Driver Administration Guide

NetIQ® Identity Manager

January 2016

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About this Book and the Library

The *Identity Manager Driver Administration Guide* provides information about administration tasks that are common to all Identity Manager drivers.

Intended Audience

This guide is for administrators, consultants, and network engineers who require a high-level introduction to Identity Manager business solutions, technologies, and tools.

Other Information in the Library

The library provides the following information resources:

Identity Manager Setup Guide

Provides an overview of Identity Manager and its components. This book also provides detailed planning and installation information for Identity Manager.

Designer Administration Guide

Provides information about designing, testing, documenting, and deploying Identity Manager solutions in a highly productive environment.

User Application: Administration Guide

Describes how to administer the Identity Manager User Application.

User Application: User Guide

Describes the user interface of the Identity Manager User Application and how you can use the features it offers, including identity self-service, the Work Dashboard, role and resource management, and compliance management.

User Application: Design Guide

Describes how to use the Designer to create User Application components, including how to work with the Provisioning view, the directory abstraction layer editor, the provisioning request definition editor, the provisioning team editor, and the role catalog.

Identity Reporting Module Guide

Describes the Identity Reporting Module and how you can use the features it offers, including the Reporting Module user interface and custom report definitions, as well as providing installation instructions.

Analyzer Administration Guide

Describes how to administer Analyzer for Identity Manager.

Identity Manager Driver Guides

Provide implementation information about specific Identity Manager drivers.

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1 Introduction to Drivers

As part of your Identity Manager deployment, NetIQ provides Identity Manager drivers to connect information between popular business applications, directories, and databases. The business policies you implement using drivers can help to reduce management costs, increase productivity and security, and provide event reporting and auditing.

This guide provides conceptual, procedural, and reference information that is applicable to all Identity Manager drivers. For information that is specific to individual drivers, see the appropriate guide on the Identity Manager Drivers documentation web page at https://www.netiq.com/documentation/idm45drivers/.

1.1 Understanding Drivers

The Identity Manager engine processes all data changes that occur in the Identity Vault or a connected application. For events that occur in the Identity Vault, the engine processes the changes and issues commands to the application via the driver. For events that occur in the application, the engine receives the changes from the driver, processes the changes, and issues commands to the Identity Vault.

Drivers connect the Identity Manager engine to the applications. A driver has two basic responsibilities: reporting data changes (events) in the application to the Identity Manager engine and carrying out data changes (commands) submitted by the Identity Manager engine to the application. Drivers must be installed on the same server as the connected application.

Identity Manager stores drivers and library objects in a container called a **driver set**. Only one driver set can be active on a server at a time. However, more than one server might be associated with one driver set. Also, a driver can be associated with more than one server at a time. However, the driver should be running on only one server at a time. The driver should be in a disabled state on the other servers. Any server that is associated with a driver set must have the Identity Vault installed on it.

1.2 Activating Drivers

Identity Manager, Integration Modules (drivers), and the Roles Based Provisioning Module must be activated within 90 days after installation, or they shut down.

2 Stopping, Starting, or Restarting Drivers

You might need to start or stop the Identity Manager drivers to ensure that an installation or upgrade process can modify or replace the correct files. It is important to stop a driver before you modify any files for the driver.

2.1 Stopping, Starting, or Restarting a Driver in Designer

1. Open a project in the Modeler, then right-click the driver line.
2. Click **Live**, then click the appropriate option to stop, start, or restart the driver.

2.2 Stopping, Starting, or Restarting a Driver in iManager

1. In the **Roles and Tasks** view, click **Identity Manager > Identity Manager Overview**.
2. In the **Search in** field, specify the fully distinguished name of the container where you want to start searching and then click , or click to browse for and select the container in the tree structure.
3. Click the upper right corner of the driver icon whose status you want to change, then click the appropriate option to stop, start, or restart the driver.

3 Viewing Version Information

The Identity Manager engine, the driver shims, and the driver configuration files each contain a separate version number. The Version Discovery Tool in iManager helps you find the versions of the Identity Manager engine and the driver shims versions. The driver configuration files contain their own naming convention.

3.1 Viewing a Hierarchical Display of Version Information

1. In iManager, click **Identity Manager > Identity Manager Overview**, then click **Search** to find the driver sets in the Identity Vault.
2. Click the specific driver set in the list.
3. Click **Driver Set > Version information** on the Driver Set Overview page.
4. View a top-level display of versioning information. The unexpanded hierarchical view displays the following:
   - The eDirectory tree that you are authenticated to
   - The driver set that you selected
   - Servers that are associated with the driver set

     If the driver set is associated with two or more servers, you can view Identity Manager information on each server.
   - Drivers
5. View version information related to servers by expanding the server icon. The expanded view of a top-level server icon displays the following:
   - Last log time
   - Version of Identity Manager that is running on the server
6. View version information related to drivers by expanding the driver icon.

   The expanded view of a top-level driver icon displays the following:
   - The driver name
   - The driver module (for example, com.novell.nds.dirxml.driver.nds.DriverShimImpl)

   The expanded view of a server under a driver icon displays the following:
   - The driver ID
   - The version of the instance of the driver running on that server

3.2 Viewing and Saving Version Information as a Text File

Identity Manager publishes versioning information to a file. You can view this information in text format and save it to a text file on your local or network drive. The textual representation is the same information contained in the hierarchical view.

1. In iManager, click **Identity Manager > Identity Manager Overview**, then click **Search** to find the driver sets in the Identity Vault.
2. Click the specific driver set in the list.
3. Click **Driver Set > Version information** in the Driver Set Overview page.
4. To view the information in the Report Viewer window, click **View**.
5. To save the information to a text file, click **Save As**, specify a file name and location, and click **Save**.

3.3 Driver Configuration Files Naming Convention

The driver configuration file naming convention is:

```
<base name>[-<type>]-IDM<min. engine version>-V<config version>.xml
```

- **Base Name:** The name of the connected system or service the driver provides. For example, Active Directory or Delimited Text.
- **Type:** An additional descriptor for the driver configuration file. If there are multiple configuration files, the type distinguishes among the different files.
- **Minimum Engine Version:** Lists the minimum engine version that the driver can run against. The elements to date are:
  - IDM2_0_0
  - IDM2_0_1
  - IDM2_0_2
  - IDM3_0_0
  - IDM3_0_1
  - IDM3_5_0
  - IDM3_5_1
  - IDM3_6_0

  NOTE: Driver version numbers are independent from engine version numbers. The driver version number does not indicate the support for the corresponding Identity Manager versions.

- **Configuration Version:** Specifies the particular driver configuration file version. It is a number that is incriminated with each release of a new driver configuration file.
  - V1
  - V2
  - V11
  - V23

For example:

```
ActiveDirectory-IDM3_6_0-V4.xml
DelimitedText-CSVSample-IDM3_6_0-V2.xml
```

4 Backing Up Drivers

After you have created a driver, it is important to create a backup of the driver. You can use Designer or iManager to create an XML file of the driver. The file contains all of the information entered into the driver during configuration. If the driver becomes corrupted, the exported file can be imported to restore the configuration information.

IMPORTANT: If the driver has been deleted, all of the associations on the objects are purged. When the XML file is imported again, new associations are created through the migration process.

Not all server-specific information stored on the driver is contained in the XML file. Make sure this information is documented through the Doc Gen process in Designer. See "Documenting Projects" in the *NetIQ Designer for Identity Manager Administration Guide*.

You can also run the driver in factory mode, if you created the driver with packages.

4.1 Exporting the Driver in Designer

1. Open a project in Designer, then right-click the driver object.
2. Select **Export to Configuration File**.
3. Specify a unique name for the configuration file, browse to location where it should be saved, then click **Save**.
4. Click **OK** in the Export Configuration Results window.

4.2 Exporting the Driver in iManager

1. In iManager, click **Identity Manager > Identity Manager Overview**.
2. Browse to and select the driver set object, then click **Search**.
3. Click the driver icon.
4. Select **Export** in the Identity Manager Driver Overview page.
5. Browse to and select the driver object you want to export, then click **Next**.
6. Select **Export all policies, linked to the configuration or not** or select **Only export policies that are linked to the configuration**, depending upon the information you want to have stored in the XML file.
7. Click **Next**.
8. Click **Save As**, then click **Save**.
9. Browse and select a location to save the XML file, then click **Save**.
10. Click **Finish**.

4.3 Running the Driver in Factory Mode

If you created the driver in Designer using packages, you can run a driver in the default factory mode.

There are two options for using Factory mode:

- **Strict:** Designer removes all customizations and custom configurations from your driver. Custom configurations are new policies, jobs, mapping policies, or other objects created on the driver.
- **Relaxed:** Designer removes all customizations but no custom configurations from your driver.

To run the driver in the factory mode:

1. In Designer, right-click the driver, then click **Driver > Properties**.
2. Click **Packages**, then select **Run driver in Factory mode**.
3. Select how Package Manager handles the customizations and custom configuration of your driver. You can select either **Strict** or **Relaxed**.
4. Click **Activate** to save the selected change.
5. (Optional) Click the **Configure Factory mode** icon if you want to change the selected option, then click **Activate** again.
6. Click **Apply** or **OK** to make the change active.

For more information, see "Running a Driver in Factory Mode" in the *NetIQ Designer for Identity Manager Administration Guide*.

5 Monitoring Driver Health

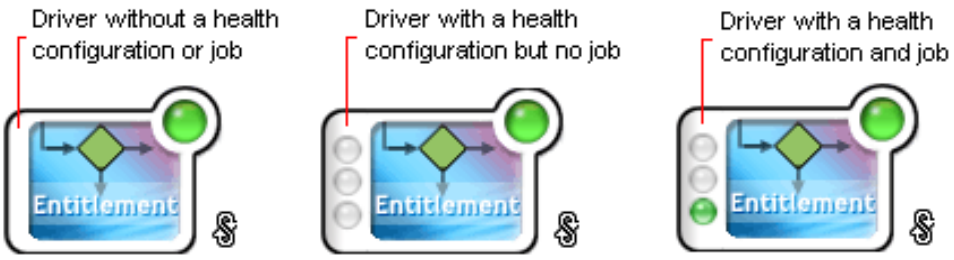
Driver health monitoring allows you to view a driver's current state of health as green, yellow, or red, and to define the actions to perform in response to each of these health states.

You create the conditions (criteria) that determine each of the health states, and you also define the actions you want performed whenever the driver's health state changes. For example, if the driver's health changes from a green state to a yellow state, you can perform such actions as restarting the driver, shutting down the driver, and sending an email to the person designated to resolve issues with the driver.

You can also define custom states. Whenever the conditions for the custom state are met, the associated actions are performed regardless of the driver's current state of green, yellow, or red.

The driver's health state is not monitored unless both a health configuration and a health job exist and the health job is running. (The health configuration for drivers is automatically created.) If the configuration and job exist and the job is running, the driver icon displays a green, yellow, or red indicator. Otherwise, the indicator does not appear or appears without a color.

Figure 5-1 *Driver health indicator*



To turn on health monitoring for the driver, create a driver health job. After you have created the driver's health job, you can use the steps in the following sections to modify the conditions and actions associated with each health state and to create one or more custom states:

- Section 5.3, "Modifying the Conditions for a Driver Health Configuration," on page 24
- Section 5.4, "Modifying the Actions for a Driver Health Configuration," on page 27
- Section 5.5, "Creating a Custom State," on page 28

5.1 Creating a Driver Health Job

The health of a driver is evaluated during the periodic execution of a Driver Health job. The job evaluates the conditions for the health states and assigns the driver the appropriate state. The job also executes any actions associated with the assigned state.

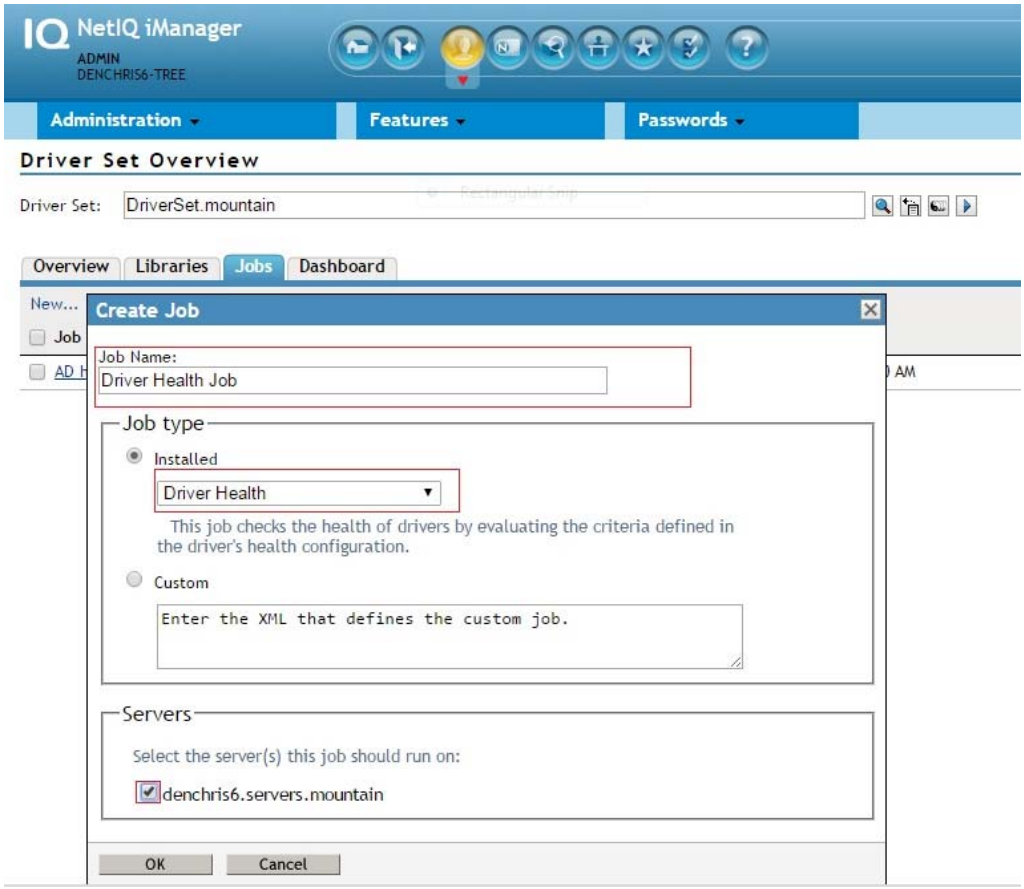
If a Driver Health job does not exist, the Driver Health Configuration page displays a **Run the New Driver wizard and import the Driver Health Job's configuration** prompt. If the page does not display this prompt, the Driver Health job already exists, and you can skip to Section 5.3, "Modifying the Conditions for a Driver Health Configuration," on page 24.

To create a Driver Health job:

1 In iManager, under Identity Manager Overview, select the **Jobs** tab.

2 Click **New** to create a Driver Health Job.

3 Select the type as Health Job and ensure that the server on which the job will run on is selected.



4 Click **OK**.

After the job is created, you can adjust the job settings as desired. For example, you can modify how often the job runs, which drivers use the job, and how much data the job maintains to support transaction history. For instructions, continue with Section 5.2, “Modifying the Driver Health Job’s Settings,” on page 22.

5.2 Modifying the Driver Health Job’s Settings

The Driver Health job evaluates the conditions for the health states and assigns the driver the appropriate state. The job also executes any actions associated with the assigned state.

As with all driver jobs, there are several Driver Health job settings that you can modify to optimize health monitoring performance for your environment, including settings for how often the job runs, which drivers use the job, and how much data the job maintains to support transaction history.

To modify the job settings:

1 In iManager, under Identity Manager Overview, select the **Jobs** tab.

2 Click the job you want to modify.

3 Open the Driver Health Configuration page for the driver that uses the Driver Health job you want to modify:

   3a Open the Identity Manager Administration page.

   3b In the **Administration** list, click **Driver Health Configuration**.

4 Click the Driver Health job.

5 Change the desired settings on the following tabs:

- **Schedule:** The Driver Health job is a continuously running job, meaning that it does not stop unless a health state action shuts it down or it is shut down manually. The job must run continuously to be able to support transaction data collection for use in Transactions History conditions.

  If the job does stop, it is restarted based on the schedule. The default schedule checks every minute to see if the job is running. If the job is not running, it is started.

- **Scope:** By default, the job applies to all drivers in the driver set. This means that you need only one Driver Health job per driver set. However, you can create multiple Driver Health jobs for different drivers within the same driver set. For example, you might have some drivers whose health you want updated more frequently than other drivers, in which case you would need at least two Driver Health jobs.

- **Parameters:** You can change any of the following parameters:

  - **Login ID:** This defaults to the login ID that was used when creating the driver job. You should change this only if you want the driver to authenticate with different credentials.

    You need the following rights to run the health job:

    - Read permission with inheritance to the `DirXML-AccessConfigure` attribute of the Driver Set object
    - Read permission with inheritance to the `DirXML-AccessRun` attribute of the Driver Set object
    - Write permission with inheritance to the `DirXML-AccessSubmitCommand` attribute of the Driver Set object

  - **Login password:** This is the password required for the login ID that you supplied in the Login ID field.

  - **Subscriber Heartbeat:** Controls whether the Driver Health job does a heartbeat query on a driver's Subscriber channel before performing a health check on the driver.

  - **Polling interval:** Determines how often the job evaluates the conditions for the health states, assigns the driver the appropriate state, executes any actions associated with the assigned state, and stores the driver's transaction data. The default polling interval is one minute.

  - **Polling interval units:** Specifies the time unit (minutes, hours, days, weeks) for the number specified in the **Polling interval** setting.

  - **Duration sampling data is kept:** Specifies how long a driver's transaction data is kept. The default, two weeks, causes a transaction to be retained for two weeks before being deleted. A longer duration provides a greater time period that can be used in "Transactions History:" on page 25conditions, but requires more memory. For example, to use a Transactions History condition that evaluates of the number of publisher reported events for the last 10 days, you need to keep transaction data for at least 10 days.

- **Duration units:** Specifies the time unit (minutes, hours, days, weeks) for the number specified in the Duration transaction data is kept setting.

6 Click **OK** to save your changes.

5.3 Modifying the Conditions for a Driver Health Configuration

You control the conditions that determine each health state. The green state is intended to represent a healthy driver, and a red state is intended to represent an unhealthy driver.

The conditions for the green state are evaluated first. If the driver fails to meet the green conditions, the yellow conditions are evaluated. If the driver fails to meet the yellow conditions, the driver is automatically assigned a red health state.

To modify the conditions for a state:

1 In iManager, open the Driver Health Configuration page for a driver whose conditions you want to modify:

   1a Open the Identity Manager Administration page.

   1b In the **Administration** list, click **Driver Health Configuration**.

2 Click the tab for the state (Green or Yellow) you want to modify.

The tab displays the current conditions for the health state. Conditions are organized into groups, and logical operators, either AND or OR, are used to combine each condition and each group. Consider the following example for the green state:

```
GROUP1
Condition1 and
Condition2
Or
GROUP2
Condition1 and
Condition2 and
Condition3
```

In the example, the driver is assigned a green state if either the GROUP1 conditions or the GROUP2 conditions evaluate as true. If neither group of conditions is true, then the conditions for the yellow state are evaluated.

The conditions that can be evaluated are:

- **Driver State:** Running, stopped, starting, not running, or shutting down. For example, one of the default conditions for the green health state is that the driver is running.
- **Driver in Cache Overflow:** The state of the cache used for holding driver transactions. If the driver is in cache overflow, all available cache has been used. For example, the default condition for the green health state is that the Driver in Cache Overflow condition is false and the default for the yellow health state is that the Driver in Cache Overflow condition is true.
- **Newest:** The age of the newest transaction in the cache.
- **Oldest:** The age of the oldest transaction in the cache.
- **Total Size:** The size of the cache.
- **Unprocessed Size:** The size of all unprocessed transactions in the cache.
- **Unprocessed Transactions:** The number of unprocessed transactions in the cache. You can specify all transactions types or specific transaction types (such as adds, removes, or renames).
- **Transactions History:** The number of transactions processed at various points in the Subscriber or Publisher channel over a given period of time. This condition uses multiple elements in the following format:

  <transaction type> <transaction location and time period > <relational operator> <transaction number>.

  - *<transaction type>*: Specifies the type of transaction being evaluated. This can be all transactions, adds, removes, renames, and so forth.
  - *<transaction location and time period>*: Specifies the place in the Subscriber or Publisher channel and the time period being evaluated. For example, you might evaluate the total number of transactions processed as Publisher reported events over the last 48 hours. By default, transaction history data is kept for two weeks, which means that you cannot specify a time period greater than two weeks unless you change the default Transaction Data Duration setting. This setting is specified on the Driver Health job. See Section 5.2, “Modifying the Driver Health Job’s Settings,” on page 22 for information about changing the setting.
  - *<relational operator>*: Specifies that the identified transactions must be equal to, not equal to, less than, less than or equal to, greater than, or greater than or equal to the <transaction number>.
  - *<transaction number>*: Specifies the number of transactions being used in the evaluation.

  The following provides an example of a Transactions History condition:

  ```
  <number of adds> <as publisher commands> <over the last 10 minutes> <is
  less than> <1000>
  ```

- **Available History:** The amount of transaction history data that is available for evaluation. The primary purpose for this condition is to ensure that a Transactions History condition does not cause the current state to fail because it does not have enough transaction history data collected for the time period being evaluated.

  For example, assume that you want to use the Transactions History condition to evaluate the number of adds as Publisher commands over the last 48 hours (the example shown in the Transactions History section above). However, you don't want the condition to fail if there is not yet 48 hours worth of data, which can be the case after the initial setup of the driver's health configuration or if the driver's server restarts (because transaction history data is kept in memory). Therefore, you create condition groups similar to the following:

```
Group1
Available History <is less than> <48 hours>

or

Group2
Available History <is greater than or equal to> <48 hours> and
Transactions History <number of adds> <as publisher commands> <over the
last 48 hours> <is less than> <1000>
```

The state evaluates to true if either condition group is true, meaning that a) there is less than 48 hours of data, or b) there is at least 48 hours of data and the number of adds as Publisher commands over the last 48 hours is less than 1000.

The state evaluates to false if both conditions evaluate to false, meaning that a) there is at least 48 hours of data and b) the number of adds as publisher commands over the last 48 hours is greater than 1000.

3 Modify the criteria as desired.

- To add a new group, click **New Group**.
- To add a condition, click the plus (+) icon next to the group heading.
- To reorder condition groups or individual conditions, select the check box next to the group or condition you want to move, then click the arrow buttons to move it up and down. You can also use the arrow buttons to move a condition from one group to another.
- To copy condition groups or individual conditions, select the check box next to the group or condition you want to copy, click **Edit > Copy selections to clipboard**, click the tab for the health state where you want to copy the group or condition, then click **Edit > Append items on clipboard**. For example, assume that you want to copy a condition from one condition group to another. You would select the condition, copy it to the clipboard, then append it. The condition is added as its own condition group; if desired, use the arrow buttons to move it into another condition group.
- To move condition groups or individual conditions, select the check box next to the group or condition you want to move, click **Edit > Cut selections to clipboard**, click the tab for the health state where you want to move the group or condition, then click **Edit > Append items on clipboard**. For example, assume that you want to move a condition group from the green health state to the yellow health state. You would select the condition group, cut it to the Clipboard, open the yellow health state, then append it.

4 Click **Apply** to save your changes.

5 If you want to change the actions associated with the conditions you have set, continue with Section 5.4, “Modifying the Actions for a Driver Health Configuration,” on page 27.

5.4 Modifying the Actions for a Driver Health Configuration

You can determine the actions that you want performed when the driver health state changes. For example, if the state changes from green to yellow, you can shut down or restart the driver, generate an event, or start a workflow. Or, if the state changes from yellow to green, any actions associated with the green state are performed.

A health state's actions are performed only once each time the conditions are met; as long as the state remains true, the actions are not repeated. If the state changes because its conditions are no longer met, the actions are performed again the next time the conditions are met.

