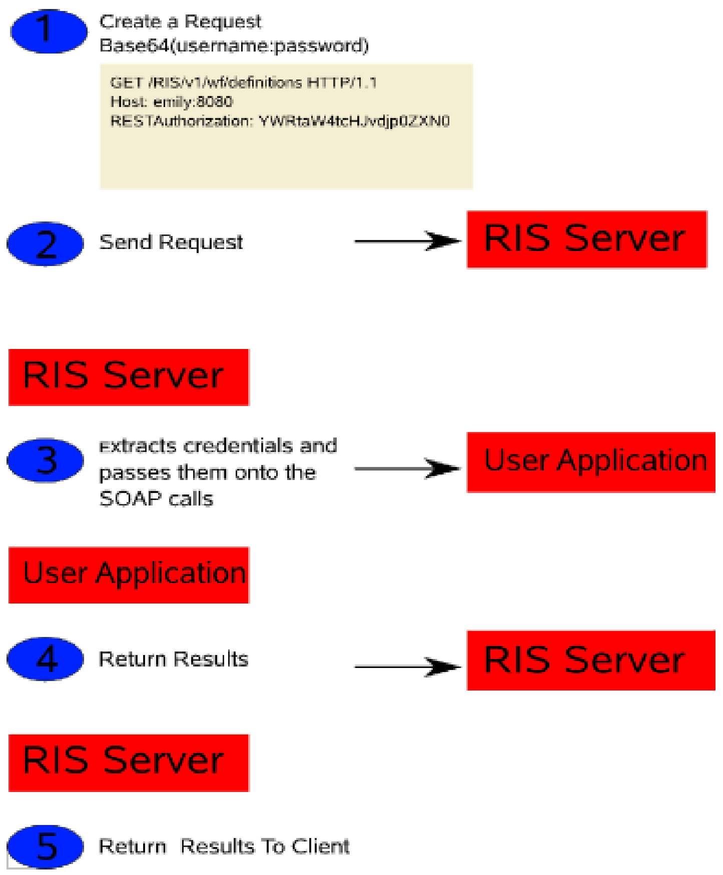
1. Developers must include the Base64(username:password)) string in an HTTP header (RESTAuthorization) before making the call to the REST service. The HTTP header name can be configured at installation time. The default name is:

   ```
   RESTAuthorization
   ```

2. The client application sends the request to the RIS server.
3. The RIS server extracts the credentials from the header and passes those credentials onto the SOAP service. The actual authentication check is performed at the User Application server.
4. The User Application SOAP call is either granted or denied and the result is returned to the RIS server.
5. The RIS server returns the result to the client application.

The following picture illustrates the flow:

***Figure 27-1** Option 1 Authorization Flow*



***Example 27-1** Example*

Suppose you issue the following REST call:

```
/v1/wf/definitions
```

Here is the request:

```
GET /RIS/v1/wf/definitions HTTP/1.1
Host: localhost:8080
User-Agent: Mozilla/5.0 (X11; U; Linux i686; en-US; rv:1.9.0.7) Gecko/2009022800
SUSE/3.0.7-1.4 Firefox/3.0.7
Accept: application/json
Accept-Language: en,it;q=0.8,fr;q=0.6,de;q=0.4,en-us;q=0.2
Accept-Encoding: gzip,deflate
Accept-Charset: ISO-8859-1,utf-8;q=0.7,*;q=0.7
Keep-Alive: 300
Connection: keep-alive
RESTAuthorization: YWRtaW4tcHJvdjp0ZXN0
```

Here is the response:

```
HTTP/1.1 200 OK
Server: Apache-Coyote/1.1
X-Powered-By: Servlet 2.5; Tomcat-5.0/TomcatWeb-2.1
Content-Type: application/json
Transfer-Encoding: chunked
Date: Tue, 31 Mar 2009 13:48:05 GMT

7d2
[
   {
      "Links": [
         {
            "Link": "/RIS/v1/wf/
processes?filter=Definition=cn=Change+Title+Single+Approval,cn=RequestDefs,cn=AppC
onfig,cn=PicassoDriver,cn=TestDrivers,o=netiq",
            "Type": "wf/processes",
            "Value": "Workflow Processes"
         },
         {
            "Link": "/RIS/v1/wf/
workitems?filter=Definition=cn=Change+Title+Single+Approval,cn=RequestDefs,cn=AppC
onfig,cn=PicassoDriver,cn=TestDrivers,o=netiq",
            "Type": "wf/workitems",
            "Value": "Workflow Workitems"
         }
      ],
      "DataItems": [],
      "DN": "cn=Change Title Single
Approval,cn=RequestDefs,cn=AppConfig,cn=PicassoDriver,cn=TestDrivers,o=netiq",
      "GUID": "5a4f7af2142189430d935a4f7af21421",
      "Link": "/RIS/v1/wf/definitions/5a4f7af2142189430d935a4f7af21421",
      "Value": "Change Title Single Approval",
      "Category": "accounts",
      "DigitalSignatureType": "not-required",
      "Description": "Change Title",
      "Operation": "0",
      "Recipient": ""
   },
   {
      "Links": [
         {
            "Link": "/RIS/v1/wf/
processes?filter=Definition=cn=Change+Title,cn=RequestDefs,cn=AppConfig,cn=Picasso
Driver,cn=TestDrivers,o=netiq",
            "Type": "wf/processes",
            "Value": "Workflow Processes"
         },
         {
            "Link": "/RIS/v1/wf/
workitems?filter=Definition=cn=Change+Title,cn=RequestDefs,cn=AppConfig,cn=Picasso
Driver,cn=TestDrivers,o=netiq",
            "Type": "wf/workitems",
            "Value": "Workflow Workitems"
         }
      ],
      "DataItems": [],
      "DN": "cn=Change
Title,cn=RequestDefs,cn=AppConfig,cn=PicassoDriver,cn=TestDrivers,o=netiq",
      "GUID": "71e22c1cf4b4e74fbdb871e22c1cf4b4",
      "Link": "/RIS/v1/wf/definitions/71e22c1cf4b4e74fbdb871e22c1cf4b4",
      "Value": "Change Title",
      "Category": "accounts",
      "DigitalSignatureType": "not-required",
      "Description": "Change Title",
      "Operation": "0",
      "Recipient": ""
   }
]
```

Option 2: Session Secret Security Model

The session secret security model allows a developer to ask for an authorization unique id. This session secret ID is then used on all subsequent calls. This is to allow client developers to be more secured than passing user credentials for every call.

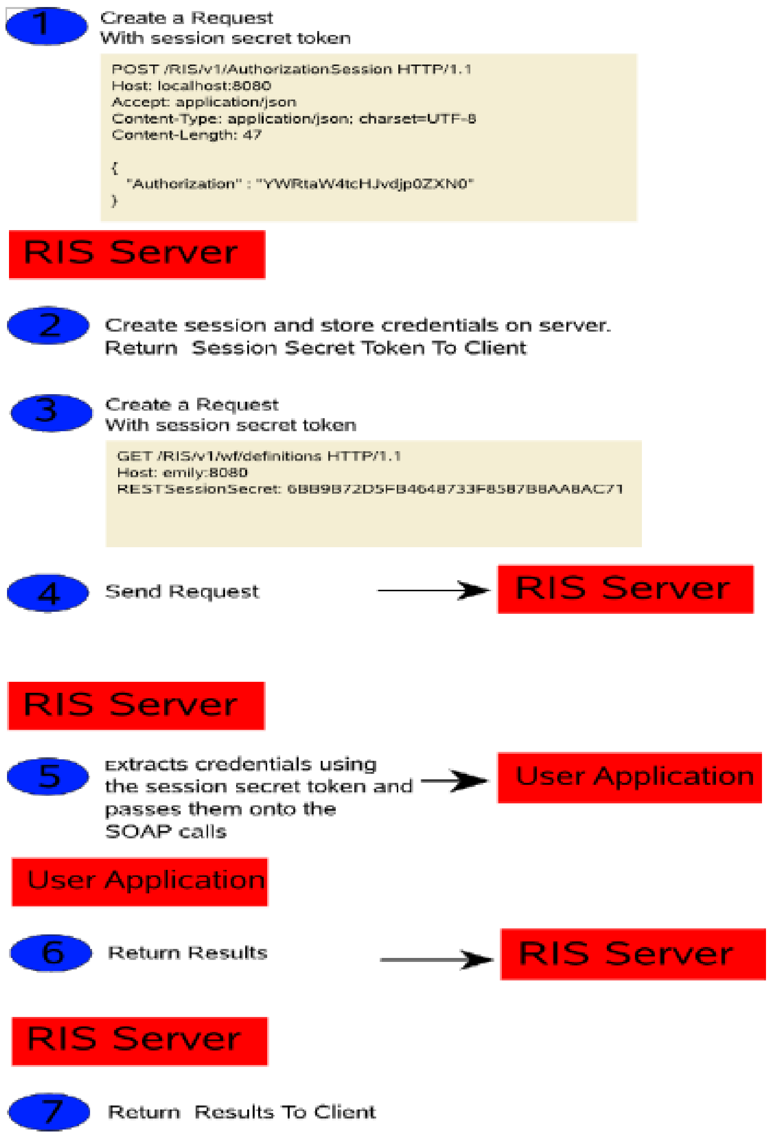
Here is the flow of control used with this option:

1. Developers must first make a call to the /v1/AuthorizationSession REST service to obtain a session token. This is a POST call with the credentials (Base64(username:password)) in the content of the message in a JSON object (see section 4).
2. The RIS server will then create a session object and stores the credentials in memory for the duration of the session. The session secret token is returned to the client application via a JSON object.
3. Developers must include the Session Secret token string in an HTTP header (RESTSessionSecret) before making any subsequent REST service calls. The HTTP header name can be configured at installation time. The default name is:

   ```
   RESTSessionSecret
   ```
4. The client application sends the request to the RIS server.
5. The RIS server extracts the session secret token from the HTTP header and retrieves the credentials from memory based on the token for that session. The credentials are passed onto he SOAP service. The actual authentication check is performed at the User Application server.
6. The User Application SOAP call is either granted or denied and the result is returned to the RIS server.
7. The RIS server returns the result to the client application.

The following picture illustrates the flow:

Figure 27-2 Option 2 Authorization Flow


1
Create a Request
With session secret token
RIS Server
2
Create session and store credentials on server.
Return Session Secret Token To Client
3
Create a Request
With session secret token
4
Send Request
RIS Server
RIS Server
5
extracts credentials using the session secret token and passes them onto the SOAP calls
User Application
User Application
6
Return Results
RIS Server
RIS Server
7
Return Results To Client

```
POST /RIS/v1/AuthorizationSession HTTP/1.1
Host: localhost:8080
Accept: application/json
Content-Type: application/json; charset=UTF-8
Content-Length: 47

{
  "Authorization" : "YWRtaW4tcHJvdjp0ZXN0"
}
```

```
GET /RIS/v1/wf/definitions HTTP/1.1
Host: emily:8080
RESTSessionSecret: 6BB9B72D5FB4648733F8587B8AA8AC71
```

Example 27-2 Example

First, you issue the following call to the Authorization REST Service:

`/v1/AuthorizationSession`

Here is the request:

```
POST /RIS/v1/AuthorizationSession HTTP/1.1
Host: localhost:8080
User-Agent: Mozilla/5.0 (X11; U; Linux i686; en-US; rv:1.9.0.7) Gecko/2009022800
SUSE/3.0.7-1.4 Firefox/3.0.7
Accept: application/json
Accept-Language: en,it;q=0.8,fr;q=0.6,de;q=0.4,en-us;q=0.2
Accept-Encoding: gzip,deflate
Accept-Charset: ISO-8859-1,utf-8;q=0.7,*;q=0.7
Keep-Alive: 300
Connection: keep-alive
Content-Type: application/json; charset=UTF-8
Content-Length: 47
Pragma: no-cache
Cache-Control: no-cache

{
   "Authorization" : "YWRtaW4tcHJvdjp0ZXN0"
}
```

Here is the response:

```
HTTP/1.1 200 OK
Server: Apache-Coyote/1.1
X-Powered-By: Servlet 2.5; Tomcat-5.0/TomcatWeb-2.1
Set-Cookie: JSESSIONID=17B5528DEEC66610D0FBB456992E10ED; Path=/RIS
Content-Type: application/json
Transfer-Encoding: chunked
Date: Tue, 31 Mar 2009 13:54:26 GMT

35
{"SessionSecret": "17B5528DEEC66610D0FBB456992E10ED"}
```

Next, you issue the REST call:

```
/v1/wf/definitions
```

Here is the request:

```
GET /RIS/v1/wf/definitions HTTP/1.1
Host: localhost:8080
User-Agent: Mozilla/5.0 (X11; U; Linux i686; en-US; rv:1.9.0.7) Gecko/2009022800
SUSE/3.0.7-1.4 Firefox/3.0.7
Accept: application/json
Accept-Language: en,it;q=0.8,fr;q=0.6,de;q=0.4,en-us;q=0.2
Accept-Encoding: gzip,deflate
Accept-Charset: ISO-8859-1,utf-8;q=0.7,*;q=0.7
Keep-Alive: 300
Connection: keep-alive
RESTSessionSecret:  17B5528DEEC66610D0FBB456992E10ED
```

Here is the response:

```
HTTP/1.1 200 OK
Server: Apache-Coyote/1.1
X-Powered-By: Servlet 2.5; Tomcat-5.0/TomcatWeb-2.1
Content-Type: application/json
Transfer-Encoding: chunked
Date: Tue, 31 Mar 2009 13:48:05 GMT

7d2
[
   {
      "Links": [
         {
            "Link": "/RIS/v1/wf/
processes?filter=Definition=cn=Change+Title+Single+Approval,cn=RequestDefs,cn=AppC
onfig,cn=PicassoDriver,cn=TestDrivers,o=netiq",
            "Type": "wf/processes",
            "Value": "Workflow Processes"
         },
         {
            "Link": "/RIS/v1/wf/
workitems?filter=Definition=cn=Change+Title+Single+Approval,cn=RequestDefs,cn=AppC
onfig,cn=PicassoDriver,cn=TestDrivers,o=netiq",
            "Type": "wf/workitems",
            "Value": "Workflow Workitems"
         }
      ],
      "DataItems": [],
      "DN": "cn=Change Title Single
Approval,cn=RequestDefs,cn=AppConfig,cn=PicassoDriver,cn=TestDrivers,o=netiq",
      "GUID": "5a4f7af2142189430d935a4f7af21421",
      "Link": "/RIS/v1/wf/definitions/5a4f7af2142189430d935a4f7af21421",
      "Value": "Change Title Single Approval",
      "Category": "accounts",
      "DigitalSignatureType": "not-required",
      "Description": "Change Title",
      "Operation": "0",
      "Recipient": ""
   },
   {
      "Links": [
         {
            "Link": "/RIS/v1/wf/
processes?filter=Definition=cn=Change+Title,cn=RequestDefs,cn=AppConfig,cn=Picasso
Driver,cn=TestDrivers,o=netiq",
            "Type": "wf/processes",
            "Value": "Workflow Processes"
         },
         {
            "Link": "/RIS/v1/wf/
workitems?filter=Definition=cn=Change+Title,cn=RequestDefs,cn=AppConfig,cn=Picasso
Driver,cn=TestDrivers,o=netiq",
            "Type": "wf/workitems",
            "Value": "Workflow Workitems"
         }
      ],
      "DataItems": [],
      "DN": "cn=Change
Title,cn=RequestDefs,cn=AppConfig,cn=PicassoDriver,cn=TestDrivers,o=netiq",
      "GUID": "71e22c1cf4b4e74fbdb871e22c1cf4b4",
      "Link": "/RIS/v1/wf/definitions/71e22c1cf4b4e74fbdb871e22c1cf4b4",
      "Value": "Change Title",
      "Category": "accounts",
      "DigitalSignatureType": "not-required",
      "Description": "Change Title",
      "Operation": "0",
      "Recipient": ""
   }
]
```

Authorization REST Service

The Authorization REST Service lets you obtain a session token. When you make a call to the service, the RIS server creates a session object and stores the credentials in memory for the duration of the session. The session secret token is returned to the client application via a JSON object. The only media type supported is application/json, which uses a JSON Array format for the list of items and a single JSON object for detailed information.

The following table shows the complete URI syntax for all resource end points associated with the Authorization REST Service, along with a description for each URI and a list of supported HTTP methods:

Table 27-1 *URI Syntax for the Authorization REST Service*

URI	Description
/v1/AuthorizationSession	Creates a new session authorization session and obtains a session token. The following HTTP methods are supported: GET – Not supported POST – Creates a new authorization session object and returns the session secret token in the response. Request JSON Object: { "Authorization" : Base64(username:password)} Response JSON Object: { "SessionSecret": "session secret token”} PUT – Not supported DELETE – Not supported

URI	Description
/v1/AuthorizationSession/{session secret token}	Deletes and invalidates the authorization session object. The following HTTP methods are supported: GET – Not supported PUT – Not supported POST – Not supported DELETE – Deletes and invalidates the authorization session object. POST with Matrix parameter DELETE – Same as DELETE because of limitations in browsers to set the DELETE method

The following matrix parameters are available for debugging and displaying the schema:

Table 27-2 *Matrix Parameters for Debugging and Displaying the Schema*

URI	Description
/v1/AuthorizationSession;debug	This `debug` matrix parameter displays the JSON structure of the content type in human readable format, as opposed to compressed format. This matrix parameter can be put anywhere in the URI.
/v1/AuthorizationSession;schema	The `schema` matrix parameter can be put anywhere in the URI and in combination with the “Accept” header type will return the appropriate schema document for the content type. In this case a JSON schema document is returned for the workitems.

Example 27-3 *Example*

Here is an example of a call to the Authorization service that includes the debug and schema parameters:

```
/v1/AuthorizationSession;debug;schema
```

Here is the request:

```
POST /RIS/v1/AuthorizationSession;schema;debug HTTP/1.1
Host: localhost:8080
User-Agent: Mozilla/5.0 (X11; U; Linux i686; en-US; rv:1.9.0.7) Gecko/2009022800
SUSE/3.0.7-1.4 Firefox/3.0.7
Accept: application/json
Accept-Language: en,it;q=0.8,fr;q=0.6,de;q=0.4,en-us;q=0.2
Accept-Encoding: gzip,deflate
Accept-Charset: ISO-8859-1,utf-8;q=0.7,*;q=0.7
Keep-Alive: 300
Connection: keep-alive
Content-Type: application/json; charset=UTF-8
Content-Length: 38
Pragma: no-cache
Cache-Control: no-cache

{
   "Authorization" : "YWRtaW4tcHJvdjp0ZXN0"
}
```

Here is the response:

```
HTTP/1.1 200 OK
Server: Apache-Coyote/1.1
X-Powered-By: Servlet 2.5; Tomcat-5.0/TomcatWeb-2.1
Content-Type: application/json
Transfer-Encoding: chunked
Date: Tue, 31 Mar 2009 13:18:45 GMT

171
{
   "Request": {"SessionInfo": {
      "description": "schema for: /v1/AuthorizationSession",
      "type": "object",
      "properties": {"Authorization": {"type": "string"}}
   }},
   "Response": {"SessionSecret": {
      "description": "schema for: /v1/AuthorizationSession",
      "type": "object",
      "properties": {"SessionSecret": {"type": "string"}}
   }}
}
```

Configuration Parameters

The RIS.war uses the following filter parameters, all of which are set in the WEB.XML file.

Table 27-3 Filter Parameters

Parameter	Description
AUTHORIZATION_HEADER	The AUTHORIZATION_HEADER filter parameter specifies the HTTP header name for option 1 - Authorization Security model. If not supplied, then the default will be: RESTAuthorization This HTTP header will hold the user credentials. Example: RESTAuthorization: Base64(username:password)
SESSION_SECRET_HEADER	The SESSION_SECRET_HEADER filter parameter specifies the HTTP header name to hold the session secret for Option 2 – Session Secret Security Model. If not supplied, then the default will be: RESTSessionSecret This HTTP header will hold the session secret returned from the RIS server when an access token is requested via the REST service: /RIS/v1/AuthenticationSession Example: RESTSessionSecret: <token>
USER_APP_URL	The USER_APP_URL filter parameter will point to the User Application associated with the RIS server. All SOAP calls will use this URL for the SOAP end point.
STUB_CONNECTION_POOL	The STUB_CONNECTION_POOL filter parameter holds the number of connection that we want to maintain from the RIS server to the User Application server. This is to make the client perform better.

In addition to these filter parameters, the configuration also supports the following session parameter:

Table 27-4 Session Parameter

Parameter	Description
Session Timeout	This setting is used to control the length of the sessions. It is specified in minutes.

Here is a sample Web.XML that illustrates the use of the configuration parameters:

```
<filter>
        <filter-name>Authorization Filter</filter-name>
        <filter-class>com.novell.ris.common.impl.ServletFilter</filter-class>
        <init-param>
            <param-name>AUTHORIZATION_HEADER</param-name>
            <param-value>RESTAuthorization</param-value>
        </init-param>
        <init-param>
            <param-name>SESSION_SECRET_HEADER</param-name>
            <param-value>RESTSessionSecret</param-value>
        </init-param>
        <init-param>
            <param-name>USER_APP_URL</param-name>
            <param-value>http://localhost:8080/IDMProv</param-value>
        </init-param>
<!-- If not entered, Stub Connection size will default to 10 stub connections -->
        <init-param>
            <param-name>STUB_CONNECTION_POOL</param-name>
            <param-value>10</param-value>
        </init-param>
    </filter>
….
    <session-config>
      <session-timeout>30</session-timeout>
    </session-config>
```

WADL Document

To see the Web Application Description Language (WADL) document for the RIS facility, enter the following URI on whatever server the RIS.war has been deployed to.

```
RIS/application.wadl
```

The WADL document shows the available resource paths for the RIS application, as shown below:

```
<?xml version="1.0" encoding="UTF-8" standalone="yes"?>
<application xmlns="http://research.sun.com/wadl/2006/10">
    <doc xmlns:jersey="http://jersey.dev.java.net/" jersey:generatedBy="Jersey:
1.0.3 04/15/2009 11:52 PM"/>
    <resources base="http://emily:8080/RIS/">
        <resource path="/v1">
            <method name="GET" id="getRootJSON">
                <response>
                    <representation mediaType="application/json"/>
                </response>
            </method>
            <resource path="roles">
               <param xmlns:xs="http://www.w3.org/2001/XMLSchema" type="xs:string"
style="template" name="roles"/>
                <method name="GET" id="getListJSON">
                    <request>
                        <param xmlns:xs="http://www.w3.org/2001/XMLSchema"
type="xs:string" style="query" name="filter"/>
                    </request>
                    <response>
                        <representation mediaType="application/json"/>
                    </response>
                </method>
                <resource path="{GUID}">
```

```
                    <param xmlns:xs="http://www.w3.org/2001/XMLSchema"
type="xs:string" style="template" name="GUID"/>
                    <param xmlns:xs="http://www.w3.org/2001/XMLSchema"
type="xs:string" style="template" name="GUID"/>
                    <method name="GET" id="getRoleJSON">
                        <response>
                            <representation mediaType="application/json"/>
                        </response>
                    </method>
                    <resource path="/sods">
                        <param xmlns:xs="http://www.w3.org/2001/XMLSchema"
type="xs:string" style="template" name="GUID"/>
                        <method name="GET" id="getSoDListJSON">
                            <response>
<representation mediaType="application/json"/>
                            </response>
                        </method>
                    </resource>
                    <resource path="/sods/{SODID}">
                        <param xmlns:xs="http://www.w3.org/2001/XMLSchema"
type="xs:string" style="template" name="GUID"/>
                        <param xmlns:xs="http://www.w3.org/2001/XMLSchema"
type="xs:string" style="template" name="SODID"/>
                        <method name="GET" id="getSoDJSON">
                            <response>
<representation mediaType="application/json"/>
                            </response>
                        </method>
                    </resource>
                    <resource path="/assignments">
                        <param xmlns:xs="http://www.w3.org/2001/XMLSchema"
type="xs:string" style="template" name="GUID"/>
                        <method name="GET" id="getAssigmentListJSON">
                            <response>
<representation mediaType="application/json"/>
                            </response>
                        </method>
                        <method name="PUT" id="postAssignment">
                            <request>
<representation mediaType="*/*"/>
                            </request>
                        </method>
                    </resource>
                    <resource path="/assignments/{ASSIGNMENTID}">
                        <param xmlns:xs="http://www.w3.org/2001/XMLSchema"
type="xs:string" style="template" name="ASSIGNMENTID"/>
                        <param xmlns:xs="http://www.w3.org/2001/XMLSchema"
type="xs:string" style="template" name="GUID"/>
                        <method name="GET" id="getAssignmentJSON">
                            <response>
<representation mediaType="application/json"/>
                            </response>
                        </method>
                        <method name="DELETE" id="deleteAssignment"/>
                    </resource>
                </resource>
            </resource>
            <resource path="identities">
               <param xmlns:xs="http://www.w3.org/2001/XMLSchema" type="xs:string"
style="template" name="identities"/>
```

```
                <method name="GET" id="getListJSON">
                    <request>
                        <param xmlns:xs="http://www.w3.org/2001/XMLSchema"
default="" type="xs:string" style="query" name="filter"/>
                    </request>
                    <response>
                        <representation mediaType="application/json"/>
                    </response>
                </method>
                <resource path="{GUID}">
                    <param xmlns:xs="http://www.w3.org/2001/XMLSchema"
type="xs:string" style="template" name="GUID"/>
                    <param xmlns:xs="http://www.w3.org/2001/XMLSchema"
type="xs:string" style="template" name="GUID"/>
                    <method name="GET" id="getIdentityJSON">
                        <response>
                            <representation mediaType="application/json"/>
                        </response>
                    </method>
                    <resource path="/{ATTRIBUTE}">
                        <param xmlns:xs="http://www.w3.org/2001/XMLSchema"
type="xs:string" style="template" name="GUID"/>
                        <param xmlns:xs="http://www.w3.org/2001/XMLSchema"
type="xs:string" style="template" name="ATTRIBUTE"/>
                        <method name="GET" id="getAttributeJSON">
                            <response>
<representation mediaType="application/json"/>
                            </response>
                        </method>
                        <method name="POST" id="updateAttribute">
                            <request>
<representation mediaType="*/*"/>
                            </request>
                        </method>
                    </resource>
                </resource>
            </resource>
            <resource path="AuthorizationSession">
               <param xmlns:xs="http://www.w3.org/2001/XMLSchema" type="xs:string"
style="template" name="AuthorizationSession"/>
                <method name="POST" id="createAuthorizationSession">
                    <request>
                        <representation mediaType="application/json"/>
                    </request>
                    <response>
                        <representation mediaType="application/json"/>
                    </response>
                </method>
                <resource path="{GUID}">
                    <param xmlns:xs="http://www.w3.org/2001/XMLSchema"
type="xs:string" style="template" name="GUID"/>
                    <param xmlns:xs="http://www.w3.org/2001/XMLSchema"
type="xs:string" style="template" name="GUID"/>
                    <method name="DELETE" id="terminateSession"/>
                    <method name="POST" id="postTerminateSession"/>
                </resource>
            </resource>
            <resource path="wf/definitions">
               <param xmlns:xs="http://www.w3.org/2001/XMLSchema" type="xs:string"
style="template" name="wf/definitions"/>
```

```
                <method name="GET" id="getListJSON">
                    <response>
                        <representation mediaType="application/json"/>
                    </response>
                </method>
                <resource path="{GUID}">
                    <param xmlns:xs="http://www.w3.org/2001/XMLSchema"
type="xs:string" style="template" name="GUID"/>
                    <param xmlns:xs="http://www.w3.org/2001/XMLSchema"
type="xs:string" style="template" name="GUID"/>
                    <method name="POST" id="startProcess">
                        <request>
                            <representation mediaType="application/json"/>
                        </request>
                    </method>
                    <method name="GET" id="getDefinitionJSON">
                        <response>
                            <representation mediaType="application/json"/>
                        </response>
                    </method>
                </resource>
            </resource>
            <resource path="wf/processes">
               <param xmlns:xs="http://www.w3.org/2001/XMLSchema" type="xs:string"
style="template" name="wf/processes"/>
                <method name="GET" id="getListJSON">
                    <request>
                        <param xmlns:xs="http://www.w3.org/2001/XMLSchema"
type="xs:string" style="query" name="filter"/>
                    </request>
                    <response>
                        <representation mediaType="application/json"/>
                    </response>
                </method>
                <resource path="{GUID}">
                    <param xmlns:xs="http://www.w3.org/2001/XMLSchema"
type="xs:string" style="template" name="GUID"/>
                    <param xmlns:xs="http://www.w3.org/2001/XMLSchema"
type="xs:string" style="template" name="GUID"/>
                    <method name="GET" id="getProcessJSON">
                        <response>
                            <representation mediaType="application/json"/>
                        </response>
                    </method>
                    <method name="DELETE" id="terminateProcess"/>
                    <method name="POST" id="postItem"/>
                </resource>
            </resource>
            <resource path="wf/workitems">
               <param xmlns:xs="http://www.w3.org/2001/XMLSchema" type="xs:string"
style="template" name="wf/workitems"/>
                <method name="GET" id="getListJSON">
                    <request>
                        <param xmlns:xs="http://www.w3.org/2001/XMLSchema"
type="xs:string" style="query" name="filter"/>
                    </request>
                    <response>
                        <representation mediaType="application/json"/>
                    </response>
                </method>
                <resource path="{GUID}">
                    <param xmlns:xs="http://www.w3.org/2001/XMLSchema"
type="xs:string" style="template" name="GUID"/>
                    <param xmlns:xs="http://www.w3.org/2001/XMLSchema"
type="xs:string" style="template" name="GUID"/>
                    <method name="GET" id="getItemJSON">
                        <response>
                            <representation mediaType="application/json"/>
                        </response>
                    </method>
                    <method name="PUT" id="putItemJSON">
                        <request>
                            <representation mediaType="application/json"/>
                        </request>
                    </method>
                    <method name="POST" id="postItemJSON">
                        <request>
                            <representation mediaType="application/json"/>
                        </request>
                    </method>
                </resource>
            </resource>
        </resource>
    </resources>
</application>
```

28 Identities Service

This section describes the Identities Service.

About the Identities Service

The Identities Service provides a REST endpoint for retrieving information about identities.

Accessing and Using the Identities Service

The Identities Service exposes resources to retrieve identity information. The service allows a user to retrieve lists of identities or access specific identities by filter expression or identity ID.

Available Resources

There are several types of resources available for the service.

Identities Service

The service provides a resource URI for every object exposed. The Identities resource supports two basic URI patterns:

- Resource for returning a collection of identities
- Resource for returning a specific identity instance

Services for Filtering, Debugging, and Displaying Schema Information

The service supports the following paramters to allow you to perform operations on the primary identities data set:

- A filter parameter to enable the filtering of result sets
- A debug matrix parameter to enable you to return the JSON structures in a human readable format
- A schema matrix parameter to enable you to return the schema for the data set

Complete URI Syntax

The following table shows the complete URI syntax for all resource end points associated with the Identities Service, along with a description for each URI and a list of supported HTTP methods:

Table 28-1 Resource URIs

URI	Description
/v1	Entry point for the service.
/vi/identities	Will return a list of identities with minimum information and a list of identity URI links that include the identity GUID. The VDX services will be used to provide identity information. This information will be based on how the DAL user entity is defined. All attributes defined by the DAL entry will be made available to the identity JSON payload. The following HTTP methods are supported with this URI: GET - This will return a collection of identies (JSON Array). POST – Not supported PUT – Not supported DELETE – Not supported
identities?filter={identity filter}	GET - The Identity ID parameter will be a GUID to identify a specific identity within the LDAP realm. The payload will include links to the identity's roles, resources, and work items. The VDX services will be used to provide identity information. This information will be based on how the DAL user entity is defined. All attributes defined by the DAL entry will be made available to the identity JSON payload. POST – Not supported PUT – Not supported DELETE – Not supported If the “Accept” header is “image/gif”, then the identity photo will be returned.
identities/{Identity Id}	GET - The Identity ID parameter will be a GUID to identify a specific identity within the LDAP realm. The payload will include links to the identity's roles, resources, and work items. The VDX services will be used to provide identity information. This information will be based on how the DAL user entity is defined. All attributes defined by the DAL entry will be made available to the identity JSON payload. In the case of image type data, this might be just a link to this information (still needs to be flushed out) POST – Not supported PUT – Not supported DELETE – Not supported If the “Accept” header is “image/gif”, then the identity photo will be returned.

URI	Description
identities/{Identity Id}/{attribute ID}	GET - A specific attribute for a specific identity ID. POST – Not supported PUT – Not supported DELETE – Not supported Note: application/json will be returned for all attributes except for the attribute types of binary which an “image/gif” content type will be returned.
identities/{GUID}	GET - Retrieves a user by GUID.
identities/{Fully qualified DN}	GET - Retrieves a user by fully qualified DN. Example: /v1/identities/ cn=ablake,ou=users,ou=idmsample,o=netiq
identities/{GUID}/{ATTRIBUTE}	GET - Retrieves a specific attribute for a user by GUID.
identities/{Fully qualified DN}/{ATTRIBUTE}	GET - Retrieves a specific attribute for a user by fully qualified DN.

Table 28-2 *Matrix Parameters for Debugging and Displaying the Schema*

URI	Description
identities;debug	This `debug` matrix parameter displays the identities JSON structure in human readable format, as opposed to compressed format. This matrix parameter can be put anywhere in the URI.
identities;schema	The `schema` matrix parameter can be put anywhere in the URI and in combination with the “Accept” header type will return the appropriate schema document for the content type. In this case a JSON schema document is returned for the workitems.

JSON Representations Received by the Client

This section shows the JSON structures received by the client for each resource. In each case, the HTTP method is GET.

Identities Endpoint

The identities end point (/identities) returns a collection (JSON Array) of identities available to the Directory Abstraction Layer (DAL).

```
[
{
   "Managers": [{
      "DN": "cn=mmackenzie,ou=users,ou=medical-idmsample,o=netiq",
      "GUID": "1b9d83fa6f03b64e5bba1b9d83fa6f03",
      "Link": "/RIS/v1/identities/1b9d83fa6f03b64e5bba1b9d83fa6f03",
      "Value": "Margo MacKenzie"
   }],
   "DirectReports": [{}],
   "Groups": [{
      "DN": "cn=HR,ou=groups,ou=medical-idmsample,o=netiq",
      "GUID": "7f7f381d9cc3ad4694967f7f381d9cc3",
      "Link": "",
      "Value": "Human Resources"
   }],
   "Links": [
      {
         "Type": "wf/workitems",
         "Value": "Workitems",
         "Link": "/RIS/v1/wf/
workitems?filter=Addressee%3Dcn%3Dablake%2Cou%3Dusers%2Cou%3Dmedical-
idmsample%2Co%3Dnetiq"
      },
      {
         "Type": "roles",
         "Value": "Roles",
         "Link": "/RIS/v1/
roles?filter=User%3Dcn%3Dablake%2Cou%3Dusers%2Cou%3Dmedical-idmsample%2Co%3Dnetiq"
      }
   ],
   DN": "cn=ablake,ou=users,ou=medical-idmsample,o=netiq",
   "GUID": "26b65d8611075849e2b226b65d861107",
   "Link": "/RIS/v1/identities/26b65d8611075849e2b226b65d861107",
   "FirstName": "Allison",
   "LastName": "Blake",
   "Title": "Payroll",
   "Department": "HR",
   "Location": "Northeast",
   "Email": "mthibault@netiq.com",
   "TelephoneNumber": "(555) 555-1222",
   "City": "",
   "Country": "",
   "PostalCode": "",
   "State": "",
   "Street": ""
},
…. More identities
]
```

Identities/{Identity Id} Endpoint

The identities/{Identity Id} endpoint returns specific identity information from the Directory Abstraction Layer This information will be based on how the DAL user entity is defined. All attributes defined by the DAL entry are made available to the identity JSON payload.

```
{
   "Managers": [{
      "DN": "cn=mmackenzie,ou=users,ou=medical-idmsample,o=netiq",
      "GUID": "1b9d83fa6f03b64e5bba1b9d83fa6f03",
      "Link": "/RIS/v1/identities/1b9d83fa6f03b64e5bba1b9d83fa6f03",
      "Value": "Margo MacKenzie"
   }],
   "DirectReports": [{}],
   "Groups": [{
      "DN": "cn=HR,ou=groups,ou=medical-idmsample,o=netiq",
      "GUID": "7f7f381d9cc3ad4694967f7f381d9cc3",
      "Link": "",
      "Value": "Human Resources"
   }],
   "Links": [
      {
         "Type": "wf/workitems",
         "Value": "Workitems",
         "Link": "/RIS/v1/wf/
workitems?filter=Addressee%3Dcn%3Dablake%2Cou%3Dusers%2Cou%3Dmedical-
idmsample%2Co%3Dnetiq"
      },
      {
         "Type": "roles",
         "Value": "Roles",
         "Link": "/RIS/v1/
roles?filter=User%3Dcn%3Dablake%2Cou%3Dusers%2Cou%3Dmedical-idmsample%2Co%3Dnetiq"
      }
   ],
   DN": "cn=ablake,ou=users,ou=medical-idmsample,o=netiq",
   "GUID": "26b65d8611075849e2b226b65d861107",
   "Link": "/RIS/v1/identities/26b65d8611075849e2b226b65d861107",
   "FirstName": "Allison",
   "LastName": "Blake",
   "Title": "Payroll",
   "Department": "HR",
   "Location": "Northeast",
   "Email": "mthibault@netiq.com",
   "TelephoneNumber": "(555) 555-1222",
   "City": "",
   "Country": "",
   "PostalCode": "",
   "State": "",
   "Street": ""
}
```

identities/{Identity Id}/{attribute ID} Endpoint

The identities/{Identity Id} endpoint returns a specific identity attribute.

```
{
   DN": "cn=ablake,ou=users,ou=medical-idmsample,o=netiq",
   "GUID": "26b65d8611075849e2b226b65d861107",
   "Link": "/RIS/v1/identities/26b65d8611075849e2b226b65d861107",
   "FirstName": "Allison"
}
```

Event Status Codes

This section shows the event status codes for the available resources:

Table 28-3 *Event Status Codes*

URI	Status codes
identities	HTTP GET - Status 200 - OK
identities?filter={identity filter}	HTTP GET - Status 200 - OK
identities/{Identity Id}	HTTP GET - Status 200 - OK
identities/{Identity Id}/{attribute ID}	HTTP GET - Status 200 - OK

The Jersey implemented error conditions are used. When server errors are found, Jersey returns the appropriate 400 and 500 level codes.

29 Resources Service

This section describes the Resources Services.

About the Resources Service

The Resources Service provides a REST endpoint for retrieving information about resources.

Accessing and Using the Resources Service

The Resources Service exposes resources to retrieve resources information. The service allows you to retrieve lists of resources or access specific resources by filter expression or resource ID.

IMPORTANT: To view resource detail and resource assignments by using the resource/{resource id} and resource/{resource id}/assignments end points, you need to be a Resource Administrator and a Provisioning Administrator. The Resource Administrator must have appropriate permissions on the Provisioning domain. To provide these permissions:

1. Log into the User Application as the Provisioning Administrator.
2. Provide all domain rights to the Resource Administrator including rights on the Provisioning domain.
3. Log in to iManager.
4. Add Resource Administrator as a trustee of Resource-Config in iManager.

Available Resources

Resources Service

The service provides a resource URI for every object exposed. The Roles resource supports the following URI patterns:

- Resource for returning a collection of resources
- Resource for returning a specific resource instance
- Resource for returning all assignments for a specific resource instance
- Resource for returning a particular resource assignment

Services for Filtering, Debugging, and Displaying Schema Information

The service supports the following parameters to allow you to perform operations on the primary resources data set:

- A filter parameter to enable the filtering of result sets
- A debug matrix parameter to enable you to return the JSON structures in a human readable format
- A schema matrix parameter to enable you to return the schema for the data set

Complete URI Syntax

The following table shows the complete URI syntax for all resource end points associated with the Resources Service, along with a description for each URI and a list of supported HTTP methods:

Table 29-1 *Resource URIs*

URI	Description
/resources	GET - Will return a list of resources with minimal information and a list of role URI links that include the role GUID
	POST – Not supported
	PUT – Not supported
	DELETE – Not Supported
/resources/{ResourceId}	GET - The Resource ID parameter is a GUID used to identify a specific resource within the LDAP realm
	POST – Not supported
	PUT – Not supported
	DELETE – Not Supported
/resources/{ResourceId}/assignments	GET - Will return a list of assignments for a specific resource. This will be a list of assignments to users.
	POST – Not supported
	PUT – Not supported
	DELETE – Not Supported
/resources/{ResourceId}/assignments/{assignment id}	GET - Displays information on a specific resource assignment.
	POST – Not supported
	PUT – Not supported
	DELETE – Not Supported

URI	Description
/resources/refreshCodeMap	GET - Not supported
	POST – Triggers a code map refresh for an entitlement. The request to trigger the refresh takes in an entitlement DN and the response includes a detailed status containing information about the codemap refresh, such as the last refresh time and refresh status.
	PUT – Not supported
	DELETE – Not Supported
/resources/refreshStatus/{GUID}	GET - Fetches the status of a code map refresh (RUNNING, COMPLETED, FAILED). The request to fetch the refresh status takes in an entitlement DN and returns details outlining the status of the code map refresh that was triggered previously.
	POST – Not supported
	PUT – Not supported
	DELETE – Not Supported
/resources/checkCodeMapValueStatus	GET - Not supported
	POST – Checks for the existence of an entitlement value in the RBPM code map.
	PUT – Not supported
	DELETE – Not Supported
/resources/checkMultiCodeMapValueStatus	GET - Not supported
	POST – Checks for the existence of multiple entitlement values in the RBPM code map.
	PUT – Not supported
	DELETE – Not Supported

The following table lists the parameters for debugging and displaying the schema:

Table 29-2 *Matrix Parameters for Debugging and Displaying the Schema*

URI	Description
resources;debug	This `debug` matrix parameter displays the resources JSON structure in human readable format, as opposed to compressed format. This matrix parameter can be put anywhere in the URI.
resources;schema	The `schema` matrix parameter can be put anywhere in the URI and in combination with the “Accept” header type will return the appropriate schema document for the content type. In this case a JSON schema document is returned for the resources.

JSON Representations

This section provides the JSON representation for the resources endpoint.

Resources Endpoint

JSON Response The resources end point (/resources) returns a collection (JSON Array) of resources.

```
{
      "Link": "\/RIS\/resources\/9ca222fa9f942e4a7f879ca222fa9f94",
      "DN": 
"cn=BuildingAccessWest,cn=ResourceDefs,cn=RoleConfig,cn=AppConfig,cn=DoradoDriver,
cn=TestDrivers,o=netiq",
      "GUID": "9ca222fa9f942e4a7f879ca222fa9f94"
      "Name": "West Building Access",
      "description" : "West Building Access",
      "CategoryKey": ["default"],
}
```

RefreshCodeMap Endpoint

JSON Request The refreshCodeMap endpoint (/resources/refreshCodeMap) sends a JSON request in this format.

```
{
"DN" : "cn=Building Pass,cn=GroupEntitlementLoopback,cn=TestDrivers,o=netiq"
}
```

JSON Response The refreshCodeMap endpoint (/resources/refreshCodeMap) returns a detailed status containing information about the code map refresh.

```
{"GUID":"46d1b6b9aea3264b9ca946d1b6b9aea3","Status":"true","DN":"cn=Building 
Pass,cn=GroupEntitlementLoopback,cn=TestDrivers,o=netiq","DetailedStatus":[[{"GUID
":"46d1b6b9aea3264b9ca946d1b6b9aea3","Status":"SUCCESS","Entitlement-
DN":"cn=Building Pass,cn=GroupEntitlementLoopback,cn=TestDrivers,o=netiq","Last-
Refresh":"1329373072390","Connection-Name":"1111"}]]}
```

RefreshStatus Endpoint

JSON Response The refreshStatus endpoint (/resources/refreshStatus/{GUID}) returns details outlining the status of a previously triggered code map refresh.

```
{"CodeMapRefreshStatus":[{"GUID":"46d1b6b9aea3264b9ca946d1b6b9aea3","Status":"1329
373072390","Entitlement-DN":"cn=Building 
Pass,cn=GroupEntitlementLoopback,cn=TestDrivers,o=netiq","Last-
Refresh":"1329373072390","Connection-Name":"1111"}]}
```

CheckCodeMapValueStatus Endpoint

JSON Request The checkCodeMapValueStatus endpoint (/resources/checkCodeMapValueStatus) sends a JSON request in this format:

```
{
"entitlementDN" : "cn=Building
Pass,cn=GroupEntitlementLoopback,cn=TestDrivers,o=netiq",
"connectionName" : "test",
"codeMapValue" : "Waltham:Spring Street"
}
```

JSON Response The checkCodeMapValueStatus endpoint (/resources/checkCodeMapValueStatus) returns the status for an entitlement value in this format:

```
{"UpToDate":"false","Value":"Waltham:Spring
Street","RefreshStatus":{"GUID":"46d1b6b9aea3264b9ca946d1b6b9aea3","Status":"SUCCE
SS","Entitlement-DN":"cn=Building
Pass,cn=GroupEntitlementLoopback,cn=TestDrivers,o=netiq","Last-
Refresh":"1329712008390","Connection-Name":"test"}}
```

CheckMultiCodeMapValueStatus Endpoint

JSON Request The checkMultiCodeMapValueStatus endpoint (/resources/checkMultiCodeMapValueStatus) sends a JSON request in this format:

```
{ "entitlementParams" : [
  {
    "entitlementDN" : "cn=Building
Pass,cn=GroupEntitlementLoopback,cn=TestDrivers,o=netiq",
    "connectionName" : "test",
    "codeMapValue" : "Waltham:Spring Street"
  },
  {
    "entitlementDN" : "cn=Parking
Permission,cn=GroupEntitlementLoopback,cn=TestDrivers,o=netiq",
    "connectionName" : "test1",
    "codeMapValue" : "Cambridge:Main Street"
  }
]
}
```

JSON Response The checkCodeMapValueStatus endpoint (/resources/checkMultiCodeMapValueStatus) returns the status for the specified entitlement values in this format:

```
{"CodeMapValueStatus":[{"UpToDate":"false","Value":"Waltham:Spring
Street","RefreshStatus":{"GUID":"46d1b6b9aea3264b9ca946d1b6b9aea3","Status":"SUCCE
SS","Entitlement-DN":"cn=Building
Pass,cn=GroupEntitlementLoopback,cn=TestDrivers,o=netiq","Last-
Refresh":"1329712008390","Connection-
Name":"test"}},{"UpToDate":"false","Value":"Cambridge:Main
Street","RefreshStatus":{"GUID":"d33a80ae1cb82e4c80b9d33a80ae1cb8","Status":"SUCCE
SS","Entitlement-DN":"cn=Parking
Permission,cn=GroupEntitlementLoopback,cn=TestDrivers,o=netiq","Last-
Refresh":"1329686444156","Connection-Name":"test1"}}]}
```

30 Roles Service

This section describes the Roles Service.

About the Role Service

The Roles Service provides a REST endpoint for retrieving information about roles.

Accessing and Using the Role Service

The Roles Service exposes resources to retrieve roles information. The service allows you to retrieve lists of roles or access specific roles by filter expression or role ID.

IMPORTANT: To view role detail and role assignments by using the role/{role id} and role/{role id}/assignments end points, you need to be a Role Administrator and a Provisioning Administrator. The Role Administrator must have appropriate permissions on the Provisioning domain. To provide these permissions:

1. Log into the User Application as the Provisioning Administrator.
2. Give all domain rights to the Role Administrator including rights on the Provisioning domain.
3. Login to iManager.
4. Add Role Administrator as a trustee of Role-Config in iManager.

Available Resources

There are several types of resources available for the service.

Roles Service

The service provides a resource URI for every object exposed. The Roles resource supports the following URI patterns:

- Resource for returning a collection of roles
- Resource for returning a specific role instance
- Resource for returning assignments for a specific role instance
- Resource for returning SoDs for a specific role instance

Services for Filtering, Debugging, and Displaying Schema Information

The service supports the following parameters to allow you to perform operations on the primary roles data set:

- A filter parameter to enable the filtering of result sets
- A debug matrix parameter to enable you to return the JSON structures in a human readable format
- A schema matrix parameter to enable you to return the schema for the data set

Complete URI Syntax

The following table shows the complete URI syntax for all resource end points associated with the Roles Service, along with a description for each URI and a list of supported HTTP methods:

Table 30-1 *Resource URIs*

URI	Description
/roles	GET - Will return a list of roles with minimum information and a list of role URI links that include the role GUID POST – Not supported PUT – Future. The PUT operation with the appropriate JSON structure will be used to create a new role. The Role JSON structure will be the same as the one used for the /roles/{RoleID} GET end point DELETE – Not Supported

URI	Description

/roles?filter={role filter expression}	GET - The above list can then be filtered by entering a role filter expression on the URI.
	
	The role filter expression must use the following syntax:
	
	`Attribute%20Operator%20'Value'`
	
	`Attribute` must be one of the following:
	◆ `Name`
	◆ `Description`
	
	`Operator` must be one of the following:
	◆ `equal`
	◆ `startwith`
	◆ `endwith`
	◆ `notequal`
	
	For example:
	
	`/roles?filter=Description%20 startwith%20'test'`
	
	NOTE: The expression must include spaces between the *`Attribute`*, *`Operator`*, and *`Value`* elements, and the *`Value`* must be enclosed in single quotes (`'`).

/roles/{RoleId}	GET - The Role ID parameter will be a GUID to identify a specific role within the LDAP realm. POST – Future. Provide ability to modify a specific role. PUT – Not supported DELETE – Future. Will remove the role.
/roles/{RoleId}/assignments	GET - Will return a list of assignments for a specific role. This will include assignments to other users, groups, and containers assigned to a role. It does not include role relationship information (information about roles assigned to another to a role). PUT – Future. The PUT operation with the appropriate JSON structure will be used to assign the role to another role, user, group, or container. POST – Not supported DELETE – Not supported

URI	Description
/roles/{RoleId}/assignments/{assignmentID}	GET – Display information on a specific role assignment. The assignment ID will be a GUID representing either a role, group, user or container. PUT – Not supported POST – Not supported DELETE – Future. Remove the specific assignment
/roles/{RoleId}/sods	GET - Will return a list of SODs for a specific role. This information will be crucial for clients that want to assign roles. Before the assignment, this REST end point should be executed to determine if any SODs exist for that particular role. PUT – Not supported POST – Not supported DELETE – Not supported
/roles/{RoleId}/sods/{sodID}	GET – Display information on a specific SOD. PUT – Not supported POST – Not supported DELETE – Not supported

Table 30-2 *Matrix Parameters for Debugging and Displaying the Schema*

URI	Description
roles;debug	This `debug` matrix parameter displays the roles JSON structure in human readable format, as opposed to compressed format. This matrix parameter can be put anywhere in the URI.
roles;schema	The `schema` matrix parameter can be put anywhere in the URI and in combination with the “Accept” header type will return the appropriate schema document for the content type. In this case a JSON schema document is returned for the roles.

JSON Representations

This section shows the JSON structures received by the client for each resource. In each case, the HTTP method is GET.

Roles Endpoint

The roles end point (/roles) returns a collection (JSON Array) of roles.

```
[
   {
      "Links": [{
         "Link": "/RIS/v1/roles/372c47071345ae463db5372c47071345/assignments",
         "Type": "Assignments",
         "Value": "Assignments"
      },
             {
         "Link": "/RIS/v1/roles/372c47071345ae463db5372c47071345/sods",
         "Type": "SODS",
         "Value": "SODS"
      }],
      "DN": "cn=Scheduler System
Access,cn=Level10,cn=RoleDefs,cn=RoleConfig,cn=AppConfig,cn=PicassoDriver,cn=TestD
rivers,o=netiq",
      "GUID": "372c47071345ae463db5372c47071345",
      "Link": "/POC/roa/v1/roles/372c47071345ae463db5372c47071345",
      "Name": "Scheduler System Access",
      "Description": "Scheduler System Access",
      "CategoryKey": ["system"],
      "RoleLevel": {
         "Name": "Permission Role",
         "Description": "Permission to connected systems",
         "level": "10"
      }
   },
   {
      "Links": [{
         "Link": "/RIS/v1/roles/3059a9b358c8ba4f0ab53059a9b358c8/assignments",
         "Type": "Assignments",
         "Value": "Assignments"
      },
            {
         "Link": "/RIS/v1/roles/3059a9b358c8ba4f0ab53059a9b358c8/sods",
         "Type": "SODS",
         "Value": "SODS"
      }],
      "DN": "cn=ER Access-
West,cn=Level10,cn=RoleDefs,cn=RoleConfig,cn=AppConfig,cn=PicassoDriver,cn=TestDri
vers,o=netiq",
      "GUID": "3059a9b358c8ba4f0ab53059a9b358c8",
      "Link": "/RIS/v1/roles/3059a9b358c8ba4f0ab53059a9b358c8",
      "Name": "ER Access(West Campus)",
      "Description": "ER Access (West Campus)",
      "CategoryKey": ["building"],
      "RoleLevel": {
         "Name": "Permission Role",
         "Description": "Permission to connected systems",
         "level": "10"
      }
   },
…..
]
```

Roles/{RoleId} Endpoint

The roles/{RoleId} endpoint returns specific role information.

```
{
      "Links": [{
         "Link": "/RIS/v1/roles/372c47071345ae463db5372c47071345/assignments",
         "Type": "Assignments",
         "Value": "Assignments"
      },
             {
         "Link": "/RIS/v1/roles/372c47071345ae463db5372c47071345/sods",
         "Type": "SODS",
         "Value": "SODS"
      }],
      "DN": "cn=Scheduler System 
Access,cn=Level10,cn=RoleDefs,cn=RoleConfig,cn=AppConfig,cn=PicassoDriver,cn=TestD
rivers,o=netiq",
      "GUID": "372c47071345ae463db5372c47071345",
      "Link": "/POC/roa/v1/roles/372c47071345ae463db5372c47071345",
      "Name": "Scheduler System Access",
      "Description": "Scheduler System Access",
      "CategoryKey": ["system"],
      "RoleLevel": {
         "Name": "Permission Role",
         "Description": "Permission to connected systems",
         "level": "10"
      }
}
```

Roles/{RoleId}/assignments Endpoint

This endpoint returns a list of assignments for a specific role.

```
{
   "Containers": [],
   "Groups": [],
   "Roles": [
      {
         "DN": "cn=Write 
Prescriptions,cn=Level10,cn=RoleDefs,cn=RoleConfig,cn=AppConfig,cn=PicassoDriver,c
n=TestDrivers,o=netiq",
         "GUID": "7cee8c618a2e8a436eb87cee8c618a2e",
         "Value": "Write Prescription",
         "link": "/RIS/v1/roles/7cee8c618a2e8a436eb87cee8c618a2e"
      },
      {
         "DN": "cn=Administer 
Drugs,cn=Level10,cn=RoleDefs,cn=RoleConfig,cn=AppConfig,cn=PicassoDriver,cn=TestDr
ivers,o=netiq",
         "GUID": "edcc5430f3e1a74041acedcc5430f3e1",
         "Value": "Administer Drug",
         "Link": "/RIS/v1/roles/edcc5430f3e1a74041acedcc5430f3e1"
      },
      {
         "DN": "cn=Order Medical 
Tests,cn=Level10,cn=RoleDefs,cn=RoleConfig,cn=AppConfig,cn=PicassoDriver,cn=TestDr
ivers,o=netiq",
         "GUID": "1a3381b0b849c04c1f981a3381b0b849",
         "Value": "",
         "Link": "/RIS/v1/roles/1a3381b0b849c04c1f981a3381b0b849"
      },
      {
         "DN": "cn=Perform Medical
Tests,cn=Level10,cn=RoleDefs,cn=RoleConfig,cn=AppConfig,cn=PicassoDriver,cn=TestDr
ivers,o=netiq",
         "GUID": "4146615061202f4231b6414661506120",
         "Value": "",
         "Link": "/RIS/v1/roles/4146615061202f4231b6414661506120"
      }
   ],
   "Users": [{
      "DN": "cn=ablake,ou=users,ou=medical-idmsample,o=netiq",
      "GUID": "26b65d8611075849e2b226b65d861107",
      "Value": "Allison Blake",
      "Link": "/RIS/v1/identities/26b65d8611075849e2b226b65d861107"
   }],
   "DN":
"cn=Doctor,cn=Level20,cn=RoleDefs,cn=RoleConfig,cn=AppConfig,cn=PicassoDriver,cn=T
estDrivers,o=netiq",
   "GUID": "80146f8473973942ceb380146f847397",
   "Link": "/RIS/v1/roles/80146f8473973942ceb380146f847397",
   "Name": "Doctor",
   "Description": "Doctor"
}
```

Roles/{RoleId}/assignments/{assignmentID} Endpoint

This endpoint returns information on a specific role assignment.

```
{
 "Users": [{
      "DN": "cn=ablake,ou=users,ou=medical-idmsample,o=netiq",
      "GUID": "26b65d8611075849e2b226b65d861107",
      "Value": "Allison Blake",
      "Link": "/RIS/v1/identities/26b65d8611075849e2b226b65d861107"
   }],
   "DN":
"cn=Doctor,cn=Level20,cn=RoleDefs,cn=RoleConfig,cn=AppConfig,cn=PicassoDriver,cn=T
estDrivers,o=netiq",
   "GUID": "80146f8473973942ceb380146f847397",
   "Link": "/RIS/v1/roles/80146f8473973942ceb380146f847397",
   "Name": "Doctor",
   "Description": "Doctor"
}
```

Roles/{RoleId}/sods Endpoint

This endpoint return a list of SoDs for a specific role. This information is crucial for clients that want to assign roles. Before the assignment, this REST end point should be executed to determine if any SODs exist.

```
[
{
  "DN":
"cn=SOD,cn=SodDefs,cn=RoleConfig,cn=AppConfig,cn=PicassoDriver,cn=TestDrivers,o=ne
tiq",
  "GUID": "80146f8473973942ceb380146f847397",
  "Link": "/RIS/v1/roles/3059a9b358c8ba4f0ab53059a9b358c8/sods/
80146f8473973942ceb380146f847397",
  "Name" : "sod name",
  "Description" : "sod description",
  "Quorum" : "50%",
  "ApprovalType" : "SOD approval type",
  "Roles" : [ {"DN":
"cn=Doctor,cn=Level20,cn=RoleDefs,cn=RoleConfig,cn=AppConfig,cn=PicassoDriver,cn=T
estDrivers,o=netiq",
               "GUID": "3059a9b358c8ba4f0ab53059a9b358c8",
               "Link": "/RIS/v1/roles/3059a9b358c8ba4f0ab53059a9b358c8",
               "Name": "Doctor",
               "Description": "Doctor"},
        {"DN":
"cn=Nurse,cn=Level20,cn=RoleDefs,cn=RoleConfig,cn=AppConfig,cn=PicassoDriver,cn=Te
stDrivers,o=netiq",
               "GUID": "3059a9b358c8ba4f0ab53059a9b358c8",
               "Link": "/RIS/v1/roles/3059a9b358c8ba4f0ab53059a9b358c8",
               "Name": "Nurse",
               "Description": "Nurse"}
                   ]
  "RequestDefinition" : {
               "Value": "Role Approval",
                "DN": "cn=Role
Approval,cn=RequestDefs,cn=AppConfig,cn=CaribouDriver,cn=TestDrivers,o=netiq",
               "GUID": "c24dc77790ea497eb07617341c01e718",
                "Link": "/RIS/wf/definition/c24dc77790ea497eb07617341c01e718"
        },
  "Approvers" : [ {"DN": "cn=ablake,ou=users,ou=medical-idmsample,o=netiq",
                   "GUID": "26b65d8611075849e2b226b65d861107",
               "Link": "/RIS/v1/identities/26b65d8611075849e2b226b65d861107",
       "Value" : "Allison Blake"},
      {"DN": "cn=mmackenzie,ou=users,ou=medical-idmsample,o=netiq",
                   "GUID": "26b65d8611075849e2b226b65d861107",
               "Link": "/RIS/v1/identities/26b65d8611075849e2b226b65d861107",
       "Value" : "Margo Mackenzie"}
} ,
….
]
```

Roles/{RoleId}/sods/{sodID}

This endpoint returns information on a specific SoD.

```
{
  "DN":
"cn=SOD,cn=SodDefs,cn=RoleConfig,cn=AppConfig,cn=PicassoDriver,cn=TestDrivers,o=ne
tiq",
  "GUID": "80146f8473973942ceb380146f847397",
  "Link": "/RIS/v1/roles/3059a9b358c8ba4f0ab53059a9b358c8/sods/
80146f8473973942ceb380146f847397",
  "Name" : "sod name",
  "Description" : "sod description",
  "Quorum" : "50%",
  "ApprovalType" : "SOD approval type",
  "Roles" : [ {"DN":
"cn=Doctor,cn=Level20,cn=RoleDefs,cn=RoleConfig,cn=AppConfig,cn=PicassoDriver,cn=T
estDrivers,o=netiq",
               "GUID": "3059a9b358c8ba4f0ab53059a9b358c8",
               "Link": "/RIS/v1/roles/3059a9b358c8ba4f0ab53059a9b358c8",
               "Name": "Doctor",
               "Description": "Doctor"},
        {"DN":
"cn=Nurse,cn=Level20,cn=RoleDefs,cn=RoleConfig,cn=AppConfig,cn=PicassoDriver,cn=Te
stDrivers,o=netiq",
               "GUID": "3059a9b358c8ba4f0ab53059a9b358c8",
               "Link": "/RIS/v1/roles/3059a9b358c8ba4f0ab53059a9b358c8",
               "Name": "Nurse",
               "Description": "Nurse"}
                   ]
  "RequestDefinition" : {
               "Value": "Role Approval",
                "DN": "cn=Role
Approval,cn=RequestDefs,cn=AppConfig,cn=CaribouDriver,cn=TestDrivers,o=netiq",
               "GUID": "c24dc77790ea497eb07617341c01e718",
                "Link": "/RIS/wf/definition/c24dc77790ea497eb07617341c01e718"
        },
  "Approvers" : [ {"DN": "cn=ablake,ou=users,ou=medical-idmsample,o=netiq",
                   "GUID": "26b65d8611075849e2b226b65d861107",
               "Link": "/RIS/v1/identities/26b65d8611075849e2b226b65d861107",
       "Value" : "Allison Blake"},
      {"DN": "cn=mmackenzie,ou=users,ou=medical-idmsample,o=netiq",
                   "GUID": "26b65d8611075849e2b226b65d861107",
               "Link": "/RIS/v1/identities/26b65d8611075849e2b226b65d861107",
       "Value" : "Margo Mackenzie"}
}
```

Event Status Codes

This section shows the event status codes for the available resources:

Table 30-3 Event Status Codes

URI	Status codes
roles	HTTP GET - Status 200 - OK
	HTTP PUT – Status 200 - OK
roles/{RoleId}	HTTP GET - Status 200 - OK
	HTTP POST – Status 200 – OK
	HTTP DELETE – Status 204 – No Content
roles/{RoleId}/assignments	HTTP GET - Status 200 - OK
	HTTP PUT – Status 200 - OK
roles/{RoleId}/assignments/{assignmentID}	HTTP GET - Status 200 - OK
	HTTP DELETE – Status 204 – No Content
roles/{RoleId}/sods	HTTP GET - Status 200 - OK
roles/{RoleId}/sods/{sodID}	HTTP GET - Status 200 - OK

The Jersey implemented error conditions are used. When server errors are found, Jersey returns the appropriate 400 and 500 level codes.