1. In iManager, open the Driver Health Configuration page for a driver whose actions you want to modify:
   - **1a** Open the Identity Manager Administration page.
   - **1b** In the **Administration** list, click **Driver Health Configuration**.
2. Click the **Green**, **Yellow**, or **Red** tab for the state whose actions you want to modify.
3. Click the plus (+) icon next to the **Actions** heading to add an action, then select the type of action you want:
   - **Start Driver:** Starts the driver.
   - **Stop Driver:** Stops the driver.
   - **Restart Driver:** Stops and then starts the driver.
   - **Clear Driver Cache:** Removes all transactions, including unprocessed transactions, from the cache.
   - **Send Email:** Sends an email to one or more recipients. The template you want to use in the email message body must already exist. To include the driver name, server name, and current health state information in the email, add the `$Driver$`, `$Server$`, and `$HealthState$` tokens to the email template and then include the tokens in the message text. For example:

     ```
     The current health state of the $Driver$ driver running on $Server$ is
     $HealthState$.
     ```

     IMPORTANT: To send emails to multiple users, separate each email address only with a comma (,). Do not use semi-colon instead of comma.
   - **Write Trace Message:** Writes a message to the Driver Health job's log file or the driver set's log file if the trace file is not configured on the Driver Health job.
   - **Generate Event:** Generates an event that can be used by Audit and Sentinel.
   - **Execute ECMAScript:** Executes an existing ECMAScript. Use the or buttons to select the DirXML-Resource object that contains the ECMAScript.

     For information about how to construct ECMA scripts, refer to "Using ECMAScript in Policies" in the *NetIQ Identity Manager Policies in Designer*.
   - **Start Workflow:** Starts a provisioning workflow.
   - **On Error:** If an action fails, instructs what to do with the remaining actions, the current health state, and the Driver Health job.
     - **Affect actions by:** You can continue to execute the remaining actions, stop execution of the remaining actions, or default to the current setting. The current setting applies only if you have multiple On Error actions and you set the Affect actions by option in one of the preceding On Error actions.

- **Affect state by:** You can save the current state, reject the current state, or default to the current setting. Saving the state causes the state's conditions to continue to evaluate as true. Rejecting the state causes the state's conditions to evaluate as false. The current setting applies only if you have multiple On Error actions and you set the Affect state by option in one of the preceding On Error actions.
- **Affect Driver Health Job by:** You can continue to run the job, abort and disable the job, or default to the current setting. Continuing to run the job causes the job to finish evaluating the conditions to determine the driver's health state and perform any actions associated with the state. Aborting and disabling the job stops the job's current activity and shuts down the job; the job does not run again until you enable it. The current setting applies only if you have multiple On Error actions and you set the Affect Driver Health Job by setting in one of the preceding On Error actions.

4 If you want the actions executed every time the conditions evaluate to true, click **Always execute actions when conditions are true**.

By default, actions are performed only once while a driver's health state remains the same. Regardless of the number of times the conditions are evaluated, as long as the health state remains true, the actions are not repeated. For example, when the driver's health state changes from red to green, the green state's actions are executed. The next time the conditions are evaluated, if the health state is still green, the actions are not repeated.

Selecting the **Always execute actions when conditions are true** setting causes the actions to be repeated each time the condition evaluates to true. For example, if the driver's health state repeatedly evaluates to green without changing to another state, the green state's actions are repeated after each evaluation.

5 Click **Apply** to save your changes.

5.5 Creating a Custom State

You can create one or more custom states to perform actions independent of the driver's current health state (green, yellow, red). If a custom state's conditions are met, its actions are performed regardless of the current health state.

As with the green, yellow, and red health states, a custom state's actions are performed only once each time the conditions are met; as long as the state remains true, the actions are not repeated. If the state changes because its conditions are no longer met, the actions are performed again the next time the conditions are met.

1 In iManager, open the Driver Health Configuration page for a driver for which you want to create a custom state:

   1a Open the Identity Manager Administration page.

   1b In the **Administration** list, click **Driver Health Configuration**.

2 On any of the tabs, click **Actions**, then click **New Custom State**.

3 Follow the instructions in Section 5.3, "Modifying the Conditions for a Driver Health Configuration," on page 24 and Section 5.4, "Modifying the Actions for a Driver Health Configuration," on page 27 to define the custom state's conditions and actions.

5.6 Memory Requirements for Driver Health

The combination of interval, interval-units, duration, and duration-units define how much sampling data is maintained by the Driver Health Job. The values for these parameters directly affect how much memory the Driver Health Job requires to run.

The number of samples per driver per server is calculated as:

Number of samples = ((duration * duration units) / (polling interval * polling units)) + 1

For example, if

duration = 12 hours
polling interval = 1 minute

Number of samples = (12*60) / (1*1) + 1 = 721

If there are 4 drivers on 1 server, total number of samples = 4*1*721 = 2884.

Each sample stores data from 5 points in the publisher channel and 5 points in the subscriber channel.

Publisher Channel Points:

publisher-commands
publisher-command-results
publisher-post-event-transformation
publisher-post-input-transformation
publisher-reported-events

Subscriber Channel Points:

subscriber-commands
subscriber-command-results
subscriber-pre-output-transformation
subscriber-post-event-transformation
subscriber-reported-events

A sample contains a list of IDs and counts for each point. IDs correspond to operations such as query, status, instance, add-association, and so on.

Consider the following driver cache statistics:

```
<subscriber>
   <operations>
        <command-results>
            <status>12</status>
            <instance>12</instance>
        </command-results>
   </operations>
</subscriber>
```

For subscriber-command-results, the list has IDs 7,21 (for instance and status) and counts 12,12.

Each sample consumes ~700 bytes.

721 samples consume ~ 500 KB. This is the memory requirement per driver.

For 4 drivers, 2 MB is required for storing sampling data.

6 Viewing Driver Statistics

You can use NetIQ iManager to view a variety of statistics for a single driver or for an entire driver set. This includes statistics such as the cache file size, the size of the unprocessed transactions in the cache file, the oldest and newest transactions, and the total number of unprocessed transactions by category (add, remove, modify, and so forth).

6.1 Viewing Statistics for an Individual Driver

1. In iManager, open the Identity Manager Administration page.
2. In the **Administration** list, click **Identity Manager Overview** to display the Identity Manager Overview page.

   You use the Identity Manager Overview page to locate the driver set in which the driver resides.
3. In the **Search in** field, specify the fully distinguished name of the container where you want to start searching for the driver set, then click ▸. Or, click the browse icon to browse for and select the container in the tree structure.

   iManager keeps a record of the objects you have previously selected, so you can also use the to select the container from a list of previously selected objects. Or, you can search from the root of the tree by clicking ▸.
4. After the search completes and displays the driver sets, click the driver set in which the driver resides to display the Driver Set Overview page.
5. Locate the driver whose statistics you want to check, click the driver's **Status** icon (the green or red circle on the driver icon), then click **Statistics**.

6.2 Viewing Statistics for a Driver Set

1. In iManager, open the Identity Manager Administration page.
2. In the **Administration** list, click **Driver Set Dashboard** to display the Driver Set Query page.
3. In the **Driver Set** field, specify the fully distinguished name of the driver set, then click **OK**. Or, click the browse icon to browse for and select the driver set in the tree structure, then click **OK**.

   iManager keeps a record of the objects you have previously selected, so you can also use the icon to select the container from a list of previously selected objects.

   A page appears that allows you to view the statistics for all of the drivers contained in the driver set.

   - To refresh the statistics, click **Refresh**, then select **Refresh now** or select a refresh interval.
   - To close the statistics for a driver, click the button in the upper right corner of the driver's statistics window.
   - To open the statistics for all drivers, click **Actions** > **Show all drivers**.
   - To collapse the list of unprocessed transactions for a driver, click the button located above the list. To collapse the list of unprocessed transactions for all drivers, click **Actions** > **Collapse all transactions**.

- To expand the list of transactions, click the button. To expand the list of unprocessed transactions for all drivers, click **Actions** > **Expand all transactions**.
- To change the layout of the driver dashboard, click **Actions**, then select a column layout.

7 Managing Associations between Drivers and Objects

7.1 Associations

A relationship is established between an Identity Vault object and a connected system object when the two objects represent the same entity. This relationship is called an association and is stored in the Identity Vault on the associated Identity Vault object. Identity Manager uses the association to keep track of which object in the connected system matches with an object in the Identity Vault. In almost all cases, this should be a 1:1 match to say that "Herman Munster, employee number 1234567" in the HR system matches exactly with the user object "hmunster13" in the Identity Vault, with "Munster, Herman" in Active Directory, and "hmunster13@example.com" in the email system.

Associations are stored only in the Identity Vault. The shim provides a unique key value for each application object and the Identity Manager engine manages the storage of those key values in the Identity Vault. On the Subscriber channel, the Identity Manager engine uses this value to allow the shim to modify the correct object in the connected system. On the Publisher channel, the shim supplies the association value, allowing the identity Manager engine to quickly and easily find the correct object in the Identity Vault to work with. The following Association states are stored in the Identity Vault:

- **0 Disabled:** Changes in the driver objects are not synchronized with the Identity Vault.
- **1 Processed:** A successful association has been created between driver objects and the Identity Vault.
- **2 Pending:** The Identity Manager engine identified a modification to an object, and attempted to match it or create it in the connected system, but was unable to do so.
- **3 Manual:** A manual association was created by the user.
- **4 Migrate:** The account was synchronized or migrated.
- **blank No association:** No association has been created.

7.2 No-Reference Associations

Identity Manager maintains associations in an eDirectory attribute (Syntax : SYN_PATH) named DirXML-Associations. This attribute has three parts to it.

```
dirxml-associations: cn=DT-1,cn=DS1,o=n#1#abc@novell.com
```

The first part is a `driver-dn`, which denotes the driver this association is for; the second field denotes the association state; and the final field denotes the association value. The part that is used to store the `driver-dn` is stored as an eDirectory DN. If there are any object renames or moves, the associations do not get broken and are preserved.

However, any updates to the referred object also result in a reference check. This causes a small overhead that can impact performance in very large deployments.

To improve performance in large deployments, a new no-reference association has been introduced in Identity Manager. Though the existing association continues to be the default option, Identity Manager provides you an option to switch to the new association format for a driver. In your Identity

Manager deployment, some drivers can have the legacy reference association while others create a no-reference association. The driver's DN is maintained as a string with the new no-reference association. If you change this, the mapping of the object from the Identity Vault to the connected system might get broken.

A new attribute, `DirXML-AssociationsLite` of type `SYN_CI_STRING`, is included to store the no-reference association. The new attribute contains the stringized version of the object association.

```
dirxml-associationslite: \ABC-SLES10SP2X86-NDSTREE\n\DS1\bedir-174-18-4-
32#648F713EC4AB284967AB648F713EC4AB#1
```

The new association attribute uses "#" to delimit the components of the association. The first component is the complete `driver-dn` including the eDirectory tree name in the slash format. The second component is the association value and the last component is the association state.

A new attribute, `DirXML-UseNoRefAssoc` of type `SYN_BOOLEAN`, is included with the drivers to denote the type of association to be used for the drivers. The absence of this attribute or a value of false implies that the driver uses the legacy association attribute (`DirXML-Associations`). If the value is set to true, the driver uses the new association attribute (`DirXML-AssociationsLite`) for the association.

NOTE: You should use the new association format with Identity Manager Standard Edition that provides limited Reporting features or in very large deployments where referential checks cause considerable performance impact. If you use it with Identity Manager Advanced Edition, all aspects of the Reporting functionality might not work as expected.

7.3 Migration Between Associations

The dxcmd menu is updated to provide new actions to enable easier and seamless migration of association from one format to the other. Additionally, maintenance actions are available to handle the associations.

NOTE: The Association actions in dxcmd utility are hidden by default. You must invoke this utility by using the `-u` option to see the Association actions.

The association actions are available at two levels in the dxcmd menu. The association actions are available in the main dxcmd menu and also in the driver menu. You need to shut down the driver before performing these actions.

7.3.1 Association Actions in the Main Menu

You can select an association operation from the following list:

- 1: Migrate to no-ref association

  This action modifies the driver and sets the value of `DirXML-UseNoRefAssoc` to True. It also converts the existing object associations for this driver to use the `DirXMLAssociationsLite` attribute (new no-ref association).

- 2: Migrate to ref association

  This action modifies the driver and sets the value of `DirXML-UseNoRefAssoc` to False. It also converts the existing object associations for this driver to use the `DirXMLAssociations` attribute (legacy association).

- 3: Get no-ref associated entries

Applicable only if using no-reference association for the driver. This action lists the object's associations.

- 4: Delete no-ref associated entries

  Applicable only if using no-reference association for the driver. This action deletes the object's associations.

- 5: Rename no-ref association

  Applicable only if using no-reference association for the driver. This action renames the object's associations. As the DN is stored as a string, renaming the driver or renaming, or moving the object (if using DN as association value) may break the association. You can use the rename action to correct this behavior.

- 99: Exit

7.3.2 Association Actions in the Driver Menu

You can select an association operation from the following list:

- 1: Migrate to no-ref association

  This action modifies the driver and sets the value of `DirXML-UseNoRefAssoc` to True. It also converts the existing object associations for this driver to use the `DirXMLAssociationsLite` attribute (new no-ref association).

- 2: Migrate to ref association

  This action modifies the driver and sets the value of `DirXML-UseNoRefAssoc` to False. It also converts the existing object associations for this driver to use the `DirXMLAssociations` attribute (legacy association).

- 3: Get to no-ref associated entries

  Applicable only if using no-reference association for the driver. This action lists the object's associations.

- 4: Delete no-ref associated entries

  Applicable only if using no-reference association for the driver. This action deletes the object's associations.

- 99: Exit

7.4 Tools for Managing Associations

NetIQ iManager provides two tools to enable you to view and manage the associations between drivers and objects (data):

- The **Driver Inspector** displays all objects associated with a driver and lets you perform various actions on those associations, such as deleting an object or modifying its properties.
- The **Object Inspector** displays all connected systems associated with an object. For each association, you can perform various actions, including viewing the object's data flow between the Identity Vault and the connected system, configuring the connected system's driver or driver set, viewing the entitlements, and removing the association between the object and the connected system.

7.4.1 Inspecting Objects

You can use the Object Inspector to view detailed information about how an object participates in Identity Manager relationships. These relationships include the connected systems that are associated with the object, how data flows between the Identity Vault and the connected systems, the attribute values that are currently stored in the Identity Vault and on the connected systems, the connected system driver configurations, and so forth.

1. In iManager, open the Identity Manager Administration page.
2. In the **Administration** list, click **Object Inspector** to display the Object Inspector page.
3. Specify the fully distinguished name of the object that you want to inspect, or click the browse icon to browse to and select the desired object.

   iManager keeps a record of the objects you have previously selected, so you can also use the icon to select from a list of previously selected objects.
4. After you have selected the object, click **OK** to display the Object Inspector page.

   The Connected Systems section lists each of the connected systems with which the object is associated. You can perform any of the following actions:

   - **Delete:** To delete an association with a connected system, select the check box to the left of the association and click **Delete**. To delete all associations, select the check box beneath the Delete column, then click **Delete**.
   - **Refresh:** Select **Refresh** to re-read the connected system associations and refresh the table.
   - **Actions:** Select a connected system by clicking the check box to the left of the association reference (you do not need to select any boxes for the **Add New Association** action item). Click **Actions**, then choose one of the following options:
     - **Run Overview on Driver:** Launches the overview page for the connected system's driver.
     - **Run Overview on Driver Set:** Launches the overview page for the connected system's driver set.
     - **Configure Driver:** Launches the properties page for the connected system's driver so that you can modify the driver’s properties.
     - **Configure Driver Set:** Launches the properties page for the connected system's driver set so that you can modify the driver set’s properties.
     - **Add New Association:** Prompts you for the parameters necessary to add new attribute values to the object's DirXML-Association attribute.
     - **Edit Selected Association:** Prompts you to edit the parameters of the connected system's DirXML-Association attribute values.
     - **View Entitlements:** Displays a list of the entitlements associated with the connected system. The list displays the current state of the entitlement (granted or revoked) as well as the source of the entitlement (for example, workflow or role-based).
   - **Connector:** Lists the connected system's fully distinguished name that is associated with the object. Click the plus (+) icon next to the connected system to see how data flows through the connected system.

     The Servers entry shows the servers that are associated with the driver set. Clicking the **Edit** icon to the right of the server brings up the server’s properties page in a pop-up window. Clicking the **Query** icon queries the attribute values for all classes in the driver filter. The larger the filter, the longer the query takes. If the Inspector cannot communicate with the connected system, you see a message stating that the attribute cannot be queried from the application.

The driver filter's associated classes (such as Group) and their attributes (such as Description and Member) are listed under the Server entry. Click the class to see all of the values for the defined attributes in that class. You can also click an attribute to see its values, or you can click the entries to the right of the attributes to see just the Identity Vault value or the application value. If no value has been defined, the entry displays No Values. If the Inspector cannot communicate with the connected system, you see a message stating that the attribute cannot be queried from the application.

- **States:** The connected system's driver states are Enabled, Disabled, Processed, Pending, Manual, and Migrate.
- **Object ID:** The identification value of the associated object to the connected system. If the connected system driver has no identification, this column displays **None**.

7.4.2 Inspecting Drivers

You can use the Driver Inspector to view detailed information about the objects associated with a driver.

1. In iManager, open the Identity Manager Administration page.
2. In the **Administration** list, click **Driver Inspector** to display the Driver Inspector page.
3. In the **Driver to inspect** field, specify the fully distinguished name of the driver that you want to inspect, or click the browse icon to browse to and select the desired driver.

   iManager keeps a record of the objects you have previously selected, so you can also use the icon to select from a list of previously selected objects.
4. After you have selected the driver to inspect, click **OK** to display the Driver Inspector page.

   The page displays information about the objects associated with the selected driver. You can perform any of the following actions:

   - **Driver:** Displays the name of the inspected driver. Click the driver name to display the Driver Overview page.
   - **Driver Set:** Displays the name of the driver set in which the inspected driver resides. Click the driver set name to display the Driver Set Overview page.
   - **Delete:** Removes the association between the driver and an object. Select the check box in front of the object you no longer want associated with the driver, click **Delete**, then click **OK** to confirm the deletion.
   - **Refresh:** Select this option to re-read all of the objects associated with the driver and refresh the information.
   - **Show:** Select the number of associations to display per page. You can select a predefined number (25, 50, or 100) or specify another number of your choice. The default is 50 associations per page. If there are more associations than the number displayed, you can use the arrow buttons to display the next and previous pages of associations.
   - **Actions:** Perform actions on the objects associated with the driver. Click **Actions**, then select one of the following options:
     - **Show All Associations:** Displays all objects associated with the driver.
     - **Filter for Disabled Associations:** Displays all objects associated with the driver that have a Disabled state.
     - **Filter for Manual Associations:** Displays all objects associated with the driver that have a Manual state.
     - **Filter for Migrate Associations:** Displays all objects associated with the driver that have a Migrate state.

    - **Filter for Pending Associations:** Displays all objects associated with the driver that have a Pending state.
    - **Filter for Processed Associations:** Displays all objects associated with the driver that have a Processed state.
    - **Filter for Undefined Associations:** Displays all objects associated with the driver that have an Undefined state.
    - **Association Summary:** Displays the state of all objects associated with the driver.
  - **Object DN:** Displays the DN of the associated objects.
  - **State:** Displays the association state of the object.
  - **Object ID:** Displays the value of the association.

8 Managing Driver Cache Files

8.1 Viewing a Transaction

You can use iManager to view the transactions in a driver's cache file. The Driver Cache Inspector displays information about the cache file, including a list of the events to be processed by the driver.

1. In iManager, open the Identity Manager Administration page.
2. In the **Administration** list, click **Driver Cache Inspector**.
3. In the **Driver to inspect** field, specify the fully distinguished name of the driver whose cache you want to inspect, or click the browse icon to browse to and select the desired driver, then click **OK** to display the Driver Cache Inspector page.

   A driver's cache file can be read only when the driver is not running. If the driver is stopped, the Driver Cache Inspector page displays the cache as shown in the screen shot below. If the driver is running, the page displays a `Driver not stopped, cache cannot be read` note in place of the cache entries. To stop the driver, click the button; the cache is then read and displayed.

   - **Driver:** Lists the driver that is associated with the cache file. Click the link to display the Driver Overview page.
   - **Driver Set:** Lists the driver set in which the driver resides. Click the link to display the Driver Set Overview page.
   - **Driver's cache on:** Lists the server that contains this instance of the cache file. If the driver is running on multiple servers, you can select another server in the list to view the driver's cache file for that server.
   - **Start/Stop Driver icons:** Displays the current state of the driver and allows you to start or stop the driver. The cache can be read only while the driver is stopped.
   - **Edit icon:** Allows you to edit the properties of the currently selected server.
   - **Delete:** Select entries in the cache, then click **Delete** to remove them from the cache file.
   - **Refresh:** Select this option to re-read the cache file and refresh the information.
   - **Show:** Select the number of entries to display per page. You can select a predefined number (25, 50, or 100) or specify another number of your choice. The default is 50 entries per page. If there are more entries than the number displayed, you can use the arrow buttons to display the next and previous pages.
   - **Actions:** Allows you to perform actions on the entries in the cache file. Click **Actions** to expand the menu, then select one of the following options:
     - **Expand All:** Expands all of the entries displayed in the cache file.
     - **Collapse All:** Collapses all of the entries displayed in the cache file.
     - **Go To:** Allows you to access a specified entry in the cache file. Specify the entry number, then click **OK**.
     - **Cache Summary:** Summarizes all of the events stored in the cache file.

8.2 Viewing the Out of Band Sync Cache

To view events in the Out of Band Sync cache:

1. In iManager, open the Identity Manager Administration page.
2. In the **Administration** list, click **Driver Out of Band Sync Cache Inspector**.
3. Specify the fully distinguished name of the driver whose cache you want to inspect, or click the browse icon to browse to and select the desired driver, then click **OK**. A driver's cache file can be read only when the driver is not running. For more information, see Section 8.1, "Viewing a Transaction," on page 39.

8.3 Relocating the Event Cache File

Every driver that is configured in Identity Manager has an associated event cache file. Events are cached in a TAO file before a driver processes them. By default, the TAO files are placed in the `dib` directory.

Identity Manager allows you to place the TAO files anywhere in the file system. Distributing the file I/O across multiple file systems improves the I/O throughput. Each driver can have an optional single-valued server readable attribute `DirXML-CacheLocation`. The value of this attribute is an absolute path to the TAO files in the file system. When the engine is restarted, it looks for the `DirXML-CacheLocation` attribute and the associated TAO files.

You can change the location of the TAO file by using the dxcmd utility:

Run `dxcmd > login > Driver Operations > (Select the Driver) > 14. Cache Operations > 10. Get Cache Path/11. Set Cache Path`

NOTE: You can change the location of the cache file only when the driver is in a disabled state, otherwise it throws an `INVALID_REQUEST` exception. If the path does not exist, it throws a `BAD_FILE_NAME` exception.

To relocate the TAO file:

1. Shut down the driver on which you want to set a new TAO file location.
2. Take note of the system time.

   You might need this data to force resynchronization of objects if any events are missed during the TAO file relocation.
3. Move the driver's TAO file to the new location and disable the driver.
4. Set the new TAO file location by using the `dxcmd` utility.
5. Enable the driver by deselecting the **Do not automatically synchronize** option.
6. Start the driver.
7. Use the **Synchronize** option to force resynchronization of objects from the time noted in Step 2.

9 Securely Storing Driver Passwords with Named Passwords

Identity Manager allows you to securely store multiple passwords for a driver. This functionality is referred to as **named passwords**. Each different password is accessed by a key, or name.

You can add named passwords to a driver set or to individual drivers. Named passwords for a driver set are available to all drivers in the set. Named passwords for an individual driver are available only to that driver.

To use a named password in a driver policy, you refer to it by the name of the password, instead of using the actual password, and the Identity Manager engine sends the password to the driver. The method described in this section for storing and retrieving named passwords can be used with any driver without making changes to the driver shim.

NOTE: The sample configurations provided for the Identity Manager Driver for Lotus Notes include an example of using named passwords in this way. The Notes driver shim has also been customized to support other ways of using named passwords, and examples of those methods are also included. For more information, see the section on named passwords in the *Identity Manager Driver Guide for Lotus Notes*.

9.1 Using Designer to Configure Named Passwords

1. In Designer, select the driver, then right-click and select **Properties**.
2. Select **Named Password**, then click **New**.
3. Specify a name, display name, and a password, then click **OK** twice.

9.2 Using iManager to Configure Named Passwords

1. Locate the driver set or driver where you want to add a named password:
   - **1a** In iManager, open the Identity Manager Administration page.
   - **1b** In the **Administration** list, click **Identity Manager Overview**.
   - **1c** If the driver set is not listed on the **Driver Sets** tab, use the **Search In** field to search for and display the driver set.
   - **1d** Click the driver set to open the Driver Set Overview page.
2. To add a named password to a driver set, click the **Driver Set** menu, then click **Edit Driver Set properties**.

   or

   To add a named password to a driver, click the upper right corner of the driver icon, then click **Edit properties**.
3. On the **Identity Manager** tab, click **Named Passwords**.
4. Click **Add**.