31 Work Items Service

This section describes the Work Items Service.

About the Work Items Service

The Work Items Service provides a REST endpoint for retrieving work items associated with provisioning workflows.

Accessing and Using the Work Items Service

The Provisioning Work Items Service exposes resources to retrieve provisioning work item information. The service allows a user is able to retrieve all work items related to himself or herself and then act upon a specific work item if so desired (Approve, Deny, Refuse).

Removing Administrator Credential Restrictions By default, the Provisioning Work Items Service requires that the HTTP session logged in user have administrator credentials. This restriction can be removed to allow a session with a logged in user who does not have administrator credentials to invoke the methods for the service. To allow non-administrative users to call workflow endpoints, you need to modify your configuration as described in "About the Provisioning Web Service" on page 261 and "About the Directory Abstraction Layer (VDX) Web Service" on page 357.

Available Resources

There are three types of resources available for the service.

Entry Point

The entry point URI for the Provisioning Work Items Service is:

```
/v1
```

The root entry point returns a list of all resources available.

Workitems Resource

The service provides a resource URI for every object exposed. The Work Items resource supports two basic URI patterns:

- Resource for returning a collection of work items
- Resource for returning a specific work item instance

Resources for Filtering, Debugging, and Displaying Schema Information

The service supports the following parameters to allow you to perform operations on the primary work items data set:

- A filter parameter to enable the filtering of result sets
- A debug matrix parameter to enable you to return the JSON structures in a human readable format
- A schema matrix parameter to enable you to return the schema for the data set

Complete URI Syntax

The following table shows the complete URI syntax for all resource end points associated with the Work Items Service, along with a description for each URI and a list of supported HTTP methods:

Table 31-1 *Resource URIs*

URI	Description
/v1	Entry point for the service.
/v1/wf/workitems	Will return a collection (JSON Array) of work items available in the work flow sub system. Note: the URI is preceded with “wf/” this is to allow us to introduce other work flow related ROA services in the future such as “wf/processes” which will list all processes available in the work flow sub system. The following HTTP methods are supported with this URI: GET - This will return a collection of work items (JSON Array). POST – Not supported PUT – Not supported DELETE – Not supported

URI	Description
/v1/wf/workitems?filter={parameter}={value}	Return a collection of work items (JSON Array) for a specific addressee DN. The possible query parameters are listed below: **Addressee** Addressee DN **DefinitionId** Process DN **ProcessId** Process request instance ID (GUID) **ActivityId** Activity ID **Status** Status code (Integer) **Owner** Owner DN **Priority** Priority (Integer) **CreationTime** Creation time (date-time format) followed by operator (EQ, LT, LE, GT, GE). Example: 20080723044715000-0400EQ **ExpTime** Expiry time(date-time format) followed by operator (EQ, LT, LE, GT, GE). Example: 20080723044715000-0400EQ **CompletionTime** Completion time(date-time format) followed by operator (EQ, LT, LE, GT, GE). Example: 20080723044715000-0400EQ **Recipient** Recipient DN **Initiator** Initiator DN Here is an example that illustrates filtering by addressee: `/v1/wf/workitems?filter=addressee%3dcn%3dadmin,ou%3didmsample,o%3dnetiq`
/v1/wf/workitems?filter=workid={work id}	Return a specific work item (JSON Array) instance based on the work item GUID. Example: `/v1/wf/workitems?filter=workid%3d456789afbc78` Note: the URI must be fully URL encoded.

URI	Description
/v1/wf/workitems/{WorkId}	This will return a single JSON Object with all the work item details. This will include the data items and actions allowed on the work item. The following HTTP methods are supported with this URI: GET - Return a specific work item instance (JSON Object) with all details. This will include the actions supported and data items available for that work item PUT – Forward the appropriate action on the work item. POST – Same as PUT because of limitations in browsers to set the PUT method DELETE – Not supported

Table 31-2 *Matrix Parameters for Debugging and Displaying the Schema*

URI	Description
/v1/wf/workitems;debug	This `debug` matrix parameter displays the workitems JSON structure in human readable format, as opposed to compressed format. This matrix parameter can be put anywhere in the URI.
/v1/wf/workitems/{WorkId};debug	This `debug` matrix parameter displays the work ID JSON structure in human readable format, as opposed to compressed format. This matrix parameter can be put anywhere in the URI.
/v1/wf/workitems;schema	The `schema` matrix parameter can be put anywhere in the URI and in combination with the “Accept” header type will return the appropriate schema document for the content type. In this case a JSON schema document is returned for the workitems.
/v1/wf/workitems/{WorkId};schema	The `schema` matrix parameter can be put anywhere in the URI and in combination with the “Accept” header type will return the appropriate schema document for the content type. In this case a JSON schema document is returned for the work ID.

JSON Representations Received by the Client

This section shows the JSON structures received by the client for each resource. In each case, the HTTP method is GET.

In all JSON structures, date-time values follow this format:

`yyyyMMddhhmmssSSS-ZZZZ`

Here is an example that illustrates the format:

```
20080723044715000-0400
```

Root entry point

The root entry point returns this structure:

```
[
   {
      "Link": "/RIS/v1/wf/workitems",
      "Type": "wf/workitems",
      "Value": "Workflow Workitems"
   }
]
```

Where:Link – relative link to the service availableType – Non localized internal code for the service. Value – Localized value of the service.

Workitems end point

The workitems end point (/v1/wf/workitems) returns a collection (JSON Array) of work items available in the Workflow subsystem.

```
[
   {
      "AvailableActions": [
         {
            "Value": "Deny",
            "Code": "1"
         },
         {
            "Value": "Approve",
            "Code": "0"
         }
      ],
      "GUID": "6d8650ac062548fb84cb0e21bfc3cea6",
      "Link": "/RIS/v1/wf/workitems/
6d8650ac062548fb84cb0e21bfc3cea6?filter=ProcessId%3Dc24dc77790ea497eb07617341c01e7
18",
      "ActivityId": "Activity",
      "ActivityName": "Approve Role Request (Serial)",
      "Addressee": {
         "DN": "cn=admin,ou=medical-idmsample,o=netiq",
         "Value": "Application Administrator Of Sample Data",
         "GUID": "",
         "Link": ""
      },
      "AssignmentType": "0",
      "Created": "20080723044715000-0400",
      "Owner": "Unclaimed",
      "Priority": "2",
      "Definition": {
         "Value": "Role Approval",
         "DN": "cn=Role
Approval,cn=RequestDefs,cn=AppConfig,cn=CaribouDriver,cn=TestDrivers,o=netiq",
         "GUID": "",
         "Link": "",
         "Version": "8"
      },
      "Process": {
         "GUID": "c24dc77790ea497eb07617341c01e718",
         "Link":""
      },
      "Status": "0",
      "DigitalSignatureType": "not-required",
      "Initiator": {
         "DN": "CN=admin,OU=medical-idmsample,O=netiq",
         "Value": "Application Administrator Of Sample Data",
         "GUID": "",
         "Link":""
      },
      "Recipient": {
         "DN": "cn=admin,ou=medical-idmsample,o=netiq",
         "Value": "Application Administrator Of Sample Data",
         "GUID": "",
         "Link":""
      }
   },
   .....
]
```

Single workitem end point

The end point for accessing a single workitem (/v1/wf/workitems/{work id} returns a single JSON Object with all the workitem details. This object includes the data items and actions allowed on the workitem.

```
{"AvailableActions":[{"Code":"0","Value":"Approve"}],"DataItems":[{"Name":"unmappe
d","Type":"string","Values":[{"Value":""}],"MultiValued":false},{"Name":"reason","
Type":"string","Values":[{"Value":"test"}],"MultiValued":false},{"Name":"requester
","Type":"dn","Values":[{"Value":"cn=uaadmin,ou=sa,o=data"}],"MultiValued":false},
{"Name":"multivaluedField","Type":"string","Values":[{"Value":"one"},{"Value":"two
"}],"MultiValued":true}],"GUID":"2417e36457f44a4d908aa3265e0f1e09","Link":"\/RIS\/
wf\/workitems\/
2417e36457f44a4d908aa3265e0f1e09","ActivityId":"Activity1","ActivityName":"Approva
l
iPhone","Addressee":{"DN":"CN=uaadmin,OU=sa,O=data","GUID":"7f39d29c9e1de04b31bb7f
39d29c9e1d","Link":"","Value":"aaron
admin"},"AssignmentType":"0","Created":"20120402174027000-
0400","Owner":"Unclaimed","Priority":"2","Definition":{"DN":"cn=startFromIphoneMul
tivalued,cn=RequestDefs,cn=AppConfig,cn=UserApplication,cn=Driver
Set,o=netiq","GUID":"368c905cf6f3d048e2ac368c905cf6f3","Link":"\/RIS\/wf\/
definitions\/368c905cf6f3d048e2ac368c905cf6f3","Value":"start
from iphone
multivalued"},"Process":{"GUID":"fa463317b85849bba3f6118bf4ff4dab","Link":"\/RIS\/
wf\/processes\/
fa463317b85849bba3f6118bf4ff4dab"},"Status":"0","Completed":"","Initiator":{"DN":"
cn=uaadmin,ou=sa,o=data","GUID":"7f39d29c9e1de04b31bb7f39d29c9e1d","Link":"\/RIS\/
identities\/7f39d29c9e1de04b31bb7f39d29c9e1d","Value":"aaron
admin"},"Recipient":{"DN":"cn=uaadmin,ou=sa,o=data","GUID":"7f39d29c9e1de04b31bb7f
39d29c9e1d","Link":"\/RIS\/identities\/
7f39d29c9e1de04b31bb7f39d29c9e1d","Value":"aaron
admin"},"Comment":""}
```

JSON Representations Sent by the Client

This section shows the JSON structure sent by the client for the single workitem end point when the HTTP PUT or HTTP POST method is used.

Single workitem end point

When the client uses the HTTP PUT or HTTP POST method with the /v1/wf/workitems/{work id} URI, the JSON Object structure is the same as the GET operation. However, the only information used by the server is the AvailableActions and the DataItems sections. The first available action found is taken as the forwarding action to perform on the work item.

```
{"AvailableActions":[{"Code":"0","Value":"Approve"}],"DataItems":[{"Name":"unmappe
d","Type":"string","Values":[{"Value":""}],"MultiValued":false},{"Name":"reason","
Type":"string","Values":[{"Value":"test"}],"MultiValued":false},{"Name":"requester
","Type":"dn","Values":[{"Value":"cn=uaadmin,ou=sa,o=data"}],"MultiValued":false},
{"Name":"multivaluedField","Type":"string","Values":[{"Value":"one"},{"Value":"two
"}],"MultiValued":true}],"GUID":"2417e36457f44a4d908aa3265e0f1e09","Link":"\/RIS\/
wf\/workitems\/
2417e36457f44a4d908aa3265e0f1e09","ActivityId":"Activity1","ActivityName":"Approva
l
iPhone","Addressee":{"DN":"CN=uaadmin,OU=sa,O=data","GUID":"7f39d29c9e1de04b31bb7f
39d29c9e1d","Link":"","Value":"aaron
admin"},"AssignmentType":"0","Created":"20120402174027000-
0400","Owner":"Unclaimed","Priority":"2","Definition":{"DN":"cn=startFromIphoneMul
tivalued,cn=RequestDefs,cn=AppConfig,cn=UserApplication,cn=Driver
Set,o=netiq","GUID":"368c905cf6f3d048e2ac368c905cf6f3","Link":"\/RIS\/wf\/
definitions\/368c905cf6f3d048e2ac368c905cf6f3","Value":"start
from iphone
multivalued"},"Process":{"GUID":"fa463317b85849bba3f6118bf4ff4dab","Link":"\/RIS\/
wf\/processes\/
fa463317b85849bba3f6118bf4ff4dab"},"Status":"0","Completed":"","Initiator":{"DN":"
cn=uaadmin,ou=sa,o=data","GUID":"7f39d29c9e1de04b31bb7f39d29c9e1d","Link":"\/RIS\/
identities\/7f39d29c9e1de04b31bb7f39d29c9e1d","Value":"aaron
admin"},"Recipient":{"DN":"cn=uaadmin,ou=sa,o=data","GUID":"7f39d29c9e1de04b31bb7f
39d29c9e1d","Link":"\/RIS\/identities\/
7f39d29c9e1de04b31bb7f39d29c9e1d","Value":"aaron
admin"},"Comment":""}
```

Event Status Codes

This section shows the event status codes for the available resources:

Table 31-3 *Event Status Codes*

URI	Status codes
/v1	HTTP GET - Status 200 - OK
/v1/wf/workitems	HTTP GET - Status 200 - OK
v1/wr/workitems/{work id}	HTTP GET – Status 200 – OK
	HTTP PUT – Status 204 – OK with no content
	HTTP POST – Status 204 – OK with no content

The Jersey implemented error conditions are used. When server errors are found, Jersey returns the appropriate 400 and 500 level codes.

JSON Schema

The service supports the use of a schema matrix parameter to return the JSON schema for any returned data set. The JSON schema is based on the proposed schema for JSON as described at:

`http://www.json.com/json-schema-proposal/`

Root entry point schema

The schema for the root ROA entry point (/v1;schema) is as follows:

```
{
   "description" : "schema for: /v1",
   "type" : "array",
   "properties" :

   {
      "Link": {"type" : "string",
          "enum": ["/RIS/v1/wf/workitems"]
         },
      "Type": {"type" : "string",
          "enum": ["wf/workitems"]
         },
      "Value":{"type" : "string",
          "enum": ["Workflow Workitems"]
         }
   }
}
```

Workitems end point schema

The schema for the workitems end point (/v1/wf/workitems;schema) is as follows:

```
{
  "description" : "schema for: /v1/wf/workitems",
    "type" : "array",
    "properties" :
   {
      "AvailableActions" :
      { "type" : "array",
        "properties" :
        {
            "Value" :
             { "type" : "string",
          "enum": ["Approve", "Deny", "Refuse"]
        }
            "Code" :
             { "type" : "integer",
          "enum": [0, 1, 2]
        }
      },
      "DataItems":
      { "type" : "array",
        "properties" :
        {
         "Name": { "type" : "string"},
         "Type": { "type" : "string"},
         "Value": { "type" : "string"}
        }
      },
      "GUID" : { "type" : "string"},
      "Link" : { "type" : "string"},
      "ActivityId" : { "type" : "string"},
      "ActivityName" : { "type" : "string"},
      "Addressee":
      { "type" : "object",
        "properties" :
        {
         "DN": { "type" : "string"},
         "Value": { "type" : "string"},
         "GUID": { "type" : "string"},
         "Link": { "type" : "string"}
      },
      "AssignmentType": { "type" : "integer"},
      "Created":
      { "type" : "string",
        "format" : "date-time"
      },
      "ExpiryDate":
      { "type" : "string",
        "format" : "date-time",
        "optional" : "true"
      },
      "Owner": { "type" : "string"},
      "Priority": { "type" : "integer"},
      "Definition":
      { "type" : "object",
        "properties" :
        {
         "Value": { "type" : "string"},
         "DN": { "type" : "string"},
         "GUID": { "type" : "string"},
         "Link": { "type" : "string"},
         "Version": { "type" : "string"}
        }
      },
      "Process":
      { "type" : "object",
        "properties" :
        {
         "GUID": { "type" : "string"},
         "Link": { "type" : "string"}
        }
      },
      "Status": { "type" : "integer",
                  "minimum" : 0,
                  "maximum" : 5
                },
      "LegalDisclaimer": { "type": "string",
                           "optional": true
                    }
      "DigitalSignatureType":
          { "type" : "string",
       "enum": ["data". "form", "not-required"]
          },
      "Completed":
      { "type" : "string",
        "format" : "date-time",
        "optional" : "true"
      },
      "Initiator":
      { "type" : "object",
        "properties" :
        {
         "DN": { "type" : "string"},
         "Value": { "type" : "string"},
         "GUID": { "type" : "string"},
         "Link": { "type" : "string"}
        }
      },
      "Recipient":
      { "type" : "object",
        "properties" :
        {
         "DN": { "type" : "string"},
         "Value": { "type" : "string"},
         "GUID": { "type" : "string"},
         "Link": { "type" : "string"}
        }
      },
      "ProxyFor": { "type": "object",
                    "properties":
         {
         "DN": {"type": "string"},
         "Value": {"type": "string"},
         "GUID": {"type": "string"},
         "Link": {"type": "string"
         },
                    "optional": true
      }
   }
}
```

Single workitem end point schema

The schema for the single workitem end point (/v1/wf/workitems/{work id};schema) is as follows:

```
{
  "description" : "schema for: /v1/wf/workitems{work id}",
    "type" : "object",
    "properties" :
   {
      "AvailableActions" :
      { "type" : "array",
        "properties" :
        {
            "Value" :
             { "type" : "string",
          "enum": ["Approve", "Deny", "Refuse"]
        }
            "Code" :
             { "type" : "integer",
          "enum": [0, 1, 2]
        }
      },
      "DataItems":
      { "type" : "array",
        "properties" :
        {
         "Name": { "type" : "string"},
         "Type": { "type" : "string"},
         "Value": { "type" : "string"}
        }
      },
      "GUID" : { "type" : "string"},
      "Link" : { "type" : "string"},
      "ActivityId" : { "type" : "string"},
      "ActivityName" : { "type" : "string"},
      "Addressee":
      { "type" : "object",
        "properties" :
        {
         "DN": { "type" : "string"},
         "Value": { "type" : "string"},
         "GUID": { "type" : "string"},
         "Link": { "type" : "string"}
      },
      "AssignmentType": { "type" : "integer",
                          "minimum" : 0,
                          "maximum" : 17
                        },
      "Created":
      { "type" : "string",
        "format" : "date-time"
      },
      "ExpiryDate":
      { "type" : "string",
        "format" : "date-time",
        "optional" : "true"
      },
      "Owner": { "type" : "string"},
      "Priority": { "type" : "integer"},
      "Definition":
      { "type" : "object",
        "properties" :
        {
         "Value": { "type" : "string"},
         "DN": { "type" : "string"},
         "GUID": { "type" : "string"},
         "Link": { "type" : "string"},
         "Version": { "type" : "string"}
        }
      },
      "Process":
      { "type" : "object",
        "properties" :
        {
         "GUID": { "type" : "string"},
         "Link": { "type" : "string"}
        }
      },
      "Status": { "type" : "integer",
                  "minimum" : 0,
                  "maximum" : 5
                },
      "LegalDisclaimer": { "type": "string",
                           "optional": true
```

```
                }
        "DigitalSignatureType":
            { "type" : "string",
         "enum": ["data". "form", "not-required"]
            },
        "Completed":
        { "type" : "string",
          "format" : "date-time",
          "optional" : "true"
        },
        "Initiator":
        { "type" : "object",
          "properties" :
          {
           "DN": { "type" : "string"},
           "Value": { "type" : "string"},
           "GUID": { "type" : "string"},
           "Link": { "type" : "string"}
          }
        },
        "Recipient":
        { "type" : "object",
          "properties" :
          {
           "DN": { "type" : "string"},
           "Value": { "type" : "string"},
           "GUID": { "type" : "string"},
           "Link": { "type" : "string"}
          }
      },
        "ProxyFor": { "type": "object",
                      "properties":
           {
           "DN": {"type": "string"},
           "Value": {"type": "string"},
           "GUID": {"type": "string"},
           "Link": {"type": "string"
           },
                      "optional": true
      }
  }
```

32 Workflow Process and Definition Service

This section describes the Workflow Process and Definition Service.

About the Workflow Process and Definition Service

The Workflow Process and Definition Service provides a REST interface for retrieving information about running workflow processes and provisioning request definitions (PRDs) available to the Workflow system.

The Workflow Process and Definition Service provides a REST interface for managing workflow processes. This will include REST end points for the identification and definitions of existing workflows and the ability to start an existing work flow. REST end points are also provided to allow you to display the status of current work flows in the Workflow system. Existing processes will also have a link to connect to the existing work items that are associated with that particular workflow process.

Workflow Processes Behave Differently in REST than in the User Application Workflows executed within the REST environment behave somewhat differently than the same processes running within the User Application. For example, a workflow request submitted through REST may succeed without providing any values for a mandatory field. This is because the User Application has access to the workflow form, whereas the REST interface does not. There is no way for the REST interface to know whether the data items are mandatory. It is up to the REST client to introspect the data items and enforce the business requirements.

Accessing and Using the Workflow Process and Definition Service

The Workflow Process and Definition Service exposes resources for managing workflow processes. The service allows a way for you to retrieve all provisioning request definitions in the system, or access a particular definition by ID. In addition, the service provides a way to retrieve all existing workflow processes, or access a particular process by ID.

Available Resources

There are four basic types of resources available with the Workflow Process and Definition Service:

Entry Point

The entry point URI for the Workflow Process and Definition Service is:

```
/v1
```

The root entry point returns a list of all resources available.

Definitions Resource

The Definitions resource supports two basic URI patterns:

- Resource for returning a collection of provisioning request definitions (PRDs)
- Resource for returning a specific PRD

Processes Resource

The Processes resource supports two basic URI patterns:

- Resource for returning a collection of existing workflow processes
- Resource for returning a specific process

Resources for Filtering, Debugging, and Displaying Schema Information

The service supports the following parameters to allow you to perform operations on the primary work items data set:

- A filter parameter to enable the filtering of result sets
- A debug matrix parameter to enable you to return the JSON structures in a human readable format
- A schema matrix parameter to enable you to return the schema for the data set

Complete URI Syntax

The following table shows the complete URI syntax for all resource end points associated with the Workflow Process and Definition Service, along with a description for each URI and a list of supported HTTP methods:

Table 32-1 *Resource URIs*

URI	Description
/v1	Entry point for the service.
/v1/wf/definitions	Returns a collection (JSON Array) of workflow definitions (provisioning request definitions) available in the Workflow system. The following HTTP methods are supported with this URI: GET - This will return a collection of workflow definitions in JSON Array. POST – Not supported PUT – Not supported DELETE – Not supported

URI	Description
/v1/wf/definitions/{definition ID}	Returns a specific workflow definition (JSON Object) available in the Workflow system. The following HTTP methods are supported with this URI: GET - Returns a specific workflow definition (JSON Object) with all the details. This will include the data items associated with that definition. PUT – Not supported. POST – Start a work flow process. DELETE – Not supported **Starting a workflow process** To start a workflow process, you need to perform a GET operation to retrieve a provisioning request definition first. Once you have the JSON structure for the definition, you need to massage this JSON structure and perform a POST. For details on the JSON structure for GET operations, see “JSON Representations Received by the Client” on page 575. For details on the minimal JSON structure required for POST operations, see “JSON Representations Sent by the Client” on page 579.
/v1/wf/processes	Returns a collection of workflow processes in a JSON Array. The following HTTP methods are supported with this URI: GET - Returns a collection of workflow processes currently in the Workflow system in a JSON Array. POST – Not supported PUT – Not supported DELETE – Not supported
/v1/wf/processes/{process id}	Returns a single JSON Object with all the workflow process details. The following HTTP methods are supported with this URI: GET - Returns a specific work flow process (JSON Object) with all the details. PUT – Not supported. POST – Same as DELETE because of limitations in browsers to set the DELETE method DELETE – Terminates a work flow process
/v1/wf/processes/{process id}/comments	GET - Returns all comments for a specified workflow process.

URI	Description
/v1/wf/processes?filter={process parameter}={process value}	Returns a collection of work flow processes (JSON Array) for a specific process query parameter and value. The possible process query parameters are listed below: **Definition** Definition DN **ProcessId** Process request instance ID (GUID) **EngineId** Engine ID **Recipient** Recipient DN **Initiator** Initiator DN **ApprovalStatus** Approval status code (Integer) **ProcessStatus** Process status code (Integer) **CreationTime** Creation time (date-time format) followed by operator (EQ, LT, LE, GT, GE). Example: 20080723044715000-0400EQ **CompletionTime** Completion time(date-time format) followed by operator (EQ, LT, LE, GT, GE). Example: 20080723044715000-0400EQ **CorrelationId** Correlation ID Here is an example that illustrates filtering by recipient: `/v1/wf/processes?filter=recipient%3dcn%3dadmin,ou%3didmsample,o%3dnetiq`

***Table 32-2** Matrix Parameters for Debugging and Displaying the Schema*

URI	Description
/v1/wf/definitions;debug	This `debug` matrix parameter displays the definitions JSON structure in human readable format, as opposed to compressed format. This matrix parameter can be put anywhere in the URI.
/v1/wf/definitions/{DefinitionID};debug	This `debug` matrix parameter displays the definition ID JSON structure in human readable format, as opposed to compressed format. This matrix parameter can be put anywhere in the URI.
/v1/wf/definitions;schema	The `schema` matrix parameter can be put anywhere in the URI and in combination with the “Accept” header type will return the appropriate schema document for the content type. In this case a JSON schema document is returned for the definitions.

URI	Description
/v1/wf/definitions/{Definition ID};schema	The `schema` matrix parameter can be put anywhere in the URI and in combination with the “Accept” header type will return the appropriate schema document for the content type. In this case a JSON schema document is returned for the specified definition ID.
/v1/wf/processes;debug	This `debug` matrix parameter displays the workflow processes JSON structure in human readable format, as opposed to compressed format. This matrix parameter can be put anywhere in the URI.
/v1/wf/processes/{Process ID};debug	This `debug` matrix parameter displays the process ID JSON structure in human readable format, as opposed to compressed format. This matrix parameter can be put anywhere in the URI.
/v1/wf/processes;schema	The `schema` matrix parameter can be put anywhere in the URI and in combination with the “Accept” header type will return the appropriate schema document for the content type. In this case a JSON schema document is returned for the workflow processes.
/v1/wf/processes/{Process ID};schema	The `schema` matrix parameter can be put anywhere in the URI and in combination with the “Accept” header type will return the appropriate schema document for the content type. In this case a JSON schema document is returned for the specified process ID.

JSON Representations Received by the Client

This section shows the JSON structures received by the client for each resource. In each case, the HTTP method is GET.

In all JSON structures, date-time values follow this format:

`yyyyMMddhhmmssSSS-ZZZZ`

Here is an example that illustrates the format:

`20080723044715000-0400`

Root entry point

The root entry point returns this structure:

```
[
   {
      "Link": "/RIS/v1/wf/workitems",
      "Type": "wf/workitems",
      "Value": "Workflow Workitems"
   }
]
```

Where:Link – relative link to the service availableType – Non localized internal code for the service. Value – Localized value of the service.

Definitions end point

The definitions end point (/v1/wf/definitions) returns a collection (JSON Array) of provisioning request definitions available in the Workflow System.

```
[
   {
      "Links": [
         {
            "Link": "/RIS/v1/wf/
processes?filter=Definition%3Dcn%3DPageWizardForm%2Ccn%3DRequestDefs%2Ccn%3DAppCon
fig%2Ccn%3DPicassoDriver%2Ccn%3DTestDrivers%2Co%3Dnetiq",
            "Type": "wf/processes",
            "Value": "Workflow Processes"
         },
         {
            "Link": "/RIS/v1/wf/
workitems?filter=Definition%3Dcn%3DPageWizardForm%2Ccn%3DRequestDefs%2Ccn%3DAppCon
fig%2Ccn%3DPicassoDriver%2Ccn%3DTestDrivers%2Co%3Dnetiq",
            "Type": "wf/workitems",
            "Value": "Workflow Workitems"
         }
      ],
      "DataItems": [{
         "Name": "recipient",
         "Type": "string",
         "Value": ""
      }],
      "Value": "PageWizardForm",
      "DN":
"cn=PageWizardForm,cn=RequestDefs,cn=AppConfig,cn=PicassoDriver,cn=TestDrivers,o=n
etiq",
      "GUID": "8d64ba822ada934512968d64ba822ada",
      "Link": "/RIS/v1/wf/definitions/8d64ba822ada934512968d64ba822ada",
      "Category": "entitlements",
      "DigitalSignatureType": "not-required",
      "Description": "PageWizardForm",
      "Operation": "0"
   },
......
]
```

Single definition end point

The end point for accessing a single definition (/v1/wf/workitems/{work id} returns a single JSON Object with all the details for the definition. The return payload also includes the data items required to start a work flow process.

```
{
      "Links": [
         {
            "Link": "/RIS/v1/wf/
processes?filter=Definition%3Dcn%3DPageWizardForm%2Ccn%3DRequestDefs%2Ccn%3DAppCon
fig%2Ccn%3DPicassoDriver%2Ccn%3DTestDrivers%2Co%3Dnetiq",
            "Type": "wf/processes",
            "Value": "Workflow Processes"
         },
         {
            "Link": "/RIS/v1/wf/
workitems?filter=Definition%3Dcn%3DPageWizardForm%2Ccn%3DRequestDefs%2Ccn%3DAppCon
fig%2Ccn%3DPicassoDriver%2Ccn%3DTestDrivers%2Co%3Dnetiq",
            "Type": "wf/workitems",
            "Value": "Workflow Workitems"
         }
      ],
      "DataItems": [{
         "Name": "recipient",
         "Type": "string",
         "Value": ""
      }],
      "Value": "PageWizardForm",
      "DN":
"cn=PageWizardForm,cn=RequestDefs,cn=AppConfig,cn=PicassoDriver,cn=TestDrivers,o=n
etiq",
      "GUID": "8d64ba822ada934512968d64ba822ada",
      "Link": "/RIS/v1/wf/definitions/8d64ba822ada934512968d64ba822ada",
      "Category": "entitlements",
      "DigitalSignatureType": "not-required",
      "Description": "PageWizardForm",
      "Operation": "0"
   }
```

Workflow processes end point

The workflow processes end point (/v1/wf/processes) returns a collection (JSON Array) of running workflow processes available in the Workflow System.

```
[
   {
      "Links": [{
                 "Type": "wf/workitems",
         "Value": "Workflow Workitems"
         "Link": "/POC/roa/v1/wf/
workitems?filter=ProcessId%3De11a2f10c90f489895f968d565b15091"
      }],
      "GUID": "e11a2f10c90f489895f968d565b15091",
      "Link": "/RIS/v1/wf/processes/e11a2f10c90f489895f968d565b15091",
      "Initiator": {
         "DN": "CN=admin,OU=medical-idmsample,O=netiq",
         "Value": "Application Administrator Of Sample Data",
         "GUID": "",
         "Link": ""
      },
      "Recipient": {
         "DN": "cn=ablake,ou=users,ou=medical-idmsample,o=netiq",
         "Value": "Allison Blake",
         "GUID": "",
         "Link": ""
      },
      "Definition": {
         "Value": "Role Approval",
         "DN": "cn=Role 
Approval,cn=RequestDefs,cn=AppConfig,cn=CaribouDriver,cn=TestDrivers,o=netiq",
         "GUID": "d8c8e1a6d6432341fa84d8c8e1a6d643",
         "Link": "/RIS/v1/wf/definitions/e11a2f10c90f489895f968d565b15091",
         "Version":"8"
      },
      "Created": "20080723044715000-0400",
      "Completed": "",
      "ApprovalStatus": "Processing",
      "ProcessStatus": "Running",
      "Version": "8",
      "EngineId": "ENGINE"
   }
]
```

Single workflow process end point

The end point for accessing a single process (/v1/wf/processes/{process id} returns a single JSON Object with all the details for the process.

```
{
      "Links": [{
                   "Type": "wf/workitems",
         "Value": "Workflow Workitems"
         "Link": "/POC/roa/v1/wf/
workitems?filter=ProcessId%3De11a2f10c90f489895f968d565b15091"
      }],
      "GUID": "e11a2f10c90f489895f968d565b15091",
      "Link": "/RIS/v1/wf/processes/e11a2f10c90f489895f968d565b15091",
      "Initiator": {
         "DN": "CN=admin,OU=medical-idmsample,O=netiq",
         "Value": "Application Administrator Of Sample Data",
         "GUID": "",
         "Link": ""
      },
      "Recipient": {
         "DN": "cn=ablake,ou=users,ou=medical-idmsample,o=netiq",
         "Value": "Allison Blake",
         "GUID": "",
         "Link": ""
      },
      "Definition": {
         "Value": "Role Approval",
         "DN": "cn=Role 
Approval,cn=RequestDefs,cn=AppConfig,cn=CaribouDriver,cn=TestDrivers,o=netiq",
         "GUID": "d8c8e1a6d6432341fa84d8c8e1a6d643",
         "Link": "/RIS/v1/wf/definitions/e11a2f10c90f489895f968d565b15091",
         "Version":"8"
      },
      "Created": "20080723044715000-0400",
      "Completed": "",
      "ApprovalStatus": "Processing",
      "ProcessStatus": "Running",
      "Version": "8",
      "EngineId": "ENGINE"
   }
```

JSON Representations Sent by the Client

This section shows the JSON structure sent by the client for the single workitem end point when the HTTP PUT or HTTP POST method is used.