5 Specify a name, display name and a password, then click **OK** twice.

6 A message appears: `Do you want to restart the driver to put your changes in effect?` Click **OK**.

9.3 Using Named Passwords in Driver Policies

9.3.1 Using the Policy Builder

The Policy Builder allows you to make a call to a named password. Create a new rule and select **Named Password** as the condition, then set an action depending upon if the named password is available or not available.

1 In Designer, launch the Policy Builder, right-click, then click **New > Rule**.

2 Specify the name of the rule, then click **Next**.

3 Select the condition structure, then click **Next**.

4 Select **named password** for the **Condition**.

5 Browse to and select the named password that is stored on the driver.

   In this example, it is `user info`.

6 Select whether the operator is available or not available, then click **Next**.

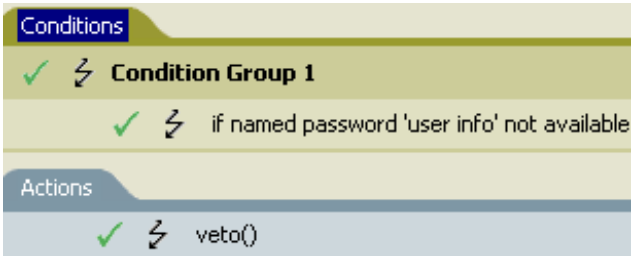
7 Select an action for the **Do** field.

   In this example, the action is `veto`.

8 Click **Finish**.

The example indicates that if the `user info` named password is not available, then the event is vetoed.

Figure 9-1 *A Policy Using Named Passwords*



9.3.2 Using XSLT

The following example shows how a named password can be referenced in a driver policy on the Subscriber channel in XSLT:

```
<xsl:value-of
select="query:getNamedPassword($srcQueryProcessor,'mynamedpassword')"
xmlns:query="http://www.novell.com/nxsl/java/
com.novell.nds.dirxml.driver.XdsQueryProcessor"/>
```

9.4 Using the DirXML Command Line Utility to Configure Named Passwords

9.4.1 Creating a Named Password in the DirXML Command Line Utility

1. Run the DirXML Command Line utility.

   For more information, see Chapter 12, “Using the DirXML Command Line Utility,” on page 49.
2. Specify your user name and password.
3. Specify one of the following options:
   - Option **3** for Driver Operations
   - Option **4** for Driver Set Operations

   Option 3 for Driver Operations: If you specified **3**, a numbered list of drivers appears. Do the following:

   1. Specify the number for the driver to which you want to add a named password.
   2. Specify **13** for Password Operations.
   3. Specify **5** to set a new named password.

      Go to Step 4.

   Option 4 for Driver Set Operations: If you specified **4**, a numbered list of driver set operations appears.

   Do the following:

   1. Specify **5** for Password Operations.
   2. Specify **1** to set a new named password.

      Go to Step 4.
4. At the prompt, specify the name by which you want to refer to the named password.
5. At the prompt, specify a description of the password.
6. At the prompt, specify the actual password that you want to secure.

   The characters you type for the password do not appear on the screen.
7. At the prompt, confirm the password by specifying it again.

   The password operations menu appears.
8. Specify the **99** option twice to exit the menu and quit the DirXML Command Line utility.

9.4.2 Removing a Named Password in the DirXML Command Line Utility

This option is useful if you no longer need named passwords you previously created.

1. Run the DirXML Command Line utility.

   For more information, see Chapter 12, “Using the DirXML Command Line Utility,” on page 49.
2. Specify your user name and password.

3 Specify one of the following:

- Option 3 for Driver Operations
- Option 4 for Driver Set Operations

Option 3 for Driver Operations: If you specified 3, a numbered list of drivers appears. Do the following:

1. Enter the number for the driver from which you want to remove named passwords.
2. Specify 13 for Password Operations.
3. (Optional) Specify 7 to see the list of existing named passwords.

   This helps you to make sure that you are removing the correct password.
4. Specify 6 to remove one or more named passwords.
5. Go to Step 4.

Option 4 for Driver Set Operations: If you specified 4, a numbered list of driver set operations appears.

Do the following:

1. Specify 5 for Password Operations.
2. (Optional) Specify 3 to see the list of existing named passwords.

   This helps you to make sure that you are removing the correct password.
3. Specify 2 to remove one or more named passwords.
4. Go to Step 4.

4 At the following prompt, enter `No` to remove a single named password:

```
Do you want to clear all named passwords? (yes/no):
```

5 At the following prompt, enter the name of the named password you want to remove:

```
Enter password name:
```

The password operations menu appears.

6 (Optional) Specify the appropriate number to see the list of existing named passwords.

This step helps you to verify that you have removed the correct password.

7 Specify the 99 option twice to exit the menu and quit the DirXML Command Line utility.

10 Configuring Java Environment Parameters

Rather than use command line options and configuration files to set the environment parameters for the Java virtual machine (JVM) associated with a driver set, you can use iManager or Designer.

10.1 Using iManager to Configure the Java Environment Parameters

1. In iManager, open the Identity Manager Administration page.
2. Open the properties for the driver set whose parameters you want to configure:
   - **2a** In the **Administration** list, click **Identity Manager Overview**.
   - **2b** If the driver set is not listed on the **Driver Sets** tab, use the **Search In** field to search for and display the driver set.
   - **2c** Click the driver set to open the Driver Set Overview page.
   - **2d** Click the **Driver Set** menu, then click **Edit Driver Set properties**.
3. Click **Misc** to display the property page that contains the Java environment parameters.
4. Modify the following settings as desired:

   Classpath Additions: Specify additional paths for the JVM to search for package (`.jar`) and class (`.class`) files. Using this parameter is the same as using the `java -classpath` command. When entering multiple class paths, separate them with a semicolon (;) for a Windows JVM and a colon (:) for a UNIX or Linux JVM.

   JVM Options: Specify additional options to use with the JVM. Refer to your JVM documentation for valid options.

   `DHOST_JVM_OPTIONS` is the corresponding environment variable. It specifies the arguments for JVM 1.2. For example:

   ```
   -Xnoagent -Xdebug -Xrunjdwp: transport=dt_socket,server=y, address=8000
   ```

   Each option string is separated by whitespace. If an option string contains whitespace, then it must be enclosed in double quotes.

   The driver set attribute option has precedence over the `DHOST_JVM_OPTIONS` environment variable. This environment variable is tacked on to the end of driver set attribute option.

   Initial Heap Size: Specify the initial (minimum) heap size available to the JVM. Increasing the initial heap size can improve startup time and throughput performance. Use a numeric value followed by G, M, or K. If no letter size is specified, the size defaults to bytes. Using this parameter is the same as using the `java -Xms` command.

   `DHOST_JVM_INITIAL_HEAP` is the corresponding environment variable. It specifies the initial JVM heap size in decimal number of bytes. It has precedence over the driver set attribute option.

   Refer to your JVM documentation for information about the JVM's default initial heap size.

   Maximum Heap Size: Specify the maximum heap size available to the JVM. Use a numeric value followed by G, M, or K. If no letter size is specified, the size defaults to bytes. Using this parameter is the same as using the `java -Xmx` command.

`DHOST_JVM_MAX_HEAP` is the corresponding environment variable. It specifies the maximum JVM heap size in decimal number of bytes. It has precedence over the driver set attribute option.

Refer to your JVM documentation for information about the JVM's default maximum heap size.

5 Click **OK** to save your changes.

6 Restart eDirectory to apply the changes.

10.2 Using Designer to Configure the Java Environment Parameters

1 Open your project in the Modeler.

2 Right-click the driver set icon , then click **Properties** > **Java**.

3 Modify the following settings as desired:

Server: If the driver set is associated with multiple Identity Manager servers, select the server whose JVM parameters you want to configure.

Classpath Additions: Specify additional paths for the JVM to search for package (`.jar`) and class (`.class`) files. Using this parameter is the same as using the `java -classpath` command. When entering multiple class paths, separate them with a semicolon (;) for a Windows JVM and a colon (:) for a UNIX/Linux JVM.

JVM Options: Specify additional options to use with the JVM. Refer to your JVM documentation for valid options.

`DHOST_JVM_OPTIONS` is the corresponding environment variable. It specifies the arguments for JVM 1.2. For example:

```
-Xnoagent -Xdebug -Xrunjdwp: transport=dt_socket,server=y, address=8000
```

Each option string is separated by whitespace. If an option string contains whitespace, then it must be enclosed in double quotes.

The driver set attribute option has precedence over the `DHOST_JVM_OPTIONS` environment variable. This environment variable is tacked on to the end of driver set attribute option.

Initial Heap Size: Specify the initial (minimum) heap size available to the JVM in bytes. Increasing the initial heap size can improve startup time and throughput performance. Using this parameter is the same as using the `java -Xms` command.

`DHOST_JVM_INITIAL_HEAP` is the corresponding environment variable. It specifies the initial JVM heap size in decimal number of bytes. It has precedence over the driver set attribute option.

Refer to your JVM documentation for information about the JVM's default initial heap size.

Maximum Heap Size: Specify the maximum heap size available to the JVM. Use a numeric value followed by G, M, or K. If no letter size is specified, the size defaults to bytes. Using this parameter is the same as using the `java -Xmx` command.

`DHOST_JVM_MAX_HEAP` is the corresponding environment variable. It specifies the maximum JVM heap size in decimal number of bytes. It has precedence over the driver set attribute option.

Refer to your JVM documentation for information about the JVM's default maximum heap size.

4 Click **OK** to save your changes.

5 To deploy the changes into your Identity Vault, right-click the driver set icon , click **Live** > **Deploy**, and follow the deployment prompts.

6 Restart eDirectory to apply the changes.

11 Rights Needed by a Driver on Identity Vault Objects

An Identity Manager driver requires the following minimum rights to the Identity Vault objects:

- Read rights to the attributes in the Subscriber channel filter. The driver needs these rights at least to the objects within the scope of objects that the driver will be working on.
- Read and Write rights to all objects and attributes in the Publisher filter for the scope of the objects that the driver works with. The driver must have Read rights to the objects outside its scope for appropriate matching rules.
- Read rights to passwords of objects in the driver scope to set passwords.
- Read rights to the DirXML Script policy objects.
- Read and Write rights to the driver objects and objects under it for updating the following attributes:
  - DirXML-DriverStorage attribute on the driver object (resides in the driver object and regularly modified)
  - DirXML-State attribute (modified by the driver operation)
  - DirXML-StatusLog attribute (resides in driver, Publisher channel, and Subscriber channel objects)

12 Using the DirXML Command Line Utility

The DirXML Command Line utility allows you to use a command line interface to manage the driver. The primary use of this utility is to allow you to create platform-specific scripts to manage the driver.

The utility and scripts are installed on all platforms during the Identity Manager installation. The utility is installed to the following locations:

- Windows: `\Novell\Nds\dxcmd.bat`
- UNIX/Linux: `/usr/bin/dxcmd`

There are two different methods for using the DirXML Command Line utility:

- Interactive mode
- Command line mode

12.1 Interactive Mode

The interactive mode provides a text interface to control and use the DirXML Command Line utility.

1. At the console, enter `dxcmd`.
2. Enter the name of a user with sufficient rights to the Identity Manager objects, such as admin.novell.
3. Enter the user's password.
4. Enter the number of the command you want to perform.

   Table 12-1 on page 50 contains the list of options and what functionality is available.
5. Enter 99 to quit or return to the main menu.

NOTE

- If there are more than 99 menu items, use 999 option to return to the main menu to avoid any conflict. For example, if the drivers listed are more than 100, then the dxcmd option to return to the main menu is 999.
- If you are running eDirectory 8.8 on UNIX or Linux, you must specify the -host and -port parameters. For example, `dxcmd -host 10.0.0.1 -port 524`. If the parameters are not specified, a jclient error occurs.

```
novell.jclient.JCException: connect (to address) 111 UNKNOWN ERROR
```

By default, eDirectory 8.8 is not listening to localhost. The DirXML Command Line utility needs to resolve the server IP address or hostname and the port to be able to authenticate.

Table 12-1 Interactive Mode Options

Option	Description
1: Start Driver	Starts the driver. If there is more than one driver, each driver is listed with a number. Enter the number of the driver to start the driver.
2: Stop Driver	Stops the driver. If there is more than one driver, each driver is listed with a number. Enter the number of the driver to stop the driver.
3: Driver operations	Lists the operations available for the driver. If there is more than one driver, each driver is listed with a number. Enter the number of the driver to see the operations available. For a list of operations, see Table 12-2 on page 50.
4: Driver set operations	Lists the operations available for the driver set. For a list of operations, see Table 12-3 on page 53.
5: Log events operations	Lists the operations available for logging events through Audit. For a description of these options, see Table 12-6 on page 56.
6: Get DirXML version	Lists the version of Identity Manager installed.
7: Job operations	Manages jobs created for Identity Manager.
8: JVM Statistics	Lists the performance statistics such as, memory, thread, runtime, classloader, garbage collection and OS information for an instrumented Java Virtual Machine (JVM).
99: Quit	Exits the DirXML Command Line utility.

Table 12-2 Driver Options

Options	Description
1: **Start driver**	Starts the driver.
2: **Stop driver**	Stops the driver.
3: **Get driver state**	Lists the state of the driver. ◆ 0 - Driver is stopped ◆ 1 - Driver is starting ◆ 2 - Driver is running ◆ 3 - Driver is stopping
4: **Get driver start option**	Lists the current driver start option. ◆ 1 - Disabled ◆ 2 - Manual ◆ 3 - Auto
5: **Set driver start option**	Changes the start option of the driver. ◆ 1 - Disabled ◆ 2 - Manual ◆ 3 - Auto ◆ 99 - Exit

Options	Description
6: **Resync driver**	Forces a resynchronization of the driver. It prompts for a time delay: `Do you want to specify a minimum time for resync? (yes/no).` If you enter **Yes**, specify the date and time you want the resynchronization to occur: `Enter a date/time (format 9/27/05 3:27 PM)`. If you enter **No**, the resynchronization occurs immediately.
7: **Migrate from application into DirXML**	Processes an XML document that contains a query command: `Enter filename of XDS query document:` Create the XML document that contains a query command by using the Novell `nds.dtd` (http://developer.novell.com/ndk/doc/dirxml/dirxmlbk/ref/ndsdtd/query.html). Examples: NetWare: `sys:\files\query.xml` Windows: `c:\files\query.xml` Linux: `/files/query.xml`

8: **Submit XDS command document to driver**	Submits an XDS command document to the driver's Subscriber channel, bypassing the driver cache. The document is processed before anything that might be in the cache at the time of the submission. It also means that the submission fails if the driver is not running.
	
	`Enter filename of XDS command document:`
	
	Examples:
	
	Windows: `c:\files\user.xml`
	
	Linux: `/files/user.xml`
	
	`Enter name of file for response:`
	
	Examples:
	
	Windows: `c:\files\user.log`
	
	Linux: `/files/user.log`

Options	Description
9: Submit XDS event document to driver	Submits an XDS event document to the driver's Subscriber channel, bypassing the driver cache. The document is processed before anything that might be in the cache at the time of the submission. It also means that the submission fails if the driver is not running. `Enter filename of XDS event document:` Examples: Windows: `c:\files\add.xml` Linux: `/files/add.xml`
10: Queue event for driver	Submits a document to the driver's Subscriber channel by queuing the document in the driver cache. The document is processed after anything that might be in the cache at the time of the submission. The submission does not fail if the driver is not running. `Enter filename of XDS event document:` Examples: Windows: `c:\files\add.xml` Linux: `/files/add.xml`
11: **Check object password**	Validates that an object's password in the connected system is associated with a driver. It matches the object's eDirectory password (Distribution Password, used with Universal Password). `Enter user name:`
12: **Initialize new driver object**	Performs an internal initialization of data on a new Driver object. This is only for testing purposes.
13: **Password operations**	There are nine Password options. See Table 12-4 on page 54 for a description of these options.
14: **Cache operations**	There are five Cache operations. See Table 12-5 on page 55 for a descriptions of these options.
99: **Exit**	Exits the driver options.

Sample XDS Event Document

```
<nds dtdversion="1.1" ndsversion="8.6" xml:space="default">
  <input>
    <add class-name="User" src-dn="Doe John">
      <association>JDoe@novell.com</association>
      <add-attr attr-name="LastName">
        <value type="string">John</value>
      </add-attr>
      <add-attr attr-name="FirstName">
        <value type="string">Doe</value>
      </add-attr>
      <add-attr attr-name="Email">
        <value type="string">JDoe@novell.com</value>
      </add-attr>
    </add>
  </input>
</nds>
```

Sample XDS Command Document

```
<nds dtdversion="3.5" ndsversion="8.x">
  <source>
    <product version="3.5.11.4223">DirXML</product>
    <contact>Novell, Inc.</contact>
  </source>
  <input>
    <add cached-time="20080519102858.809Z" class-name="User" eventid=
      "blr-krajiv-sles#20080519102858#1#1" qualified-srcdn=
      "O=n\OU=People\CN=JDoe" src-dn="\KRAJIV-LINUXTREE\n\People\JDoe"
      src-entry-id="32956" timestamp="1211192938#9">
      <add-attr attr-name="Internet EMail Address">
        <value timestamp="1211192938#8"
          type="string">JDoe@novell.com</value>
      </add-attr>
      <add-attr attr-name="Given Name">
        <value timestamp="1211192938#5" type="string">John</value>
      </add-attr>
      <add-attr attr-name="Surname">
        <value timestamp="1211192938#9" type="string">Doe</value>
      </add-attr>
    </add>
  </input>
</nds>
```

Table 12-3 *Driver Set Operations*

Operation	Description
1: Associate driver set with server	Adds a driver set to the server after which the driver set becomes active.
2: Disassociate driver set from server	Removes a driver set from the server after which the driver set becomes inactive.
3: Export Identity Manager server public key certificate	Exports the DirXML server's public key certificate which is used for encrypting data when setting passwords.

Operation	Description
4: Regenerate Identity Manager server keypair	Makes the DirXML Engine regenerate the public key/private key pair which is used for encrypting data when setting passwords.
5: Passwords operations	There are four password operations. For description of these operations, see the operations 5, 6, 7, and 99 in the Table 12-4 on page 54.
6: Get default reciprocal attribute mappings	Lists the default reciprocal attribute mappings.
7: Regenerate all Identity Manager server keys	Makes the DirXML Engine regenerate all server-specific encryption keys.
99: **Exit**	Exits the current menu and takes you back to the DirXML commands.

Table 12-4 *Password Operations*

Operation	Description
1: **Set shim password**	Sets the application password. This is the password of the user account you are using to authenticate into the connected system with.
2: **Clear shim password**	Clears the application password.
3: **Set Remote Loader password**	The Remote Loader password is used to control access to the Remote Loader instance. Enter the Remote Loader password, then confirm the password by typing it again.
4: **Clear Remote Loader password**	Clears the Remote Loader password so no Remote Loader password is set on the Driver object.
5: **Set named password**	Allows you to store a password or other pieces of security information on the driver. For more information, see Chapter 9, "Securely Storing Driver Passwords with Named Passwords," on page 41. There are four prompts to fill in: ◆ **Enter password name:** ◆ **Enter password description:** ◆ **Enter password:** ◆ **Confirm password**
6: **Clear named passwords**	Clears a specified named password or all named passwords that are stored on the driver object: `Do you want to clear all named passwords? (yes/no).` If you enter **Yes**, all named passwords are cleared. If you enter **No**, you are prompted to specify the password name that you want to clear.

Operation	Description
7: **List named passwords**	Lists all named passwords that are stored on the driver object. It lists the password name and the password description.
8: **Get password state**	Lists if a password is set for: ◆ Driver Object password: ◆ Application password: ◆ Remote loader password: The dxcmd utility allows you to set the Application password and the Remote Loader password. You cannot set the Driver Object password with this utility. It shows if the password has been set or not.
99: **Exit**	Exits the current menu and takes you back to the Driver options.

Table 12-5 *Cache Operations*

Operation	Description
1: **Get driver cache limit**	Displays the current cache limit that is set for the driver.
2: **Set driver cache limit**	Sets the driver cache limit in kilobytes. A value of 0 is unlimited.
3: **View cached transactions**	A text file is created with the events that are stored in cache. You can select the number of transactions to view. ◆ **Enter position token** (default=0): ◆ **Enter maximum transactions records to return** (default=1): ◆ **Enter name of file for response:**
4: **Delete cached transactions**	Deletes the transactions stored in the cache. ◆ **Enter position token** (default=0): ◆ **Enter event-id value of first transaction record** to delete (optional): ◆ **Enter number of transaction records to delete** (default=1):
99: **Exit**	Exits the current menu and takes you back to the Driver options.

NOTE: In the same dxcmd session, if you wish to view the cached transactions after deleting few transactions, you have to reset the position value to 0 rather than accepting the default value. If you accept the default value, you may receive an `ERR_INVALID_REQUEST` exception.

Table 12-6 Log Events Operations

Operation	Description
1: **Set driver set log events**	Allows you to log driver set events through Audit. There are 49 items you can select to log. See Table 12-7 on page 56 for a list of these options. Enter the number of the item you want to log. After the items are selected, enter 99 to accept the selections.
2: **Reset driver set log events**	Resets all of the log event options.
3: **Set driver log events**	Allows you to log driver events through Audit. There are 49 items to select to log. See Table 12-7 on page 56 for a list of these options. Enter the number of the item you want to log. After the items are selected, enter 99 to accept the selections.
4: **Reset driver log events**	Resets all of the log event options.
99: **Exit**	Exits the log events operations menu.

Table 12-7 Driver Set and Driver Log Events

Options
1: Status success
2: Status retry
3: Status warning
4: Status error
5: Status fatal
6: Status other
7: Query elements
8: Add elements
9: Remove elements
10: Modify elements
11: Rename elements
12: Move elements
13: Add-association elements
14: Remove-association elements
15: Query-schema elements
16: Check-password elements
17: Check-object-password elements
18: Modify-password elements
19: Sync elements

Options
20: Pre-transformed XDS document from shim
21: Post input transformation XDS document
22: Post output transformation XDS document
23: Post event transformation XDS document
24: Post placement transformation XDS document
25: Post create transformation XDS document
26: Post mapping transformation <inbound> XDS document
27: Post mapping transformation <outbound> XDS document
28: Post matching transformation XDS document
29: Post command transformation XDS document
30: Post-filtered XDS document <Publisher>
31: User agent XDS command document
32: Driver resync request
33: Driver migrate from application
34: Driver start
35: Driver stop
36: Password sync
37: Password request
38: Engine error
39: Engine warning
40: Add attribute
41: Clear attribute
42: Add value
43: Remove value
44: Merge entire
45: Get named password
46: Reset Attributes
47: Add Value - Add Entry
48: Set SSO Credential
49: Clear SSO Credential
50: Set SSO Passphrase
51: User defined IDs
99: Accept checked items

Table 12-8 Job Operations

Options	Description

1: **Get available job definitions**	Allows you to select an existing job.
	`Enter the driverset number or the driver number:`
	`Do you want to filter the job definitions by containment?` Enter Yes or No
	`Enter name of the file for response:`
	Examples:
	Windows: `c:\files\user.log`
	Linux: `/files/user.log`

2: **Operations on specific job object**	Allows you to perform operations for a specific job. `Enter the job number:` The following list of options appears: **1: Send job update notification** **2: Start job** **3: Abort running job** **4: Get job state** **5: Check job configuration** **6: Passwords operations** **99: Exit**

12.2 Command Line Mode

The command line mode allows you to use script or batch files. Table 12-9 on page 58 contains the different options that are available.

To use the command line options, decide which items you want to use and string them together.

Example: `dxcmd -user admin.headquarters -host 10.0.0.1 -password n0vell -start test.driverset.headquarters`

This example command starts the driver.

Table 12-9 Command Line Options

Option	Description
Configuration	
-user *<user name>*	Specify the name of a user with administrative rights to the drivers you want to test.
-host *<name or IP address>*	Specify the IP address of the server where the driver is installed.
-password *<user password>*	Specify the password of the user specified above.