Single definition end point

When the client uses the HTTP POST method with the /v1/wf/definitions/{definition id} URI, the following minimum information from a definition JSON structure is required to start a workflow process.

```
{
      "DataItems": [{
         "Name": "reason",
         "Type": "string",
         "Values": [{"Value": ""}],
         "MultiValued": false
      }],
      "Recipient": "cn=ablake,ou=users,ou=medical-idmsample,o=netiq"
}
```

All elements of the JSON object received from a GET call can be returned to the server. However, only the two items shown above are necessary. All other elements will be ignored by the server.

Single workflow process end point

When the client uses the HTTP DELETE method with the /v1/wf/processes{process id} URI, there is no need to send a JSON object to the server. This action terminates the specified workflow process. The key to the process instance is specified as part of the URI.

Event Status Codes

This section shows the event status codes for the available resources:

Table 32-3 Event Status Codes

URI	Status Codes
/v1	HTTP GET - Status 200 - OK
/v1/wf/definitions	HTTP GET - Status 200 - OK
/v1/wf/definitions/{Definition ID}	HTTP GET – Status 200 – OK
	HTTP POST – Status 204 – OK with no content
/v1/wf/processes	HTTP GET - Status 200 - OK
/v1/wf/processes/{Process ID}	HTTP GET – Status 200 – OK
	HTTP DELETE – Status 204 – OK with no content
	HTTP POST – Status 204 – OK with no content

JSON Schema

The service supports the use of a schema matrix parameter to return the JSON schema for any returned data set. The JSON schema is based on the proposed schema for JSON as described at:

`http://www.json.com/json-schema-proposal/`

Root entry point schema

The schema for the root ROA entry point (/v1;schema) is as follows:

```
{"Link": {
   "description": "schema for: /v1",
   "type": "array",
   "properties": {
      "Link": {"type": "string"},
      "Type": {
         "type": "string",
         "enum": [
            "root",
            "wf/definitions",
            "wf/processes",
            "wf/workitems"
         ]
      },
      "Value": {"type": "string"}
   }
}}
```

Definitions end point schema

The schema for the definitions end point (/v1/wf/definitions;schema) is as follows:

```
{"DefinitionInfo": {
   "description": "schema for: /v1/wf/definitions",
   "type": "array",
   "properties": {
      "Links": {
         "type": "array",
         "properties": {
            "Link": {"type": "string"},
            "Type": {
               "type": "string",
               "enum": [
                  "root",
                  "wf/definitions",
                  "wf/processes",
                  "wf/workitems"
               ]
            },
            "Value": {"type": "string"}
         }
      },
      "DataItems": {
         "type": "array",
         "properties": {
            "Name": {"type": "string"},
            "Type": {"type": "string"},
            "Value": {"type": "string"}
         }
      },
      "Value": {"type": "string"},
      "DN": {"type": "string"},
      "GUID": {"type": "string"},
      "Link": {"type": "string"},
      "Category": {"type": "string"},
      "LegalDisclaimer": {"type": "string"},
      "DigitalSignatureType": {"type": "string"},
      "Description": {"type": "string"},
      "Operation": {"type": "string"},
      "Recipient": {"type": "string"}
   }
}}
```

Single definition end point schema

The schema for the single definition end point (/v1/wf/definitions/{Definition id};schema) is as follows:

```
{
   "description": "schema for: /v1/wf/definitions/{Definition ID}",
   "type": "object",
   "properties": {
      "Links": {
         "type": "array",
         "properties": {
            "Link": {"type": "string"},
            "Type": {
               "type": "string",
               "enum": [
                  "root",
                  "wf/definitions",
                  "wf/processes",
                  "wf/workitems"
               ]
            },
            "Value": {"type": "string"}
         }
      },
      "DataItems": {
         "type": "array",
         "properties": {
            "Name": {"type": "string"},
            "Type": {"type": "string"},
            "Value": {"type": "string"}
         }
      },
      "Value": {"type": "string"},
      "DN": {"type": "string"},
      "GUID": {"type": "string"},
      "Link": {"type": "string"},
      "Category": {"type": "string"},
      "LegalDisclaimer": {"type": "string"},
      "DigitalSignatureType": {"type": "string"},
      "Description": {"type": "string"},
      "Operation": {"type": "string"},
      "Recipient": {"type": "string"}
   }
```

Workflow processes end point schema

The schema for the processes end point (/v1/wf/processes;schema) is as follows:

```
{"ProcessInfo": {
   "description": "schema for: /v1/wf/processes",
   "type": "array",
   "properties": {
      "Links": {
         "type": "array",
         "properties": {
            "Link": {"type": "string"},
            "Type": {
               "type": "string",
               "enum": [
                  "root",
                  "wf/definitions",
                  "wf/processes",
                  "wf/workitems"
               ]
            },
            "Value": {"type": "string"}
         }
      },
      "GUID": {"type": "string"},
      "Link": {"type": "string"},
      "Initiator": {
         "type": "object",
         "properties": {
            "DN": {"type": "string"},
            "Value": {"type": "string"},
            "GUID": {"type": "string"},
            "Link": {"type": "string"}
         }
      },
      "Recipient": {
         "type": "object",
         "properties": {
            "DN": {"type": "string"},
            "Value": {"type": "string"},
            "GUID": {"type": "string"},
            "Link": {"type": "string"}
         }
      },
      "Definition": {
         "type": "object",
         "properties": {
            "Value": {"type": "string"},
            "DN": {"type": "string"},
            "GUID": {"type": "string"},
            "Link": {"type": "string"}
         }
      },
      "Created": {
         "type": "string",
         "format:": "date-time"
      },
      "Completed": {
         "type": "string",
         "format:": "date-time",
         "optional": true
      },
      "Proxy": {
         "type": "string",
         "optional": true
      },
      "CorrelationId": {
         "type": "string",
         "optional": true
      },
      "ApprovalStatus": {"type": "string"},
      "ProcessStatus": {"type": "string"},
      "Version": {"type": "string"},
      "EngineId": {"type": "string"}
   }
}}
```

Single process end point schema

The schema for the single process end point (/v1/wf/processes/{Process ID};schema) is as follows:

```
{
   "description": "schema for: /v1/wf/processes/{Process ID}",
   "type": "object",
   "properties": {
      "Links": {
         "type": "array",
         "properties": {
            "Link": {"type": "string"},
            "Type": {
               "type": "string",
               "enum": [
                  "root",
                  "wf/definitions",
                  "wf/processes",
                  "wf/workitems"
               ]
            },
            "Value": {"type": "string"}
         }
      },
      "GUID": {"type": "string"},
      "Link": {"type": "string"},
      "Initiator": {
         "type": "object",
         "properties": {
            "DN": {"type": "string"},
            "Value": {"type": "string"},
            "GUID": {"type": "string"},
            "Link": {"type": "string"}
         }
      },
      "Recipient": {
         "type": "object",
         "properties": {
            "DN": {"type": "string"},
            "Value": {"type": "string"},
            "GUID": {"type": "string"},
            "Link": {"type": "string"}
         }
      },
      "Definition": {
         "type": "object",
         "properties": {
            "Value": {"type": "string"},
            "DN": {"type": "string"},
            "GUID": {"type": "string"},
            "Link": {"type": "string"},
            "Version": {"type": "string"}
         }
      },
      "Created": {
         "type": "string",
         "format:": "date-time"
      },
      "Completed": {
         "type": "string",
         "format:": "date-time",
         "optional": true
      },
      "Proxy": {
         "type": "string",
         "optional": true
      },
      "CorrelationId": {
         "type": "string",
         "optional": true
      },
      "ApprovalStatus": {"type": "string"},
      "ProcessStatus": {"type": "string"},
      "Version": {"type": "string"},
      "EngineId": {"type": "string"}
   }
}
```

Testing the Client with the CURL Command

You can use the CURL command to test the REST client.

NOTE: To use the CURL command, you must also use either RESTAuthorization or RESTSessionSecret.

Table 32-4 CURL Commands for Testing the Client

URI	Command
http://domain:port/RIS/v1	curl -v -H "Accept: application/json" http://domain:port/RIS/v1
wf/definitions	curl -v -H "Accept: application/json" http://domain:port/RIS/v1/wf/definitions
wf/definitions/{defintion id}	curl -v -H "Accept: application/json" http://domain:port/RIS/v1/wf/definitions/{definition id}
wf/definitions/{definition id} To start a process, store the JSON structure in a file and pass it to the curl command.	curl -v -H "Accept: application/json" -H "Content-Type: application/json" -X POST --data-binary @<filename of JSON structure> http://domain:port/RIS/v1/wf/definitions/{definition id}
wf/processes	curl -v -H "Accept: application/json" http://domain:port/RIS/v1/wf/processes
wf/processes/{request id}	curl -v -H "Accept: application/json" http://domain:port/RIS/v1/wf/processes/{request id}
wf/processes/{request id} To terminate a process, store the JSON structure in a file and pass it to the curl command.	curl -v -H "Accept: application/json" -X DELETE http://domain:port/RIS/v1/wf/processes/{request id}

VIII Appendixes

The following sections provide additional reference information and advanced topics for the Identity Manager User Application.

A Configuring the Identity Manager Approvals App

The NetIQ Identity Manager Approvals app allows managers and resource owners to approve or deny requests remotely, using an iPhone or iPad with the iOS operating system or any device with Android operating system installed. Your users can see and work with the same approval tasks in the app that they would normally see in the User Application interface. All changes are synchronized between the Approvals app and the User Application.

This appendix provides information about configuring your environment to allow users to use the new interfaces. These sections are intended to provide necessary information to administrators who want to enable and configure the Approvals app in their environment.

Most users should not need to refer to this document, but should instead be able to install, configure, and use the app without additional instructions. For information about installing or using the Approvals app, see "Using the Identity Manager Approvals App" in the *NetIQ Identity Manager - User's Guide to the Identity Applications*.

Product Requirements

The Approvals app has the following prerequisites:

- **On the Roles Based Provisioning Manager server:**
  - Identity Manager 4.5 Advanced Edition or later
  - Identity Manager Roles Based Provisioning Module 4.5 or later
  - Designer for Identity Manager 4.5 or later with User Application driver and latest User Application Base package installed
  - SSL

  NOTE: For detailed information on configuring and enabling SSL in your Identity Manager environment, see "Enabling SSL for User Access" on page 50.
- **On the device:** Apple iPhone or iPad with Apple iOS 5 or later or any device with Android operating system

Enabling Non-Administrators to Use the Approvals App

If you want users who are not provisioning administrators on the Roles Based Provisioning Manager server to use the Approvals app, you must open the SOAP endpoints used by the server and app to non-provisioning administrator users.

NOTE: Opening SOAP endpoints to non-provisioning administrator users does not compromise security. Identity Manager continues to enforce all other existing security checks.

Complete the following steps to open the SOAP endpoints on the Roles Based Provisioning Module server:

1. Stop the server.
2. Create a backup of the existing `IDMProv.war` file.
3. Open the `IDMProv.war` file.
4. In `IDMProv.war`, open the file `WEB-INF/lib/IDMfw.jar`.
5. In `IDMfw.jar`, change the following configuration file properties to the specified values:

Configuration File	Property	Value
`WorkflowService-conf/config.xml`	`WorkflowService/SOAP-End-Points-Accessible-By-ProvisioningAdminOnly`	`false`
	`WorkflowService/soap/addComment`	`false`
	`WorkflowService/soap/getComments`	`false`
`VirtualDataService-conf/config.xml`	`VirtualDataService/soap`	`false`

6. Save and close all files.
7. Restart the server.

Setting Up the Approvals App

Before your users can use the Approvals app, you must first configure your Identity Manager Roles Based Provisioning Module environment.

After installing the app, users can configure the app manually or automatically. Because manually configuring the Approvals app can be difficult, we recommend that administrators simplify the configuration process by providing users the necessary information as part of the provisioning process.

You provide configuration information to your users through a configuration link you customize for your Identity Manager Roles Based Provisioning Module environment. The structure of the configuration link is as follows:

```
idmapproval://settings/
?userid=Username&passwordInKeychain=Password&host=HostName&port=PortNumber&
rbpmContext=Context&userContainer=UserContainer&timeout=Timeout&vdxUserEntity=User
Entity&
vdxNameFormatAttribute=NameFormat&vdxFirstNameAttribute=FirstNameAttr&vdxLastNameA
ttribute=
LastNameAttr&vdxPhotoAttribute=UserPhotoAttr&vdxPhotoAttributeLdap=PhotoLDAPAttr&v
dxPhoneAttribute=
WorkPhoneAttr&vdxMobileAttribute=MobilePhoneAttr&vdxEmailAttribute=EmailAttr&namin
gAttribute=
NamingAttr&provAdminGetTasksWorkaroundInPlace=ProvisioningAdmin
```

The link must include settings specific to your environment, so that users can easily connect to the Roles Based Provisioning Module server from the Approvals app. However, none of the settings are explicitly required for the link. If you leave any setting values empty, each user must configure those settings on their device.

For example, if you want to provide a standard configuration link for all users in your environment, you would leave the `userid` and `passwordInKeychain` values empty:

```
idmapproval://settings/?userid=&passwordInKeychain=&host=123.112.20.109&port=8180&
rbpmContext=IDMProv&userContainer=ou=users,o=data&timeout=5&vdxUserEntity=user&vdx
NameFormatAttribute=
FirstName%20LastName&vdxFirstNameAttribute=FirstName&vdxLastNameAttribute=LastName
&
vdxPhotoAttribute=UserPhoto&vdxPhotoAttributeLdap=photo&vdxPhoneAttribute=Telephon
eNumber&
vdxMobileAttribute=mobile&vdxEmailAttribute=Email&namingAttribute=cn&
provAdminGetTasksWorkaroundInPlace=YES
```

For detailed information about the configuration settings, see "Understanding Approvals App Settings" on page 591.

You can provide a configuration link to your users in one of the following ways:

- Customize and deploy the default "Request Mobile Approval App" process request definition (PRD) to your User Application. A user can log into the User Application and request access to the app using the PRD, which sends an email notification with a personalized configuration link that includes information specific to that user.
- Embed your custom configuration link in an HTML page hosted on a Web server in your environment. All users in your environment can navigate to the HTML page in a browser on their device and then click the configuration link.
- Create a QR code from the configuration link and embed the QR code in an HTML page. Users can use a QR code reader on their device to scan the code.

Understanding Approvals App Settings

An Approvals app configuration link can include the following settings:

Configuration Setting Name	Login Setting Description
`userid`	Specifies the user name the user uses to access the Roles Based Provisioning Module server.
`passwordInKeychain`	Specifies the password the user uses to access the Roles Based Provisioning Module server.
`host`	Specifies the fully qualified domain name or IP address of the Roles Based Provisioning Module server.
`port`	Specifies the HTTPS port the app uses to connect to the server.
`rbpmContext`	Specifies the context used when installing the User Application WAR file. The default value is `IDMProv`.

Configuration Setting Name	Login Setting Description
`userContainer`	Specifies the full DN of the Identity Vault container that contains the user LDAP entry. **NOTE:** If you specify a user container to use, the Approvals app uses that container. If you do not specify a user container, the app attempts to detect the appropriate user container in the Identity Vault, searching all containers and subcontainers starting with the user container dn specified when running the User Application Configuration (configupdate) utility. If your Roles Based Provisioning Module environment includes a number of user containers, we recommend that you specify the container you want the app to use. You can configure a provisioning request definition (PRD) like the default "Request Mobile Approval App" definition to easily provision and configure your mobile end users. For more information about customizing the default PRD, see "Customizing and Using the Default Approvals App Provisioning Request Definition" on page 593.
`timeout`	Specifies the number of seconds the app waits when attempting to connect to the server before cancelling the connection. The default value is 5 seconds.
`vdxUserEntity`	Specifies the LDAP entity that represents a user in the Identity Vault. The default value is `user`.
`vdxNameFormatAttribute`	Specifies the DAL attribute representation the app uses to format a user's full name. The default value is `FirstName%20LastName`.
`vdxFirstNameAttribute`	Specifies the name of the DAL attribute that represents a user's first name. The default value is `FirstName`.
`vdxLastNameAttribute`	Specifies the name of the DAL attribute that represents a user's last name. The default value is `LastName`.
`vdxPhotoAttribute`	Specifies the name of the DAL attribute that contains a user's photo. The default value is `UserPhoto`. **NOTE:** If a user does not have a picture configured in the Identity Manager or has configured their Identity Manager settings to not display a picture, the app displays a generic image instead.
`vdxPhotoAttributeLdap`	Specifies the name of the LDAP attribute that contains the photo of the user. The default value is `photo`.
`vdxPhoneAttribute`	Specifies the name of the DAL attribute that represents a user's work phone number. The default value is `TelephoneNumber`.
`vdxMobileAttribute`	Specifies the name of the DAL attribute that represents a user's mobile phone number. The default value is `mobile`.
`vdxEmailAttribute`	Specifies the name of the DAL attribute that represents a user's email address. The default value is `Email`.

Configuration Setting Name	Login Setting Description
`namingAttribute`	Specifies the naming DAL attribute used in the Identity Vault to describe a name. The default value is `cn`.
`provAdminGetTasksWorkaroundInPlace`	Specifies whether the user is a Provisioning Administrator on the Roles Based Provisioning Module server. The default value is YES.

Customizing and Using the Default Approvals App Provisioning Request Definition

As an administrator, you can use Designer to customize a generic “Request Mobile Approval App” PRD that your users can use, through the User Application, to request access to the Approvals application.

When a user requests access, Identity Manager then verifies that the user has the permissions required to access the mobile interface and that the Roles Based Provisioning Module server supports the application. If the server is not configured correctly or does not have the correct patch installed, the PRD generates a task for the provisioning administrator that lets the administrator know what needs to be fixed in order to enable use of the Approvals app.

After Identity Manager verifies the user and environment meet all requirements, the PRD triggers an email notification to the user. The user should open this email on the iPhone or iPad where the user has already installed the Approvals app.

This email notification includes a special `idmapproval://`*`settings`* link that automatically provides the settings the user needs to access the Approvals app from their device. The user clicks the link from their device and can then access their tasks through the Approvals app.

The default “Request Mobile Approval App” is included in the User Application Base package, which you can upgrade in Designer.

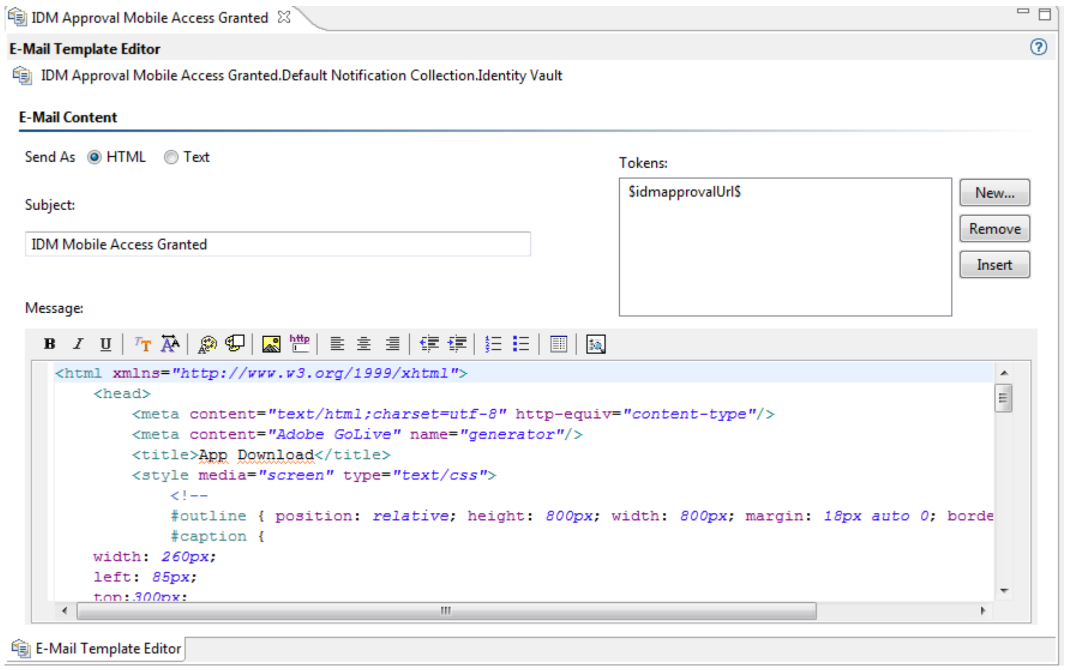
NOTE: The PRD and notification template provided in the User Application Base package are generic. Most administrators need to modify the generic PRD and template for their specific environments. However, we recommend that only users familiar with PRDs modify the default templates.

Customizing the Generic Notification Template

We recommend customizing the generic email notification template for your environment. To customize the default template to notify users they have access to the Approvals app and provide a link to automatically configure the app:

1. Ensure your Identity Manager environment meets all necessary requirements. For more information about prerequisites for using the Approvals app, see “Product Requirements” on page 589.
2. In Designer, ensure you have a valid User Application driver in production. If a User Application driver does not exist in your Designer installation, install the driver before proceeding.
3. Upgrade the User Application Base package to the latest available version and install any dependent packages. For information about upgrading packages in Designer, see Upgrading Installed Packages in the *NetIQ Designer for Identity Manager Administration Guide*.
4. In the Outline view, expand **Default Notification Collection**.

5. Right-click **IDM Approval Mobile Access Granted** and select **Edit**.
6. Modify the **Subject** field, if necessary.
7. In the **Message** field, modify the notification HTML as necessary for your environment. You can customize the email message text sent to your users, include graphics, or change the color and layout of the message to fit your company’s branding. The following image shows the default email message in the template editor:



IDM Approval Mobile Access Granted

E-Mail Template Editor

IDM Approval Mobile Access Granted.Default Notification Collection.Identity Vault

E-Mail Content

Send As [✓ HTML] Text

Subject:

IDM Mobile Access Granted

Tokens:

$idmapprovalUrl$

Message:

```
<html xmlns="http://www.w3.org/1999/xhtml">
    <head>
        <meta content="text/html;charset=utf-8" http-equiv="content-type"/>
        <meta content="Adobe GoLive" name="generator"/>
        <title>App Download</title>
        <style media="screen" type="text/css">
            <!--
            #outline { position: relative; height: 800px; width: 800px; margin: 18px auto 0; borde
            #caption {
    width: 260px;
    left: 85px;
    top:300px;
```

WARNING: If you customize or modify the default notification template, do not remove or modify the token `$idmapprovalUrl$`, either in the Tokens list or in the HTML. The PRD uses the `$idmapprovalUrl$` token to provide the notification template a customized configuration link for the requesting user.

---

8. When finished making any customizations, close and save the notification template.
9. In the Outline view, right-click **IDM Approval Mobile Access Granted** and select **Live > Deploy**.
10. Click **Deploy**.
11. Click **OK**.

Customizing the Generic PRD

We recommend customizing the generic PRD for your environment. You can customize the category, workflow activities, entities, and forms. The PRD includes three forms by default:

- **request_form:** Request form users use to request access to the Approvals app.
- **approval_form:** Approval form managers use to approve or deny requests for access.
- **approval_form_prov_admin:** Approval form provisioning administrators use to fix issues with the provisioning server configuration.

To create and customize a PRD to automatically configure your users' settings in the Approvals app:

1. In the Outline view, navigate to the User Application driver.
2. Expand **User Application Driver > Provisioning Request Definitions > Accounts**.
3. Right-click **Request Mobile Approval Access** and select **Edit**.
4. Modify the **Display Name** and **Description** fields, if necessary.
5. (Optional) If you want to move the PRD from the default Accounts category, click the **Category** drop-down menu and select the category you want to use.

   NOTE: Most users do not need to modify the **Status**, **Flow Strategy**, and **Process Type** fields for the generic PRD. We recommend only advanced users modify these fields.

   ---

6. (Optional) By default, the User DAL entity does not have an attribute configure for a user's mobile telephone number. If you do not currently have a `Mobile` attribute configured for User entities in your environment, you may need to add the attribute. Complete the following steps to add the attribute to the entity:

   6a In the Provisioning view, expand **User Application Driver > Directory Abstraction Layer > Entities**.

   6b Right-click **User** and select **Edit**.

   6c In the Data Abstraction Layer view, expand **Entities > User**.

   6d Right-click **User** and select **Add Attribute**.

   6e In the Add Attribute window, select the `mobile` attribute in the Available Attributes for Entity Class list.

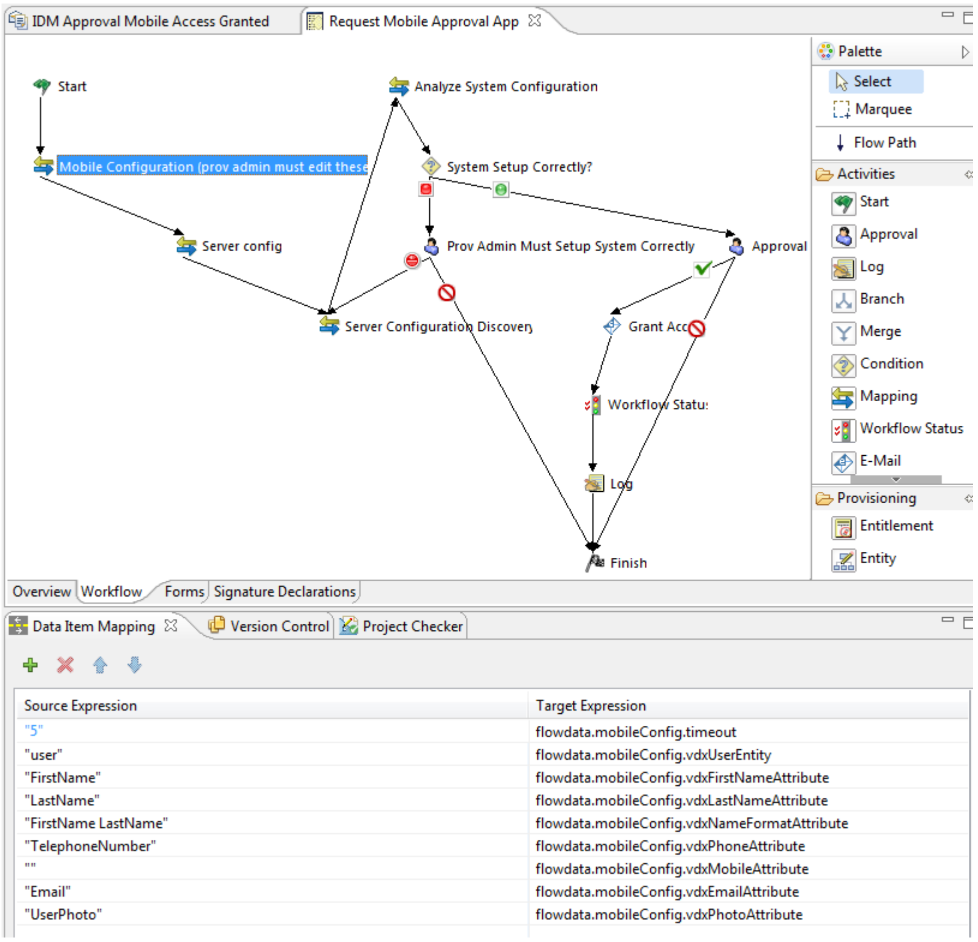
   6f Click **Add Attribute** to move the attribute to the Entity Attributes list.

   6g Click **OK**.

   6h Close and save the Data Abstraction Layer.

7. Click the Workflow tab.
8. Click **Mobile Configuration (prov admin must edit these)**.
9. Click **Data Item Mapping**.
10. Edit the data item mapping expressions for the Mobile Configuration workflow activity. Ensure that the data item mapping matches the way your DAL User entity is configured.

    The following image shows the workflow activity and data item mapping:



Source Expression	Target Expression
"5"	flowdata.mobileConfig.timeout
"user"	flowdata.mobileConfig.vdxUserEntity
"FirstName"	flowdata.mobileConfig.vdxFirstNameAttribute
"LastName"	flowdata.mobileConfig.vdxLastNameAttribute
"FirstName LastName"	flowdata.mobileConfig.vdxNameFormatAttribute
"TelephoneNumber"	flowdata.mobileConfig.vdxPhoneAttribute
""	flowdata.mobileConfig.vdxMobileAttribute
"Email"	flowdata.mobileConfig.vdxEmailAttribute
"UserPhoto"	flowdata.mobileConfig.vdxPhotoAttribute

11 (Optional) If you want to modify the default **Trustee rights** for the PRD, complete the following steps:

11a Click the Overview tab.

11b Click the plus icon.

11c Select the group or user you want to be able to request access to the Approvals app.