Option	Description
-port *<port number>*	Specify a port number, if the default port is not used.
-q *<quiet mode>*	Displays very little information when a command is executed.
-v *<verbose mode>*	Displays detailed information when a command is executed.
-s *<stdout>*	Writes the results of the dxcmd command to stdout.
-? *<show this message>*	Displays the help menu.
-help *<show this message>*	Displays the help menu.
-cert *<X.509 DER certificate filename>*	Certificate file used for encrypting passwords.
-version *<n.n[.n[.n]]>*	Changes engine version by force.
-nossl	Uses clear socket for LDAP.
-keystore *<keystore path and filename>*	Specifies the filename of the Java keystore that contains the trusted root certificate of the issuer of the certificate used by the remote interface shim.
-storepass *<keystore password>*	Specifies the password for the Java keystore specified by the keystore parameter.
-dnform *<slash|qualified-slash|dot|qualified-dot|ldap>*	Changes the dn form by force.
Actions	
-start *<driver dn>*	Starts the driver.
-stop *<driver dn>*	Stops the driver.
-getstate *<driver dn>*	Returns the value that indicates the state of the driver (0 - stopped, 2 - running, and so on).
-getdriverstats *<driver dn>* *<output filename>*	Shows the statistics of the driver.
-resetdriverstats *<driver dn>*	Resets the statistics of the driver.
-getstartoption *<driver dn>*	Shows the startup option of the driver.
-setstartoption *<driver dn>* *<disabled|manual|auto>* *<resync|noresync>*	Sets how the driver starts if the server is rebooted. Sets whether the objects are to be resynchronized when the driver restarts.
-getcachelimit *<driver dn>*	Lists the cache limit set for the driver.
-setcachelimit *<driver dn>* *<0 or positive integer>*	Sets the cache limit for the driver.
-migrateapp *<driver dn>* *<filename>*	Processes an XML document that contains a query command. Create the XML document that contains a query command by using the Novell `nds.dtd` (http://www.novell.com/documentation/idm35/index.html?page=/documentation/idm35/policy_dtd/data/dtdndsoverview.html#dtdndsoverview).
-setshimpassword *<driver dn>* *<password>*	Sets the application password. This is the password of the user account you are using to authenticate into the connected system with.

Option	Description
-clearshimpassword *<driver dn>* *<password>*	Clears the application password.
-setremoteloaderpassword *<driver dn>* *<password>*	Sets the Remote Loader password. The Remote Loader password is used to control access to the Remote Loader instance.
<clearremoteloaderpassword *<driver dn>*	Clears the Remote Loader password.
-sendcommand *<driver dn>* *<input filename>* *<output filename>*	Submits a document to the driver's Subscriber channel, bypassing the driver cache. The document gets processed ahead of anything that might be in the cache at the time of the submission. It also means that the submission fails if the driver is not running. Specify the XDS command document as the input file. Examples: NetWare: `sys:\files\user.xml` Windows: `c:\files\user.xml` Linux: `/files/user.log` Specify the output filename to see the results. Examples: NetWare: `sys:\files\user.log` Windows: `c:\files\user.log` Linux: `/files/user.log`
-sendevent *<driver dn>* *<input filename>*	Submits a document to the driver's Subscriber channel, bypassing the driver cache. The document gets processed ahead of anything that might be in the cache at the time of the submission. It also means that the submission fails if the driver is not running.
-queueevent *<driver dn>* *<input filename>*	Submits a document to the driver's Subscriber channel by queuing the document in the driver cache. The document gets processed after anything that might be in the cache at the time of the submission. The submission won't fail if the driver isn't running.
-setlogevents *<dn>* *<integer ...>*	Sets Audit log events on the driver. The integer is the option of the item to log. See Table 12-7 on page 56 for the list of the integers to enter.
-clearlogevents *<dn>*	Clears all Audit log events that are set on the driver.
-setdriverset *<driver set dn>*	Associates a driver set with the server.
-cleardriverset	Clears the driver set association from the server.
-getversion	Shows the version of Identity Manager that is installed.
-initdriver object *<dn>*	Performs an internal initialization of data on a new Driver object. This is only for testing purposes.

Option	Description
-setnamedpassword *<driver dn>* *<name>* *<password>* *[description]*	Sets named passwords on the driver object. You specify the name, the password, and the description of the named password.
-clearnamedpassword *<driver dn>* *<name>*	Clears a specified named password.
-startjob *<job dn>*	Starts the specified job.
-abortjob *<job dn>*	Aborts the specified job.
-getjobrunningstate *<job dn>*	Returns the specified job's running state.
-getjobenabledstate *<job dn>*	Returns the specified job's enabled state.
-getjobnextruntime *<job dn>*	Returns the specified job's next run time.
-getjvmstats*<driver dn><output file>*	Shows details of memory, thread, runtime, classloader, garbage collection and OS that is installed.
-updatejob *<job dn>*	Updates the specified job.
-clearallnamedpaswords *<driver dn>*	Clears all named passwords set on a specific driver.

If a command line is executed successfully, it returns a zero. If the command line returns anything other than zero, it is an error. For example, 0 means success, and -641 means invalid operation. -641 is an eDirectory error code. Table 12-10 on page 61 contains other values for specific command line options.

Table 12-10 *Command Line Option Values*

Command Line Option	Values
-getstate	0- stopped
	1- starting
	2- running
	3- shutting down
	11- get schema
	Anything else that is returned is an error.
	The getstate option returns the state of the driver. It does not show the state.
	You can access the return value by using '$?' in UNIX/ Linux and '%errorlevel%' in Windows. The return value can be used in a batch or shell script.
-getstartoption	0- disabled
	1- manual
	2- auto
	Anything else that is returned is an error.
-getcachelimit	0- unlimited
	Anything else that is returned is an error.

Command Line Option	Values
-getjobrunningstate	0- stopped 1- running Anything else that is returned is an error.
-getjobenabledstate	0- disabled 1- enabled 2- configuration error Anything else that is returned is an error.
-getjobnextruntime	The return is the next scheduled time for the job in eDirectory time format (number of seconds since 00:00:00 Jan 1, 1970 UTC).

13 Synchronizing Objects

The following sections explain how data is synchronized between the Identity Vault and connected systems.

13.1 What Is Synchronization?

The actions commonly referred to as “synchronization” in Identity Manager refer to several different but related actions:

- Synchronization (or merging) of attribute values of an object in the Identity Vault with the corresponding attribute values of an associated object in a connected system.
- Migration of all Identity Vault objects and classes that are included in the filter on the Subscriber channel.
- Generation of the list of objects to submit to the driver’s Subscriber channel for synchronization or migration in response to a user request (a manual synchronization).
- Generation of the list of objects to submit to the driver’s Subscriber channel for synchronization or migration in response to enabling a formerly disabled driver, or in response to a cache error.

13.2 When Is Synchronization Done?

The Identity Manager engine performs object synchronization or merging in the following circumstances:

- A `<sync>` event element is submitted on the Subscriber or Publisher channel.
- A `<sync>` event element is submitted on the Subscriber channel in the following circumstances:
  - The state of the object’s association value is set to “manual” or “migrate.” (This causes an eDirectory event, which in turn causes the Identity Manager caching system to queue an object synchronization command in the affected driver’s cache.)
  - An object synchronization command is read from the driver’s cache.
- A `<sync>` event element is submitted on the Publisher channel in the following circumstances:
  - A driver submits a `<sync>` event element. No known driver currently does this.
  - The Identity Manager engine submits a `<sync>` event element for each object found as the result of a migrate-into-NDS query. These `<sync>` events are submitted by using the Subscriber thread, but are processed using the Publisher channel filter and policies.
- An `<add>` event (real or synthetic) is submitted on a channel and the channel Matching policy finds a matching object in the target system.
- An `<add>` event with an association is submitted on the Subscriber channel. This normally occurs only in exceptional cases, such as the bulk load of objects into eDirectory with DirXML-Associations attribute values.
- An `<add>` event is submitted on the Publisher channel and an object is found in eDirectory that already has the association value reported with the `<add>` event.

The Identity Manager engine generates synchronization requests for zero or more objects in the following cases:

- The user issues a manual driver synchronization request. This corresponds to the **Resync** button in the Driver Set property page in ConsoleOne, or to the **Synchronize** button on the iManager Identity Manager Driver Overview page.
- The Identity Manager engine encounters an error with the driver's cache and cannot recover from the cache error. The driver's cache is deleted and the engine generates object synchronization commands as detailed in Section 13.3, "How Does the Identity Manager Engine Decide Which Object to Synchronize?," on page 64.

13.3 How Does the Identity Manager Engine Decide Which Object to Synchronize?

The Identity Manager engine processes both manually-initiated and automatically-initiated synchronization requests in the same manner. The only difference in the processing of manually-initiated versus automatically-initiated driver synchronization requests is the starting filter time used to filter objects being considered for synchronization.

The starting filter time is used to filter objects that have modification or creation times that are older than the starting time specified in the synchronization request.

For automatically-initiated driver synchronization, the starting filter time is obtained from the time stamps of cached eDirectory events. In particular, the starting filter time is the earliest time for the cached events that have not yet been successfully processed by the driver's Subscriber channel.

For manually-initiated driver synchronization, the default starting filter time is the earliest time in the eDirectory database. In Identity Manager 2 and Identity Manager 3, an explicit starting filter time can also be set. In DirXML 1.1a there is no facility to set the starting filter time value for synchronization when manually initiating driver synchronization.

The Identity Manager engine creates a list of objects to be synchronized on the Subscriber channel in the following manner:

1. It finds all objects that have an entry modification time stamp greater than or equal to the starting filter time.
2. It finds all objects that have an entry creation time stamp greater than or equal to the starting filter time.
3. It adds a `synchronize object` command to the driver cache for each unique object found that has an entry modification time stamp greater than or equal to the starting filter time.

13.4 How Does Synchronization Work?

After the Identity Manager engine determines that an object is to be synchronized, the following processes occur:

1. Each system (the Identity Vault and the connected system) is queried for all attribute values in the appropriate filters.
   - eDirectory is queried for all values in the Subscriber filter, and for values that are marked for synchronization in Identity Manager 2.x and Identity Manager 3.x.
   - The connected system is queried for all values in the Publisher filter, and for values that are marked for synchronization in Identity Manager 2.x and Identity Manager 3.x.

2. The returned attribute values are compared and modification lists are prepared for the Identity Vault and the connected system according to Table 13-1 on page 66, Table 13-2 on page 67, and Table 13-3 on page 69.

   In the tables the following pseudo-equations are used:

   - `Left = Right` indicates that the left side receives all values from the right side.
   - `Left = Right[1]` indicates that the left side receives one value from the right side. If there is more than one value, it is indeterminate.
   - `Left += Right` indicates that the left side adds the right side values to the left side's existing values.
   - `Left = Left + Right` indicates that the left sides receives the union of the values of the left and right sides.

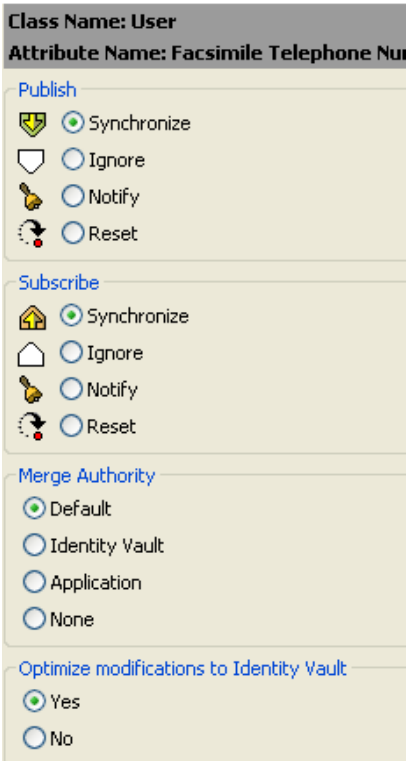
There are three different combinations of selected items in the filter, and each one creates a different output.

- Section 13.4.1, "Scenario One," on page 65
- Section 13.4.2, "Scenario Two," on page 66
- Section 13.4.3, "Scenario Three," on page 68

13.4.1 Scenario One

The attribute is set to **Synchronize** on the Publisher and Subscriber channels, and the merge authority is set to **Default**.

Figure 13-1 *Scenario One*



The following table contains the values that the Identity Manager engine synchronizes when the attribute is sent through a filter that is set to the configuration for Scenario One. The table shows different outputs depending upon whether the attribute comes from the Identity Vault or the Application, if the attribute is single-valued or multi-valued, and if the attribute is empty or non-empty.

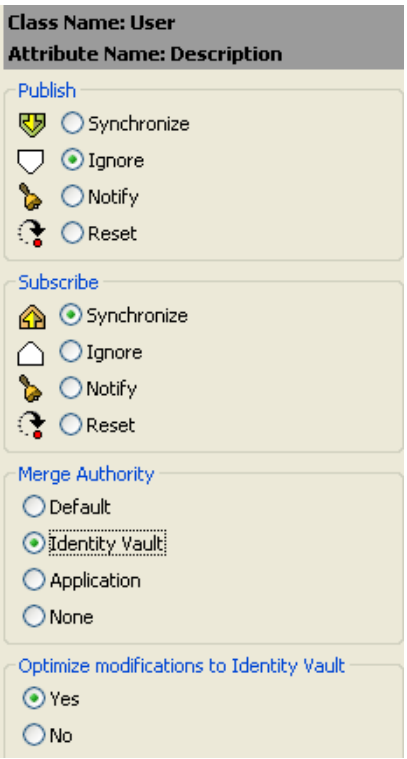
Table 13-1 *Output of Scenario One*

	Identity Vault single-valued empty	**Identity Vault single-valued non-empty**	**Identity Vault multi-valued empty**	**Identity Vault multi-valued non-empty**
Application single-valued empty	No change	App = Identity Vault	No change	App = Identity Vault[1]
Application single-valued non-empty	Identity Vault = App	App = Identity Vault	Identity Vault = App	Identity Vault + = App
Application multi-valued empty	No change	App = Identity Vault	No change	App = Identity Vault
Application multi-valued non-empty	Identity Vault = App[1]	App + = Identity Vault	Identity Vault = App	App = App + Identity Vault Identity Vault = App + Identity Vault

13.4.2 Scenario Two

The attribute is set to **Synchronize** only on the Subscriber channel, or it is set to **Synchronize** on both the Subscriber and Publisher channels. The merge authority is set to **Identity Vault**.

Figure 13-2 *Scenario Two*



The following table contains the values that the Identity Manager engine synchronizes when the attribute is sent through a filter that is set to the configuration for Scenario Two. The table shows different outputs depending upon whether the attribute comes from the Identity Vault or the Application, if the attribute is single-valued or multi-valued, and if the attribute is empty or non-empty.

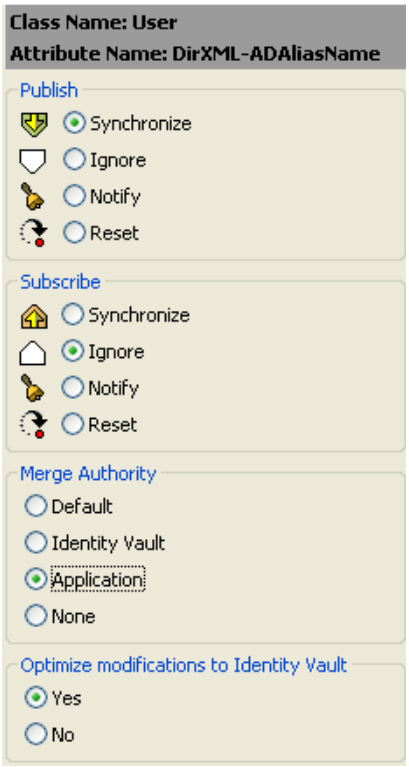
Table 13-2 *Output of Scenario Two*

	Identity Vault single-valued empty	**Identity Vault single-valued non-empty**	**Identity Vault multi-valued empty**	**Identity Vault multi-valued non-empty**
Application single-valued empty	No change	App = Identity Vault	No change	App = Identity Vault[1]
Application single-valued non-empty	App = empty	App = Identity Vault	Identity Vault = App	App = Identity Vault
Application multi-valued empty	No change	App = Identity Vault	No change	App = Identity Vault
Application multi-valued non-empty	App = empty	App = Identity Vault	App = empty	App = Identity Vault

13.4.3 Scenario Three

The attribute is set to **Synchronize** on the Publisher channel or the merge authority is set to **Application**.

Figure 13-3 *Scenario Three*



The following table contains the values that the Identity Manager engine synchronizes when the attribute is sent through a filter that is set to the configuration for Scenario Three. The table shows different outputs depending upon whether the attribute comes from the Identity Vault or the Application, if the attribute is single-valued or multi-valued, and if the attribute is empty or non-empty.

Table 13-3 Output of Scenario Three

	Identity Vault single-valued empty	Identity Vault single-valued non-empty	Identity Vault multi-valued empty	Identity Vault multi-valued non-empty
Application single-valued empty	No change	Identity Vault = empty	No change	Identity Vault = empty
Application single-valued non-empty	Identity Vault = App	Identity Vault = App	Identity Vault = App	Identity Vault = App
Application multi-valued empty	No change	Identity Vault = empty	No change	Identity Vault = empty
Application multi-valued non-empty	Identity Vault = App[1]	Identity Vault = App[1]	Identity Vault = App	Identity Vault = App

14 Association Statistics

By using the Identity Manager Association Statistics feature, you can find the association details of the identities managed by Identity Manager. Identity Manager uses the association statistics to obtain the association count for the Identity Manager drivers.

To obtain active, inactive, and system managed objects for a driver, run the association statistics job. You can schedule the association statistics job on a daily, weekly, monthly, or yearly basis. By default, the job is scheduled to run every week. To modify the configuration setting for this job, use iManager. For more information, see Modifying the Association Statistics Job Configuration in the NetIQ Identity Manager Jobs Guide.

The Association Statistics dashboard displays the association details. Alternatively, you can view the details by exporting the associations to a file.

NOTE

- The association count for the drivers is per server. If an object is associated with more than one driver, the association count is calculated uniquely for each driver.
- If you have more than 200,000 associations, NetIQ recommends you to set the maximum heap size for the driverset to 2 GB or more. For information about setting the heap size, see "Using iManager to Configure the Java Environment Parameters" on page 45.

To view the association statistics:

1. Log in to iManager.
2. Click to view the Identity Manager administration page.

   NOTE: Make sure that you enable pop-ups on your browser before you run the Association Statistics tool.

3. In the **Administration** section, click **Association Statistics**.

   Alternatively, you can access **Association Statistics** from the **Roles and Tasks** page. Expand **Identity Manager** node and click **Association Statistics**.

4. In the **Driverset** field, click to browse and select the driverset on which you want to run the association statistics.
5. Click **OK**. The association count displays the previously computed result.

   iManager displays the association count for active, inactive, and system managed objects for all the drivers associated with the driverset.

   iManager considers groups and organization units as system managed objects. iManager considers an object inactive, if the `Login Disabled` attribute in the object is set to true and the object has not been modified within the last 120 days. All the remaining objects are considered as active managed objects.

6. Click **Recompute** and then click **OK** to obtain the updated results.

   When a driver is disabled on the server, iManager does not display the driver in the dashboard.

7. To view the association count for drivers associated with a different server, select the server from the **Driver Information From** drop-down list.

8 Click **Export Association Statistics** to export the system details and association count details for the drivers associated with the server.

9 To export the objects associated with a specific driver, click ⬇ next to the required objects and save the file.

NOTE: In case of Fan-Out drivers, only unique objects are exported. If an object is associated with multiple instances of a Fan-Out driver, iManager displays all the association counts in the dashboard. However, if you choose to export the objects in a file, iManager exports only the unique objects.

---

10 Click **Actions** and select the required option to organize the association count dashboard.

15 Enabling Out of Band Sync

The Identity Manager drivers process events in the order they occur, which guarantees that all changes required for an event to successfully process are applied in the order they occur.

However, there are instances when you want a certain event to take precedence over others. For example, events that involve password changes, locking an account, or disabling an account should take precedence over other events. Identity Manager provides the Out of Band Sync feature that allows you to assign a higher priority to these events, so that they are processed before other events in the queue.

When you enable this feature for an attribute, Identity Manager creates a new cache for the driver for storing the Out of Band Sync events. You can enable or disable this functionality, by using the new setting included in the driver filter. Also, Identity Manager creates an Out of Band Sync status cache for maintaining the status of events, which are synchronized from the Out of Band Sync sync cache. By maintaining the status of events in the Out of Band Sync status cache, Identity Manager drivers avoid duplication of events or sending of old events from the base driver cache.

15.1 Enabling Out of Band Sync Using Designer

To enable this feature, open a driver's filter, select the desired attribute, and then set the option **Perform Out of Band Sync (Subscriber)** to Yes. This option is available only for attributes, not classes, and is set to No by default.

15.2 Enabling Out of Band Sync Using iManager

Perform the following steps:

1. In iManager, open the Identity Manager Administration page.
2. In the **Administration** list, click **Identity Manager Overview** to display the Identity Manager Overview page.
3. In the **Driver Sets** list, select the desired driver set to display the Driver Set Overview page.
4. Select the desired driver to display the Driver Overview page.
5. Click the **Driver Filter** icon to open the Filter page.
6. Click the attribute for which you want to enable Out of Band Sync, and then set **Perform Out of Band Sync (Subscriber)** to **Yes**. By default, it is set to **No**.

15.3 Specifying the Out of Band Sync Status Interval

When you enable Out of Band Sync, the driver maintains a status cache to store the status of the events that are successfully processed from the Out of Band cache. This status cache is used to ensure that duplicate or old events are not sent across when events from the normal driver cache are processed.

The Out of Band Sync status cleanup interval specifies the time in minutes, after which the entries in the event out of band sync status cache are checked for cleanup. This cleans up only the status entries of those events that are already processed from the normal cache. It takes effect only if you enable Out of Band Sync.

The driver includes a new GCV for the Out of Band Sync status cleanup interval on the DriverSet, namely `dirxml.engn.ps.stat.purge.interval`. This GCV can take a minimum value of 1 and a maximum value of 300 minutes. The default value is 5 minutes. If this GCV does not exist on the Driverset, the driver assumes a default value of 5 minutes.

You can use the `dirxml.engn.ps.stat.purge.interval` GCV to set the Out of Band Sync status cleanup interval, as shown in this example:

```
<definition critical-change="true" display-name="Out of Band Sync status purge
interval" name="dirxml.engn.ps.stat.purge.interval" range-hi="300" range-lo="1"
type="integer">
<description>Specify the time in minutes, after which the entries in the
Out of Band Sync status cache will be checked for cleanup.</description>
<value>5</value>
</definition>
```

For information about how to view the Out of Band Sync cache, see Section 8.2, “Viewing the Out of Band Sync Cache,” on page 40.

16 Migrating and Resynchronizing Data

Identity Manager synchronizes data when the data changes. If you want to synchronize all data immediately, you can choose from the following options in iManager:

- **Migrate Data from Identity Vault:** Allows you to select containers or objects you want to migrate from the Identity Vault to an application. When you migrate an object, the Identity Manager engine applies all of the Matching, Placement, and Create policies, as well as the Subscriber filter, to the object.
- **Migrate Data into Identity Vault:** Assumes that the remote application can be queried for entries that match the criteria in the Publisher filter.
- **Synchronize:** The Identity Manager engine looks in the Subscriber class filter and processes all objects for those classes. Associated objects are merged. Unassociated objects are processed as Add events.

To use one of the options described above:

1. In iManager, in the **Roles and Tasks** view, click **Identity Manager > Identity Manager Overview**.
2. Browse to and select the driver set where the driver exists, then click **Search**.
3. Click the driver icon, then click the **Migrate** tab.
4. Click the appropriate migration button.

For more information, see Chapter 13, “Synchronizing Objects,” on page 63.

17 Viewing Identity Manager Processes

To view Identity Manager processing events, use DSTrace. You use this only during testing and troubleshooting Identity Manager. Running DSTrace while the drivers are in production increases the load on the Identity Manager server and can cause events to process very slowly.

To see Identity Manager processes in DSTrace, you add values to the driver set and the drivers. You can do this in Designer and iManager.

17.1 Adding Trace Levels in Designer

You can add trace levels to each driver or to the driver set.

17.1.1 Driver

1. In an open project in Designer, select the driver in the Outline view.
2. Right-click and select **Properties**, then click **8. Trace**.
3. Set the parameters for tracing, then click **OK**. See Table 17-1 for more information about the driver trace parameters.

   If you set the parameters only on the driver, information for only that driver appears in the DSTrace log.

Table 17-1 *Driver Trace Parameters*

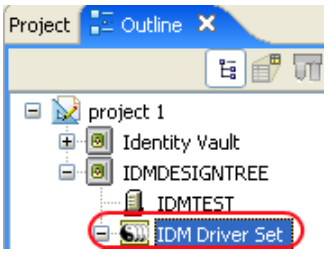
Parameter	Description
Trace level	As the driver trace level increases, the amount of information displayed in DSTrace increases. Trace level one shows errors, but not the cause of the errors. If you want to see password synchronization information, set the trace level to five. If you select **Use setting from Driver Set**, the value is taken from the driver set.
Trace file	Specify a file name and location of where the Identity Manager information is written for the selected driver. If you select **Use setting from Driver Set**, the value is taken from the driver set.
Trace file encoding	The trace file uses the system's default encoding. You can specify another encoding if desired.