NOTE: By default, the PRD trustee rights are set to `[ROOT]`. This default setting allows all users to request access to the Approvals app. Administrators can configure the trustee rights to limit access to only certain users, if necessary.

11d Click **OK**.

12 (Optional) If you want to customize the default PRD request and approval forms, complete the following steps:

12a In the Forms view, click the name of the form.

12b Modify the fields in the Form Controls window, as necessary.

12c Click the Preview icon to view the form.

12d Click **OK** when finished.

13 When finished, close and save the Request Mobile Approval App tab.

14 In the Outline view, right-click **Request Mobile Approval App** and select **Sync to Package**.

15 Right-click **Request Mobile Approval App** and select **Live > Deploy**.

16 Click **Deploy**.

17 Click **OK**.

Creating and Deploying a Custom Configuration Link

If you want to provide a “generic” set of configuration settings to any user who installs the Approvals app, you can embed a configuration link in an HTML page on a Web server your users can access.

Include the standard configuration link syntax in a link, as in the following example:

```
<a href="idmapproval://settings/
?userid=&passwordInKeychain=&host=123.112.20.109&port=8180&rbpmContext=IDMProv&
userContainer=ou=users,o=data&timeout=5&vdxUserEntity=user&vdxNameFormatAttribute=
FirstName%20LastName&
vdxFirstNameAttribute=FirstName&vdxLastNameAttribute=LastName&vdxPhotoAttribute=Us
erPhoto&vdxPhotoAttributeLdap=
photo&vdxPhoneAttribute=TelephoneNumber&vdxMobileAttribute=mobile&vdxEmailAttribut
e=Email&namingAttribute=cn&
provAdminGetTasksWorkaroundInPlace=YES">Configure Approvals App</a>
```

Unless you create a custom link for one specific user, most configuration links should leave the `userid` and `passwordInKeychain` values blank, providing the Roles Based Provisioning Module server information and Identity Vault information users need to be able to use the app.

A user clicks the link, and the link automatically configures the app with any settings you include in the link. The user then manually configures their Username and Password settings within the app.

Creating and Deploying a Custom Configuration QR Code

If your users cannot access their work email from their devices, you can create a QR code from the Approvals app configuration link and email that code to your users.

You can use any QR code generator you want to create the code, generating the code using a configuration link customized for your environment. Embed the code in an HTML page on a Web server your users can access.

For the example provided in “Setting Up the Approvals App” on page 590, the QR code could look like the following image:

A user can then install the app, open the email on their work computer, and use a QR code reader on their device to scan the code displayed on the screen.

The QR code acts as a configuration link, automatically configuring the app with any settings you include in the link. In most environments, your users need to then manually configure their Username and Password settings within the app.

Optimizing Designer Forms for the Approvals App

The Approvals app renders Designer forms using either native iOS controls or HTML, depending on the complexity of each specific form. Native iOS controls provide a more standard look and feel to forms, while HTML-rendered forms look similar to forms in the User Application interface.

When creating new forms in Designer, we recommend simplifying forms as much as possible so that the app uses native iOS controls.

You can also configure your forms to display a more complex version of the form in the User Application and a less complex version in the Approvals app, using the suffix `_mobile`.

For example, if you have an Approval activity form called `approveLaptop`, you can create a new form called `approveLaptop_mobile` that acts as a simplified version of the original Approval activity form. In order for data item mapping to function correctly, the `_mobile` form must include the same fields as the original. We recommend you keep both versions of the form synchronized.

The following steps can help you optimize your forms so the app can render using iOS controls:

1. Ensure the Roles Based Provisioning Module server has the correct version and patch installed. The server must have version 4.0.2 Patch B or later installed.
2. Ensure the form has no scripts.
3. Ensure the form contains only fields with the following supported data types and control types:
   - `boolean`: any control type
   - `date`: any control type
   - `time`: any control type
   - `decimal` or `integer`: `Text` control type only
   - `dn`: `DNDisplay` or read-only `MVEditor` control types only
   - `string`: `Text`, `Password`, `Title`, `TextArea`, or read-only MVEditor control types only

For more detailed information about creating forms in Designer, see “Creating Forms for a Provisioning Request Definition,” in the *NetIQ Identity Manager - Administrator’s Guide to Designing the Identity Applications*.

Understanding Language Support in the Approvals App

The Approvals app includes localized text for all built-in text strings. For example, the titles displayed at the top of a view within the app are available in multiple languages, depending on the user’s locale. Approvals app strings are provided in the following languages, by default:

- Chinese (Simplified)
- Chinese (Traditional)
- Danish
- Dutch
- English
- French
- German
- Italian

- Japanese
- Portuguese (Brazilian)
- Russian
- Spanish
- Swedish

As an administrator, you can also localize the form text displayed in the Approvals app. For example, the Approvals app does not provide localized text for specific Approval tasks. You must localize text strings for each of your PRDs, including form text, using Designer. For information about localizing objects in Designer, see "Localizing Provisioning Objects," in the *NetIQ Identity Manager - Administrator's Guide to Designing the Identity Applications*.

B Schema Extensions for the User Application

This section describes the schema extensions used by the User Application.

Attribute Schema Extensions

Attribute Name	Description
srvprvAllowMgrInitiate	A flag that indicates if the manager is allowed to initiate a provisioning request.
srvprvAllowMgrRetract	A flag to indicate if the manager is allowed to retract a provisioning request.
srvprvAllowMgrSetAvailability	A flag that indicates whether the manager can set a proxy for the team.
srvprvAllowMgrSetDelegate	A flag to indicate if the manager is allowed to set delegates for a provisioning request.
srvprvAllowMgrSetProxy	A flag to indicate if the manager is allowed to set a team proxy.
srvprvAllowMgrTaskClaim	A flag to indicate if the manager is allowed to claim a provisioning approval task.
srvprvAllowMgrTaskReassign	A flag to indicate if the manager is allowed to reassign a provisioning approval task.
srvprvAllRequests	A flag to indicate if the assignment covers all provisioning request definitions for a team.
srvprvAOLIMAddress	AOL IM address.
srvprvAssetRef	Representation of the aggregate asset properties for a named asset associated to a user via the srvprvAssetRecipientAux class.
srvprvAssignExpiration	Time at which a proxy or delegate assignment expires.
srvprvAssignFromContainer	Container subjects of a proxy or delegate assignment.
srvprvAssignFromGroup	Group subjects of a proxy or delegate assignment.
srvprvAssignFromUser	User subjects of a proxy or delegate assignment.
srvprvAssignStartTime	Time at which a delegation assignment takes effect.
srvprvAssignToRelationship	A target relationship of a delegate assignment.
srvprvAssignToUser	The User targets of a proxy or delegate assignment.
srvprvAutoDisplayTeam	Automatically display team members.

Attribute Name	Description
srvprvCapabilities1-5	Listing of skills for a user.
srvprvCategoryKey	Associates a given Provisioning Request Definition to a set of provisioning categories. Values are keys to a srvprvChoice instance.
srvprvCurrentDelegatees	The delegations associated with a user.
srvprvCurrentDelegators	The delegations associated with a user.
srvprvDefault	The default .
srvprvDelegateeDef	The delegates definition DN.
srvprvDelegationDef	The delegation definition DN.
srvprvDelegators	The users who are defined as delegators by this assignment.
srvprvEntitlementRef	Reference to a DirXML-Entitlement.
srvprvEntityType	Specifies Directory Abstraction Layer Entity definition type.
srvprvFlowStrategy	Specifies the flow invocation strategy to be used for the Provisioning Request Definition.
srvprvGrant	Flag which if true specifies that the Provisioning Request Definition supports a Grant operation.
srvprvGroupwiseIMAddress	Groupwise IM address.
srvprvHideAttributes	Flag indicating if certain attributes should be hidden and not displayed.
srvprvHideUser	Flag indicating if the user should be hidden when search list queries are executed.
srvprvIMAddress	Instant Messenger address.
srvprvIsTaskManager	Indicates if user is a task group manager.
srvprvLocalizedDescrs	Provides set of localized description strings for the provisioning web applications, Designers and iManager.
srvprvLocalizedNames	Provides set of localized display name strings for the provisioning web applications, Designers and iManager.
srvprvManager	Indicates users who are managers.
srvprvManagerGroup	Indicates a group containing managers.
srvprvManagerNotMember	Indicates that the manager is not a member of the team.
srvprvMember	Indicates users who are team members.
srvprvMemberContainer	The name of the container containing team members.
srvprvMemberGroup	The name of the group containing team members.

Attribute Name	Description
srvprvMemberRelationship	The name of the directory abstraction layer relationship that determines members based attribute in manager object.
srvprvModified	Flag to indicate changes to definitions object instances in the directory model container.
srvprvNotificationPrefs	Defines the set of notification types users want to receive.
srvprvPreferredLocale	Users preferred locale.
srvprvProcessXML	XML document representing a Provisioning process definition including Workflow and Provisioning Action.
srvprvQueryList	List of saved query/search criteria.
srvprvRelationship	Defines relationships between objects in the identity vault.
srvprvRequest	Exposes one item to be granted or revoked, including the workflow process which defines the run-time aspects of the Workflow and Provisioning Target.
srvprvRequestDefName	The provisioning request definition name associated with a delegate definition.
srvprvRequestScope	The scope of provisioning requests.
srvprvRequestXML	XML document representing the initial request form and its data bindings.
srvprvRevoke	If true, this flag specifies that the Provisioning Request Definition supports a Revoke operation.
srvprvStatus	Specifies the status of the Provisioning Object Supported values.
srvprvTaskGroups	Groups for which the user is a task manager.
srvprvTaskManager	Task manager of the task group.
srvprvTaskScopeAddressee	The addressee’s task scope.
srvprvTaskScopeRecipient	The recipient’s task scope.
srvprvTeam	The container for team definitions.
srvprvUser	The users associated with a delegation assignment.
srvprvUUID	Unique identifier for portlet.
srvprvYahooIMAddress	Yahoo* IM address.

Objectclass Schema Extensions

Objectclass Name	Description
srvprvAppConfig	Container for application configuration objects of the Provisioning System to which its DirXML-Driver parent connects.
srvprvAppDefs	Container for configuration objects used to initialize the Provisioning run-time environment, such as s for the Identity Portal.
srvprvAssetRecipientAux	Records the provisioning of non-IT assets on a user.
srvprvChoice	Enumeration of values that can be assigned to a particular attribute, used in a query, for use in the Identity Portlets and other Web Application components.
srvprvChoiceDefs	Container for Directory Abstraction Layer Choice definitions, to be exposed by the Identity Portlets and Web Applications.
srvprvDelegateeAssignment	Delegates assignment definition.
srvprvDelegateeDefs	Container for delegates definitions.
srvprvDelegationAssignment	Delegation or availability assignment definition.
srvprvDelegationDefs	Container for delegation and delegators definitions.
srvprvDelegatorAssignment	Delegation or availability assignment definition.
srvprvDirectoryModel	Container for Directory Abstraction Layer meta-level objects, selected contents of the directory to be exposed by the Identity Portlets and Web Applications.
srvprvDirectoryModelConfig	Runtime Directory Abstraction Layer configuration parameters.
srvprvEntity	Defines a view of selected attributes for defined classes in the directory, used by the Identity Portlets and other Web Application components.
srvprvEntityAux	Standard ObjectClass.
srvprvEntityDefs	Container for Directory Abstraction Layer Entity definitions, to be exposed by the Identity Portlets and Web Applications.
srvprvProxyAssignment	Proxy assignment definition.
srvprvProxyDefs	Container for proxy definitions.
srvprvQuery	Directory abstraction layer query definition.
srvprvQueryDefs	Container for directory abstraction layer query definition.
srvprvRelationship	Defines relationships between objects in the directory, for use in the Identity Portlets and other Web Application components.

Objectclass Name	Description
srvprvRelationshipDefs	Container for Directory Abstraction Layer Relationship definitions, to be exposed by the Identity Portlets and Web Applications.
srvprvRequest	Exposes one item to be granted or revoked, including the workflow process which defines the run-time aspects of the Workflow and Provisioning Target.
srvprvRequestDefs	Container for Provisioning Request Definitions, the set of items to the Web Application run-time.
srvprvResource	Defines the set of directory assignments to execute for a provisioning fulfillment operation (either Grant or Revoke).
srvprvResourceDefs	Container for Provisioning Target definitions, including design-time descriptions plus any template or unused targets.
srvprvService	Describes how to invoke a specific Web Service from an Workflow This includes specification of input and return values.
srvprvServiceDefs	Container for Service Definition objects, which wrap Web Services called by Workflows.
srvprvTaskGroupAux	Service provisioning task group.
srvprvTeam	Team for provisioning request management.
srvprvTeamDefs	Container for team definitions.
srvprvTeamRequest	Team provisioning requests.
srvprv	Object.
srvprvUserAux	Service provisioning user entity.
srvprvWebAppConfig	Web Application configuration object.
srvprvWorkflow	Defines the network of activities including traversal conditions to be executed in order to obtain approval for a provisioning action.
srvprvWorkflowDefs	Container for Workflow objects, including design-time descriptions plus any template or unused flows.

Resource Definition Object (nrfResource)

The schema object that contains provisioning resource definitions.

Table B-1 *Resource Definition Object Schema Definition*

Attribute Name	Description
nrfLocalizedName	The localized name of the resource.
nrfLocalizedDescrs	The localized description of the resource.

Attribute Name	Description
Owner	The owner of the resource. It is the DN of an inetOrgPerson user.
nrfRequestDefGrant	Provisioning request definition used for approving the granting of a resource assignment.
nrfRequestDefRevoke	Provisioning request definition usef for approving the revocation of a resource assignment.
nrfEntitlementRef	IDM entitlement associated with the resource. Supports embedding of dynamic parameter macros to allow users to specify values at request time.
nrfApprovers	Resource approvers. Order of approvers is maintained by an integer in the second element.
nrfQuorum	Used to support quorum approvals in tempated PRDs. This is the quorum condition. Can be percentage or number of approvers required.
nrfDynamicParameters	XML document that describes allowable parameter values that can be specified at request time when the resource is being granted.
nrfCategoryKey	Used to categorize resource.
nrfAllowAprOveride	Allow requesting system (such as role provisioning) to override approval of the resource provisioning.
nrfAllowMulti	Allow the resource to be assigned to the same user multiple times.

Resource Request Object (nrfResourceRequest)

The schema object whose instances contain a resource request object. The resource request object is used by the resource driver to provision the resource.

Table B-2 *Resource Request Object Sechema Definition*

Attribute	Description
nrfRequestDate	Date-time resource request started.
nrfCategory	10-Resource To User Add
	15 - Resource to User Remove
nrfResource	DN of resource to grant or revoke.
nrfEntitlementRef	Entitlement reference value of the resource being granted. This value is copied from the resource definition with parameter values populated at the time of the request.
nrfTargetDN	DN of user who will be granted the resource or from whom the resource will be revoked.
nrfRequester	DN of user or role that requested assignment.
nrfStatus	Status of request. Valid codes are described in Section , “Resource Request Status Codes (nrfStatus),” on page 607.
nrfDescription	Description/Comment of the resource request.

Attribute	Description
nrfRequestDef	Provisioning request definitoin used for approving the role
nrfApprovers	Resource approvers. Order of approvers can be maintained by an integer in the second element.
nrfQuorum	Used to support quorum approvals in templated PRDs. The quorum condition can be percentage or numbers of approvers required.
nrfApprovalInfo	Holds approval data needed by resource view and reports.
nrfApprovalProcessid	Workflow process instance ID for resource assignment approval.

Resource Request Status Codes (nrfStatus)

Table B-3 *Valid Resource Request (nrfStatus) Status Codes*

Status Code	Key	Description
01	New Request	Initial value when request is created
12	Approval_Retry	
13	Pending_Approval_RETRY	
15	Approval Pending	Set by driver after successful assignment/ revocation workflow.
20	Approved	Set by resource assignment/revocation workflow when approved.
30	Provision/Deprovision	Set by driver after all necessary approvals have been approved and role activation time has been reached.
50	Provisioned/Deprovisioned	Set by driver after role has been provisioned or deprovisioned.
70	Cancel	Request cancellation
75	Cancelled	Cancellation request completed.
80	Provisioning Error	Set by driver when an error occurred during provisioning or deprovisioning.
95	DeniedSet	Set by assignment/revocation workflow when approved.
100	CleanupSet	When nrfResourceRequest workflow should be deleted.

Role-Resource Configuration (nrfConfiguration)

Table B-4 Role-Resource Configuration Object Schema

Attribute	Definition
nrfResourceRequestContainer	Root container for resource requests.
nrfResourcesContainer	Root container for resource definitions.
nrfResourceRevokeRequestDef	Default PRD for approving resource revocations
nrfResourceGrantRequestDef	Default PRD for approving resource assignments.

Resource Binding to Users (nrfIdentity)

Table B-5 Resource Binding to Users Object Schema

Attribute	Description
nrfResource	Currently assigned and assigned resources. Attribute contains DN for the resource DN, the binding state of the resource, and the cause of the assignment and approval information.
nrfResourceHistory	Contains historical information about each resource grant, revocation, denial. Contains the resource as well as XML that contains the resource binding state, (0=inactive, 1=active, 2=pending, 3= deactivated). The XML also contains the entitlement reference value used to grant the entitlement, grant history (who and when), and revocation history (similar to approval information)

Resource Containers

ResourceRequests (nrfResourceRequests): A container objects that persists resource requests.

ResourceDefs (nrfResourceDefs): A container object that persists the definition of a resource.

C JavaScript Search API

The underlying framework for the Identity Manager User Application supports a JavaScript API for executing searches that access the Directory Abstraction Layer. This API lets you build, save, and execute queries from a JSP page running outside of the User Application itself. To run a query, you can invoke the services of the SearchListPortlet, passing parameters that specify the search criteria and formatting options. Alternatively, you can run a search by using the API directly without involving the SearchListPortlet.

Launching a Basic Search using the SearchListPortlet

To perform a basic search, you can specify a *deep link* to the SearchListPortlet from a JSP page. The URL for the portlet must either pass a simple set of request parameters that specify the search criteria, or pass a JSON-formatted query string. A basic search defines a single search criterion, such as the following:

```
First Name starts with A
```

To launch a search, you can call the single portlet render url for the SearchListPortlet. You must pass the request parameter MODE=MODE_RESULTS_LIST

Passing Request Parameters

You can pass a simple set of request parameters to the SearchListPortlet. These parameters specify an entity, an attribute to search on, an operator, and a search string. The following script shows the URL for the portlet, as well as the four request parameters you need to use:

```
<script type="text/javascript">
function openSearchResults(extraUrlParams) {
  var url = "/IDMProv/portal/portlet/SearchListPortlet?";
  url += "urlType=Render&novl-regid=SearchListPortlet";
  url += "&novl-inst=IDMProv.SearchListPortlet";
  url += "&wsrp-mode=view&wsrp-windowstate=normal";
  url += "&MODE=MODE_RESULTS_LIST&";
  url += extraUrlParams;
  var feat = "width=700,height=600";
  feat += ",menubar=no,resizable=yes,toolbar=no,scrollbars=yes";
  var win = window.open(url, "TestSearchPopup", feat);
  if (win) win.focus();
}

var search1a = "ENTITY_DEF=user";
search1a += "&COND_ROW_ATTR=FirstName";
search1a += "&COND_ROW_REL_OP=starts-with";
search1a += "&COND_ROW_VAL=A";
...
```

To call this function, you might have a button on the form with onclick event that looks like this:

```
<input type="button" value="GO" onclick="openSearchResults(search1a)"/>
```

The following table describes the request parameters:

Table C-1 Request Parameters for Basic Search

Request Parameter	Description
ENTITY_DEF	Specifies the key value for an entity in the Directory Abstraction Layer.
COND_ROW_ATTR	Specifies the attribute to search on.
COND_ROW_REL_OP	Specifies the operator to use in the search expression. The following operators are supported for attributes of type string, boolean, integer, time, dn_lookup, dynamic_list, and static_list: equals present not_equals not_present The following operators are supported for attributes of type string: starts_with ends_with contains not_starts_with not_ends_with not_contains The following operators are supported for attributes of type integer and time: greater greater_or_equal less less_or_equal not_greater not_greater_or_equal not_less not_less_or_equal
COND_ROW_VAL	The value to search on.

Using a JSON-formatted String to Represent a Query

If you prefer to format your query as a JSON string, you need to pass the QUERY parameter to the SearchListPortlet, instead of the request parameters described in the section above. The JavaScript variable shown below illustrates how the QUERY parameter is constructed:

```
var search1b ='QUERY={"k":"Lastname starts with B","mxPg":"10",';
search1b +='"mxRes":"0","ptr":"1","grp":[{"map":{"row":[{"map":{';
search1b +='"rowRop":"starts-with","rowVal":"B","rowAttr":"LastName"';
search1b +='}}],"rowLop":"and"}}],';
search1b +='"orderBy":"LastName","entDef":"user",';
search1b +='"sScope":"","sRoot":"","grpLop":"and",';
search1b +='"selAttr":["FirstName","LastName",';
search1b +='"Title","Email","TelephoneNumber"]}';
```

The JSON structure gives you a way to specify values for most of the settings and preferences associated with the SearchListPortlet.

The following table describes the JSON name/value pairs that define the QUERY parameter passed to the SearchListPortlet:

Table C-2 *JSON Structure for Defining the QUERY Parameter*

JSON Setting	Description
k	Specifies a name for the search. (Optional)
mxPg	Specifies the maximum number of rows per page. (Optional)
mxRes	Specifies the maximum number of total rows retrieved. (Optional)
ptr	Sets the scroll pointer, which defines the pagination offset. (Optional)
grp	Defines a condition group. You can specify one or more condition groups. For details on the settings for a condition group, see Table C-3 on page 611.
orderBy	Specifies the attribute to sort on. (Optional)
entDef	Specifies an entity in the Directory Abstraction Layer.
sScope	Sets the search scope. (Optional)
sRoot	Sets the search root. (Optional)
grpLop	Defines the logical operator (`and` or `or`) for groups within this query.
selAttr	Lists the attributes to include in the search results.

The following table describes the JSON structure for defining a condition group:

Table C-3 *JSON Structure for Defining a Condition Group*

JSON Setting	Description
row	Defines a condition row. You can specify one or more condition rows. For details on the settings for a condition row, see Table C-4 on page 612.
rowLop	Defines the logical operator (`and` or `or`) for rows within this group.

The following table describes the JSON structure for defining a condition row:

***Table C-4** JSON Structure for Defining the Fields for a Condition Row*

JSON Setting	Description
rowRop	Defines the relational operator. The relational operators supported in JSON are the same as those for basic searches using request parameters. For a complete list of the relational operators, see the description of COND_ROW_REL_OP in Table C-1 on page 610.
rowVal	Sets the search value.
rowAttr	Specifies the attribute to search on.

Creating a New Query using the JavaScript API

As an alternative to using the basic search request parameters, or the JSON structure, you can call a JavaScript API to execute queries. This section describes some simple techniques for using the API, as well as reference documentation for the API.

The search API relies on the ajax framework embedded in the User Application component named JUICE. JUICE (JavaScript UI Controls and Extensions) is compliant with and uses the dojo library. JUICE is merged into the dojo release used in the User Application.

Therefore, to use JUICE on a custom page within the IDM User Application WAR file, you need to have a script reference to dojo.js (not to JUICE). After adding the reference to dojo.js, you can add a JavaScript line to tell dojo to download JUICE.

Before using the JavaScript API, you need to perform some setup steps on the page to make the dojo module available for use:

1 Add a script tag for dojo.js in the HTML header. The reference to dojo.js must be in the header (not the body), as shown below.

```
<html>
<head>
<META http-equiv="Content-Type" content="text/html; charset=UTF-8">
<title>JavaScript Search</title>
<script type="text/javascript">
  if(typeof dojo=="undefined"){
    var djConfig={isDebug: false,
                  baseScriptUri: "/IDMProv/javascript/dojo/"};
    var buf="<script type='text\/javascript' ";
    buf+="src='/IDMProv/UIQuery?js=dojo\/dojo.js'><\/script>";
    document.writeln(buf);
  }
</script>
</head>
```

2 Add this JavaScript statement to load JUICE into the browser's memory:

```
<script type="text/javascript">
  //This line must precede any code using JUICE.
  dojo.require("JUICE.*");
</script>
```

3 To take advantage of the JUICE.IDM services, which include entity searching, also add this JavaScript statement:

```
<script type="text/javascript">
  //This line must precede any code using JUICE.IDM services.
  dojo.require("JUICE.IDM.*");
</script>
```

To build the query, you need to call the create() method on the JUICE.IDM.Entities.Search object, passing in the name you want to give to the query. The create() method is a static method. Here's how you invoke it:

```
var newQuery = JUICE.IDM.Entities.Search.create("My New Search");
```

Once you've created the query object, you can call methods on this object to define the basic settings for the query, as well as the condition groups and condition rows. The query structure you create with the JavaScript API follows the model of the JSON representation. After you've created the query object you append it to the QUERY request parameter.

The JavaScript example shown below illustrates how you use the JavaScript API to build a query:

```
function buildQuery3() {
  var newQuery = JUICE.IDM.Entities.Search.create("My New Search");
  newQuery.setFrom("user");
  var selAttrs = ["FirstName","LastName"];
  newQuery.setSelects(selAttrs);
  var newCondGrp1 = newQuery.addConditionGroup();
  var newCondRow1_1 = newCondGrp1.addConditionRow();
  newCondRow1_1.setRowAttr("FirstName");
  newCondRow1_1.setRowRop("contains");
  newCondRow1_1.setRowVal("C");
  openSearchResults("QUERY=" + newQuery);
}
```

JavaScript API

This section provides reference documentation for the JavaScript API for searching entities in the Directory Abstraction Layer.

The following table describes the static methods for the JUICE.IDM.Entities.Search object:

Table C-5 *Static methods for JUICE.IDM.Entities.Search*

Method	**Description**
<Query> (createsearchName)	Creates a new Query with the searchName
<void> load(uuid)	Loads a user's saved search with the uuid
<Query> get(uuid)	Returns the user's saved search with uuid as a Query
<String[]> getNames()	Returns the names of all the logged in user's saved searches
<String> getUUID(searchName)	Returns the uuid of the saved search with the searchName

The following table describes the methods for the Query object:

Table C-6 *Methods for the Query object*

Method	Description
<void> setKey(searchName)	Sets the searchName
<void> setFrom(defKey)	Sets the from entity-definition
<void> setSelects(attrKey[])	Sets the selects (optional, if using SearchListPortlet)
<void> setSearchScope(scp)	Sets the search scope (optional)
<void> setSearchRoot(rt)	Sets the search root (optional)
<void> setMaxPage(int)	Sets the max rows per page (optional)
<void> setMaxResults(int)	Sets the max rows in total (optional)
<void> setOrderBy(attrKey)	Sets the sort (optional)
<void> setPointer(int)	Sets the pagination offset (optional)
<void> setGroupLop(lop)	Sets the inter-group logical operator
<String> getKey()	Gets the searchName
<String> getFrom()	Gets the from entity-definition
<String> getSelects()	Gets the selects
<String> getSearchScope()	Gets the search scope
<String> getSearchRoot()	Gets the search root
<int> getMaxPage()	Gets the max rows per page
<int> getMaxResults()	Gets the max rows in total
<String> getOrderBy()	Gets the sort
<int> getPointer()	Gets the pagination offset
<String> getGroupLop()	Gets the inter-group logical operator
<int> nbConditionGroups	Returns the number of condition groups
<CondGroup> addConditionGroup	Creates and returns a new condition group (CondGroup object) appended to the query
<void> removeConditonGroup(i)	Removes the condition group at i
<CondGroup> getConditonGroup(i)	Returns the condition group at i

The following table describes the methods for the CondGroup object:

Table C-7 *Methods for the CondGroup object*

Method	Description
<void> setRowLop(lop)	Sets the intra-group logical operator
<String> getRowLop()	Gets the intra-group logical operator
<int> nbConditionRows()	Returns the number of condition rows

Method	Description
<CondRow> addConditionRow()	Creates and returns a new condition row appended to the condition group
<void> removeConditionRow(i)	Removes the condition row at i
<CondRow> getConditionRow(i)	Returns the condition row at i

The following table describes the methods for the CondRow object:

***Table C-8** Methods for the CondRow object*

Method	Description
<void> setRowAttr(attrKey)	Sets the attribute
<void> setRowRop(rop)	Sets the relational operator.
<void> setRowVal(val)	Sets the search value
<String> getRowAttr()	Gets the attribute
<String> getRowRop()	Gets the relational operator
<String> getRowVal()	Gets the search value

Performing an Advanced Search Using a JSON-formatted Query

You can use the QUERY parameter to perform an advanced search using JSON. The JSON syntax rules are the same as those for the basic search. The only difference is that an advanced search typically defines multiple condition groups and condition rows. The JavaScript variable shown below illustrates how the QUERY parameter might be constructed for a search that uses several condition groups and condition rows:

```
var search2 = 'QUERY={"k":"Complicated Search All
OK","mxPg":"10","mxRes":"0","ptr":"1","grp":[{"map":{"row":[{"map":{"rowRop":"equa
ls","rowVal":"cn=bg1,ou=groups,ou=idmsample,o=netiq","rowAttr":"group"}},{"map":{"
rowRop":"contains","rowVal":"0","rowAttr":"FirstName"}}],"rowLop":"and"}},{"map":{
"row":[{"map":{"rowRop":"not-
present","rowVal":"","rowAttr":"TelephoneNumber"}},{"map":{"rowRop":"equals","rowV
al":"cn=ablake,ou=users,ou=idmsample,o=netiq","rowAttr":"directReports"}},{"map":{
"rowRop":"equals","rowVal":"cn=cnano,ou=users,ou=idmsample,o=netiq","rowAttr":"man
ager"}}],"rowLop":"and"}},{"map":{"row":[{"map":{"rowRop":"not-
present","rowVal":"","rowAttr":"TelephoneNumber"}},{"map":{"rowRop":"equals","rowV
al":"cn=ablake,ou=users,ou=idmsample,o=netiq","rowAttr":"directReports"}},{"map":{
"rowRop":"equals","rowVal":"cn=cnano,ou=users,ou=idmsample,o=netiq","rowAttr":"man
ager"}}],"rowLop":"and"}}],"orderBy":"LastName","entDef":"user","sScope":"","sRoot
":"","grpLop":"or","selAttr":["FirstName","Title","Email","TelephoneNumber"]}';
```

For details on each of the JSON settings, see Section , “Using a JSON-formatted String to Represent a Query,” on page 610.

Retrieving all Saved Queries for the Current User

You can use the JavaScript API to retrieve all saved queries for the user who is currently logged on. To do this, you need to call the getNames() static method on the JUICE.IDM.Enities.Search object.

The following JavaScript example illustrates the procedure for retrieving all saved queries for the current user:

```
function query4GetSavedQueries() {
  var searchNames = JUICE.IDM.Entities.Search.getNames();
  var replaceDiv = document.getElementById("savedQueryNames");
  replaceDiv.innerHTML = searchNames;
}
```

Running an Existing Saved Query

You can use the JavaScript API to execute a saved query. Before you execute a saved query, you need to perform the following JavaScript statement to retrieve the saved queries (as described in the previous section):

```
JUICE.IDM.Entities.Search.getNames();
```

You need to call getNames() first, even if you know the name of the saved search you want to run.

After calling the getNames() function, you need to perform these steps to execute the saved search:

1. Call the getUUID() method to access the UUID associated with the search name.
2. Call the load() method on the JUICE.IDM.Entities.Search object to load the saved query with the UUID.
3. Call the get() method to retrieve the saved query structure.

All of these methods are static methods.

Once you have the query structure, you can use it to construct a QUERY request parameter.

The following JavaScript example illustrates the procedure for launching a saved query:

```
function runQuery4() {
  var textField = document.getElementById("savedQueryToRun");
  var queryName = textField.value;
  var queryUUID = JUICE.IDM.Entities.Search.getUUID(queryName);
  JUICE.IDM.Entities.Search.load(queryUUID);
  var myQuery = JUICE.IDM.Entities.Search.get(queryUUID);

  openSearchResults("QUERY=" + myQuery);
}
```

Performing a Search on All Searchable Attributes

You can use the JavaScript API to search all of the searchable attributes for an entity. This type of search only applies to attributes that have a type of string. Therefore, it does not work with DN, date, integer, boolean, and so forth.

To perform a search on all searchable attributes, you create a query object in the same manner that you would using other search techniques (as described above). Then you need to get the list of attributes for an entity definition by calling JUICE.IDM.Definition.load(). Once you have the list of attributes, you need to verify that each attribute is a string and is searchable. For each attribute that is a string and is searchable, you can now add a condition row by calling the addConditionRow() method on the condition group object. When all condition rows have been added, you can execute the search.

The following JavaScript example illustrates how to perform a search on all searchable attributes.

```
function buildQuery5() {
  var searchStr = document.getElementById("query5Text").value;
  if (searchStr == "") {
    alert("Enter a search string in the text field.");
    return;
  }
  var newQuery = JUICE.IDM.Entities.Search.create("My New Search");
  var entDef = "user";
  newQuery.setFrom(entDef);
  var selAttrs = new Array();
  selAttrs.push("FirstName");
  selAttrs.push("LastName");
  newQuery.setSelects(selAttrs);
  var newCondGrp1 = newQuery.addConditionGroup();
  newCondGrp1.setRowLop("or");

  //get all the searchable attributes of entity-definition user that are type
string (excludes DN, date, integer, boolean, etc)
  JUICE.IDM.Definitions.load(entDef);
  var attrKeys = JUICE.IDM.Definitions.getAttributeKeys(entDef);
  for (var i = 0; i < attrKeys.length; i++) {
    var attrDef = JUICE.IDM.Definitions.getAttribute(entDef, attrKeys[i]);
    var attrType = attrDef.getType();
    var searchable = attrDef.isSearchable();

    if (attrType == "String" && searchable ) {
      var newCondRow = newCondGrp1.addConditionRow();
      newCondRow.setRowAttr(attrKeys[i]);
      newCondRow.setRowRop("contains");
      newCondRow.setRowVal(searchStr);
    }
  }
  openSearchResults("QUERY=" + newQuery);
}
```

D Trouble Shooting

This section describes tips for working around common errors.

Permgen Space Error

You might encounter the following error when you redeploy the User Application:

```
11:32:20,194 ERROR [[PortalAggregator]] Servlet.service() for servlet
PortalAggregator threw exception java.lang.OutOfMemoryError: PermGen space
```

To avoid this error, either:

- Restart the Tomcat server.

or

- Or, increase the PermSpace value by passing -XX:MaxPermSize to the Java virtual machine by means of JAVA_OPTS in the start-tomcat script, for example:

  ```
  -XX:MaxpermSize=128m
  ```

Email Notification Templates

If your email notification templates are displaying in a single language and not in the user’s default locale as you expect, check to see what notification template is selected. You can select a default template or a localized version of the template. When you select a localized template, the language of the localized template is used regardless of the user’s default language. When you select the default template (the template without a locale code), the email is in the user’s default language (if the default is a supported language).

Org Chart and Guest Access

If you encounter an error like this at runtime, then you must modify the service definitions in the User Application WAR:

```
error: "an error occurred Control instantiation of JUICE.OrgChartCtrl failed
(Object doesn't support this property or method). Please contact your system
administrator. Detailed information can be found in the console." when accessing
the portlet in a browser.
```

Provisioning Notification

If the **Notify Other Users of these Changes** check box does not display on the following pages:

- Edit Availability

* My Proxy Assignments
* My Delegate Assignments
* Team Proxy Assignments
* Team Delegate Assignments
* Team Availability

Verify that Email Notification templates have been defined. You define them through the **Administration > RBPM Provisioning and Security > Delegation and Proxy**.

javax.naming.SizeLimitExceededException

If you encounter a `javax.naming.SizeLimitExceededException` when you use the **Administration > Page Admin > Set As Default**, you might have encountered a maximum size limit. You can modify this limit in the `PortalGroupPageDefaults` portlet settings in the `portlet.xml` as follows:

```
<portlet>
    <portlet-name>PortalGroupPageDefaults</portlet-name>
   <portlet-class>
com.novell.afw.portal.portlet.core.permission.PortalGroupPageDefaults
</portlet-class>
    <init-param>
      <name>MIN_CACHE_SIZE</name>
      <value>20</value>
    </init-param>
    <init-param>
      <name>MAX_CACHE_SIZE</name>
      <value>200</value>
    </init-param>
    <init-param>
      <name>PAC_MAX_RESULTS</name>
      <value>2000</value>
    </init-param>
    ...
</portlet>
```

If you have more than 200 groups and want to assign groups to the View permissions for the Page Admin tab, you also need to update the settings for the `PortalUserGroupSelection` portlet. Modify this limit in the `portlet.xml` as follows:

```
<portlet>
    <portlet-name>PortalUserGroupSelection</portlet-name>
   <portlet-class>
com.novell.afw.portal.portlet.core.permission.PortalUserGroupSelection
</portlet-class>
    <init-param>
      <name>MIN_CACHE_SIZE</name>
      <value>20</value>
    </init-param>
    <init-param>
      <name>MAX_CACHE_SIZE</name>
      <value>200</value>
    </init-param>
    <init-param>
      <name>PAC_MAX_RESULTS</name>
      <value>2000</value>
    </init-param>
    ...
</portlet>
```

Redeploy the User Application after you make your changes.

Linux Open Files Error

If you run the User Application on Linux, you might encounter a **Too Many Open Files** Error.Linux allows 1024 open files for each process, but the User Application often requires more. NetIQ suggests increasing the number of open files to 4096 to avoid the **Too Many Open Files** error.

Use the `ulimit` command to increase the number of open files. There are some restrictions on `ulimit` for non-root users. Here is an example of how you can use the `ulimit` command to increase the number of open files to 4096 for a non-root user:

1. Log in as root.
2. Edit the file /etc/security/limits.conf. Add an entry for the user named **smith** and allow **nofile** up to 4096:

   ```
   smith   hard    nofile    4096
   ```

3. Log in as user **smith** and pass 4096 to the `ulimit -n` command. You can issue the command again with no argument to see the current value:

   ```
   smith@myhost:~> ulimit -n 4096
   smith@myhost:~> ulimit -n
   ```

You might want to specify `ulimit` in the user environment or the start-tomcat script so that the new value is always used.

33 How OSP Works with Identity Manager

The identity applications provide authentication and single sign-on (SSO) through the One SSO Provider service (OSP). OSP authenticates a user or a service on behalf of identity applications. For OSP to function, you must install OSP included in the Identity Manager installation package. The identity applications set up a trust relationship with an OSP instance via shared secrets and a public or private key pair through TLS protocol. For information about installing OSP, see "Installing the Single Sign-on Component" in the *NetIQ Identity Manager Setup Guide*.

After authenticating an entity, OSP sends a token to the identity applications. The identity applications use the token to obtain the identity information about the authenticated entity. The identity applications then use the identity information to perform authorization to resources controlled by the identity applications.

The identity applications components interact with OSP through OAuth 2.0, where OSP acts as the OAuth 2.0 provider. Although other configurations are possible, this chapter explains OSP configuration through OAuth 2.0.

OSP supported with OAuth 2.0 specification requires an LDAP authentication server. By default, Identity Manager uses Identity Vault as an authentication server. OSP can communicate with other types of authentication sources, or identity vaults, to handle the authentication requests. You can configure the type of authentication that you want OSP to use, such as user ID and password, Kerberos, or SAML. If you use Kerberos or SAML, OSP accepts authentication from the Kerberos ticket server or SAML Identity Provider (IDP) and then issues an OAuth 2.0 access token to the component where the user logged in. However, OSP does not support MIT-style Kerberos or SAP login tickets.

OSP APIs expose all OAuth functionalities as endpoints for obtaining access tokens. The identity applications expose these APIs. For example, OSP provides an HTTP endpoint that an application uses to validate a token and obtain the identity information associated with the token. OSP also provides an HTTP endpoint that allows an identity application to inform OSP that a user has requested to log out of the application.

OSP Concepts

This section describes the basic concepts of OSP.

OSP Configuration

The configuration template for OSP resides in the `osp-conf.jar` file. The template includes information from the following resources:

- `ism-configuration.properties` file
- User Application configuration locations including Identity Vault and the file system

Most of the OSP properties are configured by using the Configuration Update utility (`configupdate.sh` or `configupdate.bat`).

Access Tokens and Refresh Tokens

OAuth-defined authentication provides two types of tokens: **access token** and **refresh token**.

Access token is a bearer token. Any entity that obtains an access token may use the token. To keep away the chances of unauthorized access, the lifetime of an access token is typically very short.

Refresh token is used when possibility of token leakage is low. For example, when the token is held on a server than in a browser. A refresh token can be used to obtain an access token without requiring the user to re-enter the credentials. The lifetime of a refresh token is typically quite long.

Authentication Timeouts

The authentication process involves a number of different and related timeout values. The two most important timeout values are:

- OAuth access token lifetime (default value is 120 seconds)
- OSP session timeout (session time-to-live; default value is 20 minutes)

Each time an access token expires, the application requests a new access token from OSP. Each time a browser request is made to OSP, the session time-to-live token is reset. Therefore, as long as a user is using an application and the application is getting new access tokens, the user is not logged out.

A refresh token allows an application to obtain a new access token without user interaction. Refresh tokens are used by applications that can keep them secure. Therefore, refresh tokens have long lifetimes (default 30 days although effective lifetime is 48 hours due to revocation timeout). The identity applications use refresh tokens in the backend.

OSP automatically revokes a refresh token that was obtained through a browser-based request when an OSP session is logged out.

Applications that obtain refresh token through a backend request use the `http[s]://<host>[:port]/osp/a/idm/auth/oauth2/revoke` endpoint as described in RFC 7009. A refresh token obtained through OAuth 2.0 Resource Owner Password Grant (backend name/password method) must be manually revoked. If a refresh token is not revoked through session logout or through a backend request, then the token revocation information remains in the oidpInstanceData (osp.sch) attribute on the LDAP user object. When a user does not log out of the identity applications, OSP does not remove the login entry from the oidpInstanceData. If the user continues to log in without logging out, the size of the entry grows large and prevents OSP from updating the attribute and eventually causes login failure for the user. For troubleshooting this issue, see "Managing the Size of oidPInstancedata Attribute" on page 653.

OSP Cookies

OSP uses the following types of cookies in the authentication process:

- **OSP Session Cookie:** Records user information, such as user identifier and time-to-live. It is stored in temporary memory and not retained after the browser is closed. This type of cookie is removed when a user closes the web browser. Absence or expiry of this cookie means that the user is not authenticated.
- **OAuth2 Cookie:** Records OAuth 2.0 state between redirects. The default settings of Microsoft browsers sometimes prevent the submission of OSP cookies to the OSP server that can be determined by using browser developer tools or the OSP log.

Browser Code for the OAuth 2.0 Interaction

The identity applications require JavaScript to implement interactions with OSP.

The open source project, Spiffy UI, provides an easy way to interact with OSP when using Google Web Toolkit (GWT). For detailed information, see the following resources:

- http://www.spiffyui.org
- https://github.com/spiffyui?tab=repositories

If using AngularJS, the following project may be helpful: https://github.com/Gromit-Soft

OSP URLs

OSP uses the following URLs in authentication:

- grant
- getattributes
- logout

Examples used in the following sections assume a secured connection (`HTTPS`), where OSP is hosted on a server named `authentication host` with the default port `8443`, and the tenant is named `idm`.

grant URL

Invoke this URL in a browser: `https://authenticationhost:8443/osp/a/idm/auth/oauth2/grant`

This is the OAuth 2.0 Authorization endpoint defined by Section 3.1 of RFC 6749.

An implicit grant request can look similar to this:

```
https://authenticationhost:8443/osp/a/idm/auth/oauth2/
grant?response_type=token&redirect_uri=http://applicationhost:8180/landing/
com.netiq.ualanding.index/
oauth.html&client_id=ualanding&state=spiffystate0.5457210745662451
```

The allowable HTTP methods and parameters are as defined in Section 4 of RFC 6749.

getattributes URL

Invoke this URL in a browser: `https:// authenticationhost:8443/osp/a/idm/auth/oauth2/getattributes`

This is the OAuth 2.0 Token endpoint defined by Section 3.2 of RFC 6749. The identity applications issue this token to obtain identity information about the entity for which an access token was created. The identity information is presented in the form of attributes (name-value pairs).

A token validation request from a web page can look similar to this:

```
https://authenticationhost:8443/osp/a/idm/auth/oauth2/
getattributes?attributes=name+expiration&access_token=eHwA[...etc.]&callback=jQuer
y20305550091890618205_1463435676921&_=1463435676922
```

The desired attributes are specified by a space-separated list of attribute names using the “attributes” query item. The available attributes and their names are primarily defined by the tenant's authentication configuration in authcfg.xml. There are also several pre-defined attributes related to token management.

logout URL

Invoke this URL in a browser: `https://authenticationhost:8443/osp/a/idm/auth/app/logout`

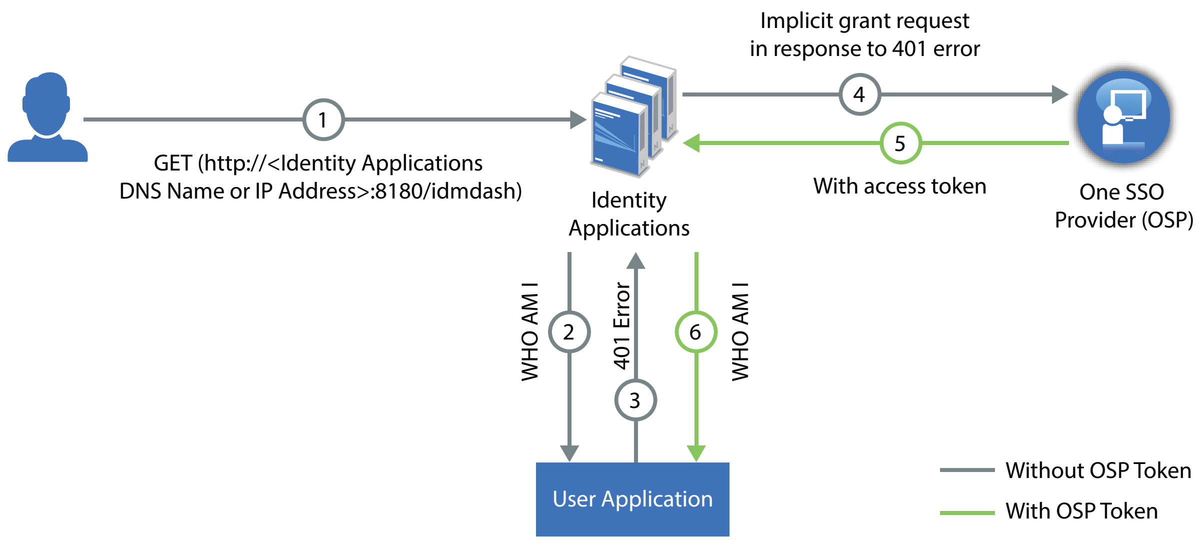
This is an OSP-specific endpoint that identity applications use to inform OSP that a user has requested a logout and that OSP must invalidate the OSP session information from the encrypted browser cookie. Typically this endpoint is invoked when a user selects **Logout** link on the identity application's web page.

Understanding How OSP Works with Identity Manager

When using OAuth 2.0, the Identity Manager communication with OSP primarily consists of the following actions:

1. Obtain an access token in the client browser.
2. Validate the access token when the client browser submits it to the identity applications server.

The following figure illustrates the components and process flow involved in basic authentication:



1. A user navigates to the identity application's home page.
2. The browser loads the identity application home page.
3. The application web page makes an HTTP request to the identity applications server endpoint.

   Note that the application has not yet obtained an authentication token. Therefore, it does not have any authentication information in the request and the identity applications server returns an HTTP 401 status (unauthorized).
4. The identity applications web page recognizes that 401 status means that the web page must obtain a valid authentication token. The web page directs the client browser to OSP `grant` endpoint for an implicit grant request. In the implicit flow, OSP issues the client browser an access token instead of an authorization code. For more information about implicit grant type, see Section 4.2 of RFC 6749.

At this point, no authentication information exists because the OSP session cookie is either not present or, if present, indicates that the browser session is unauthenticated. Therefore, OSP presents a login web page.

5. The user enters authentication credentials (typically user name and password) on the OSP page and selects **Next**.

   OSP looks up the user in the Identity Vault and validates the user-entered password. You can also configure OSP for one or more additional authentication factors.

6. After the user is authenticated using the provided credentials, OSP creates an access token and redirects the browser to a `redirect URI` that the web application has provided. The access token and other data defined by OAuth 2.0 is appended to the redirect URI as a URI fragment. In addition, OSP returns its secure, encrypted session cookie to the browser.

7. The browser loads Identity Applications web page indicated by the redirect URI. Identity Applications then extracts the access token from the URI fragment and validates the state information contained in the fragment.

   NOTE: The redirection endpoint URI must be an absolute URI as defined by Section 4.3 of RFC3986. The endpoint URI may include an `application/x-www-form-urlencoded` formatted query component according to Section 3.4 of RFC3986, which must be retained when adding additional query parameters. The endpoint URI must not include a fragment component. For more information, see sections 4.2.1 and 4.2.2 of RFC 6759.

   ---

8. The identity applications inject the access token in the HTTP Authorization header (typically using the `Bearer` authentication type) and request the identity applications server for validating the token.

9. The identity applications server contacts OSP via a back-channel HTTP request to validate the supplied token and to obtain identity information associated with the token. The identity applications server then responds to the HTTP request appropriately.

10. If the token is validated, the identity applications web pages allow the user to perform the tasks the user is allowed to do. When additional HTTP requests are made to the identity applications server, the access token is supplied as part of the request in an HTTP authorization header.

11. The access token in use is set to expire within the default expiration time interval of two minutes. If the identity applications server attempts to validate an access token after the token has expired, OSP informs the identity applications server that the token is no longer valid. The identity applications server then responds with an HTTP 401 status. The web application page again directs the client browser to OSP to request an access token.

12. OSP determines (via OSP's secure session cookie) that the user is still authorized (the session has not timed-out due to inactivity and has not been explicitly logged out) and redirects the user back to the web application page with an access token without asking the user for re-entering the credentials.

OSP Login Request Examples by Using REST Endpoints

The Identity Applications server supports APIs that expose all OAuth functionalities as endpoints for obtaining access tokens, and so forth.

The following is an example of the authentication sequence:

Browser requests Identity Applications Landing Page

```
GET    http://<ip address/DNS name of identity applications>:8180/idmdash/
```

Result: 200 text/html

The query includes a bunch of requests to obtain stylesheet (css), JavaScript, and so on.

Landing Page makes “who am I” REST call to the Identity Applications server

The Landing Page makes a request to Identity Applications with no authorization header as the landing page has no access token.

```
GET     http://prvdvnam850.namdom025.lab:8180/IDMProv/rest/access/users/fullName
```

Authorization header: none

Result: 401 error

The Landing Page causes browser to go to OSP grant URL

As Identity Applications do not yet have an OAuth access token, it responds with a 401 error. This causes the Landing page to go to OSP to get an access token. Note that there are no OSP cookies yet.

```
GET
http://<ipaddress>:8180/osp/a/idm/auth/oauth2/
grant?response_type=token&redirect_uri=http:// <ipaddress>:8180/landing/
com.netiq.ualanding.index/
oauth.html&client_id=ualanding&state=spiffystate0.7645864660083901
```

Result: 200 text/html (The resulting page is the OSP login page)

The query includes a bunch of requests to obtain stylesheet (`css`) and favicon.

The result of the request to OSP (from the browser's point-of-view) is that a page is displayed with entry fields for the user's name and password. There are also cookies returned from OSP with the login page that will be sent by the browser in subsequent requests.

Browser POSTs user credentials from the login page

```
POST http://<ipaddress>:8180/osp/a/idm/auth/app/login?acAuthCardId=np-contract-
{%24default-card}&sid=1
```

Cookies: JSESSIONID 95...79 End Of Session

x-oidp-oauth2-1449687159117—1013136951 "Wtf...zx0~" End Of Session

x-oidp-session59303d34382c2d310 200-GX0...97kISI~ End Of Session

Result: 302 Redirect to OSP implicitcontinue

```
GET http://<ipaddress>:8180/osp/a/idm/auth/oauth2/
implicitcontinue?privateId=bb5b94976815f348307b&client_id=ualanding&irdpkg=1449687
159117--1013136951
```

Cookies: JSESSIONID 95...79 End Of Session

x-oidp-oauth2-1449687159117--1013136951 "Wtf...zx0~" End Of Session

x-oidp-session59303d34382c2d310 200-PP+...RzX0F6 End Of Session

Result: 302 Redirect to Identity Manager landing OAuth result page

After an internal redirect between the OSP pages, the result is a redirect to the `redirect_uri` parameter that was originally sent with the initial request to OSP.

Browser redirects to the Landing OAuth Result Page

```
GET   http://<ipaddress>:8180/idmdash/oauth.html
```

Cookies: x-oidp-session59303d34382c2d310   200-AZ...b/HQ~~   End Of Session

Result: 200

A fragment containing the access token (see section 4.2.2 of RFC 6749) is appended to the URL. The Landing page extracts the OAuth access token from this fragment. You cannot see this fragment because HTTP does not capture it.

Landing Page again makes the "who am I" request

The Landing Page again makes the "who am I" request, but this time with an authorization header as the Landing page has an access token.

```
GET http://<ipaddress>:8180/IDMProv/rest/access/users/fullName
```

Authorization header: Authorization bearer eHw...343

Result: 200 {"dn":"cn=mary,ou=users,o=data","name":"Mary Contrary"}

Using Kerberos for Single Sign-On

You can use Kerberos as an authentication method for the identity applications that allows single sign-on (SSO). This also allows users to use Integrated Windows Authentication to log in to the applications. For more information, see Using Kerberos for Single Sign-On in the *NetIQ Identity Manager Setup Guide*.

Using SAML with NetIQ Access Manager for Single Sign-On

You can configure both NetIQ Access Manager and OSP to support single sign-on access in Identity Manager using SAML 2.0 authentication For more information, see Using SAML Authentication with NetIQ Access Manager for Single Sign-on in the *NetIQ Identity Manager Setup Guide*.

Integrating Single Sign-on Access with Identity Governance

If you have installed Identity Manager, your users can log in a single time to access Identity Applications, Identity Reporting, and Identity Governance from the Identity Manager Home page. To ensure single sign-on access, you must configure both Identity Manager and Identity Governance. Users can easily shift between the two applications without needing to enter their credentials a second time.

Identity Governance must use the same authentication server that the identity applications use.

Ensuring Rapid Response to Authentication Requests

You can configure OSP so users can log in with an email address or another attribute available in the Identity Vault. If you use a non-default attribute, the server might take longer to respond to authentication requests. Also, OSP automatically times out LDAP connections after 15 seconds. To ensure a rapid response time, the LDAP authentication server should have an index for the login attribute. You also must specify that attribute in the RBPM Configuration Utility.

1 To specify the login attribute, complete the following steps:

- **1a** Run the RBPM Configuration utility.

  For more information, see Configuring the Settings for the Identity Applications in the *NetIQ Identity Manager Setup Guide*.

- **1b** Select **Authentication > Show Advanced Options**.

  For more information, see Authentication Parameters in the *NetIQ Identity Manager Setup Guide*.

- **1c** For **Duplicate resolution naming attribute**, specify the attribute that you want to use for login activities. For example, `Internet Email Address`.

- **1d** Save your changes.

2 (Conditional) To create an index for the login attribute in the Identity Vault, complete the following steps:

- **2a** Create the index.

  For more information, see "Creating an Index" in the *NetIQ eDirectory Administration Guide*.

- **2b** For the attribute, select the same attribute that you specified for **Duplicate resolution naming attribute** in the configuration utility.

- **2c** For the index rule, specify **Value**.

- **2d** Complete the process for creating the index.

Configuring Identity Governance for Integration

For proper integration, you must link Identity Governance to the Identity Manager Home page for the identity applications. You can also choose to use the same authentication server that the identity applications use to verify login attempts. This process includes the following activities:

- "Adding a Link to Identity Manager Home in the Identity Governance Menu" on page 630
- "Using the Same Authentication Server as Identity Manager" on page 631

Adding a Link to Identity Manager Home in the Identity Governance Menu

This section describes how to add a link in Identity Governance so users can easily switch to Identity Manager Home.

1 Log in to Identity Governance with an account that has the Global Administrator authorization.

2 Select **Administration > General Settings**.

3 For **Home Page URL**, specify the URL for Identity Manager Home.

4 Select **Save**.

5 Sign out of Identity Governance.

6 (Optional) To verify the integration, complete the following steps:

   6a Log in to Identity Governance. Verify that Identity Governance lists **Home** in the navigation pane.

   6b Select **Home**, and verify that it takes you to the Identity Manager Home page.

Using the Same Authentication Server as Identity Manager

This section describes how to configure Identity Governance to use the same authentication server as Identity Manager identity applications for verifying users who log in. This section assumes that, when you installed Identity Governance, you did not specify the Identity Manager authentication server. For example, you might have installed Identity Governance before adding Identity Manager to your environment.

1. Stop Identity Governance (and Tomcat).

   For example:

   ```
   /etc/init.d/idmapps_tomcat_init stop
   ```

2. In the Identity Governance Configuration Utility, select **Authentication Server Details**.
3. Clear **Same as IG Server**.
4. Specify the protocol, DNS host name or IP address, and port that represent the authentication server for Identity Manager identity applications.

   NOTE: To use TLS/SSL protocol for secure communications, select **https**.

5. Select **Save**.
6. Make a note of the settings for the authentication server.

   The values for these settings must match the settings that you specify for Identity Governance in the RBPM Configuration utility. For more information, see Section , “Configuring Identity Manager for Integration,” on page 632.

7. Select **Security Settings**, and make a note of the settings in the **General Service** section.

   The values for these settings must match the settings that you specify for Identity Governance in the RBPM Configuration utility. For more information, see Section , “Configuring Identity Manager for Integration,” on page 632.

8. Close the utility.
9. Start Identity Governance. For example:

   ```
   /etc/init.d/idmapps_tomcat_init start
   ```

Configuring Identity Manager for Integration

To ensure proper integration, you must update your version of Identity Manager identity applications to recognize Identity Governance. The process includes copying files from the Identity Governance installation to the Identity Manager identity applications installation.

This procedure assumes that you have configured single sign-on for the identity applications. For more information, see Configuring Single Sign-on Access in Identity Manager in the *NetIQ Identity Manager Setup Guide*.

1. On the server where you installed Identity Governance, log in as an administrator.
2. Navigate to the `/osp` folder in the installation directory for Identity Governance. For example, `/opt/netiq/idm/apps/idgov/osp`.
3. Copy the `uaconfig-ig-defs.xml` file to a location or thumb drive that you can access from the server running Identity Applications.
4. Sign out of the server.
5. On the server where you installed the identity applications, log in as an administrator.
6. Stop the application server.

   For example:

   ```
   /etc/init.d/idmapps_tomcat_init stop
   ```
7. Navigate to the `/conf` directory of the application server. For example, `installation_path/idm/apps/tomcat/conf`.
8. Place the `uaconfig-ig-defs.xml` file from the Identity Governance installation in the `/conf` directory.
9. In a text editor, open the `configupdate.sh` file, located by default in the installation directory for Identity Applications. For example, `/opt/netiq/idm/apps/UserApplication/configupdate.sh`.
10. In the file, add the following line before the `-Duser.language` entry:

    ```
    -Dcom.netiq.uaconfig.impl.custom.clients=path_to_conf_dir/uaconfig-ig-defs.xml
    ```

    For example:

    ```
    -Dcom.netiq.uaconfig.impl.custom.clients=/opt/netiq/idm/apps/tomcat/server/
    IDMProv/conf/uaconfig-ig-defs.xml
    ```
11. Save and close the file.
12. Launch the configuration update utility by running `./configupdate.sh` from the command prompt.
13. In the utility, select **Identity Governance SSO Client**.

    NOTE: If the utility does not display the **Identity Governance SSO Client** tab, ensure that you copied the correct files from the Identity Governance installation to the identity applications installation.
14. Specify the values based on the **OAuth SSO Client** and **Security Settings > General Service** settings that you observed in Step 6 through Step 7 in "Using the Same Authentication Server as Identity Manager" on page 631.

Observe the following considerations for these settings:

- By default, the **OAuth client ID** is `iac`. You specified the client ID and its password when you specified the client secret during the Identity Governance installation.
- **OAuth redirect URL** must be an absolute URL and include the specified value for OAuth client ID. For example, `http://myserver.host:8080/oauth.html`. By default, the configuration utility provides some of this URL. However, you must ensure that you add the server and port information.

15 Save your changes and close the utility.

16 In the directory of the application server, clear out the `/temp` and `/work` directories.

17 Start the application server.

For example:

```
/etc/init.d/idmapps_tomcat_init start
```

18 Add a link to Identity Governance on the Identity Manager Home page.

For more information, see Configuring Identity Manager Home Items in the *NetIQ Identity Manager Home and Provisioning Dashboard User Guide*.

19 On the Identity Governance server, start Identity Governance (and Tomcat).

For example:

```
/etc/init.d/idmapps_tomcat_init start
```

Guidelines for Enabling OSP Logging

The OSP log level is controlled by `com.netiq.idm.osp.tenant.logging.level` property typically set in the `setenv.sh` file in Tomcat's `bin` directory. For example, `/opt/netiq/idm/apps/tomcat/bin/setenv.sh` on Linux. The setenv.sh file has the below entry is at the end of the file.

```
JAVA_OPTS="-Xms1024m -Xmx1024m -XX:MaxPermSize=512m "
export JAVA_OPTS
export CATALINA_OPTS="-Dcom.netiq.ism.config=/opt/netiq/idm/apps/tomcat/conf/ism-
configuration.properties -Dcom.netiq.osp.ext-context-file=/opt/netiq/idm/apps/
osp_sspr/osp/osp-conf.jar -Dcom.netiq.idm.osp.logging.level=INFO -
Dcom.netiq.idm.osp.client.host=myserver.acme.com -
Dcom.netiq.idm.osp.tenant.logging.naudit.enabled=false -
Dcom.netiq.idm.osp.logging.file.dir=${CATALINA_BASE}/logs -Djava.awt.headless=true
-Dfile.encoding=UTF-8 -Dsun.jnu.encoding=UTF-8 -
Djavax.xml.transform.TransformerFactory=org.apache.xalan.processor.TransformerFact
oryImpl -Didmuserapp.logging.config.dir=/opt/netiq/idm/apps/tomcat/conf/ -
Dextend.local.config.dir=/opt/netiq/idm/apps/tomcat/conf/”
```

The property, `-Dcom.netiq.idm.osp.logging.level=ALL`, controls the amount of information that OSP logs. The Apache Foundation defines the following trace levels for log4j:

- `OFF`
- `FATAL`
- `ERROR`
- `WARN`
- `INFO`
- `DEBUG`

- `TRACE`
- `ALL`

By default, OSP logging is set to `INFO`. You can set other levels depending on what you are troubleshooting. After setting the log level, restart Identity Applications. For example, restart Tomcat with `idmapps_tomcat_init` script from `/etc/init.d` on Linux.