Parameter	Description
Trace file size limit	Allows you to set a limit for the Java trace file. **WARNING:** If you set the file size to unlimited, the file continues to grow in size, and consumes all the disk space. Set the file size to unlimited, only for a limited time and carefully monitor the free disk space. **NOTE:** The trace file is created in multiple files. Identity Manager automatically divides the maximum file size by ten and creates ten separate files. The combined size of these files equals the maximum trace file size. If you select **Use setting from Driver Set**, the value is taken from the driver set.
Trace name	The driver trace messages are prepended with the value entered instead of the driver name. Use if the driver name is very long.

17.1.2 Driver Set

Setting the trace level on the driver set creates very long traces that are hard to read. All events from all drivers are included in one trace file. If you are troubleshooting an issue, it is best to set the trace only on the driver you are troubleshooting.

1 In an open project in Designer, select the driver set in the **Outline** view.



2 Right-click and select **Properties**, then click **5. Trace**.

3 Set the parameters for tracing, then click **OK**. See Table 17-2 on page 78 for more information about the driver set trace parameters.

If you set the trace level on the driver set, all drivers appear in the DSTrace logs.

Table 17-2 *Driver Set Trace Parameters*

Parameter	Description
Driver trace level	As the driver trace level increases, the amount of information displayed in DSTrace increases. Trace level one shows errors, but not the cause of the errors. If you want to see password synchronization information, set the trace level to five.
XSL trace level	DSTrace displays XSL events. Set this trace level only when troubleshooting XSL style sheets. If you do not want to see XSL information, set the level to zero.
Java debug port	Allows developers to attach a Java debugger.

Parameter	Description
Java trace file	When a value is set in this field, all Java information for the driver set is written to a file. The value for this field is the patch for that file. As long as the file is specified, Java information is written to this file. If you do not need to debug Java, leave this field blank.
Trace file size limit	Allows you to set a limit for the Java trace file. **WARNING:** If you set the file size to unlimited, the file continues to grow in size, and consumes all the disk space. Set the file size to unlimited, only for a limited time and carefully monitor the free disk space. **NOTE:** The trace file is created in multiple files. Identity Manager automatically divides the maximum file size by ten and creates ten separate files. The combined size of these files equals the maximum trace file size.

17.2 Adding Trace Levels in iManager

You can add trace levels to each driver or to the driver set.

17.2.1 Driver

1. In iManager, open the Identity Manager Administration page.
2. Open the properties for the driver set that contains the driver you want to configure:
   - **2a** In the **Administration** list, click **Identity Manager Overview**.
   - **2b** If the driver set is not listed on the **Driver Sets** tab, use the **Search In** field to search for and display the driver set.
   - **2c** Click the driver set to open the Driver Set Overview page.
3. Click the upper right corner of the driver, then click **Edit properties**.
4. Select the **Misc** tab for the driver.
5. Set the parameters for tracing, then click **OK**. See Table 17-1 on page 77 for information.

17.2.2 Driver Set

1. In iManager, open the Identity Manager Administration page.
2. Open the properties for the driver set whose parameters you want to configure:
   - **2a** In the **Administration** list, click **Identity Manager Overview**.
   - **2b** If the driver set is not listed on the **Driver Sets** tab, use the **Search In** field to search for and display the driver set.
   - **2c** Click the driver set to open the Driver Set Overview page.
   - **2d** Click the **Driver Set** menu, then click **Edit Driver Set properties**.

3 Select the **Misc** tab for the driver set.

4 Set the parameters for tracing, then click **OK**. See Table 17-2 on page 78 for information about these parameters.

17.3 Capturing Identity Manager Processes to a File

Identity Manager processes are saved to a file by using a parameter on the driver or through DSTrace. The parameter on the driver is the Trace file parameter.

The driver processes that are captured through DSTrace are the processes that occur on the Identity Manager engine. If you use the Remote Loader, you need to capture a trace on the Remote Loader at the same time as you are capturing the trace on the Identity Manager engine.

The following methods help you capture and save Identity Manager processes through DSTrace on different OS platforms.

17.3.1 Windows

1 Open the Control Panel > **NDS Services** > **dstrace.dlm**, then click **Start**.

2 In the NDS Server Trace Utility window, select **Edit** > **Options**, then click **Clear All**.

This clears all of the default flags.

3 Select **DirXML** and **DirXML Drivers**.

4 Click **OK**.

5 Select **File > New**.

6 Specify the filename and location of where you want the DSTrace information saved, then click **Open**.

7 Wait for the event to occur.

8 Select **File > Close**.

This stops the information from being written to the log file.

9 Open the file in a text editor and search for the event or the object you modified.

17.3.2 UNIX

1 Enter `ndstrace` to start the ndstrace utility.

2 Enter `set ndstrace=nodebug`

This turns off all trace flags currently set.

3 Enter `set ndstrace on`

This displays trace messages to the console.

4 Enter `set ndstrace file on`

This captures trace messages to the file `ndstrace.log` in the directory where eDirectory is installed. By default it is `/var/nds`.

5 Enter `set ndstrace=+dxml`

This displays the Identity Manager events.

6 Enter `set ndstrace=+dvrs`

This displays the Identity Manager driver events.

7 Wait for the event to occur.

8 Enter `set ndstrace file off`

   This stops the logging of information to the file.

9 Enter `exit` to quit the ndstrace utility.

10 Open the file in a text editor. Search for the event or the object that was modified.

17.3.3 iMonitor

iMonitor allows you to get DSTrace information from a web browser. It does not matter where Identity Manager is running. The following files run iMonitor:

- `NDSIMON.DLM` Runs on Windows
- `ndsimonitor` Runs on UNIX

1 Access iMonitor from http://*server_ip*:8008/nds.

   Port 8008 is the default port.

2 Enter a username and password with administrative rights, then click **Login**.

3 Select **Trace Configuration** on the left side.

4 Click **Clear All**.

5 Select **DirXML and DirXML Drivers**.

6 Click **Trace On**.

7 Select **Trace History** on the left side.

8 Click the document with the **Modification Time** of **Current** to see a live trace.

9 Change the **Refresh Interval** if you want to see information more often.

10 Select **Trace Configuration** on the left side, then click **Trace Off** to turn the tracing off.

11 You can view the trace history by selecting Trace History. The files are distinguished by their time stamps.

If you need a copy of the HTML file, the default location is:

- Windows: `Drive_letter:\Novell\NDS\ndsimon\dstrace\*.htm`
- UNIX/Linux: `/var/nds/dstrace/*.htm`

17.3.4 Remote Loader

You can capture the events that occur on the computer running the Remote Loader service.

1 Launch the Remote Loader Console by clicking the icon.

2 Select the driver instance, then click **Edit**.

3 Set the **Trace Level** to 3 or above.

4 Specify a location and file for the trace file.

5 Specify the amount of disk space that the file is allowed.

6 Click **OK** twice to save the changes.

You can also enable tracing from the command line by using the switches in the following table. For more information, see "Configuring the Remote Loader and Drivers" in the *NetIQ Identity Manager Setup Guide*.

Table 17-3 Command Line Tracing Switches

Switch	Secondary Name	Parameter	Description
-trace	-t	integer	Specifies the trace level. This is used only when hosting an application shim. Trace levels correspond to those used on the Identity Manager server. Example: `-trace 3` or `-t3`

-tracefile	-tf	filename	Specifies a file to write trace messages to. Trace messages are written to the file if the trace level is greater than zero. Trace messages are written to the file even if the trace window is not open.
			
			Example:
			
			`-tracefile c:\temp\trace.txt`
			
			or
			
			`-tf c:\temp\trace.txt`

-tracefilemax	-tfm	size	Specifies the approximate maximum size that trace file data can occupy on disk. If you specify this option, there is a trace file with the name specified using the tracefile option and up to 9 additional “roll-over” files. The roll-over files are named using the base of the main trace filename plus “_n”, where n is 1 through 9. The size parameter is the number of bytes. Specify the size by using the suffixes K, M, or G for kilobytes, megabytes, or gigabytes. If the trace file data is larger than the specified maximum when the Remote Loader is started, the trace file data remains larger than the specified maximum until roll-over is completed through all 10 files. Example: `-tracefilemax 1000M or -tfm 1000M`

17.4 Setting Permission for Monitoring Trace Files

In this release, the Identity Manager install program creates a new group named `idvadmin` on Linux. The permission for the trace file is set to 640. To enable a user other than an eDirectory owner to monitor the trace files, you must add that user to the `idvadmin` group.

18 Editing Driver Configuration Files

Driver configuration files are replaced with packages. You can still use driver configuration files, but all updated driver information is contained in packages. For more information, see "Managing Packages" in the *NetIQ Designer for Identity Manager Administration Guide*.

You must have a good knowledge of XML to use the information in this section. This information allows you to add custom prompts to drivers you have created.

18.1 Variables in a Driver Configuration File

For the iManager plug-ins, several node types are defined for the driver configuration files. The following is a list of actions that the Identity Manager engine supports:

- Prompting once for a value that is used repeatedly throughout a single driver configuration file.
- Prompting once for a value that is used across multiple driver configuration files, as part of the Import Drivers Wizard.
- Allowing the user to select a value from a drop-down list of values.
- Global modification of the driver configuration files according to a contained XSL style sheet.
- Built-in variables that can be referenced without declaring them to access information about the driver and its environment. For example, tree name, driver set name, driver set DN, server name, server DN, driver name, and driver DN.
- The ability to layer prompts. It is possible to ask the user multiple sets of questions, with the second and later sets being controlled by the user's responses to prior sets of questions. For more information, see Section 18.2, "Flexible Prompting in a Driver Configuration File," on page 86.

The primary new node types are:

- **variable-decl:** Allows you to define driver configuration variables that are prompted for and placed into a driver configuration file during its import. Multiple `variable-decl` blocks can be used to define a layered set of prompts. For more information, see Section 18.2, "Flexible Prompting in a Driver Configuration File," on page 86.
- **variable-ref:** Used to reference a variable defined in a `variable-decl` within your driver configuration files.
- **xsl-modify:** Used to globally modify the driver configuration file after all variables and prompts have been resolved. The contents of this node are extracted and used as an XSL style sheet that is applied to the patched driver configuration file.

To view the driver configuration file XML extensions, see DriverConfigXMLExtension.txt (../samples/DriverConfigXMLExtension.txt).

In addition, be aware of the following:

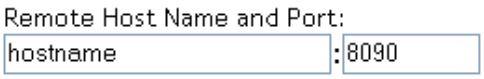
- Section 18.1.1, "General Notes," on page 84
- Section 18.1.2, "Import Driver Notes," on page 86

18.1.1 General Notes

Review the following general notes:

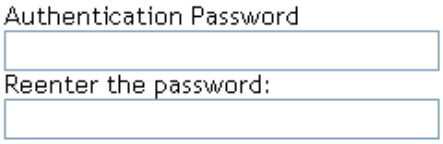
- A `variable-decl` can contain `text-var` but not `node-var`. It can contain `variable-refs` as long as the order they are resolved is taken into account.
- If a `variable-decl` contains an optional prompt attribute and an optional prompt-type attribute and does not contain an optional `browse="yes"` attribute setting, the prompt-type is treated as follows:
  - A prompt-type of `"ipa"` results in two edit fields. See Figure 18-1 for an example. The value the user specifies for the first part is appended by a colon (:) and the value the user specifies for the second part in the value is rendered by the variable.

    Figure 18-1 *Two Edit Fields*

  - A prompt-type of `"password"` results in two password edit fields. See Figure 18-2 for an example. The first prompt is for the actual password, and the second prompt is used to verify that the password specified in the first field is correct. The value rendered by the variable reference is the password.

    Figure 18-2 *Two Password Fields*

  - A prompt-type of `"hidden"` results in a field that is not displayed, but is checked to make sure a previous condition is met before proceeding to the next screen.
  - Any other prompt-type value is ignored.
- If a `variable-decl` contains an optional description attribute in addition to a prompt attribute, the description appears in the UI along with the prompt. The purpose of the description attribute is to allow a complete description of what is being asked for along with a simple prompt.

  For example:

  ```
  <text-var
          var-name="eProv.Company"
          prompt="Company name:" description="Please enter the name of your
  company. This must be the same name as you entered during the initial
  installation."
          browse="no">
        Novell
      </text-var>
  ```

  Note the differences between the `prompt` and the `description`.

  If a `variable-decl` contains an optional description attribute and an optional highlight attribute, the highlight attribute is handled as follows:

  - If the highlight is not two characters in length, it is ignored.

- If the highlight is two characters in length, all occurrences of the first character are preceded with HTML tags to turn on highlighting and all occurrences of the second character are followed by HTML tags to turn off highlighting.

  For example:

  ```
  <text-var
              var-name="foo"
              prompt="Foo:"
              description="Please enter some foo.  Format:  [foo looks like
  this]">
            Bar
          </text-var>
  ```

  When the description appears, [foo looks like this] appears and is highlighted.

- If a `variable-decl` contains a `browse="yes"` attribute, it is assumed to supply a DN and is formatted in slash format by default when applied to the driver configuration file.

  This is assumed to be more generally useful for driver writers and can be overridden on a per reference basis by adding a `dn-format="dot"` attribute to `variable-ref` nodes that reference it.

- If a `variable-ref` is to `text-var` with a `prompt-type="ipa"` attribute, a `part="..."` attribute can be included in the `variable-ref`. Supported parts are `"ipa"` and `"port"`. If `part="ipa"` is specified, only the IP address portion of the variable's value is returned. If `part="port"` is specified, only the port portion of the variable's value is returned. Any other setting is ignored and the variable's entire value is returned.
- A `dn-format` attribute on a `variable-ref` that does not have `browse="yes"` specified in its `variable-decl` causes that variable to be treated as though it supplies a DN. The DN is rendered in the `dn-format` specified.
- The supported values for the `dn-format` attribute are `"dot"` and `"slash"`. Any other value is treated as `"slash"` without an error being generated.
- The built-in defined variables are:
  - System.TreeName
  - System.DSetDN
  - System.DSetName
  - System.DriverDN
  - System.DriverName
  - System.ServerDN
  - System.ServerName
- Built-in variables can be overridden. If you include a `variable-decl` for a variable named with one of the built-in variable names, your definition overrides the built-in variable of the same name.

  This is implemented after all variable declarations have been processed (prompting, ...). Just before the code begins applying values, it walks the variables and defines all the built-ins that haven't otherwise been defined.

- The built-in variables that provide a DN can include a `dn-format` attribute in the variable-ref to control the format the DN is rendered in. By default, these are rendered in slash format.
- A `node-var` and a `text-var` cannot be named the same thing. They use the same namespace.

- If a `variable-ref` references a `node-var` and contains an `attr-name` attribute, the XSL string value of the `node-var` is stored in as the named attribute on the parent node of the `variable-ref`. The `node-var` used in this manner can have a `node-name` attribute of `"#text"`, which removes the requirement of having an `attr-name` attribute on the `node-var`.

  A `node-var` with a node-name of `"#text"` can be referenced only in this manner. Any other reference causes an error when the driver configuration file is imported.
- At patch time after the user has responded to the prompts but before the XML is actually imported. patching is done in the following order:
  1. `The text-var variable-refs` are processed.
  2. `The node-var variable-refs` are processed.
  3. `The xsl-modify` commands are processed.
  4. The `ds-object` commands are processed.
     - Patching is performed in the `variable-decl` so that by the time the `node-var` commands are patched, all the `text-var` commands contained in them have been resolved.
     - The `node-var` commands cannot contain `node-var variable-ref`.

18.1.2 Import Driver Notes

Review the following import driver notes:

- The order in which the selected driver configuration files are processed is not defined and no order can be assumed.
- For `variable-decl` commands:
  - Commands from selected drivers are carried forward from driver to driver.
  - The first one wins.
    - The first driver encountered that defines a variable foo has its variable foo used throughout all remaining driver configuration files. Care must be taken to coordinate this between drivers.
    - A variable foo that is used in multiple driver configuration files is prompted for only once, with the first driver configuration file encountered that declares it.
- Built-in variables are not propagated between drivers. This includes any variables you define to override a built-in variable. The built-in variables for each driver are handled separately.
- Other prompting is handled unchanged at the beginning of each driver configuration file's import sequence.
- Refer to Section 18.2, "Flexible Prompting in a Driver Configuration File," on page 86 for information about prompt layering supported by flexible prompting.

18.2 Flexible Prompting in a Driver Configuration File

`variable-decl` blocks can be marked to allow them to be prompted for separately, based on user input.

```
DTD changes:
-----------
* <!ENTITY % CompareMode "equals | not-equals">

  <!--******************************************************** -->
  <!--The variable-decl element contains definitions of variables   -->
  <!-- whose values can be prompted for and referred to throughout  -->
  <!-- the pre-configured driver file.                              -->
  <!-- ********************************************************** -->
  <!ELEMENT variable-decl(
    node-var*,
    text-var*)>
*  <!ATTLIST variable-decl
*    <!-- The following are used in the support of flexible -->
*    <!-- prompting.                                         -->
*    use-when-var  CDATA #IMPLIED
*    use-when-value  CDATA #IMPLIED
*    use-when-mode  (%CompareMode) "equals"
  >

* Added for flexible prompting.
```

Semantics

1. All `variable-decl` blocks with no `use-when-var` attribute are added to the prompt set.
2. All `variable-decl` blocks with a `use-when-var` attribute where the variable is defined and the variable value meets the condition are added to the prompt set.

   Variable analysis includes built-ins and variables carried forward from any previous import.
3. The user is prompted.
4. The prompt set is emptied and Steps 2 and 3 are repeated until there are no more prompts to process or all `variable-decl` blocks have been processed.
5. The import proceeds as before.

NOTE: The comparisons for `use-when-var` variables are case-insensitive.

Example 1

```
     <variable-decl use-when-var="varCheck" use-when-value="Fu" use-when-
mode="equals">
    <text-var prompt="When Fu?" var-name="fuVar"/>
  </variable-decl>

  <variable-decl use-when-var="varCheck" use-when-value="Fu" use-when-mode="not-
equals">
    <text-var prompt="When not Fu?" var-name="fuVar"/>
  </variable-decl>

  <variable-decl>
    <text-var prompt="Which other <variable-decl>?" var-name="varCheck">
      <dropdown>
        <value>Fu</value>
        <value>Bar</value>
      </dropdown>
    </text-var>
  </variable-decl>
```

In this example, the user would be prompted with a drop-down list. The description of the drop-down list is “Which other <variable-decl>?” The options in the list are Fu and Bar.

If the user select Fu from the drop-down and clicks **Next**, he or she is prompted again with a box. The description of the box is “When Fu?”

If the user selects anything else from the drop-down list and clicks **Next**, he or she is prompted with another box. The description of the box is “When not Fu?”

Example 2

```
<variable-decl use-when-var="varCheck" use-when-value="Fu">
    <text-var prompt="When Fu?" var-name="fuBarVar"/>
  </variable-decl>

  <variable-decl use-when-var="varCheck" use-when-value="Bar">
    <text-var prompt="When when Bar?" var-name="fuBarVar"/>
  </variable-decl>

  <variable-decl>
    <text-var prompt="Which other <variable-decl>?" var-name="varCheck"/>
  </variable-decl>
```

In this example, the user is presented with a box. The description of the box is “Which other <variable-decl>?” If the user specifies “Fu” in the box and clicks **Next**, he or she is presented with another box. The description on the second box is “When Fu?”

If the user specifies “Bar” in the box and clicks **Next**, he or she is presented with a box. The description is “When Bar?” If he or she specifies anything else, there are no further prompts and the variable fuBarVar is not defined.

18.3 Viewing the Informal Identity Manager Driver Configuration DTD

To view the informal Identity Manager Driver Configuration DTD, go to PCDrivers.txt (../samples/PCDrivers.txt). The DTD cannot be used for validation. It is not a valid XML DTD. It is a mechanism to document the valid constructs in a driver configuration file.

19 When and How to Use Global Configuration Values

Global Configuration Values (GCVs) are settings that are similar to driver parameters. GCVs are constant values, not global variables. There is no way to change a GCV value at runtime. The GCVs are globally accessible to the driver and driver set, but not to the tree or network.

Given these facts, GCVs are constants and cannot be changed at runtime, but they can be consumed by all drivers in a driver set or by all policies in a driver. This makes GCVs a very powerful configuration tool. Use the guidelines in the following sections when developing driver configuration files with GCVs.

19.1 Using GCVs to Adapt the Driver Configuration File to Changing Environments

GCVs help driver configuration files adapt to changing environments by externalizing environment-specific, such as placement contexts, domain names, IP addresses, usernames, dates, and times.

It is a bad practice to configure the driver to prompt for information during import and then add the answer directly into policy code. The better approach is to store the answer in a GCV and make the policies reference the GCV. If the answer to the prompt is wrong or the environment changes, the answer also needs to change. It is much simpler to change a single GCV value than to go through all policies that have the value and change the value in each policy.

By adding the configuration data as a GCV, the GCVs become the controls of the driver.

19.2 When Not to Use GCVs

If there are certain configuration values that must never change, they should not be surfaced in a GCV.

All information in a GCV can be easily changed or tuned. To keep certain configuration values and implementation details from being changed, add this information directly into the code. Everything that an administrator should see and be able to change should go into a GCV. Everything that only a developer sees or changes should go directly into the driver policy code.

The only reason to add a static value to a GCV is if it is used in many different places and it does not make sense to add it directly to the code.

19.3 When to Use Driver Set GCVs, Driver GCVs, or Global Configuration Objects in Packages

GCVs can be defined on a driver or driver set. The GCV location determines its scope and visibility. GCVs defined on the driver set are visible to all drivers and their policies in that driver set. GCVs defined on a driver can be consumed only by policies of the driver.

You can also create Global Configuration objects that contain GVCs and should be used when the configuration values are being referenced from content contained in packages. GCVs on the driver or driver set cannot be packaged. However, GCVs within a Global Configuration object can be installed, upgraded, downgraded, or removed with packages.

The scope of the Global Configuration object is determined by which driver or driver set the Global Configuration object is included in the Global Configuration list. Each driver and driver set has a Global Configuration list. The list is edited through the driver or driver set properties. On a driver, the Global Configuration list is located under the Driver Configuration option. On a driver set, the Global Configuration list is located under the Configuration option.

The GCV definitions in a Global Configuration object are identical to the GCVs that are contained on a driver or driver set. The precedence of GCV is as follows:

- GCVs from the driver
- GCVs from the driver Global Configuration list (Global Configuration objects)
- GCVs from the driver set
- GCVs from the driver set Global Configuration list (Global Configuration objects)

If a GCV defined on a driver has the same name as a GCV defined on the driver set, the driver GCV takes precedence in all policies that belong to that driver. All drivers that do not explicitly define the GCV on the driver, inherit this GCV from the driver set.

Global Configuration objects can be contained in a driver, driver set, or library. For more information, see "Global Configuration Value Definition Editor" in the *NetIQ Identity Manager Policies in Designer* guide.

19.4 Naming Convention for GCVs

The GCV naming convention addresses the different types of GCVs, the different purposes of the GCVs, and the scopes of the GCVs.

```
[<purpose/scope>.]<group>.[<subgroup>.]<name>
```

- **Purpose/Scope:** The prefix idv (Identity Value) is used with the driver set GCVs. Driver-specific values are drv or driver.
- **Group:** Groups GCVs that belong together. Examples for groups could be communications, notification, logging, or security.
- **Subgroup:** Form subgroups within groups, such as smtp or snmp.
- **Name:** Descriptive name for the GCV.

For example:

```
idv.notification.smtp.ip
idv.notification.smtp.user
idv.notification.smtp.pwd
idv.notification.snmp.ip
idv.dit.data.locations
idv.dit.system.rbs
driver.samba.server
```

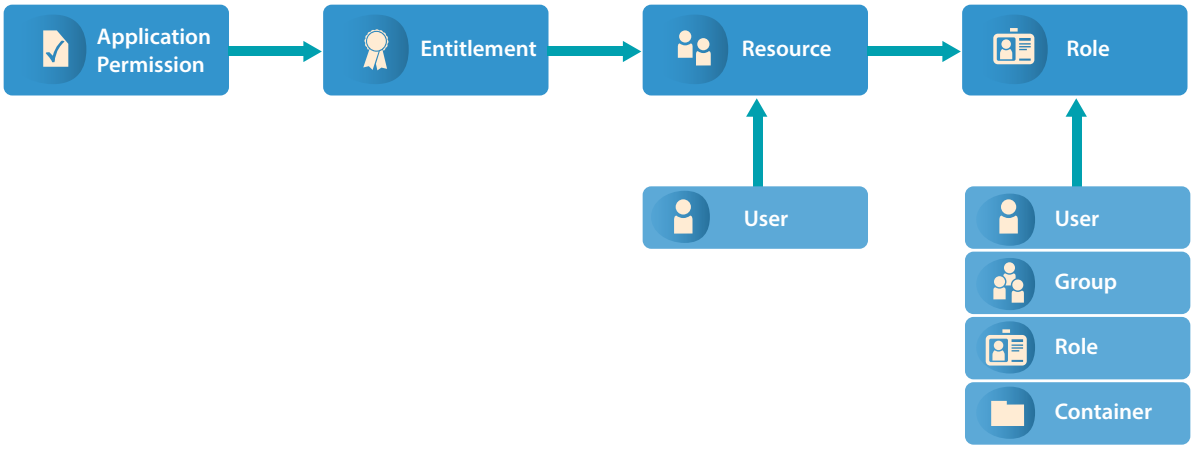
20 Understanding Permission Collection and Reconciliation Service

This chapter provides an overview of enabling Identity Manager drivers for supporting default and custom entitlements.