Before enabling logging, NetIQ recommends to review the following guidelines:

- Use `ALL` to troubleshoot if OSP is able to find the certificate that you included. This level names every single certificate in the known keystores it uses. This information can be useful because JVM has 90 or more certificates. In general, set the log level to ALL to debug or troubleshoot common issues. To generate additional messages, set com.netiq.idm.osp.debug property to true either as a Java system property in setenv.sh or ism-configuration.properties file.
- File logging is enabled by default. OSP creates files name as `osp-idm-<`*`date of log generation`*`>.log` file in the Tomcat directory. For example, `/opt/netiq/idm/apps/tomcat/logs/`. File logging records the actions that have occurred. For example, you can configure logging to list every request made to OSP. This can help you get a good idea of how often visitors are coming and how they navigate the application pages. The content logged to file logging can be controlled by specifying logger levels.
- When you enable console logging, OSP generates log messages in the `catalina.out` file located in the `logs` directory under Tomcat's root directory. For example, `/opt/netiq/idm/apps/tomcat/logs/catalina.out`. NetIQ recommends you to use file logging on Windows.
- OSP can handle thousands of requests per second. If transaction volume is high and each log entry consumes a few hundred bytes, OSP can fill up the available disk space in a matter of minutes. Logging also increases system overhead, which causes some degradation in system performance. Therefore, refrain from using console logging in a production environment because there is no default way to limit the size of the `catalina.out` file. For production use, the logging level should be set to `WARNING` or less. More verbose logging levels result in much more log data which requires both CPU resources to generate the log messages and disk resources to store the log messages.

34 Troubleshooting

The following sections contain information about troubleshooting different components of identity applications:

Using Log Files for Troubleshooting

The following sections provide information about how to use log files for troubleshooting problems:

Customizing Logging Settings

By default, log entries include only function names and not the complete class path that can make it difficult to determine which package is generating a particular message. To include the complete class path in a log message, change all the instances of the following entry in the `userapp-log4j.xml` file:

```
<param name="ConversionPattern" value="%d [%p] %c{1} %m%n"/>
```

to

```
<param name="ConversionPattern" value="%d [%p] %C %m%n"/>
```

After making this change, the following example trace entry:

```
2017-08-29 16:05:05,392 DEBUG [RBPM] Entity Definition found: sys-nrf-navitem
```

looks similar to this:

```
2017-08-29 16:05:05,392 DEBUG
com.novell.srvprv.impl.vdata.definition.VirtualDataDefinition- [RBPM] Entity
Definition found: sys-nrf-navitem
```

NOTE: The examples in the subsequent sections contain a complete class path to help you correctly interpret the meaning of log entries in the `catalina.out` file.

Virtual Data Access Logging

The Virtual Data Access (VDA) trace is logged to the `catalina.out` file when you look for an entity definition.

The VDA issues all of the identity applications LDAP queries for identity data such as entity definition and attributes on the Identity Vault. First it queries the information from the local cache residing on the identity applications server. If the information is not found in the local cache, it queries the Identity Vault. After locating the object, the identity applications read the attributes of the object and map the attributes with the entity definition in the local cache. When the entity definition matches, the identity applications send the data to the client. The trace looks similar to the following:

```
2017-08-29 16:05:05,389 [http-bio-8443-exec-10] DEBUG
com.novell.idm.nrf.util.CacheUtil- [RBPM] Role object was found in cache: cache-
key-nrf-config

2017-08-29 16:05:05,389 [http-bio-8443-exec-10] DEBUG
com.novell.idm.nrf.util.CacheUtil- [RBPM] Role object RETRIEVED from cache: cache-
key-nrf-config

2017-08-29 16:05:05,392 [http-bio-8443-exec-10] DEBUG
com.novell.srvprv.impl.vdata.model.VirtualDataAccess- [RBPM]
VDA.getEntityResultList

2017-08-29 16:05:05,392 [http-bio-8443-exec-10] DEBUG
com.novell.srvprv.impl.vdata.model.VirtualDataModel- [RBPM]
VDM.getEntityDefinition(String, Locale):sys-nrf-navitem

2017-08-29 16:05:05,392 [http-bio-8443-exec-10] DEBUG
com.novell.srvprv.spi.vdata.util.CacheUtil- [RBPM] DAL Definition is null/not
found in cache: VDM_ENTITY_DEFINITION_sys-nrf-navitem, Is object in cache?false

2017-08-29 16:05:05,392 [http-bio-8443-exec-10] DEBUG
com.novell.srvprv.impl.vdata.definition.VirtualDataDefinition- [RBPM] Entity
Definition found: sys-nrf-navitem

2017-08-29 16:05:05,393 [http-bio-8443-exec-10] DEBUG
com.novell.srvprv.spi.vdata.util.CacheUtil- [RBPM] DAL definition was found in
cache: VDD_ENTITY_ATTR_sys-nrf-navitem

2017-08-29 16:05:05,393 [http-bio-8443-exec-10] DEBUG
com.novell.srvprv.spi.vdata.util.CacheUtil- [RBPM] DAL Definition RETRIEVED from
cache: VDD_ENTITY_ATTR_sys-nrf-navitem

2017-08-29 16:05:05,393 [http-bio-8443-exec-10] DEBUG
com.novell.srvprv.spi.vdata.util.CacheUtil- [RBPM] PUT new DAL Definition into
cache: VDM_DEFINITION_ATTRIBUTE_LIST_sys-nrf-navitem

2017-08-29 16:05:05,394 [http-bio-8443-exec-10] DEBUG
com.novell.srvprv.impl.vdata.model.VirtualDataModel- [RBPM]
VDM.getEntityDefinition(String, Locale):sys-nrf-navitem
```

```
2017-08-29 16:05:05,394 [http-bio-8443-exec-10] DEBUG
com.novell.srvprv.impl.vdata.model.VirtualDataAccess- [RBPM]
VDA.getEntityResultList query filter: (&(objectClass=nrfNavItem))

2017-08-29 16:05:05,439 [http-bio-8443-exec-10] DEBUG
com.novell.idm.security.ui.UIProvSecurityUtil- [RBPM] not Admin or Compliance tab,
so checkAccess with resource =
cn=WorkDashBoard,cn=NavItems,cn=UIConfig,cn=AppConfig,cn=UserApplication,cn=driver
set,ou=idm,ou=services,o=system

2017-08-29 16:05:05,443 [http-bio-8443-exec-10] DEBUG
com.novell.srvprv.impl.vdata.model.VirtualDataModel- [RBPM]
VDM.getEntityDefinition(String, Locale):sys-nrf-user

2017-08-29 16:05:05,444 [http-bio-8443-exec-10] DEBUG
com.novell.srvprv.impl.vdata.definition.VirtualDataDefinition- [RBPM] Entity
Definition found: sys-nrf-user

2017-08-29 16:05:05,444 [http-bio-8443-exec-10] DEBUG
com.novell.srvprv.spi.vdata.util.CacheUtil- [RBPM] PUT new DAL Definition into
cache: VDM_ENTITY_DEFINITION_sys-nrf-user

2017-08-29 16:05:05,444 [http-bio-8443-exec-10] DEBUG
com.novell.srvprv.impl.vdata.model.VirtualDataAccess- [RBPM] VDA.getEntity:
cn=mytestuser,dc=data

2017-08-29 16:05:05,444 [http-bio-8443-exec-10] DEBUG
com.novell.srvprv.spi.vdata.util.CacheUtil- [RBPM] DAL definition was found in
cache: VDD_ENTITY_ATTR_sys-nrf-user

2017-08-29 16:05:05,444 [http-bio-8443-exec-10] DEBUG
com.novell.srvprv.spi.vdata.util.CacheUtil- [RBPM] DAL Definition RETRIEVED from
cache: VDD_ENTITY_ATTR_sys-nrf-user

2017-08-29 16:05:05,445 [http-bio-8443-exec-10] DEBUG
com.novell.srvprv.spi.vdata.util.CacheUtil- [RBPM] PUT new DAL Definition into
cache: VDM_DEFINITION_ATTRIBUTE_LIST_sys-nrf-user

2017-08-29 16:05:05,446 [http-bio-8443-exec-10] DEBUG
com.novell.srvprv.impl.vdata.model.VirtualDataAccess- [RBPM] VDA.getLdapAttributes
Attributes and values

2017-08-29 16:05:05,478 [http-bio-8443-exec-10] DEBUG
com.novell.srvprv.impl.vdata.model.VirtualDataAccess- [RBPM] Attribute ID: mail

2017-08-29 16:05:05,478 [http-bio-8443-exec-10] DEBUG
com.novell.srvprv.impl.vdata.model.VirtualDataAccess- [RBPM]
mytestuser@acme.com

2017-08-29 16:05:05,478 [http-bio-8443-exec-10] DEBUG
com.novell.srvprv.impl.vdata.model.VirtualDataAccess- [RBPM] Attribute ID:
modifyTimestamp

2017-08-29 16:05:05,478 [http-bio-8443-exec-10] DEBUG
com.novell.srvprv.impl.vdata.model.VirtualDataAccess- [RBPM] 20150716124158Z

2017-08-29 16:05:05,478 [http-bio-8443-exec-10] DEBUG
com.novell.srvprv.impl.vdata.model.VirtualDataAccess- [RBPM] Attribute ID:
givenName

2017-08-29 16:05:05,478 [http-bio-8443-exec-10] DEBUG
com.novell.srvprv.impl.vdata.model.VirtualDataAccess- [RBPM] mytestuser
```

```
2017-08-29 16:05:05,478 [http-bio-8443-exec-10] DEBUG
com.novell.srvprv.impl.vdata.model.VirtualDataAccess- [RBPM] Attribute ID:
objectClass

2017-08-29 16:05:05,478 [http-bio-8443-exec-10] DEBUG
com.novell.srvprv.impl.vdata.model.VirtualDataAccess- [RBPM] inetOrgPerson

2017-08-29 16:05:05,478 [http-bio-8443-exec-10] DEBUG
com.novell.srvprv.impl.vdata.model.VirtualDataAccess- [RBPM] organizationalPerson

2017-08-29 16:05:05,478 [http-bio-8443-exec-10] DEBUG
com.novell.srvprv.impl.vdata.model.VirtualDataAccess- [RBPM] Person

017-08-29 16:05:05,478 [http-bio-8443-exec-10] DEBUG
com.novell.srvprv.impl.vdata.model.VirtualDataAccess- [RBPM] ndsLoginProperties

2017-08-29 16:05:05,478 [http-bio-8443-exec-10] DEBUG
com.novell.srvprv.impl.vdata.model.VirtualDataAccess- [RBPM] Top

2017-08-29 16:05:05,478 [http-bio-8443-exec-10] DEBUG
com.novell.srvprv.impl.vdata.model.VirtualDataAccess- [RBPM] srvprvEntityAux

2017-08-29 16:05:05,478 [http-bio-8443-exec-10] DEBUG
com.novell.srvprv.impl.vdata.model.VirtualDataAccess- [RBPM] Attribute ID: sn

2017-08-29 16:05:05,478 [http-bio-8443-exec-10] DEBUG
com.novell.srvprv.impl.vdata.model.VirtualDataAccess- [RBPM] mytestuser

2017-08-29 16:05:05,479 [http-bio-8443-exec-10] DEBUG
com.novell.srvprv.impl.vdata.model.VirtualDataAccess- [RBPM] Attribute ID: cn

2017-08-29 16:05:05,479 [http-bio-8443-exec-10] DEBUG
com.novell.srvprv.impl.vdata.model.VirtualDataAccess- [RBPM] VDA.checking if
object instance contains the required objectClass per DAL definition: sys-nrf-user

2017-08-29 16:05:05,479 [http-bio-8443-exec-10] DEBUG
com.novell.srvprv.impl.vdata.model.VirtualDataAccess- [RBPM] VDA.does contain
required (search=true or auxilliary=false) objectClass:inetOrgPerson

2017-08-29 16:05:05,479 [http-bio-8443-exec-10] DEBUG
com.novell.srvprv.impl.vdata.model.VirtualDataAccess- [RBPM] VDA.object instance
is correct type

2017-08-29 16:05:05,479 [http-bio-8443-exec-10] DEBUG
com.novell.srvprv.impl.vdata.model.VirtualDataModel- [RBPM]
VDM.getEntityDefinition(String, Locale):sys-nrf-user

2017-08-29 16:05:05,479 [http-bio-8443-exec-10] DEBUG
com.novell.srvprv.spi.vdata.util.CacheUtil- [RBPM] DAL Definition RETRIEVED from
cache: VDM_ENTITY_DEFINITION_sys-nrf-user

2017-08-29 16:05:05,479 [http-bio-8443-exec-10] DEBUG
com.novell.srvprv.impl.vdata.model.VirtualDataAccess- [RBPM] VDA.getEntity:
cn=mytestuser,dc=data

2017-08-29 16:05:05,480 [http-bio-8443-exec-10] DEBUG
com.novell.srvprv.spi.vdata.util.CacheUtil- [RBPM] DAL Definition RETRIEVED from
cache: VDM_DEFINITION_ATTRIBUTE_LIST_sys-nrf-user

2017-08-29 16:05:05,481 [http-bio-8443-exec-10] DEBUG
com.novell.srvprv.impl.vdata.model.VirtualDataAccess- [RBPM] VDA.getLdapAttributes
Attributes and values
```

```
2017-08-29 16:05:05,481 [http-bio-8443-exec-10] DEBUG
com.novell.srvprv.impl.vdata.model.VirtualDataAccess- [RBPM]   Attribute ID: mail

2017-08-29 16:05:05,481 [http-bio-8443-exec-10] DEBUG
com.novell.srvprv.impl.vdata.model.VirtualDataAccess- [RBPM]
mytestuser@acme.com

2017-08-29 16:05:05,481 [http-bio-8443-exec-10] DEBUG
com.novell.srvprv.impl.vdata.model.VirtualDataAccess- [RBPM] 20150716124158Z
```

When an entity model is changed, you must clear the VDA cache for the changes to take effect. For example, entity changes occur when a new attributes is added or the existing attributes are modified or removed.

When a Code Map Refresh Is Triggered

When you initiate a code map refresh cycle, sometimes the refresh cycle is not successful. When this occurs, the trace prints messages similar to the following:

```
2016-11-14 12:28:12,045 [Timer-1] INFO com.novell.idm.nrf.service.CodeMapEngine-
[RBPM] Building the Entitlement CODE MAP tables...

2016-11-14 12:28:12,450 [Timer-1] ERROR com.novell.idm.nrf.service.CodeMapEngine-
[RBPM] Unable to complete the CODE MAP refresh for entitlement:
cn=exchangemailbox,cn=ad,cn=dset,ou=idm,o=system.

2016-11-14 12:28:12,454 [Timer-1] INFO com.novell.idm.nrf.service.CodeMapEngine-
[RBPM] CODE MAP refresh on entitlement:
cn=exchangemailbox,cn=ad,cn=dset,ou=idm,o=system, processed, next refresh time:
20161115122812-0500.

2016-11-14 12:28:12,646 [Timer-1] ERROR com.novell.idm.nrf.service.CodeMapEngine-
[RBPM] Unable to complete the CODE MAP refresh for entitlement:
cn=group,cn=ad,cn=dset,ou=idm,o=system.

2016-11-14 12:28:12,835 [Timer-1] ERROR com.novell.idm.nrf.service.CodeMapEngine-
[RBPM] Unable to complete the CODE MAP refresh for entitlement:
cn=useraccount,cn=ad,cn=dset,ou=idm,o=system.
```

The first entry indicates that code map table refresh action is being initiated. The second entry specifies that it is unable to refresh the code map table for `cn=exchangemailbox,cn=ad,cn=dset,ou=idm,o=system` entitlement. The next line has the time interval when the entitlement will be refreshed. The next two lines specify that code map table was not refreshed for `cn=group,cn=ad,cn=dset,ou=idm,o=system` and `cn=useraccount,cn=ad,cn=dset,ou=idm,o=system` entitlements.

The code map refresh process can fail when either connected system or the Identity Vault is not up at the time of obtaining entitlement information. The trace logs the actual reason for failure.

When Multiple Users Try to Authenticate From Different Interfaces

OSP supports the OAuth2 specification and requires an LDAP authentication server. By default, Identity Manager uses Identity Vault (eDirectory) as an authentication server. When multiple users try to log in to OSP from different user interfaces of the identity applications, the users are redirected to the default landing page upon a successful login. When the access token expires within the login session, OSP validates the token and refreshes the session by generating a new access token without the user’s involvement. Otherwise, it directs the user to the login page. Such a trace looks similar to the following:

```
2016-03-08 06:14:28,509 [http-bio-8443-exec-801] DEBUG
com.netiq.idm.auth.oauth.OAuthFilter- [RBPM] Original request going to RBPM is:
https://www.snet.acme.com:443/IDMProv/
workDashboard.do?apwaLeftNavItem=JSP_MENU_TASKS

2016-03-08 06:15:49,289 [http-bio-8443-exec-816] DEBUG
com.netiq.idm.auth.oauth.OAuthFilter- [RBPM] Original request going to RBPM is:
https://www.snet.acme.com:443/IDMProv/

2016-03-08 06:15:50,334 [http-bio-8443-exec-815] INFO
com.netiq.idm.auth.oauth.OAuthFilter- [RBPM] SSO Header issued by SSO Filter oauth
for User cn=Rob.Andrews,ou=Active,ou=People,o=acme.

2016-03-08 06:15:50,354 [http-bio-8443-exec-815] INFO
com.novell.common.auth.saml.AuthTokenGenerator- [RBPM] SAML Token is issued by the
request from SSO filter oauth

2016-03-08 06:15:50,414 [http-bio-8443-exec-815] INFO
com.novell.pwdmgt.util.PasswordHelper- [RBPM] [Login_Success]
cn=David.Scully,ou=Active,ou=People,o=acme successfully logged in.

2016-03-08 06:17:53,520 [http-bio-8443-exec-819] DEBUG
com.netiq.idm.auth.oauth.OAuthFilter- [RBPM] Original request going to RBPM is:
https://www.snet.acme.com:443/IDMProv/

2016-03-08 06:17:55,194 [http-bio-8443-exec-811] INFO
com.netiq.idm.auth.oauth.OAuthFilter- [RBPM] SSO Header issued by SSO Filter oauth
for User cn=neil.smith,ou=Active,ou=People,o=acme.

2016-03-08 06:17:55,204 [http-bio-8443-exec-811] INFO
com.novell.common.auth.saml.AuthTokenGenerator- [RBPM] SAML Token is issued by the
request from SSO filter oauth

2016-03-08 06:17:55,234 [http-bio-8443-exec-811] INFO
com.novell.pwdmgt.util.PasswordHelper- [RBPM] [Login_Success]
cn=neil.smith,ou=Active,ou=People,o=acme successfully logged in.

2016-03-08 06:20:56,616 [http-bio-8443-exec-813] DEBUG
com.netiq.idm.auth.oauth.OAuthFilter- [RBPM] Original request going to RBPM is:
https://www.snet.acme.com:443/IDMProv/

2016-03-08 06:21:02,129 [http-bio-8443-exec-823] INFO
com.netiq.idm.auth.oauth.OAuthFilter- [RBPM] SSO Header issued by SSO Filter oauth
for User cn=dean.gardner,ou=Active,ou=People,o=acme.

2016-03-08 06:21:02,149 [http-bio-8443-exec-823] INFO
com.novell.common.auth.saml.AuthTokenGenerator- [RBPM] SAML Token is issued by the
request from SSO filter oauth

2016-03-08 06:21:02,216 [http-bio-8443-exec-823] INFO
com.novell.pwdmgt.util.PasswordHelper- [RBPM] [Login_Success]
cn=dean.gardner,ou=Active,ou=People,o=acme successfully logged in.

2016-03-08 06:24:28,626 [http-bio-8443-exec-830] DEBUG
com.netiq.idm.auth.oauth.OAuthFilter- [RBPM] Original request going to RBPM is:
https://www.snet.acme.com:443/IDMProv/
workDashboard.do?apwaLeftNavItem=JSP_MENU_TASKS
```

```
2016-03-08 06:24:40,547 [http-bio-8443-exec-814] WARN
com.netiq.idm.auth.oauth.OAuthManager- [RBPM] Token validation failed. HTTP status
code: 401 Detail message from authentication server: The access token is expired.
```

This trace indicates that the user is accessing the application after some idle time. The last message indicates that the token has expired. When the user tried to log in again, the token failed the validation and as a result the user cannot be logged in.

When an E-Mail Approval Notification is Not Delivered

Sometimes an e-mail notification is not delivered due to errors in the connection between the client and the mail server. When this occurs, the trace looks similar to the following:

```
2016-03-08 07:42:41,575 [NOTIFICATION THREAD] ERROR
com.novell.soa.notification.impl.NotificationThread- [RBPM] Error sending email.
com.novell.soa.notification.impl.NotificationException: Error sending email.
at com.novell.soa.notification.impl.MailEngine.send(MailEngine.java:347)
at
com.novell.soa.notification.impl.NotificationThread.run(NotificationThread.java:96
)
Caused by: javax.mail.MessagingException: 421 Too many errors on this connection--
-closing

at com.sun.mail.smtp.SMTPTransport.issueCommand(SMTPTransport.java:879)
at com.sun.mail.smtp.SMTPTransport.mailFrom(SMTPTransport.java:599)
at com.sun.mail.smtp.SMTPTransport.sendMessage(SMTPTransport.java:319)
at com.novell.soa.notification.impl.MailEngine.send(MailEngine.java:344)
... 1 more
```

When an e-mail approval notification is not delivered, the first step should be to look at the logs and determine whether the connection is proper, mail server is running and accessible. Sometimes the e-mail fails to comply with e-mail template and fails to deliver.

When a Role Is Requested

When a role is requested in the identity applications, Identity Manager creates the role object in the Identity Vault. The Role and Resource Service driver checks users for assigning this role, and then provisions the role to the assigned users. When this occurs, the trace prints messages similar to the following:

```
2016-03-08 08:43:10,660 [pool-2-thread-5] INFO
com.novell.idm.nrf.service.RoleManagerService- [RBPM] [Role_Request] Requested by
cn=David.Scully,ou=Active,ou=People,o=acme, Target DN:
CN=Kaitlin.Demore,OU=active,OU=People,O=acme, Source
DN:cn=PennDOT_Vehicle_Certification,cn=Application
Access,cn=Level10,cn=RoleDefs,cn=RoleConfig,cn=AppConfig,cn=UserApplication,cn=idm
361,ou=services,o=acme, Request DN:cn=20160308084310-
15da49b28ddf4ee1b7d71b4ce220c080-
0,cn=Requests,cn=RoleConfig,cn=AppConfig,cn=UserApplication,cn=idm361,ou=services,
o=acme, Request Category: 10, Request Status: 0, Original Request Status: 0,
Correlation ID: UserApp#UserStartWorkflow#082080ec-5b10-498f-b87d-28825ab63278
```

```
2016-03-08 08:43:10,669 [pool-2-thread-5] INFO
com.novell.idm.nrf.service.RoleManagerService- [RBPM] [Role_Request] Requested by
cn=David.Scully,ou=Active,ou=People,o=acme, Target DN:
CN=Kaitlin.Demore,OU=active,OU=People,O=acme, Source DN:cn=PennDOT History and
Photos Users,cn=Application
Access,cn=Level10,cn=RoleDefs,cn=RoleConfig,cn=AppConfig,cn=UserApplication,cn=idm
361,ou=services,o=acme, Request DN:cn=20160308084310-
3c5b20b79cc046bb8267a41cad88a96a-
1,cn=Requests,cn=RoleConfig,cn=AppConfig,cn=UserApplication,cn=idm361,ou=services,
o=acme, Request Category: 10, Request Status: 0, Original Request Status: 0,
Correlation ID: UserApp#UserStartWorkflow#082080ec-5b10-498f-b87d-28825ab63278

2016-03-08 08:43:10,678 [pool-2-thread-5] INFO
com.novell.idm.nrf.service.RoleManagerService- [RBPM] [Role_Request] Requested by
cn=David.Scully,ou=Active,ou=People,o=acme, Target DN:
CN=Kaitlin.Demore,OU=active,OU=People,O=acme, Source DN:cn=JWL Eligible
Agency,cn=Application
Access,cn=Level10,cn=RoleDefs,cn=RoleConfig,cn=AppConfig,cn=UserApplication,cn=idm
361,ou=services,o=acme, Request DN:cn=20160308084310-
fc24ac874aca4fc8b1db0e1d7662d9b3-
2,cn=Requests,cn=RoleConfig,cn=AppConfig,cn=UserApplication,cn=idm361,ou=services,
o=acme, Request Category: 10, Request Status: 0, Original Request Status: 0,
Correlation ID: UserApp#UserStartWorkflow#082080ec-5b10-498f-b87d-28825ab63278

2016-03-08 08:43:10,712 [pool-2-thread-5] INFO
com.novell.idm.nrf.service.RoleManagerService- [RBPM] [Role_Request] Requested by
cn=David.Scully,ou=Active,ou=People,o=acme, Target DN:
CN=Kaitlin.Demore,OU=active,OU=People,O=acme, Source DN:cn=DPW Recipient Address
Eligible Agency,cn=Application
Access,cn=Level10,cn=RoleDefs,cn=RoleConfig,cn=AppConfig,cn=UserApplication,cn=idm
361,ou=services,o=acme, Request DN:cn=20160308084310-
411abb1e8f6f488182c37c8629275245-
3,cn=Requests,cn=RoleConfig,cn=AppConfig,cn=UserApplication,cn=idm361,ou=services,
o=acme, Request Category: 10, Request Status: 0, Original Request Status: 0,
Correlation ID: UserApp#UserStartWorkflow#082080ec-5b10-498f-b87d-28825ab63278

2016-03-08 08:43:10,737 [pool-2-thread-5] INFO
com.novell.idm.nrf.service.RoleManagerService- [RBPM] [Role_Request] Requested by
cn=David.Scully,ou=Active,ou=People,o=acme, Target DN:
CN=Kaitlin.Demore,OU=active,OU=People,O=acme, Source DN:cn=cj-users,cn=Application
Access,cn=Level10,cn=RoleDefs,cn=RoleConfig,cn=AppConfig,cn=UserApplication,cn=idm
361,ou=services,o=acme, Request DN:cn=20160308084310-
211a591e09b04fbbb195fb14d7f4df07-
4,cn=Requests,cn=RoleConfig,cn=AppConfig,cn=UserApplication,cn=idm361,ou=services,
o=acme, Request Category: 10, Request Status: 0, Original Request Status: 0,
Correlation ID: UserApp#UserStartWorkflow#082080ec-5b10-498f-b87d-28825ab63278

2016-03-08 08:43:10,790 [pool-2-thread-5] INFO
com.novell.idm.nrf.service.RoleManagerService- [RBPM] [Role_Request] Requested by
cn=David.Scully,ou=Active,ou=People,o=acme, Target DN:
CN=Kaitlin.Demore,OU=active,OU=People,O=acme, Source DN:cn=JTS Eligible
Agency,cn=Application
Access,cn=Level10,cn=RoleDefs,cn=RoleConfig,cn=AppConfig,cn=UserApplication,cn=idm
361,ou=services,o=acme, Request DN:cn=20160308084310-
5339699630814a91ac44530a244a02ba-
5,cn=Requests,cn=RoleConfig,cn=AppConfig,cn=UserApplication,cn=idm361,ou=services,
o=acme, Request Category: 10, Request Status: 0, Original Request Status: 0,
Correlation ID: UserApp#UserStartWorkflow#082080ec-5b10-498f-b87d-28825ab63278
```

```
2016-03-08 08:43:10,799 [pool-2-thread-5] INFO
com.novell.idm.nrf.service.RoleManagerService- [RBPM] [Role_Request] Requested by
cn=David.Scully,ou=Active,ou=People,o=acme, Target DN:
CN=Kaitlin.Demore,OU=active,OU=People,O=acme, Source DN:cn=Sentencing Guidelines
Eligible Agency,cn=Application
Access,cn=Level10,cn=RoleDefs,cn=RoleConfig,cn=AppConfig,cn=UserApplication,cn=idm
361,ou=services,o=acme, Request DN:cn=20160308084310-
df2398cf36a042f0ac2241e693efb93c-
6,cn=Requests,cn=RoleConfig,cn=AppConfig,cn=UserApplication,cn=idm361,ou=services,
o=acme, Request Category: 10, Request Status: 0, Original Request Status: 0,
Correlation ID: UserApp#UserStartWorkflow#082080ec-5b10-498f-b87d-28825ab63278

2016-03-08 08:43:10,800 [pool-2-thread-5] INFO
com.novell.soa.af.impl.LogEvent- [RBPM] [Role_Request_Submitted] Initiated by
cn=David.Scully,ou=Active,ou=People,o=acme, Process ID:
95f25f5f31224efcab1611fe0fc2471f, Process Name:
cn=newuserinvitation,cn=RequestDefs,cn=AppConfig,cn=UserApplication,cn=idm361,ou=s
ervices,o=acme, Activity: Activity6, Recipient:
CN=Kaitlin.Demore,OU=active,OU=People,O=acme, Correlation
ID:UserApp#UserStartWorkflow#082080ec-5b10-498f-b87d-28825ab63278, Submitted
Request:<?xml version="1.0" encoding="UTF-8"?><wfRoleRequest>
<attr name="sod-override-request">
<value>true</value>
</attr>
<attr name="target">
<value>CN=Kaitlin.Demore,OU=active,OU=People,O=acme</value>
</attr>
<attr name="action">
<value>GRANT</value>
</attr>
<attr name="targetType">
<value>USER</value>
</attr>
<attr name="roles">
<value>cn=PennDOT_Vehicle_Certification,cn=Application
Access,cn=Level10,cn=RoleDefs,cn=RoleConfig,cn=AppConfig,cn=UserApplication,ou=ser
vices,o=acme</value>
<value>cn=PennDOT History and Photos Users,cn=Application
Access,cn=Level10,cn=RoleDefs,cn=RoleConfig,cn=AppConfig,cn=UserApplication,ou=ser
vices,o=acme</value>
<value>cn=JWL Eligible Agency,cn=Application
Access,cn=Level10,cn=RoleDefs,cn=RoleConfig,cn=AppConfig,cn=UserApplication,ou=ser
vices,o=acme</value>
<value>cn=DPW Recipient Address Eligible Agency,cn=Application
Access,cn=Level10,cn=RoleDefs,cn=RoleConfig,cn=AppConfig,cn=UserApplication,ou=ser
vices,o=acme</value>
<value>cn=cj-users,cn=Application
Access,cn=Level10,cn=RoleDefs,cn=RoleConfig,cn=AppConfig,cn=UserApplication,ou=ser
vices,o=acme</value>
<value>cn=JTS Eligible Agency,cn=Application
Access,cn=Level10,cn=RoleDefs,cn=RoleConfig,cn=AppConfig,cn=UserApplication,ou=ser
vices,o=acme</value>
<value>cn=Sentencing Guidelines Eligible Agency,cn=Application
Access,cn=Level10,cn=RoleDefs,cn=RoleConfig,cn=AppConfig,cn=UserApplication,ou=ser
vices,o=acme</value>
</attr>
<attr name="correlationId">
<value>UserApp#UserStartWorkflow#082080ec-5b10-498f-b87d-28825ab63278</value>
</attr>
<attr name="nrfRequest">
```

```
<value>cn=20160308084310-15da49b28ddf4ee1b7d71b4ce220c080-
0,cn=Requests,cn=RoleConfig,cn=AppConfig,cn=UserApplication,ou=services,o=acme</
value>
<value>cn=20160308084310-3c5b20b79cc046bb8267a41cad88a96a-
1,cn=Requests,cn=RoleConfig,cn=AppConfig,cn=UserApplication,ou=services,o=acme</
value>
<value>cn=20160308084310-fc24ac874aca4fc8b1db0e1d7662d9b3-
2,cn=Requests,cn=RoleConfig,cn=AppConfig,cn=UserApplication,ou=services,o=acme</
value>
<value>cn=20160308084310-411abb1e8f6f488182c37c8629275245-
3,cn=Requests,cn=RoleConfig,cn=AppConfig,cn=UserApplication,ou=services,o=acme</
value>
<value>cn=20160308084310-211a591e09b04fbbb195fb14d7f4df07-
4,cn=Requests,cn=RoleConfig,cn=AppConfig,cn=UserApplication,ou=services,o=acme</
value>
<value>cn=20160308084310-5339699630814a91ac44530a244a02ba-
5,cn=Requests,cn=RoleConfig,cn=AppConfig,cn=UserApplication,ou=services,o=acme</
value>
<value>cn=20160308084310-df2398cf36a042f0ac2241e693efb93c-
6,cn=Requests,cn=RoleConfig,cn=AppConfig,cn=UserApplication,ou=services,o=acme</
value>
</attr>
</wfRoleRequest>
```

```
2016-03-08 08:43:10,880 [pool-2-thread-5] INFO com.novell.soa.af.impl.LogEvent-
[RBPM] [Workflow_Forwarded] Initiated by System, Process ID:
95f25f5f31224efcab1611fe0fc2471f, Process Name:
cn=newuserinvitation,cn=RequestDefs,cn=AppConfig,cn=UserApplication,ou=services,o=
acme:205, Activity: Activity6, Recipient:
cn=Nancy.Wilmer,ou=Active,ou=People,o=acme
```