20.1 Overview

Identity Manager uses a resource model for event-based reconciliation of external system permission assignments. This resource model was introduced in Identity Manager 4.0 to simplify the entitlement model and provide you a convenient way to perform resource-based provisioning actions. The resource-based provisioning actions allow you to manage resource definitions and resource assignments within your organization.

Figure 20-1 *Identity Manager Resource Model*



You can map resource assignments to users or to roles within your organization. For example, you can use resources to:

- Make resource requests for users
- Create resources and map them to entitlements

A resource is any digital entity such as a user account, computer, or database that a business user needs to be able to access. Identity Manager provides a way to manage permissions assignments in connected systems. You can think of an entitlement as a permission slip. A resource definition can have no more than one entitlement bound to it. You can bind a resource to the same entitlement more than once, with different entitlement values for each resource. For more information about entitlements in Identity Manager, see the *NetIQ Identity Manager Entitlements Guide*.

You can assign resources only to users. You cannot assign them to groups or containers. If the resource is mapped to a role then the role can be assigned to a group or container resulting in assignment of mapped resource to all the users in that group or container.

Before you can assign resources to users, these resources must be defined in the Identity Manager Resource Catalog. The Resource Catalog is a storage repository of all resources definitions and supporting data needed by the Role and Resource Subsystem. The **Resources** tab of the **Roles and Resource Administrator** allows you to view resources that have been previously defined in the Resource Catalog. It also lets you create new resources and modify, delete, and assign existing resources.

This model works well when the source of assignment changes or permission changes is Identity Manager and you need to update connected systems with these changes. However, you need additional functionality to synchronize the permission assignment changes from connected systems to Identity Manager.

For example, if a connected system administrator provides additional permissions to existing users or creates new users, the Identity Manager driver publishes these changes to the Identity Vault. With the default content shipped with the Identity Manager driver, the changes in the permission assignments are not directly updated to the User Application Resource Catalog. You need to customize the package content so that Resource Catalog reflects the current state of connected system.

Identity Manager now provides an out-of-box solution to update the resource when permission assignments are published to the Identity Vault as they occur in connected systems. It provides a way to dynamically create an entitlement and a dynamic resource for each permission and load entitlement values into the resource catalog of Identity Manager Roles Based Provisioning Module.

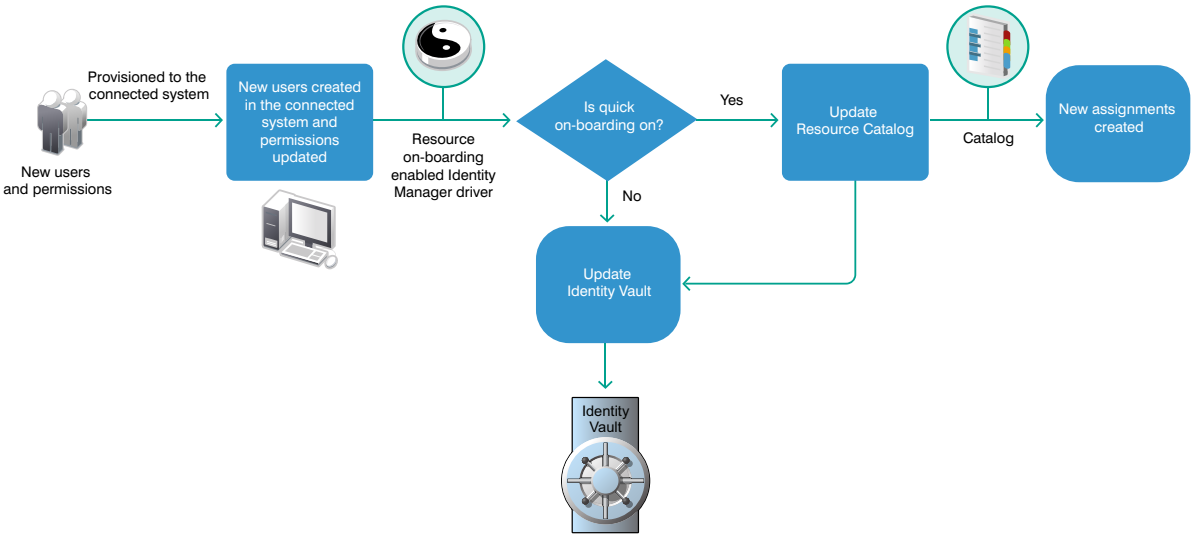
An Identity Manager driver installed with the Permission Collection and Reconciliation Service (PCRS) package content can update the Resource Catalog with the permissions in the connected system. The driver can automatically assign or revoke resources to Identity Manager identities based on attribute values changed in connected system. For a newly installed driver with this package content, you can migrate users and groups (for example, Active Directory) into the Identity Vault, which updates the Resource Catalog with the current state of connected system.

For example, you have `User1` and `User2` in the connected system (Active Directory). These users are part of a group namely `Group1` with the required permissions. A driver enabled with PCRS allows you to update the user permissions in the RBPM. To achieve this, migrate the users from the Active Directory to the Identity Vault. The PCRS policies receives this event and updates the Resource Catalog with the resource assignments.

IMPORTANT: NetIQ recommends that you migrate the users from the connected system to the Identity Vault. Group migration is not recommended because of performance issues.

You can dynamically create resources with custom entitlements populated with permission values from the connected system, and permission assignments between Identity Manager resource/entitlement model and connected systems. Figure 20-2 depicts the flow of permissions from a connected system to the Resource Catalog and then into the Identity Vault.

Figure 20-2 Flow of New Users and Permission Assignments



You can use Designer to create custom entitlements on any driver enabled with this functionality to reflect the current state of connected systems. You use the entitlement attributes in the CSV file to create new custom entitlements. Ensure that you include the custom entitlements in the specified format in the CSV file.

The CSV file includes the entitlement value, entitlement display name on the User Application, and the description of the entitlement value. You can view the display name and the description for the custom entitlements in the User Application while assigning resources to the users.

Table 18-1 list the CSV file attributes:

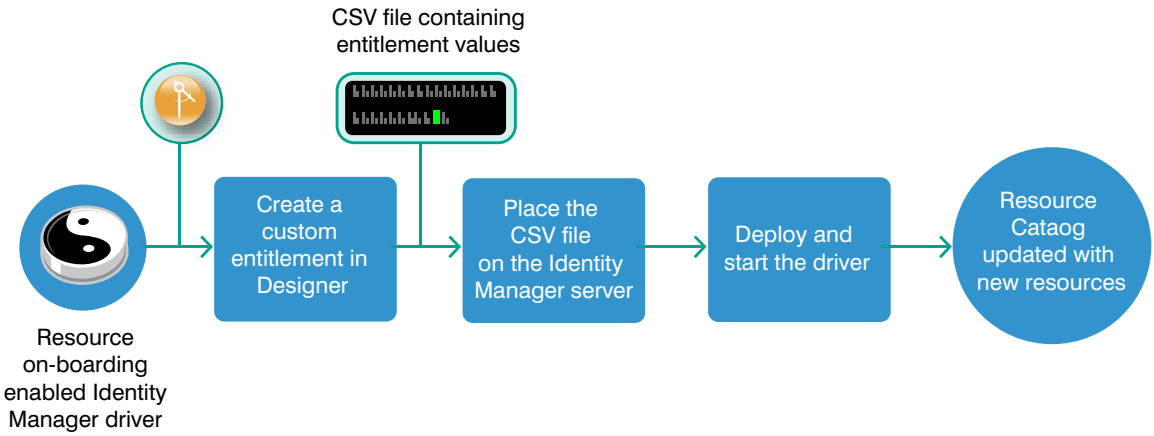
Table 20-1 CSV File Attributes

Attribute	Description
entitlement value	The custom entitlement value you want to add to the Resource Catalog.
entitlement display name	The custom entitlement name you want to display in the User Application.
entitlement description	The description for the new custom entitlement value.

You must place the CSV file containing the entitlement values on the server where Identity Manager engine is installed. Ensure that you update the **csvFile** column in the `PermissionNameToFile` mapping table with the correct path for the CSV file.

Figure 20-3 illustrates how the driver updates the Resource Catalog with custom permission assignments in entitlement changes.

Figure 20-3 Custom Entitlements Creation



After you create, deploy, and start the driver, the driver automatically creates a new resource based on the entitlement configuration and populates the resource with the entitlement values from the CSV file. The new custom entitlement and the corresponding resource object is created in the **PermissionEntMapping** table. When the permission assignments change in connected system, the driver policies consume the modified permission values and update the Resource Catalog.

The workflow for Permission Collection and Reconciliation Service is as follows:

1. Reads the CSV files containing entitlement values.
2. Populates the <name>_Values objects.
3. Creates a dynamic resource for assigning the new custom entitlement values to the users.
4. Populates the **PermissionEntMapping** object with the Resource DN.
5. Performs a refresh to recognize the new entitlements and values in the Role Based Provisioning Module.

IMPORTANT: You can create a new resource and map it to a custom entitlement and reconcile permission assignments. However, if Permission Collection and Reconciliation service is turned off, all resource assignments for the custom entitlement are disabled regardless of whether the resource is created through this service or not. The common package supplied with the Permission Collection and Reconciliation service is not supported on a driver that already supports entitlements.

The Identity Manager drivers installed with Permission Collection and Reconciliation packages perform the following actions:

- Provide a way to create custom entitlements and resources specific to your environment.
- Reconcile resource or permission assignments between the Identity Vault and connected systems.

20.1.1 CSV File Format

An Identity Manager driver can consume the entitlement information from the CSV file. The CSV should be placed on the same server where Identity Manager engine is installed. This file must contain values of the target system permissions in the format specified below. The target system administrator should maintain a separate CSV file for every custom entitlement. For example, a CSV

file can contain details about granting access to the employees for the **BuildingAccess** entitlement. A CSV file that contains **BuildingAccess** entitlement details represents this information in the following format:

```
Building A, Engineering, The engineering building
Building B, Accounting, The accounting building
Building C, Facilities, The facilities building
Building D, Warehouse, The warehouse
```

where *Building A* is the entitlement value, *Engineering* is the display name in the User Application for the entitlement value *Building A*, and *The engineering building* is the description for the entitlement value that appears in the User Application.

20.1.2 Prerequisites

The following are the prerequisites for the drivers that supports Permission Collection and Reconciliation Service:

- Designer for Identity Manager 4.0.2 AU4 and later
- Identity Manager 4.0.2 with Engine Patch 4 and later
- Managed System Gateway driver version 4.0.0.6 and later
- Driver Set Package:
  - Common Settings Advanced Edition Package (NOVLACOMSET 2.0.0 and later)
- Driver Package:
  - Driver-specific entitlements packages for Active Directory, LDAP, Delimited Text, and Loopback drivers. For example, use NOVLADENTEX for Active Directory driver, NOVLLDAPENT for LDAP driver, and NOVLDTXTENT for Delimited Text driver. For more information, see driver-specific implementation guides.
  - Permission Collection and Reconciliation service package (NOVLCOMPCRS 2.0.0 and later)

    This is the common PCRS package for defining custom entitlements on drivers such as SOAP and JDBC.

20.2 Components for Permission Collection and Reconciliation Service

The content for Permission Collection and Reconciliation service contains the following:

- **Common Settings Advanced Edition Package GCVs:** This package includes the `NOVLACOMSET-GCVs` object, which contains two new GCVs used in permission assignment onboarding process. The new entitlement packages create these GCVs and the `PermissionOnboarding` job uses them.
  - User Application Provisioning Services URL GCV (`UAProvURL`)
  - User Application Provisioning Services Administrator GCV (`UAProvAdmin`)

  For information about configuring the Common Settings GCVs, see "Configuring Common Settings GCVs" on page 102.
- **Identity Manager Policy Objects**
- **Identity Manager Job Object**
  - `PermissionOnboarding`

- **Mapping Table Resource Objects**
  - `PermissionNameToFile`
  - `PermissionEntMapping`
  - `StaticValueEntitlementMap`

You use the common PCRS package for defining custom entitlements on drivers such as SOAP and JDBC. For drivers such as AD, LDAP, Delimited Text, and Loopback drivers, use the driver specific driver entitlement package to define custom entitlements.

When you install the entitlement package, the policies of this package are added to the driver Startup policy set. The driver executes these policies only once when the driver is started. The driver policies automatically configure the following objects for your environment:

- **Entitlement Objects:** The driver creates new entitlement objects to represent the native entitlement names identified in the `PermissionNameToFile` mapping table. The name of entitlement is the value of the `entitlementName` column of the `PermissionNameToFile` mapping table. For example, if `BuildingAcess` is the native entitlement, the new object created is named as `BuildingAcess`. For more information about mapping table objects, see Mapping Tables.
- **Permission Value Resource Object:** The driver adds a new permission value resource object, `entitlementName_values`. This object contains values for `Entitlement Values`, `Description`, and `Display Name` for every custom entitlement from the CSV file. It might also contain mappings for legacy value formats. To add more values to the entitlements, update the CSV file.
- **Entitlement Configuration Resource Object:** The driver creates a new entitlement configuration resource object, `EntitlementConfiguration`.

20.2.1 PermissionOnboarding Job

The driver policies update the `PermissionOnboarding` job parameters and the `PermissionEntMapping` mapping table.

The `PermissionOnboarding` job is a standard Identity Manager job and part of the entitlement package. The driver creates the job in the Identity Vault when the driver is deployed, and the job runs when the driver starts. You can schedule the job to run periodically. Also, you can run it manually to process an updated CSV file. The driver Startup policies configure the `PermissionOnboarding` job.

The `PermissionOnboarding` job performs the following tasks:

- Reads the driver's `PermissionEntMapping` table object to obtain the list of the driver's entitlement objects populated by the Startup policies.
- Creates or verifies the existence of a dynamic `nrfResource` object to allow the assignment of the native permissions for each entitlement object in the `PermissionEntMapping` table. To do this, the job uses the Identity Manager provisioning, resource, and service SOAP APIs.
- Updates the `PermissionEntMapping` table with the nrfResource DNs.
- Reads the CSV file specified in the **csvFile** column in the `PermissionNameToFile` mapping table and populates the associated `<name>_Values` resource object with the values, display names, and descriptions for each entitlement object that specifies a CSV File catalog source in the `PermissionEntMapping` table.
- Calls a User Application private API to flush the User Application Entitlement cache so that newly created entitlements are recognized.
- Calls the User Application Entitlement refresh API to force the User Application to issue an entitlement query to obtain the catalog values for each driver entitlement.

20.2.2 Mapping Tables

The Startup policies update the following mapping table objects:

- **PermissionNameToFile:** This object contains entitlement configuration data that you specified in the Entitlements Name to CSV File Mappings page during driver creation in Designer. You can add custom entitlements to this table.
- **PermissionEntMapping:** This object is created empty but is populated by the Startup policies and `PermissionOnboarding` job. It contains the configuration data transferred from the `PermissionNameToFile` object and DNs of entitlements created by the Startup policies. It also contains the LDAP DNs of the default dynamic User Application resource objects that are used to assign entitlements to users. You should not change the data populated by the Startup policies in this table.
- **StaticValueEntitlementMap:** This object is created empty but contains mapping between specific native entitlement values and a User Application static resource DN used by the driver to reconcile that value. You need to populate this table if you want to synchronize assignments bound to a static resource.

  You must manually enter the complete DN of the static resource in the `Static Resource` column. NetIQ recommends that you create a static resource with only one entitlement value. If you require multiple entitlement values, create multiple static resources. If you have a static resource mapped to multiple entitlements, ensure that you update the `StaticValueEntitlementMap` table with both values. For example, in the User Application, if you create a static resource `BuildingAccess` and specify two entitlement values, Level1 and Level2, ensure that you update the `StaticValueEntitlementMap` table with both values.

  IMPORTANT: Restart the driver for it to take effect of any changes made to the `PermissionNameToFile` and `StaticValueEntitlementMap` mapping table objects.

These packages also include new policies specific to driver implementation. The drivers apply these policies after the Subscriber and Publisher channels are initialized.

Before continuing, ensure that you go through the prerequisites needed for enabling Permission Collection and Reconciliation service. Also, you need to set up administrative user accounts and configure a password policy for them. For more information, see "Setting Up Administrative User Accounts" on page 102 and "Setting Up Administrative Passwords" on page 103.

The following diagrams represent policy execution sequence of permission reconciliation on Publisher and Subscriber channels of the Identity Manager drivers where Permission Collection and Reconciliation service is enabled.

Figure 20-4 Publisher Channel Permission Assignment Sequence

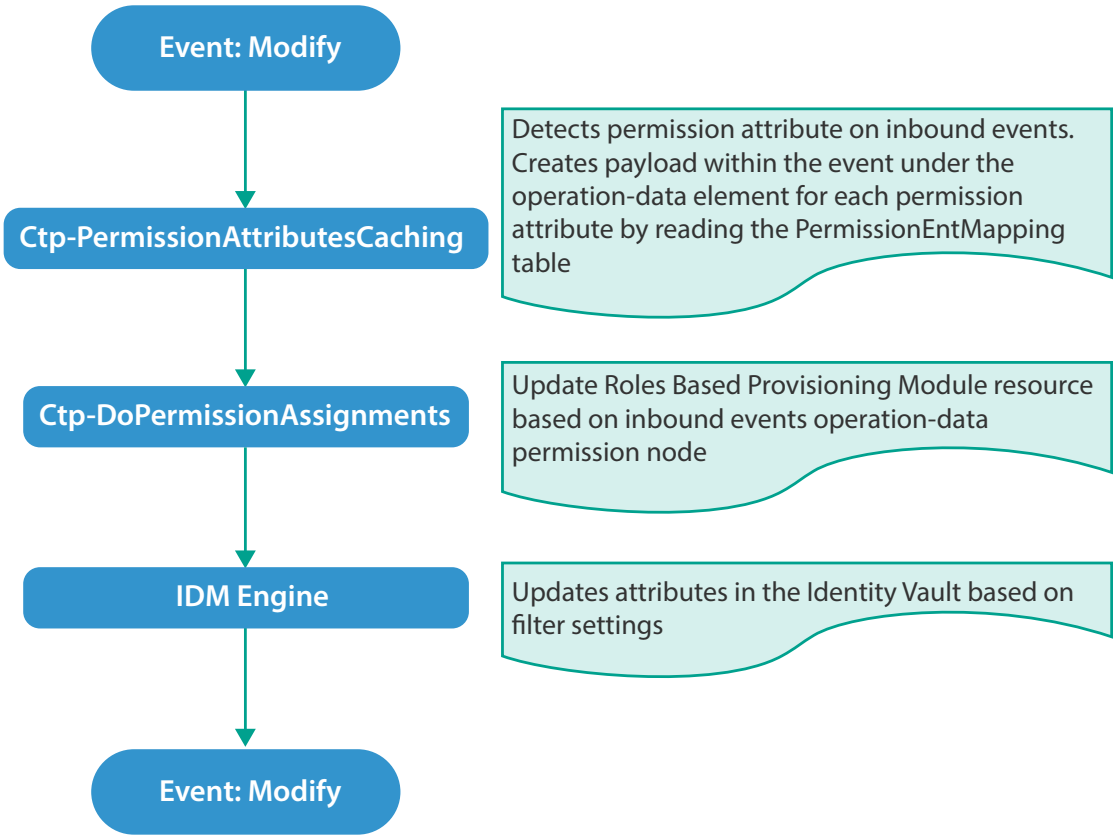


Figure 20-5 *Subscriber Channel Identity Vault Attribute Permission Assignment Sequence*

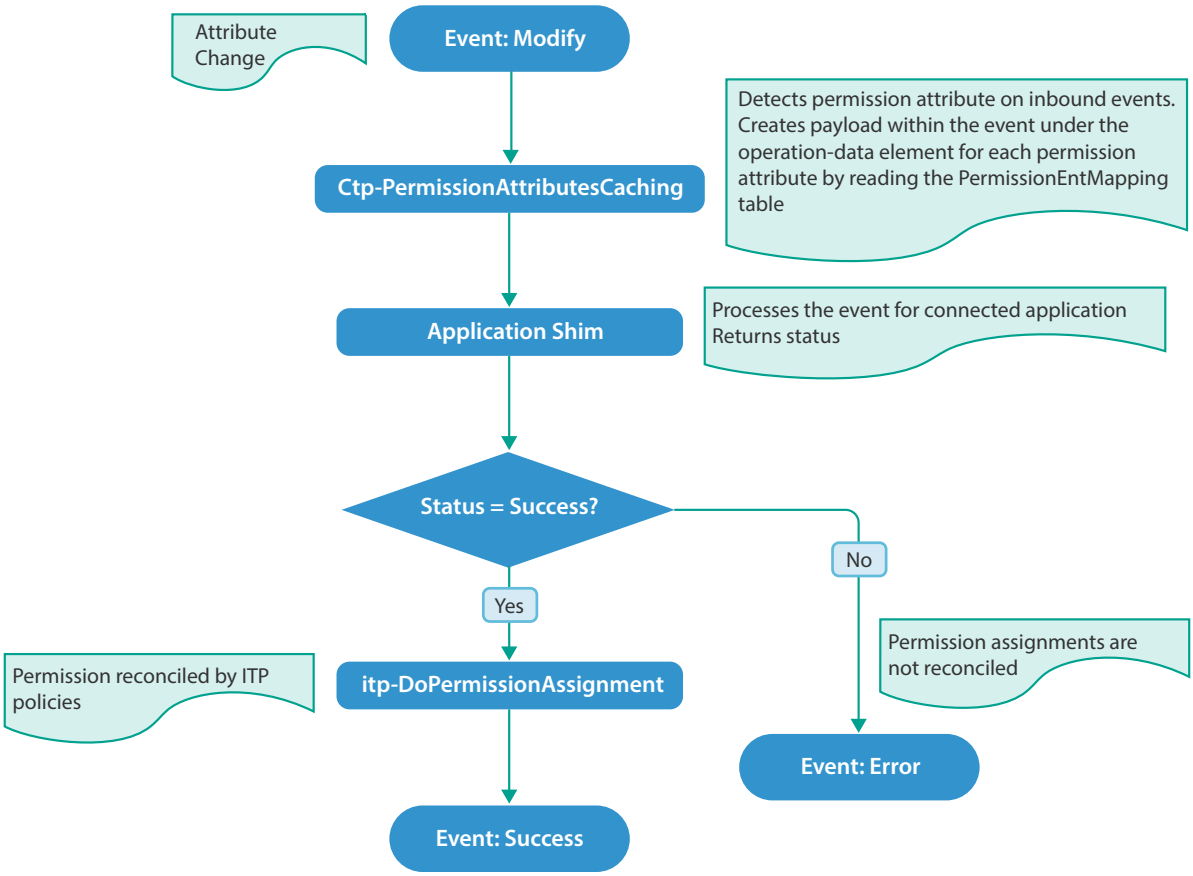
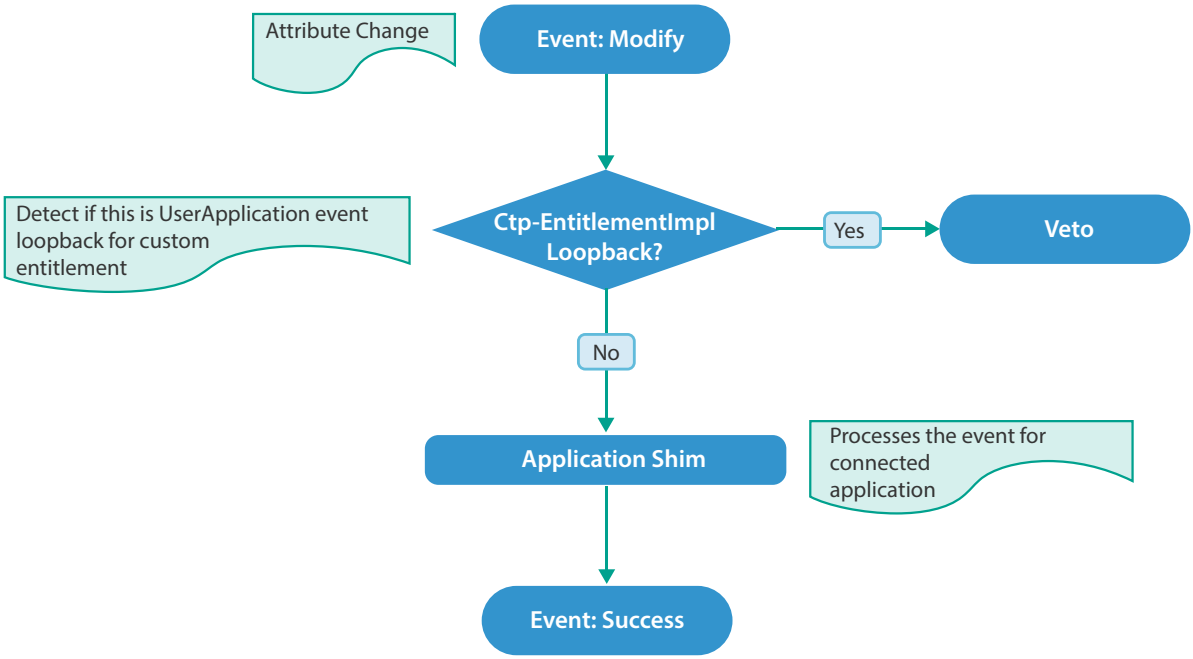


Figure 20-6 *Subscriber RBPM Permission Assignment Sequence*



20.3 Configuring Common Settings GCVs

The Common Settings Advanced Edition package contains the User Application Provisioning Administrator and User Application Provisioning URL GCVs. These GCVs are created by the new package supporting permission collection and reconciliation service, and used by the `PermissionOnboarding` job.

You must configure the GCVs on the driver set containing the drivers for quick onboarding of custom entitlements. NetIQ recommends that you install and configure the GCVs before creating or configuring a new driver.

1. Start Designer and open your project.
2. In the Outline view, right-click **Package Catalog** and select **Import Package**.
3. Clear **Show Base Packages Only**.
4. Select the **Common Settings Advanced Edition** package and click **OK**, then click **OK** when Designer finishes importing the package.
5. In the Modeler, right-click the driver set where you want to create your new drivers and select **Properties**.
6. Click **Packages**.
7. Click the **Add package** icon, select **Common Settings Advanced Edition**, then click **OK**.
8. Click **OK**.
9. (Conditional) Click **OK** to install any additional package dependencies.
10. In the Package Installation Wizard, specify the URL for your User Application installation and the DN of your User Application Administrator account, then click **Next**.
11. Click **Finish**.

20.4 Setting Up Administrative User Accounts

To create and configure the configuration objects and job for quick onboarding of identity, resources, and permission assignments, the new policies use two administrative accounts: the **Administrative user** for the Identity Vault and a **Resource Administrator** for the User Application:

- **Identity Manager Driver Administrator:** Set this administrative user in the driver's Security Equivalence attribute when you deploy the driver. The policies use the user specified by the Security Equivalence attribute. This user needs the rights to create and modify the driver policy objects and to execute the `PermissionOnboarding` job, which is part of the driver package.
- **User Application Resource Administrator:** This administrative user performs the following tasks:
  - Creates resource objects
  - Triggers cache flush and entitlement refresh actions
  - Assigns and revokes resource assignments

For the User Application Administrator user, NetIQ recommends that you create a new user. For example, you can create the new user `ResourceAdmin,OU=sa,O=data` and configure the following rights for this user in the User Application:

- **Assign Role, Resource Creation, and Assignment Rights:** Click **Administration > RBPM Provisioning and Security > Administrator Assignments > Assign System Role Administrator**, select **Domain** and assign the following rights to the user:
  - Provisioning: Select **All Permissions**.
  - Resource: Select **All Permissions**.
  - Role: Select **All Permissions**.

  NOTE: You need to assign each set of Domain permissions separately for the user.

- **Assign Application Cache Refresh Rights:** In the User Application, click **Administration > Application Configuration > User Application Administrator Assignment**, then add the user to the **Current Assignments** list.

  NOTE: This user account is also used to filter the duplicate entitlement events occurring on the Subscriber channel as a result of auto-reconciliation of resource assignments.

20.5 Setting Up Administrative Passwords

To simplify the configuration and security of Identity Manager drivers with Permission Collection and Reconciliation service, use Distribution passwords for Identity Manager Driver Administrator and User Application Resource Administrator administrative users. Identity Manager uses the Distribution password to control password synchronization between the Identity Vault and connected systems. Identity Manager reads passwords for these administrative users from their `nspmDistributionPassword` attribute.

Also, you need to configure a password policy for both of these users or use the default Sample Password Policy and assign the policy to them. For more information, see "Password Management Configuration" in the *NetIQ Identity Manager User Application: Administration Guide*.

20.6 Creating Drivers

To use the Permission Collection and Reconciliation service included in the Identity Manager drivers, you can either create a new driver with the latest packages or upgrade packages on an existing driver. In both cases, you install the driver packages and then modify the driver configuration to suit your environment. For creating new drivers, NetIQ recommends that you refer to the individual driver documentation.

The following sections provide instructions for upgrading common settings packages on existing drivers:

- Section 20.6.1, "Installing the Driver Packages," on page 104
- Section 20.6.2, "Configuring the Driver," on page 105
- Section 20.6.3, "Deploying the Driver," on page 105
- Section 20.6.4, "Starting the Driver," on page 105

20.6.1 Installing the Driver Packages

After you have imported the current driver packages into the Package Catalog, you can install the driver packages to create a new driver.

1. In Designer, open your project.
2. In the Modeler, right-click the driver set where you want to create the driver, then select **New > Driver**.
3. Follow the driver configuration wizard to create the driver.
4. On the Entitlements Name to CSV File Mappings page, click the **Add Name to File Mapping** icon to populate the page with the entitlement configuration options.

   Identity Manager uses the CSV file to map entitlements to corresponding resources in the Identity Manager catalog.

   The information that you specify on this page is used for creating the permission catalog. This page uses *BuildingAccess* as an example. Fill in the following fields, then click **Next**:

   - **Entitlement Name:** Specify a descriptive name for the entitlement to map it to the CSV file that contains the connected system entitlement details.

     Entitlement Name is the name of the entitlement. This parameter corresponds to the Entitlement Assignment Attribute in the connected system. For example, you could define an entitlement called *BuildingAccess*.

     This parameter is used to create a resource in the User Application.
   - **Entitlement Assignment Attribute:** Specify a descriptive name for the assignment attribute for an entitlement.

     This parameter holds the entitlement values from the connected system. For the engine to receive the attribute events from the Publisher channel, ensure that you add this parameter to the Driver Filter. For example, you could have an attribute called *BuildingAccess*.

     NOTE: For the Delimited Text Driver, add this parameter in the **Field Names** on the Driver Parameters page or modify it in driver settings after creating the driver.

   - **CSV File:** Specify the location of the CSV file. This file must be located on the same server as the Identity Manager engine. This file contains the values for the application entitlements in the format *value*, *displayname*, and *description*. An example for the CSV file path is `/root/user/BuildingAccess.csv`. For more information, see Section 20.1.1, “CSV File Format,” on page 96.
   - **Multi-valued?:** Set the value of this parameter to **True** if you want to assign resources and entitlements multiple times with different values to the same user. Otherwise, set it to **False**.
5. Review the summary of tasks that will be completed to create the driver, then click **Finish**.

The driver is now created. You can modify the configuration settings by continuing with the next section, Section 20.6.2, “Configuring the Driver,” on page 105. If you do not need to configure the driver, continue with Section 20.6.3, “Deploying the Driver,” on page 105.

20.6.2 Configuring the Driver

When you install the Permission Collection and Reconciliation service package, there are some settings that you must review and configure for the driver to start properly. These settings are located under **Driver Parameters** and **Global Configuration Values** on the Driver Properties page in Designer. In the Modeler, right-click the driver icon or the driver line, then select **Properties** and click **GCVs > Entitlements**.

In addition to the driver settings, you should review the set of default policies and rules provided by the basic driver configuration. The default policies and rules are discussed in the Default Driver Configuration section of each Driver Implementation Guide.

20.6.3 Deploying the Driver

After a driver is created in Designer, you must deploy it into the Identity Vault.

1. In Designer, open your project.
2. In the Modeler, right-click the driver icon or the driver line, then select **Live > Deploy**.
3. If you are authenticated to the Identity Vault, skip to Step 5. Otherwise, specify the following information:

   Host: Specify the IP address or DNS name of the server hosting the Identity Vault.

   Username: Specify the DN of the user object used to authenticate to the Identity Vault.

   Password: Specify the user's password.
4. Click **OK**.
5. Read through the deployment summary, then click **Deploy**.
6. Read the success message, then click **OK**.
7. Click **Define Security Equivalence** to assign rights to the driver.

   The driver requires rights to objects within the Identity Vault. The Admin user object is most often used to supply these rights. However, you might want to create a user account called *DriversUser*, for example, and assign security equivalence to that user.

   7a Click **Add**, then browse to and select the object with the correct rights.

   7b Click **OK** twice.
8. Click **Exclude Administrative Roles** to exclude users that should not be synchronized.

   You should exclude any administrative User objects (for example, Admin and DriversUser) from synchronization.

   8a Click **Add**, then browse to and select the user object you want to exclude.

   8b Click **OK**.

   8c Repeat Step 8a and Step 8b for each object that you want to exclude.

   8d Click **OK**.
9. Click **OK**.

20.6.4 Starting the Driver

When a driver is created, it is stopped by default. To make the driver work, you must start the driver and cause events to occur. Identity Manager is an event-driven system, so after the driver is started, it does not do anything until an event occurs.

To start the driver:

1. In Designer, open your project.
2. In the Modeler, right-click the driver icon or the driver line, then select **Live > Start Driver**.

20.7 Viewing Permission Collection and Reconciliation Service Configuration Objects

After the driver is deployed and configured with the new Permission Collection and Reconciliation service, verify that the driver correctly creates and updates the entitlements information in the Identity Vault.

Complete the following steps:

1. In iManager, open the Identity Manager Administration page.
2. In the **Administration** list, click **Identity Manager Overview**.
   - **2a** (Conditional) If the driver set is not listed on the **Driver Sets** tab, use the **Search In** field to search for and display the driver set.
   - **2b** Click the driver set to open the Driver Set Overview page.
3. Click the driver icon.
4. Click the **Jobs** tab. The `PermissionOnboarding` job appears on the Jobs page. For more information, see PermissionOnboarding Job.
5. Click **Advanced > Mapping Tables**. The DNs of the Entitlement objects appear on the Mapping Table page based on the InitEntitlementResourceObjects policy and data from the configuration objects. For more information, see Mapping Tables.
6. In iManager, click **Driver Set > Edit Driver Set properties**.
7. Click **Global Config Values** to display the driver set GCV page.

   This page contains two sets of GCVs that are consumed by the drivers in the driver set. Ensure that you configure them for the driver set containing the drivers for quick onboarding of identity, resources, and permission assignments.

   - **NOVLCOMSET:** This GCV object contains the following:
     - **User Container:** Specifies the Identity Vault container where the users are added, if they do not already exist in the Identity Vault. This value is the default value for all drivers in the driver set.
     - **Group Container:** Specifies the Identity Vault container where the groups are added, if they do not already exist in the Identity Vault. This value is the default value for all drivers in the driver set.
   - **Advanced Settings:** This GCV object contains the following:
     - **User Application Provisioning Services URL:** Specifies the User Application Identity Manager Provisioning URL.
     - **User Application Provisioning Services Administrator:** Specifies the DN of the provisioning services administrator. This user should have the rights for creating and assigning resources.

20.8 Troubleshooting Permission Collection and Reconciliation Service Issues

The following known limitations and workarounds can help you troubleshoot issues that you might encounter while using the Permission Collection and Reconciliation service:

The driver ignores permission assignments

Explanation: If you use the same user (User Application Administrator account) that the driver uses to communicate with the User Application, the driver ignores these changes and treats them as loopback events.

Action: 1. Use a different User Application administrator account for the driver.

2. Check the JBoss `server.log` file in the User Application to determine if User Application encountered any error when `PermissionOnboarding` job made SOAP calls to the `server.log` file.

3. Set the `PermissionOnboarding` job trace level to 5 to verify if the job ran successfully and was able to perform a codemap refresh, create a resource, and update the `PermissionEntMapping` table with the resource DN.

4. Set the driver trace level to 5 if you want to view policy processing sequence.

The Subscriber Channel ignores permission reconciliation

Explanation: For any Subscriber changes, permissions are reconciled only after an event is successfully processed. The driver might not reconcile permissions if it contains policies that ignore `operation-data` containing permissions when these policies create or transform the status document.

Action: Restore `operation-data`.

For example:

```
<xsl:template match="operation-data">
<operation-data>
<xsl:message>operation-data</xsl:message>
<!-- ignore this element but process all children -->
<xsl:apply-templates select="node()|@*"/>
</operation-data>
</xsl:template>
```

Deleting an entitlement value in a connected application is not reflected in the mapped resource

Explanation: This occurs when the `Optimize-Modify` value is set to `yes`.

Action: Set the filter attribute value to `Notify`.

Resources are not created in RBPM

Explanation: This occurs when the resource DN value is already populated in the `PermissionEntMapping` table.

Action: Delete the resource DN value and restart the driver. Otherwise, run the `PermissionOnboarding` job.

Changes to mapped attributes in the Identity Vault are not reflected as assignments in RBPM

Explanation: The `NOVLCOMPCRS-itp-DoPermissionAssignment` policy takes care of reconciling permissions when an attribute is successfully updated in connected application. When the status document passes through this policy, the policy acts upon `operation-data`. If you added a new transformation policy in the policy set, ensure that `operation-data` remains unchanged in the status document.

Action: Verify if the `NOVLCOMPCRS-itp-DoPermissionAssignment` policy is placed correctly in the policy hierarchy, so that changes made to the attributes in the Identity Vault are reconciled to assignment attributes in RBPM.

21 Troubleshooting

The following sections describe various ways to troubleshoot the issues that you may encounter while working with Identity Manager:

21.1 Identity Manager Treats SYN_TIME values as Signed Integers Instead of Unsigned Integers

Identity Manager stores timestamps in the Identity Vault. The timestamps use a Timestamp syntax that uses an epoch number in a 32-bit attribute to count seconds from year 1970. The attribute is 32-bits long and imposes a limitation on the time range that can be specified.

Identity Manager engine versions prior to 4.5.x and 4.6.2 treat the timestamp value as a signed integer. The range can store dates prior to 1970, allowing dates to be specified between 1903 to 2037.

Identity Manager engine versions 4.5.x, 4.6.0, 4.6.1 and 4.7 treat timestamps as unsigned integer (like eDirectory does for LDAP). This allows you to specify the time between 1970 until 2106.

To store timestamps outside these time ranges, it is recommended to use the SYN_INTEGER64 syntax.

21.2 Using NetIQ Sentinel to Log Identity Manager Events

You can log Identity Manager events by using NetIQ Sentinel. Using this service in combination with the driver log level setting provides you with tracking control at a very granular level. For more information, see the *NetIQ Identity Manager Reporting Guide for Sentinel*.

21.3 Troubleshooting Driver Processes

Viewing driver processes is necessary to analyze unexpected behavior. To view the driver processing events, use DSTrace. You should use it only during testing and troubleshooting the driver. Running DSTrace while the drivers are in production increases the utilization on the Identity Manager server and can cause events to process very slowly. For more information, see Chapter 17, “Viewing Identity Manager Processes,” on page 77.

21.4 Driver Shim Errors

This section identifies errors that might occur in the core driver shim. Error messages that contain a numerical code can have various messages depending on the application or Web service.

307 Temporary Redirect

Source: The status log or DSTrace screen.

Explanation: The Subscriber channel attempted to send data to the application or Web service but received a 307 Temporary Redirect response.

Possible Cause: The Web service is not available.

Action: The Subscriber waits for a period of time (usually 30 seconds) and tries again.

Level: Retry

408 Request Timeout

Source: The status log or DSTrace screen.

Explanation: The Subscriber channel attempted to send data to the application or Web service but received a 408 Request Timeout response.

Possible Cause: The Web service or application is busy.

Action: The Subscriber waits for a period of time (usually 30 seconds) and tries again.

Level: Retry

503 Service Unavailable

Source: The status log or DSTrace screen.

Explanation: The Subscriber channel attempted to send data to the application or Web service but received a 503 Service Unavailable response.

Possible Cause: The Web service or application is down.

Action: The Subscriber waits for a period of time (usually 30 seconds) and tries again.

Level: Retry

504 Gateway Timeout

Source: The status log or DSTrace screen.

Explanation: The Subscriber channel attempted to send data to the application or Web service but received a 504 Gateway Timeout response.

Possible Cause: The gateway is down.

Action: The Subscriber waits for a period of time (usually 30 seconds) and tries again.

Level: Retry

200-299 Messages

Source: The HTTP server.

Explanation: The messages in the 200-299 range indicate success.

Action: No action required.

Level: Success

Other HTTP Errors Messages

Source: The status log or DSTrace screen.

Explanation: Other numerical error codes result in an error message containing that code and the message provided by the HTTP server. In most cases, the driver continues to run, and the command that caused the error isn't retried.

Possible Cause: There are multiple causes for the different errors.

Action: See RFC 2616 (http://www.w3.org/Protocols/rfc2616/rfc2616-sec10.html) for a list of all HTTP error codes and explanations.

Level: Error

Problem communicating with HTTP server. Make sure server is running and accepting requests.

Source: The status log or DSTrace screen.

Explanation: The Subscriber channel received an IOException while communicating or attempting to communicate with the HTTP server.

Possible Cause: The HTTP server is not running.

Possible Cause: The HTTP server is overloaded.

Possible Cause: There are firewall restrictions blocking access to the HTTP server.

Possible Cause: The URL provided in the Subscriber configuration is not correct.

Action: Start the HTTP server.

Action: Remove services, if the HTTP server is overloaded.

Action: Change the firewall restrictions to allow access to the HTTP server.

Level: Retry

The HTTP/SOAP driver does not return any application schema by default.

Source: The status log or DSTrace screen.

Explanation: The driver is not returning any application schema, but the driver continues to run.

Possible Cause: The Identity Manager engine calls the DriverShim.getSchema() method of the driver, and the driver is not using the SchemaReporter customization.

Action: A Java class needs to be written that implements the SchemaReporter interface, and the driver needs to be configured to load the class as a Java extension.

Level: Warning

Subscriber.execute() was called but the Subscriber was not configured correctly. The command was ignored.

Source: The status log or DSTrace screen.

Explanation: The Subscriber channel of the driver isn't initialized properly. The driver continues to run but displays this message each time an event is received by the Subscriber channel.

Possible Cause: An improperly formatted driver configuration.

Action: Configure the driver correctly.

Action: Clear the Subscriber's filter so it doesn't receive commands.

Level: Warning

pubHostPort must be in the form host:port

Source: The status log or DSTrace screen.

Explanation: The driver cannot communicate.

Possible Cause: An error occurred with the Publisher channel configuration.

Action: Review the Publisher channel parameters to verify that both a valid host and a valid port number are provided.

Level: Fatal

MalformedURLException

Source: The status log or the DSTrace screen.

Explanation: There is a problem with the format of the URL.

Possible Cause: The URL supplied in the Subscriber channel parameters isn't in a valid URL format.

Action: Change the URL to a valid format.

Level: Fatal

Multiple Exceptions

Source: The status log or the DSTrace screen.

Explanation: The HTTP listener fails to properly initialize.

Possible Cause: There are a variety of reasons for this error.

Action: Check your Publisher settings to make sure you have specified a port that is not already in use and that the other Publisher settings are correct.

Level: Fatal

HTTPS Hostname Wrong: Should Be ...

Source: The status log or the DSTrace screen.

Explanation: An SSL handshake failed on the Subscriber channel.

Possible Cause: The subject presented with the server certificate doesn't match the IP address or hostname given in the HTTPS URL.

Action: Use a DNS hostname rather than an IP address in the URL.

Level: Retry

21.5 Identity Manager Driver Errors

The following errors might occur with Identity Manager drivers:

641 Unable to start the driver

Source: DSTrace screen.

Explanation: You might receive this error message when you start an Identity Manager driver through either iManager or Designer.

Possible Cause: There are several causes. The error means the Identity Manager engine cannot load properly when eDirectory loads.

Action: Perform the following troubleshooting steps on the Identity Manager engine to know what exactly the engine is doing when it is loaded, and all jvmloader related messages.

Identity Manager engine running on Windows:

NOTE: Identity Manager is installed in the directory where eDirectory's dlms are present, by default, `C:\Novell\NDS`.

---

1. Stop the eDirectory service.
2. Move the `dirxml.dlm` file from the directory where eDirectory is installed.
3. Start the eDirectory service.
4. After eDirectory is loaded, start `DSTRACE.dlm`.
5. Click **Edit > Option**.
6. Set the following flags:

   DirXML
   DirXML Drivers
   Misc Other

   Deselect all other options and click **OK**.
7. Click **File > New** and specify a filename for your trace file.
8. Move the `dirxml.dlm` file back to its original location.
9. Close/reopen the eDirectory services console.
10. Select `dirxml.dlm` and click `Start`.

The trace file contains the messages related to why the VRDIM module (IDM Engine) does not start.

Identity Manager engine running on Linux/Solaris/AIX:

1. Stop `ndsd` by using the following command:

   ```
   /etc/init.d/ndsd stop
   ```
2. Move the `libvrdim.*` files from their original directory to a different directory.

   In eDirectory 8.8.x, the files are present in the `/opt/novell/eDirectory/lib/nds-modules/` directory.
3. Start `ndsd` by using the following command:

   ```
   /etc/init.d/ndsd start
   ```
4. Start `ndstrace`.
5. In the `ndstrace`, type the following:

```
set ndstrace=nodebug
set ndstrace=+time
set ndstrace=+tags
set ndstrace=+misc
set ndstrace=+dxml
set ndstrace=+dvrs
ndstrace file on
```

6 Let `ndstrace` run on the screen.

7 Move the `libvrdim.*` files back to their original location.

8 In the `ndstrace` screen, type the following:

```
load vrdim
```

9 After you see the errors, stop `ndstrace`.

The trace file contains the messages related to why the VRDIM module (IDM Engine) does not start.

You can specify a different location for the trace file. To see the contents of a trace file, click **Edit Properties > Misc > Trace File**.

After you have performed the specified troubleshooting steps, you might encounter the "783 Unable to start the driver" on page 114error.

Level: Error

783 Unable to start the driver

Source: DSTrace screen

Explanation: You might encounter this error message after performing the Action specified under "641 Unable to start the driver" on page 113.

Possible Cause: There are several possible causes for the error. The following is a list of few possible causes with suggestions to help fix and/or track them further:

Possible Cause: Corruption in the association between the driver set and the server.

Action: Remove the association between the driverset and the server, cycle ndsd, and add the association back again.

Possible Cause: Damage/corruption in the DirXML-ServerKeys attribute that exists in the local DIB's Pseudo-Server object.

Action: DSDUMP (done only by technical support) is needed to remove the attribute with pre-Identity Manager 3.6. Use the new command within the dxcmd utility for Identity Manager 3.6 and later.

Possible Cause: Using Dib Clone or dsbk will cause damage or corruption in the DirXML-ServerKeys attribute that exists in the local DIB's Pseudo-Server object.

Action: DSDUMP (done only by technical support) is needed to remove the attribute with pre-IDM 3.6. Use the new command within the dxcmd utility for Identity Manager 3.6 and later.

Possible Cause: Misconfiguration of the JVM heap sizes.

Action: This is shown in the **+misc** flag in `ndstrace`. All jvmloader messages exist under the **MISC** flag on Linux/Unix, and the **MISC OTHER** flag on dstrace.dlm (Windows). You cannot see the jvmloader messages on Netware. But you can always check the `SYS:/ETC/JAVA.CFG` file.

Possible Cause: Corruption/damage/insufficient rights on the libraries IDM requires in the box (check the install log, also do an rpm -V on the Identity Manager packages)

Action: Try the following options:

- Use `rpm -V` liberally against all Identity Manager-related libraries. The command line works well for that:

  ```
  rpm -qa | grep DXML | xargs rpm -V
  ```

- ldd your IDM libraries to see the dependencies they have, and check the dependencies also. The `checkbin.sh` script can be of great help when checking dependencies. It is part of the `ntsutils` package that can be downloaded from the following location:

  http://www.novell.com/communities/node/2332/supportconfig-linux (http://www.novell.com/communities/node/2332/supportconfig-linux)

- Use `strace/ltrace` tool to track what is happening. Because `strace` works on scripts, it is the best option. `ltrace` can be run only against binary files. These tools provide a lot of information, and quite a bit of it requires basic knowledge of C programming language.
- Reinstall Identity Manager on top of itself. The process overwrites the libraries/rights.