When a Role Is Listed in Role Catalog

When you issue a request to display a role in Role Catalog, the identity applications obtain the role object from the cache and then display the role information in Role Catalog.

```
2017-09-22 09:28:26,495 [DEBUG] RuntimeAuthorizationManagerService [RBPM]
Authorized result for:
cn=roleAdmin,cn=System,cn=Level20,cn=RoleDefs,cn=RoleConfig,cn=AppConfig,cn=User
Application Driver,cn=driverset1,o=system:role:read=true

2017-09-22 09:28:26,495 [DEBUG] CacheUtil [RBPM] Role object was found in cache:
cache-key-nrf-config

2017-09-22 09:28:26,495 [DEBUG] CacheUtil [RBPM] Role object RETRIEVED from cache:
cache-key-nrf-config

2017-09-22 09:28:26,509 [DEBUG] RuntimeAuthDelegatorBase [RBPM] Time to calculate
sel service access rights: 0milliseconds.

2017-09-22 09:28:26,509 [DEBUG] RuntimeAuthorizationManagerService [RBPM]
Authorized result for:
cn=secAdmin,cn=System,cn=Level20,cn=RoleDefs,cn=RoleConfig,cn=AppConfig,cn=User
Application Driver,cn=driverset1,o=system:role:read=true

2017-09-22 09:28:26,510 [DEBUG] CacheUtil [RBPM] Role object was found in cache:
cache-key-nrf-config

2017-09-22 09:28:26,510 [DEBUG] CacheUtil [RBPM] Role object RETRIEVED from cache:
cache-key-nrf-config
```

```
2017-09-22 09:28:26,522 [DEBUG] RuntimeAuthDelegatorBase [RBPM] Time to calculate
sel service access rights: 0milliseconds.

2017-09-22 09:28:26,522 [DEBUG] RuntimeAuthorizationManagerService [RBPM]
Authorized result for:
cn=resourceManager,cn=System,cn=Level20,cn=RoleDefs,cn=RoleConfig,cn=AppConfig,cn=
User Application Driver,cn=driverset1,o=system:role:read=true

2017-09-22 09:28:26,522 [DEBUG] CacheUtil [RBPM] Role object was found in cache:
cache-key-nrf-config

2017-09-22 09:28:26,522 [DEBUG] CacheUtil [RBPM] Role object RETRIEVED from cache:
cache-key-nrf-config

2017-09-22 09:28:26,533 [DEBUG] RuntimeAuthDelegatorBase [RBPM] Time to calculate
sel service access rights: 0milliseconds.

2017-09-22 09:28:26,533 [DEBUG] RuntimeAuthorizationManagerService [RBPM]
Authorized result for:
cn=roleManager,cn=System,cn=Level20,cn=RoleDefs,cn=RoleConfig,cn=AppConfig,cn=User
Application Driver,cn=driverset1,o=system:role:read=true

2017-09-22 09:28:26,534 [DEBUG] CacheUtil [RBPM] Role object was found in cache:
cache-key-nrf-config

2017-09-22 09:28:26,534 [DEBUG] CacheUtil [RBPM] Role object RETRIEVED from cache:
cache-key-nrf-config

2017-09-22 09:28:26,545 [DEBUG] RuntimeAuthDelegatorBase [RBPM] Time to calculate
sel service access rights: 0milliseconds.

2017-09-22 09:28:26,545 [DEBUG] RuntimeAuthorizationManagerService [RBPM]
Authorized result for:
cn=resourceAdmin,cn=System,cn=Level20,cn=RoleDefs,cn=RoleConfig,cn=AppConfig,cn=Us
er Application Driver,cn=driverset1,o=system:role:read=true

2017-09-22 09:28:26,545 [DEBUG] CacheUtil [RBPM] Role object was found in cache:
cache-key-nrf-config

2017-09-22 09:28:26,545 [DEBUG] CacheUtil [RBPM] Role object RETRIEVED from cache:
cache-key-nrf-config

2017-09-22 09:28:26,557 [DEBUG] RuntimeAuthDelegatorBase [RBPM] Time to calculate
sel service access rights: 0milliseconds.

2017-09-22 09:28:26,557 [DEBUG] RuntimeAuthorizationManagerService [RBPM]
Authorized result for:
cn=provAdmin,cn=System,cn=Level20,cn=RoleDefs,cn=RoleConfig,cn=AppConfig,cn=User
Application Driver,cn=driverset1,o=system:role:read=true

2017-09-22 09:28:26,557 [DEBUG] CacheUtil [RBPM] Role object was found in cache:
cache-key-nrf-config

2017-09-22 09:28:26,557 [DEBUG] CacheUtil [RBPM] Role object RETRIEVED from cache:
cache-key-nrf-config

2017-09-22 09:28:26,567 [DEBUG] RuntimeAuthDelegatorBase [RBPM] Time to calculate
sel service access rights: 0milliseconds.

2017-09-22 09:28:26,567 [DEBUG] RuntimeAuthorizationManagerService [RBPM]
Authorized result for:
cn=reportAdmin,cn=System,cn=Level20,cn=RoleDefs,cn=RoleConfig,cn=AppConfig,cn=User
Application Driver,cn=driverset1,o=system:role:read=true
```

```
2017-09-22 09:28:26,567 [DEBUG] CacheUtil [RBPM] Role object was found in cache: 
cache-key-nrf-config

2017-09-22 09:28:26,567 [DEBUG] CacheUtil [RBPM] Role object RETRIEVED from cache: 
cache-key-nrf-config

2017-09-22 09:28:26,582 [DEBUG] RuntimeAuthDelegatorBase [RBPM] Time to calculate 
sel service access rights: 0milliseconds.

2017-09-22 09:28:26,582 [DEBUG] RuntimeAuthorizationManagerService [RBPM] 
Authorized result for: 
cn=provManager,cn=System,cn=Level20,cn=RoleDefs,cn=RoleConfig,cn=AppConfig,cn=User 
Application Driver,cn=driverset1,o=system:role:read=true

2017-09-22 09:28:26,582 [DEBUG] JuiceHelper [RBPM] Kicked out of main loop with: 
openR=-1 closeR=-1 i=0 idx=-1

2017-09-22 09:28:26,582 [DEBUG] JuiceHelper [RBPM] Setting RsMeta from cache: 
METAlistRoles_defaultDescription&*~Name&*~enStatus_cn=uaadmin,ou=sa,o=data

2017-09-22 09:28:26,583 [DEBUG] VirtualDataModel [RBPM] 
VDM.getEntityDefinition(String, Locale):sys-nrf-role

2017-09-22 09:28:26,583 [DEBUG] CacheUtil [RBPM] DAL Definition RETRIEVED from 
cache: VDM_ENTITY_DEFINITION_sys-nrf-role

2017-09-22 09:28:26,583 [DEBUG] CacheUtil [RBPM] DAL Definition RETRIEVED from 
cache: VDM_DEFINITION_ATTRIBUTE_LIST_sys-nrf-role

2017-09-22 09:28:26,583 [DEBUG] CacheUtil [RBPM] Role object was found in cache: 
cache-key-nrf-config

2017-09-22 09:28:26,583 [DEBUG] CacheUtil [RBPM] Role object RETRIEVED from cache: 
cache-key-nrf-config
```

The first log entry is the request to find the role object from the cache. The second log entry is the response that is returned, and it indicates that the role object was found. The object is then read and displayed in Role Catalog.

Checking the Status of Database Schema Validation

The identity applications database schema is validated when the administrator starts the identity applications server. The trace prints messages similar to the following:

```
2017-09-22 09:39:41,363 [INFO] DatabaseSchemaUpdate [RBPM] Connecting to PostgreSQL 
version 9.4.10.

2017-09-22 09:39:41,375 [INFO] DatabaseSchemaUpdate [RBPM] Checking for database 
schema

2017-09-22 09:39:41,401 [INFO] DatabaseSchemaUpdate [RBPM] Checking schema for 
table af_resource_request_status....found

2017-09-22 09:39:41,422 [INFO] DatabaseSchemaUpdate [RBPM] Checking schema for 
table af_role_request_status....found

2017-09-22 09:39:41,481 [INFO] DatabaseSchemaUpdate [RBPM] Checking schema for 
table afactivity....found

2017-09-22 09:39:41,501 [INFO] DatabaseSchemaUpdate [RBPM] Checking schema for 
table afactivitytimertasks....found
```

```
2017-09-22 09:39:41,576 [INFO] DatabaseSchemaUpdate [RBPM] Checking schema for
table afbranch....found
```

```
2017-09-22 09:39:41,612 [INFO] DatabaseSchemaUpdate [RBPM] Checking schema for
table afcomment....found
```

```
2017-09-22 09:39:41,651 [INFO] DatabaseSchemaUpdate [RBPM] Checking schema for
table afdocument....missing
```

The first log entry indicates that a connection to the database is initiated. The second log entry specifies that the database schema is being validated. The subsequent entries specify that the presence of database tables is being checked. The last trace entry indicates that `afdocument` table is not found.

Determining if Liquibase Changeset Has Executed

The Liquibase framework validates the database schema against the `changelog.xml` file, which contains the database changes. Liquibase first verifies whether all the tables are present in the schema. If any of the changesets was not executed, it indicates incomplete schema update and also identifies the changesets. Any schema changes made in the User Application are updated in the database when the User Application server is started and `com.netiq.idm.create-db-on-startup` flag is set to `true` in the `ism-configuration` properties file located by default in the `/netiq/idm/apps/tomcat/conf` directory. The database compares the existing schema with target schema and then updates the database schema. If the flag is not set, it reports the following message:

```
One or more required tables are missing. Check log for messages indicating tables
that were not found.
```

When Liquibase validates the database schema, it generates log entries similar to the following:

```
2017-09-22 09:39:47,693 [INFO] liquibase liquibase: Reading from
public.databasechangelog
```

```
2017-09-22 09:39:49,133 [INFO] liquibase liquibase: Reading from
public.databasechangelog
```

```
2017-09-22 09:39:49,427 [INFO] liquibase liquibase: Reading from
public.databasechangelog
```

```
2017-09-22 09:39:49,551 [INFO] liquibase liquibase: Reading from
public.databasechangelog
```

```
2017-09-22 09:39:50,095 [INFO] liquibase liquibase: Reading from
public.databasechangelog
```

```
2017-09-22 09:39:50,403 [INFO] liquibase liquibase: Reading from
public.databasechangelog
```

```
2017-09-22 09:39:50,514 [ERROR] EboPortalBootServlet [RBPM] Unexpected Runtime
Exception initializing servlet
java.lang.RuntimeException: com.netiq.common.i18n.LocalizedRuntimeException:
Schema is invalid. One or more required tables are missing. Check log for messages
indicating tables that were not found.
        at com.sssw.fw.servlet.EboBootServlet.init(EboBootServlet.java:115)
        at
com.sssw.portal.servlet.EboPortalBootServlet.init(EboPortalBootServlet.java:62)
        at javax.servlet.GenericServlet.init(GenericServlet.java:158)
        at
org.apache.catalina.core.StandardWrapper.initServlet(StandardWrapper.java:1183)
        at
org.apache.catalina.core.StandardWrapper.loadServlet(StandardWrapper.java:1099)
        at org.apache.catalina.core.StandardWrapper.load(StandardWrapper.java:989)
        at
org.apache.catalina.core.StandardContext.loadOnStartup(StandardContext.java:4913)
        at
org.apache.catalina.core.StandardContext.startInternal(StandardContext.java:5223)
        at org.apache.catalina.util.LifecycleBase.start(LifecycleBase.java:150)
        at
org.apache.catalina.core.ContainerBase.addChildInternal(ContainerBase.java:752)
        at org.apache.catalina.core.ContainerBase.addChild(ContainerBase.java:728)
        at org.apache.catalina.core.StandardHost.addChild(StandardHost.java:734)
        at org.apache.catalina.startup.HostConfig.deployWAR(HostConfig.java:952)
        at
org.apache.catalina.startup.HostConfig$DeployWar.run(HostConfig.java:1823)
        at java.util.concurrent.Executors$RunnableAdapter.call(Executors.java:511)
        at java.util.concurrent.FutureTask.run(FutureTask.java:266)
        at
java.util.concurrent.ThreadPoolExecutor.runWorker(ThreadPoolExecutor.java:1142)
        at
java.util.concurrent.ThreadPoolExecutor$Worker.run(ThreadPoolExecutor.java:617)
        at java.lang.Thread.run(Thread.java:745)
Caused by: com.netiq.common.i18n.LocalizedRuntimeException: Schema is invalid. One
or more required tables are missing. Check log for messages indicating tables that
were not found.
        at
com.novell.soa.persist.DatabaseSchemaUpdate.validateDatabaseSchema(DatabaseSchemaU
pdate.java:245)
        at com.sssw.fw.servlet.EboBootServlet.init(EboBootServlet.java:99) ... 18
more

Sep 22, 2017 9:39:50 AM org.apache.catalina.core.StandardContext loadOnStartup
SEVERE: Servlet [PortalAggregator] in web application [/IDMProv] threw load()
exception java.lang.NullPointerException at
com.sssw.portal.manager.EboPortalManager.<init>(EboPortalManager.java:179)
```

You must restart the application server to apply the changes. You cannot bring up the identity applications until the schema validation succeeds.

When Assigning a Resource to a User That Does Not Exist

If a user no longer exists in the system, and a request is issued to assign a resource to that user, the trace records messages similar to the following:

```
2017-09-22 11:50:53,605 [DEBUG] DataItemEvaluator [RBPM] result: Add Resource To
User - Laptop
```

```
2017-09-22 11:50:53,607 [ERROR] VirtualDataAccess [RBPM] Error occurred checking
the object type for: cn=rocio,ou=users,o=data
javax.naming.NameNotFoundException: [LDAP: error code 32 - NDS error: no such entry
(-601)]; remaining name 'cn=rocio,ou=users,o=data'
        at com.sun.jndi.ldap.LdapCtx.mapErrorCode(LdapCtx.java:3161)
        at com.sun.jndi.ldap.LdapCtx.processReturnCode(LdapCtx.java:3082)
        at com.sun.jndi.ldap.LdapCtx.processReturnCode(LdapCtx.java:2888)
        at com.sun.jndi.ldap.LdapCtx.c_getAttributes(LdapCtx.java:1329)
        at
com.sun.jndi.toolkit.ctx.ComponentDirContext.p_getAttributes(ComponentDirContext.j
ava:235)
        at
com.sun.jndi.toolkit.ctx.PartialCompositeDirContext.getAttributes(PartialComposite
DirContext.java:141)
        at
com.sun.jndi.toolkit.ctx.PartialCompositeDirContext.getAttributes(PartialComposite
DirContext.java:129)
        at sun.reflect.GeneratedMethodAccessor432.invoke(Unknown Source)
        at
sun.reflect.DelegatingMethodAccessorImpl.invoke(DelegatingMethodAccessorImpl.java:
43)
        at java.lang.reflect.Method.invoke(Method.java:498)
        at
com.sssw.fw.directory.realm.impl.jndildap.EboLdapContextProxyHandler.invokeMethod(
EboLdapContextProxyHandler.java:145)
        at
com.sssw.fw.directory.realm.impl.jndildap.EboLdapContextProxyHandler.invoke(EboLda
pContextProxyHandler.java:86)
        at com.sun.proxy.$Proxy155.getAttributes(Unknown Source)
        at
com.novell.srvprv.impl.vdata.model.VirtualDataAccess.getObjectType(VirtualDataAcce
ss.java:3943)
        at
com.novell.srvprv.impl.vdata.model.VirtualDataAccess.getObjectType(VirtualDataAcce
ss.java:4003)
        at
com.novell.srvprv.impl.vdata.model.VirtualDataModel.getObjectType(VirtualDataModel
.java:1405)
        at com.novell.soa.util.LdapUtil.isTypeOf(LdapUtil.java:109)
        at com.novell.soa.util.LdapUtil.isUser(LdapUtil.java:89)
```

The trace displays object unavailable errors only when errors occur while retrieving an object.

When Checking the Workflow Engine Heartbeat

The following are example entries that are logged when a user issues a request to check the state of the workflow engine.

```
2017-09-22 11:53:33,646 [TRACE] EngineStateDAO [RBPM] Updating heartbeat of Engine
Engine State: engineId = ENGINE, heartBeat= 2017-09-22 11:52:33.637, startTime=
2017-09-22 09:55:31.532, shutdownTime= 2017-09-22 09:52:58.773, engineState=
Running
```

```
2017-09-22 11:53:33,647 [DEBUG] HibernateUtil [RBPM] Beginning new transaction for
caller com.novell.soa.af.impl.persist.EngineStateDAO:141
```

```
2017-09-22 11:53:33,652 [TRACE] EngineStateDAO [RBPM] Engine heartbeat updated
successfully: Engine State: engineId = ENGINE, heartBeat= 2017-09-22 11:53:33.651,
startTime= 2017-09-22 09:55:31.532, shutdownTime= 2017-09-22 09:52:58.773,
engineState= Running
```

```
2017-09-22 11:53:33,660 [DEBUG] HibernateUtil [RBPM] Committed transaction for
caller com.novell.soa.af.impl.persist.EngineStateDAO:162
```

```
2017-09-22 11:53:33,660 [DEBUG] EngineImpl [RBPM] Heartbeat updated for engine:
ENGINE, time: 2017-09-22 11:53:33.651
```

```
2017-09-22 11:54:03,017 [DEBUG] HibernateUtil [RBPM] Beginning new transaction for
caller com.novell.soa.af.impl.timers.PendingActivityTimerTask:94
```

```
2017-09-22 11:54:03,018 [DEBUG] HibernateUtil [RBPM] Committed transaction for
caller com.novell.soa.af.impl.timers.PendingActivityTimerTask:94
```

If the workflow engine is not properly shutdown due to some reason, the identity applications assume that the engine is still running when you start it the next time. The following example traces are logged to indicate this situation.

```
2017-09-22 12:01:43,384 [WARN] EngineImpl [RBPM] Duplicate engine id detected. This
engine may not have been shutdown cleanly or another engine is running with engine-
id: ENGINE. Waiting 60000 ms for heartbeat to timeout.
```

```
2017-09-22 12:01:43,480 [INFO] EngineImpl [RBPM] Workflow Engine setState:
[RUNNING]
```

Troubleshooting E-Mail Based Approval Issues

Empty E-Mail Based Approval Token in the Provisioning Request Mail

This can occur if E-Mail Based Approval is not enabled. For example, the feature is accidentally disabled while using the new e-mail templates in PRDs.

Check the configuration in the Identity Manager Dashboard and enable the feature.

User Application is Not Acting on E-Mails

Check whether the incoming mailbox is connected and reachable from the server where it is deployed. For more information, refer to the catalina.out logs.

Approve or Deny Link in E-Mail is Not Working

This can occur in the following cases:

- The e-mail client is not configured.
- Default application is not selected to send e-mails.

Approve/Deny links Missing from E-Mail after configuring E-Mail Based Approval

This occurs if the e-mail templates are not properly configured on the workflows.

Verifying if E-Mail Based Approval Starts Properly

If you are enabling the feature from the new Dashboard, a success message appears indicating that the feature has started properly without errors. Messages similar to the following are logged in the `catalina.out` file:

```
INFO com.novell.soa.notification.impl.EmailReceiverEngine- [RBPM] Successfully
started persistent JMS notification system for email based approval EmailReceiver
Notification Thread]
```

```
INFO com.novell.soa.notification.impl.EmailReceiverThread- [RBPM] Starting
asynchronous notification system
```

```
INFO com.novell.soa.notification.impl.EmailReceiverEngine- [RBPM] Mailbox service
for incoming mail started successfully without any warning
```

```
INFO com.novell.soa.notification.impl.EmailReceiverEngine- [RBPM] Email based
approval token cleanup service started successfully.
```

In case the feature is accidentally turned off, check the configuration in the Identity Manager Dashboard. You can also refer to the log for detailed information for each component of this feature such as JMS, incoming mail box connection, and cleanup service.

When is Server Restart Needed

On a cluster setup, if you made changes to the incoming mailbox properties or turned off E-Mail Based Approval, you may require to restart the cluster nodes other than the active node.

If you are continuously getting errors while trying to connect to the mailbox and the issue persists for hours, verify the connectivity between the mailbox and the host.

E-Mail Based Approval Token is Empty in the Provisioning Request E-Mail

E-Mail Based Approval is accidentally disabled while using the new e-mail templates in PRDs.

Troubleshooting Self Service Password Reset Issues

Unable to Unlock Account through SSPR

Issue: This issue occurs if NMAS or eDirectory Challenge Responses are stored only in eDirectory and not in SSPR.

Workaround: Force the users to setup the challenge questions in SSPR as follows:

1. Go to SSPR **Configuration Editor**.
2. Click **Modules > Enabled > Authenticated > Setup Security Questions > Force Response**.

SSPR Reports Error 5027 When Attempting to Access Configuration Manager through Internet Explorer

Issue: In a new installation or upgraded setup of Self Service Password Reset 4.x, when you successfully log in to the SSPR portal, accessing the Configuration Manager or Configuration Editor displays the following error:

```
2016-11-01T15:54:00Z, ERROR, http.PwmResponse, {21,uaadmin} 5027
ERROR_UNAUTHORIZED (Internet Explorer version is not supported for this function.
Please use Internet Explorer 11 or higher or another web browser.)
[151.155.213.181]
```

Workaround: Disable Compatibility View in Internet Explorer for the domain that hosts your SSPR web application.

SSPR Reports Out of Order Page Request Error

Issue: This issue occurs when you click the **Back** button while in an SSPR page. SSPR displays an incorrect sequence message in the SSPR error log similar to the following:

```
ERROR, password.pwm.servlet.TopServlet, 5035 ERROR_INCORRECT_REQUEST_SEQUENCE
(expectedPageID=3, submittedPageID=4, url=<some sspr url>
```

Workaround: Disable the **Back** button detection from SSPR **Configuration Manager > Settings > Security > Web Security.**

NOTE: Changing this setting has no effect on end users.

Pressing Enter Button in SSPR’s People Search Displays Locale Screen on Internet Explorer

Issue: If you press Enter in People Search on Internet Explorer 11 browser, the Locale screen appears.

This issue is not reported on other browsers such as Microsoft Edge, Mozilla Firefox, and Google Chrome.

Workaround: Perform one of the following actions:

- The search bar searches as you type. Therefore you do not require to press Enter to search.
- Use a different browser.
- Close the locale prompt.

Troubleshooting Authentication Issues

You might encounter the following issues while working with the authentication service (OSP):

Managing the Size of oidPInstancedata Attribute

OSP creates oidpInstanceData attribute (Case Ignore, Single Valued String) for a user when the user logs in to the identity applications for the first time through OSP. OSP modifies this attribute each time a user logs in and out of the identity applications.

- When a user is logged in, OSP adds a login entry to the attribute in base64 encoded and encrypted value format.
- When the user logs out, OSP removes or modifies the login entry. When the user logs in again, OSP updates the entry. When the user logs out, OSP removes that login entry from the attribute.
- When the user logs in again, OSP updates the entry. When the user logs out, OSP removes that login entry from the attribute.

When the user closes the browser instead of logging out, OSP does not remove the login entry because closing the browser does not involve a logout action. If the user continues to log in without logging out, the size of the entry grows large. This prevents OSP from updating the attribute and causes login failure for the user.

Note that a logout operation can only remove the entry for the login it is mapped or matched to. For example, if a user logs in three times and does not log out for these logins, and if the user logs in and out one more time, OSP removes this login entry.

If a user is not required to log out from the identity applications, perform one of the following actions to manage the size of the oidPInstancedata attribute:

- Shorten the validity period of the login entry for the user. This allows OSP to automatically remove the login entry for the user. The validity period is controlled by **Refresh token lifetime (hours)** setting for OSP in the ConfigUpdate utility. The default value to store a login entry is 48 hours (2 days). After making the change in the ConfigUpdate utility, restart the Tomcat server where OSP is deployed.
- Periodically delete the oidpInstanceData attribute from the user by using an LDAP based tool (iManager, jXplore, Apache Studio, and so on).

OSP Fails to Update the oidpInstanceData Attribute

OSP cannot update the oidpInstanceData attribute for a user if one of the following conditions is true:

- When the attribute is full with user’s login entries.

  When the user logs in again, OSP fails to update the attribute with the new login entries because of insufficient space to store the entries. However, you can change the maximum length for storing the login entries based on your requirement.
- The user does not does not have sufficient rights in the Identity Vault.
- The OSP schema has not been extended in the Identity Vault and the user does not have this attribute.

Troubleshooting General Issues

You might encounter the following issues while working with the identity applications:

Mismatch of Certificates Used by Identity Manager Engine and User Application Causes Code (-9205) Error in vnd.nds.stream

Issue: The Identity Manager drivers use Identity Manager engine’s keystore instead of User Application's keystore to access the User Application. If these components use different certificates, drivers report an error message similar to the following when set at Trace level 5:

```
DirXML Log Event
```

```
Message:  Code(-9205) Error in vnd.nds.stream://VAULT/TEST/DRIVERSET1/DRIVER1/
Publisher/POLICY#XmlData:133 :
Couldn't request assignment of role: '<Role DN>' to identity: '<User DN>':
com.novell.nds.dirxml.soap.UserAppClientException: java.lang.RuntimeException:
javax.net.ssl.SSLHandshakeException: sun.security.validator.ValidatorException:
PKIX path building failed:
sun.security.provider.certpath.SunCertPathBuilderException: unable to find valid
certification path to requested target
```

Workaround: Verify that the JRE used by the Identity Manager engine has the required certificate to connect to the User Application. Otherwise, import the certificate from the User Application.

1. Locate `cacerts` in the Identity Manager engine directory.

   For example, `/opt/novell/eDirectory/lib64/nds-modules/jre/lib/security/cacerts` on Linux.
2. Determine the certificate used by the User Application.
   - **2a** Navigate to the User Application keystore.

     For example, `/opt/netiq/idm/apps/jre/lib/security/cacerts`.
   - **2b** List the certificates by running the following command from the command line:

     ```
     keytool -list -v -keystore cacerts
     ```
3. (Conditional) If you have access to the certificate, import the certificate into Identity Manager engine’s `cacerts` directory by running the following command:

   ```
   keytool -import -alias <newalias> -keystore cacerts -file certificate.der
   ```
4. (Conditional) If you do not have access to the certificate, export the certificate from the User Application’s `cacerts` directory, and then import the certificate into Identity Manager engine’s `cacerts` directory.
5. Restart the Identity Vault.

User Application Driver Fails to Communicate with the User Application Server on a Secured Connection

Issue: The User Application driver fails to communicate with the User Application server and returns a retry status error. This issue may occur if one of the following conditions is true:

- You are using Java 1.7.x in your environment.
- The User Application driver does not have the certificate required for the connection.

Workaround: Perform the following actions:

- Manually update your current Java version to version 1.8 Update 92 or later.
- Import the certificates from User Application into Identity Manager engine's JRE directory for use by the User Application driver. If your User Application server is protected by NetIQ Access Manager or a load balancer, add the certificates from Access Manager or the load balancer into Identity Manager engine's JRE directory.

Entitlement Configuration Error During Codemap Refresh

Issue: When a new resource is created in a driver, the resource is not added to the User Application after running the code map refresh for the driver. One of the reasons that can cause this issue is missing value of some of the parameters in the entitlement configuration of the driver. For example, `<entitlement data-collection="false" dn="CN=ExchangeMailbox,CN=AD Driver for Groups,CN=DriverSet,O=system" parameter-format="" resource-mapping="" role-mapping="">`.

User Application reports the following error in the `catalina.out` file:

```
2017-11-03 15:55:21,373 [http-bio-8443-exec-340] ERROR
com.novell.idm.nrf.persist.DirXMLDriverDAO- [RBPM] Error occurred parsing the
entitlement configuration XML: cn=EntitlementConfiguration,cn=AD Driver for
Groups,cn=DriverSet,o=system
```

```
java.lang.StringIndexOutOfBoundsException: String index out of range: 0
```

Workaround: Add the missing values in the entitlement configuration for the driver. For example, `<entitlement data-collection="false" dn="CN=ExchangeMailbox,CN=AD Driver for Groups,CN=DriverSet,O=system"` parameter-format.

User Application Driver Fails to Process Delete Events

If the User Application driver fails to establish a connection with the identity applications, the driver fails to process the delete operation and loops infinitely. You can confirm this by looking at the User Application driver startup and trace logs.

This issue typically occurs if the https certificates used by the identity applications are not available in the User Application driver's certificate store. The default certificate store for the driver is the Java cacerts directory (`/opt/novell/eDirectory/lib64/nds-modules/jre/lib/security/cacerts` or `<eDirectory install path>\jre\lib\security`).