Level: Error

Identity Manager Driver that is deleted without stopping, and re-created with the same port number fails to start

Source: DSTrace screen

Explanation: Delete a driver without stopping it, re-create the same driver with the same port number, and start the driver. The driver fails to start.

Possible Cause: IDM does not release the used port of a driver if the driver is deleted without stopping.

Action: Edit the driver to use another port. The driver starts.

21.6 Java Customization Errors

The following errors might occur in the customized Java extensions.

SchemaReporter init problem: extension-specific message

Source: The status log or DSTrace screen.

Explanation: The SchemaReporter Java customization had a problem initializing, and the driver shuts down.

Possible Cause: The Java extension is not initialized correctly.

Action: Verify that the Java extension is enabled in the driver.

Level: Fatal

Extension (custom code) init problem: extension-specific message

Source: The status log or DSTrace screen.

Explanation: One of the following Java extensions failed to initialize:

- SubscriberTransport
- PublisherTransport
- DocumentModifiers
- ByteArrayModifiers

Possible Cause: The Java extension is incorrect.

Action: Review the Java extension and verify it is enabled in the driver.

Level: Fatal

Various other errors

Source: The interfaces provided for Java extensions return error messages on the trace screen and sometimes to the Identity Manager engine.

Explanation: Sometimes it is difficult to distinguish errors of this type from other errors that originate in the core driver shim. If you get errors that are not listed in this section and you are using Java extensions, check with whomever provided you with the extensions for a list of error codes for that particular extension.

Level: Varies

21.7 Multiple Sync Events Occur When an Object is Moved in the Master Replica Server

When Identity Manager is not in the master replica server and if some object is moved in the master replica server, there might be multiple `sync` events generated on the drivers. Some of these `sync` events are generated before the object move is completed in the master replica server and hence these `sync` events are not reliable. If some modifications are applied to the moved object in the Identity Manager server, based on any such event, the modifications are ignored because the move is not yet completed in the master replica server.

If you encounter such a situation, check for the timestamp on the <*sync*> event. If the timestamp shows a value `0#0`, it is reliable. If it shows any other value, then it is not reliable.

The following is an example of an unreliable `sync` event, because it has a timestamp other than 0#0 (marked in bold).

```
<nds dtdversion="3.5" ndsversion="8.x">
<source>
<product version="3.5.13.20090903 ">DirXML</product>
<contact>Novell, Inc.</contact>
</source>
<input>
<sync class-name="User" event-id="sles10sp3#20130722144515#2#2" from-move="true"
qualified-src-dn="O=novell\CN=Auser1" src-dn="\SLES10SP3-TREE\Novell\Auser1"
timestamp="1374504315#0">
<association state="associated">{D6B73031-695D-074e-AAAD-D6B73031695D}</
association>
</sync>
</input>
</nds>
```

The following is an example of a reliable `sync` event, because it has a timestamp 0#0 (marked in bold).

```
<nds dtdversion="3.5" ndsversion="8.x">
<source>
<product version="3.5.13.20090903 ">DirXML</product>
<contact>Novell, Inc.</contact>
</source>
<input>
<sync cached-time="20130722144516.217Z" class-name="User" event-
id="sles10sp3#20130722144515#2#2" from-move="true" qualified-src-
dn="O=novell\CN=Auser1" src-dn="\SLES10SP3-TREE\Novell\Auser1" timestamp="0#0">
<association state="associated">{D6B73031-695D-074e-AAAD-D6B73031695D}</
association>
</sync>
</input>
</nds>
```

21.8 Rule Engine Does Not Honor the Mode Specified in the Set or Add Destination Attribute Value

When a rule set has more than one action to add additional attributes, at the time of adding an event to the destination object, the rule engine considers only the mode of the first attribute value. It ignores the modes of the attributes in the rest of the actions and applies the mode that you set for the first action.

For example, if the mode specified for the first action to add the destination attribute value is `after the current operation` (so that attribute value is set in a modify event after the add event) and the rest of the actions to set destination attributes have the `add to current operation` mode, the rest of the actions also end up being part of the modify event and not the add event, as expected.

To work around this issue, move all of the actions to add destination attributes with mode `after the current operation` to the end of the rule set. Then the attributes with `add to current operation` will be part of an add event and the rest will be in a separate modify event.

21.9 Reassociating a Driver Set Object with a Server

A driver set object is associated with a server. If the association becomes invalid for some reason, it is indicated by one of the following:

- When upgrading eDirectory on your Identity Manager server, you get the error `UniqueSPIException error -783`.
- No server is listed in the **Servers** tab on the driver or driver set.
- A server is listed next to the driver in the Identity Manager Overview screen, but the name is garbled text.

To resolve this issue, you must disassociate the driver set object and the server, and then reassociate them:

1. In iManager, open the Identity Manager Administration page.
2. In the **Administration** list, click **Identity Manager Overview**.
3. In the **Search in** field, specify the fully distinguished name of the container where you want to start searching and then click ▶, or click the browse icon to browse for and select the container in the tree structure.
4. Click the driver set object that you want to reassociate with a server.
5. On the **Overview** tab, click **Servers**.
6. Click **Remove server**.
7. Click **Add server**.

NOTE: When you reassociate a driver set object with a server, all drivers are disabled, and all passwords are cleared.

21.10 Association Statistics Tool Displays Incorrect Grouping of Drivers in the Dashboard

If a driver is not initialized, iManager displays the driver in the *IDM Driver (Other)* group on the association statistics dashboard. This is because the driver configuration does not populate the group ID for the driver.

To work around this issue, make sure that the driver is initialized with the connected system.

21.11 Association Statistics Tool Displays an Error for No-Reference Associations

If you attempt to calculate no-reference associations using the association statistics tool, iManager displays an `ERR_FAILED_AUTHENTICATION` error. This issue is randomly observed.

To work around this issue, run the Association Statistics job again.

21.12 Unable to Retrieve Application Schema Error

Issue: Some Identity Manager drivers are not intended to connect to an application. For such drivers, the engine does not retrieve an application schema because there is no connected application. Therefore, the driver shim returns an empty schema to the engine. The engine considers it as a missing schema and displays the following warning:

```
DirXML Log Event -------------------
     Driver:   \Org_Tree1\system\services\idm\Driverset1\Timed Job
     Status:   Warning
     Message: Code(-8001) Unable to retrieve application schema.
[11/10/17 15:50:58.673]:Timed Job ST:Reading driver information from the \
Org_Tree1\system\services\idm\Driverset1\Timed Job object.
[11/10/17 15:50:58.675]:Timed Job ST:Loading Java shim
com.novell.nds.dirxml.driver.nulldriver.NullDriverShim.
```

Workaround: Ignore this warning for the drivers that are not connected to an external application.

A Driver Properties

This section provides information about the properties that are common to all drivers. This includes all properties (Named Password, Engine Control Values, Log Level, and so forth) other than the Driver Configuration and Global Configuration Values properties.

The information is presented from the viewpoint of iManager. If a field is different in Designer for Identity Manager, it is marked with a Designer icon.

A.1 Accessing the Properties

In iManager:

1. In iManager, open the Identity Manager Administration page.
2. Open the driver set that contains the driver whose properties you want to edit:
   - **2a** In the **Administration** list, click **Identity Manager Overview**.
   - **2b** If the driver set is not listed on the **Driver Sets** tab, use the **Search In** field to search for and display the driver set.
   - **2c** Click the driver set to open the Driver Set Overview page.
3. Locate the driver icon, then click the upper right corner of the driver icon to display the **Actions** menu.
4. Click **Edit Properties** to display the driver's properties page.

In Designer:

1. Open a project in the Modeler.
2. Right-click the driver icon or line, then select click **Properties** > **Driver Configuration**.

A.2 Named Passwords

Identity Manager enables you to securely store multiple passwords for a driver set or individual drivers. This functionality is referred to as named passwords. Each different password is accessed by a key, or name.

You can also use the named passwords feature to store other pieces of information, such as a user name.

For more information about named passwords, see Chapter 9, "Securely Storing Driver Passwords with Named Passwords," on page 41.

A.3 Engine Control Values

The engine control values are a way that certain default behaviors of the Identity Manager engine can be changed. The values can be accessed only if a server is associated with the Driver Set object.

Option	Description
Subscriber channel retry interval in seconds	The Subscriber channel retry interval controls how frequently the Identity Manager engine retries the processing of a cached transaction after the application shim's Subscriber object returns a retry status.
Qualified form for DN-syntax attribute values	The qualified specification for DN-syntax attribute values controls whether values for DN-syntax attribute values are presented in unqualified slash form or qualified slash form. A True setting means the values are presented in qualified form.
Qualified form from rename events	The qualified form for rename events controls whether the new-name portion of rename events coming from the Identity Vault are presented to the Subscriber channel with type qualifiers. For example, CN=. A True setting means the names are presented in qualified form.
Maximum eDirectory replication wait time in seconds	This setting controls the maximum time that the Identity Manager engine waits for a particular change to replicate between the local replica and a remote replica. This affects only operations where the Identity Manager engine is required to contact a remote eDirectory server in the same tree to perform an operation and might need to wait until some change has replicated to or from the remote server before the operation can be completed (for example, object moves when the Identity Manager server does not hold the master replica of the moved object; file system rights operations for Users created from a template.)
Use non-compliant backwards-compatible mode for XSLT	This control sets the XSLT processor used by the Identity Manager engine to a backwards-compatible mode. The backward-compatible mode causes the XSLT processor to use one or more behaviors that are not XPath 1.0 and XSLT 1.0 standards-compliant. This is done for backward compatibility with existing DirXML style sheets that depend on the non-standard behaviors. For example, the behavior of the XPath “!=” operator when one operand is a node-set and the other operand is other than a node-set is incorrect in DirXML releases up to and including Identity Manager 2.0. This behavior has been corrected; however, the corrected behavior is disabled by default through this control in favor of backward compatibility with existing DirXML style sheets.
Maximum application objects to migrate at once	This control is used to limit the number of application objects that the Identity Manager engine requests from an application during a single query that is performed as part of a Migrate Objects from Application operation. If java.lang.OutOfMemoryError errors are encountered during a Migrate from Application operation, this number should be set lower than the default. The default is 50. **NOTE:** This control does not limit the number of application objects that can be migrated; it merely limits the batch size.
Set creatorsName on objects created in Identity Vault	This control is used by the Identity Manager engine to determine if the creatorsName attribute should be set to the DN of this driver on all objects created in the Identity Vault by this driver. Setting the creatorsName attribute allows for easily identifying objects created by this driver, but also carries a performance penalty. If not set, the creatorsName attribute defaults to the DN of the NCP Server object that is hosting the driver.

Option	Description
Write pending associations	This control determines whether the Identity Manager engine writes a pending association on an object during Subscriber channel processing. Writing a pending association confers little or no benefit but does incur a performance penalty. Nevertheless, the option exists to turn it on for backward compatibility.
Use password event values	This control determines the source of the value reported for the nspmDistributionPassword attribute for Subscriber channel Add and Modify events. Setting the control to False means that the current value of the nspmDistributionPassword is obtained and reported as the value of the attribute event. This means that only the current password value is available. This is the default behavior. Setting the control to True means that the value recorded with the eDirectory event is decrypted and is reported as the value of the attribute event. This means that both the old password value (if it exists) and the replacement password value at the time of the event are available. This is useful for synchronizing passwords to certain applications that require the old password to enable setting a new password.
Retry Out of Band events	This control determines whether the out-of-band sync events should be retried or not if the **retry** status for the out-of-band sync event is received. If the control is set to False, the out-of-band sync is not retried. If it is set to true, the out-of-band sync is retried till its successful.
Enable password synchronization status reporting	This control determines whether the Identity Manager engine reports the status of Subscriber channel password change events. Reporting the status of Subscriber channel password change events allows applications such as the Identity Manager User Application to monitor the synchronization progress of a password change that should be synchronized to the connected application.
Combine values from template object with those from add operation	This value determines whether the Identity Manager engine combines like values from a creation template and an add operation when performing the add operation. Setting the value to True causes the template's multi-valued attribute values to be used in addition to the values for the same attribute that are specified in the add operation. Setting the value to False causes the values from the template to be ignored if there are values for the same attribute specified in the Add operation.
Allow event loopback from publisher to subscriber channel	This value determines whether the Identity Manager engine allows an event to loop from the driver's Publisher channel to the Subscriber channel. Setting the value to False causes the Identity Manager engine to not allow events to loop back. Setting the value to True causes the Identity Manager engine to allow events to loop from the Publisher channel to the Subscriber channel.

Option	Description
Revert to calculated membership value behavior	This value determines the method used by the Identity Manager engine when performing read and search actions related to group membership. Setting this value to False (the default setting) causes the Identity Manager engine, when reading or searching the Member and Group Member attributes of Identity Vault objects, to return only those values that are “static” values. Static values are objects that received group membership by direct assignment to the group rather than inherited assignment through a nested group. Setting this value to True causes the Identity Manager engine to revert to the method used prior to Identity Manager 3.6. In pre-3.6 versions, the Identity Manager engine's search of the Member and Group Member attributes retrieved all “calculated” values. Calculated values include objects that are either 1) statically assigned membership or 2) dynamically assigned membership by virtue of the nested group hierarchy calculations used by eDirectory. A search of a group's Members attribute returns any objects that were directly assigned to the group or that were assigned membership through a nested group.
Maximum time to wait for driver shutdown in seconds	This setting controls the maximum time that the Identity Manager engine waits for the driver’s Publisher channel to shut down. If the driver does not shut down within the specified time interval, the Identity Manager engine terminates the driver.
Regular Expression escape meta-characters	This control determines the meta-characters that will be escaped while expanding the local variable when used in a regular expression context. All characters that need to be escaped must be added as a comma separated list for this control value. If a meta-character is not present in the control value, then it will not be escaped during local variable expansion containing a regular expression. While using this control, ensure the following: ◆ The value is not left empty. By default, it is populated with ***$***. ◆ To escape any meta character, specify the meta character followed by a back slash (`\`). For example, to escape **^** (carat), specify the following value: `^,\` **NOTE:** This control is available only from Identity Manager 4.0.2 Engine Patch 4.

A.4 Log Level

Each driver set and each driver has a log level field where you can define the level of errors that should be tracked. The level you indicate here determines which messages are available to the logs. By default, the log level is set to track error messages. (This also includes fatal messages.) To track additional message types, change the log level.

NetIQ recommends that you use Audit or Sentinel for logging and reporting if possible. See the *NetIQ Identity Reporting Module Guide* and *NetIQ Identity Manager Reporting Guide for Sentinel*.

Option	Description
Use log settings from the DriverSet	If this is selected, the driver logs events as the options are set on the Driver Set object.
Log errors	Logs just errors.
Log errors and warnings	Logs errors and warnings.
Log specific events	Logs the events that are selected. Click the icon to see a list of the events.
Only update the last log time	Updates the last log time.
Logging off	Turns logging off for the driver.
Turn off logging to DriverSet, Subscriber and Publisher logs	Turns all logging off for this driver on the Driver Set object, Subscriber channel, and the Publisher channel.
Maximum number of entries in the log (50-500)	Number of entries in the log. The default value is 50.

A.5 Driver Image/iManager Icon

Allows you to change the image associated with the driver in iManager. You can browse to and select a different image from the default image.

The image associated with a driver is used by the Identity Manager Overview plug-in when showing the graphical representation of your Identity Manager configuration. Although storing an image is optional, it makes the overview display more intuitive.

NOTE: The driver image is maintained when a driver configuration is exported.

A.6 Security Equals

Use the Security page to view or change the list of objects that the driver is explicitly security equivalent to. This object effectively has all rights of the listed objects.

If you add or delete an object in the list, the system automatically adds or deletes this object in that object's "Security Equal to Me" property. You don't need to add the [Public] trustee or the parent containers of this object to the list, because this object is already implicitly security equivalent to them.

Designer does not list the users the driver is security equals to.

A.7 Filter

Launches the Filter editor.

In Designer, the Filter editor is not included with the driver properties.

To access the Filter editor in Designer:

1. In an open project, click the **Outline** tab (Outline view).

2 Select the driver you want to manage the filter for, then click the plus sign to the left.
3 Double-click the **Filter** icon to launch the Filter editor.

A.8 Edit Filter XML

Allows you to edit the filter directly in XML instead of using the Filter editor.

In Designer, the XML Filter editor is not included in the driver properties.

To access the XML Filter editor in Designer:

1 In an open project, click the **Outline** tab (Outline view).
2 Select the driver for which you want to manage the filter, then click the plus sign to the left.
3 Double-click the **Filter** icon to launch the Filter editor, then click **XML Source** at the bottom of the Filter editor.

A.9 Misc/Trace

Allows you to add a trace level to your driver. With the trace level set, DSTrace displays the Identity Manager events as the Identity Manager engine processes the events. The trace level affects only the driver for which it is set. Use the trace level for troubleshooting issues with the driver when the driver is deployed. DSTRACE displays the output of the specified trace level.

Option	Description
Trace level	Increases the amount of information displayed in DSTRACE. Trace level 1 shows errors, but not the cause of the errors. If you want to see password synchronization information, set the trace level to 5.
Trace file	When a value is set in this field, all Java information for the driver is written to the file. The value for this field is the path for that file. As long as the file is specified, Java information is written to this file. If you do not need to debug Java, leave this field blank.
Trace file size limit	Allows you to set a limit for the Java trace file. If you set the file size to Unlimited, the file grows in size until there is no disk space left.
Trace name	Driver trace messages are prepended with the value entered in this field.
Use setting from Driver Set	This option is available only in Designer. It allows the driver to use the same setting that is set on the Driver Set object.

A.10 Excluded Objects

Use this page to create a list of users or resources that are not replicated to the application. NetIQ recommends that you add all objects that represent an administrative role to this list (for example, the Admin object).

Designer does not list the excluded users.

A.11 Driver Health Configuration

Driver health monitoring allows you to view a driver's current state of health as either green, yellow, or red, and to define the actions to perform in response to each of these health states. The Driver Health Configuration options are used to configure the health monitoring.

Driver health is discussed in detail in Chapter 5, "Monitoring Driver Health," on page 21.

A.12 Driver Manifest

The driver manifest is like a resumé for the driver. It states what the driver supports, and includes a few configuration settings. The driver manifest is created by default when the Driver object is imported. A network administrator usually does not need to edit the driver manifest.

A.13 Driver Cache Inspector

The Driver Cache Inspector displays information about the cache file that stores events being processed by the driver. The Driver Cache Inspector is discussed in detail in Chapter 8, "Managing Driver Cache Files," on page 39.

Designer does not include the Driver Cache Inspector.

A.14 Driver Inspector

The Driver Inspector displays information about objects associated with the driver. The Driver Inspector is discussed in detail in Chapter 7, "Managing Associations between Drivers and Objects," on page 33.

Designer does not include the Driver Inspector.

A.15 Server Variables

This page lets you enable and disable Password Synchronization and the associated options for the selected driver.

When setting up Password Synchronization, consider both the settings on this page for an individual driver and the Universal Password Configuration options in your password policies.

This page lets you control which password Identity Manager updates directly, either the Universal Password for an Identity Vault, or the Distribution Password used for password synchronization by Identity Manager.

However, NetIQ Modular Authentication Service (NMAS) controls whether the various passwords inside the Identity Vault are synchronized with each other. Password Policies are enforced by NMAS, and they include settings for synchronizing Universal Password, NDS Password, Distribution Password, and Simple Password.

To change these settings:

1. In iManager, select **Passwords > Password Policies**.
2. Select a password policy, then click **Edit**.

3 Select **Universal Password**.

This option is available from a drop-down list or a tab, depending on your version of iManager and your browser.

4 Select **Configuration Options**, make changes, then click **OK**.

NOTE: Enabling or disabling options on this page corresponds to values of True or False for certain global configuration values (GCVs) used for password synchronization in the driver parameters. NetIQ recommends that you edit them here in the graphical interface, instead of on the GCVs page. This interface helps ensure that you don't set conflicting values for the password synchronization GCVs.

Option	Description
Identity Manager accepts password (Publisher Channel)	If this option is enabled, Identity Manager allows passwords to flow from the connected system driver into the Identity Vault data store. Disabling this option means that no `<password>` elements are allowed to flow to Identity Manager. They are stripped out of the XML by a password synchronization policy on the Publisher channel. If this option is enabled, and the option below it for Distribution Password is disabled, a `<password>` value coming from the connected system is written directly to the Universal Password in the Identity Vault if it is enabled for the user. If the user's password policy does not enable Universal Password, the password is written to the NDS Password.
Use Distribution Password for password synchronization	To use this setting, you must have a version of eDirectory that supports Universal Password, regardless of whether you have enabled Universal Password in your password policies. If this option is enabled, a password value coming from the connected system is written to the Distribution Password. The Distribution Password is reversible, which means that it can be retrieved from the Identity Vault data store for password synchronization. It is used by Identity Manager for bidirectional password synchronization with connected systems. For Identity Manager to distribute passwords to connected systems, this option must be enabled. NMAS and Password policies control whether the Distribution Password is synchronized with other passwords in the Identity Vault. By default, the Distribution Password is the same as the Universal Password in the Identity Vault. If the password in the Identity Vault is to be independent of Password Synchronization, so that Identity Manager is a conduit only for synchronizing passwords among connected systems, change this default setting. In the Universal Password Configuration Options in a Password policy, disable **Synchronize Universal Password with Distribution Password**. This use of Identity Manager Password Synchronization is also referred to as “tunneling.”

Option	Description
Accept password only if it complies with user's Password Policy	To use this setting, users must have a Password policy assigned that has Universal Password enabled, and Advanced Password Rules enabled and configured. If this option is chosen, Identity Manager does not write a password from this connected system to the Distribution Password in the Identity Manager data store or publish it to connected systems unless the password complies with the user's Password policy. By using the notification option that is also on this page, you can inform users when a password is not set because it is not compliant.
If password does not comply, ignore Password Policy on the connected system by resetting user's password to the Distribution Password	This option lets you enforce Password policies on the connected system by replacing a password that does not comply. If you select this option, and a user's password on the connected system does not comply with the user's Password policy, Identity Manager resets the password on the connected system by using the Distribution Password from the Identity Vault data store. Keep in mind that if you do not select this option, user passwords can become out-of-sync on connected systems. By using the notification option that is also on this page, you can inform users when a password is not set or reset. Notification is especially helpful for this option. If the user changes to a password that is allowed by the connected system but rejected by Identity Manager because of the Password policy, the user won't know that the password has been reset until the user receives a notification or tries to log in to the connected system with the old password. **NOTE:** Consider the connected system's password policies when deciding whether to use this option. Some connected systems might not allow the reset because they don't allow you to repeat passwords.
Always accept password; ignore Password Policies	If you select this option, Identity Manager does not enforce the user's Password policy for this connected system. Identity Manager writes the password from this connected system to the Distribution Password in the Identity Vault data store, and distributes it to other connected systems, even if the password does not comply with the user's Password policy.
Application accepts passwords (Subscriber Channel)	If you select this option, the driver sends passwords from the Identity Vault data store to this connected system. This also means that if a user changes the password on a different connected system that is publishing passwords to the Distribution Password in the Identity Vault data store, the password is changed on this connected system. By default, the Distribution Password is the same as the Universal Password in the Identity Vault, so changes to the Universal Password made in the Identity Vault are also sent to the connected system. If you want the password in the Identity Vault to be independent of Password Synchronization, so that Identity Manager is a conduit only for synchronizing passwords among connected systems, you can change this default setting. In the Universal Password Configuration Options in a password policy, disable **Synchronize Universal Password with Distribution Password**. This use of Password Synchronization is also referred to as "tunneling."

Option	Description
Notify the user of password synchronization failure via-email	If you select this option, email is sent to the user if a password is not synchronized, set, or reset. The email that is sent to the user is based on an email template. This template is provided by the Password Synchronization application. However, for the template to work, you must customize it and specify an email server to send the notification messages. **NOTE:** To set up email notification, select **Passwords > Edit EMail Templates**.

B The Cache Flush Parameter

Identity Manager 4.5 provides an option to turn off the file system flush for each write. If you disable cache writes, they are not flushed immediately. Instead, it is left to the underlying operating system to take care of file system writes. Though this approach improves the performance on systems where there are heavy writes, NetIQ recommends that you do not use this approach for production systems.

NOTE: Turning off the file system flush is supported only on Linux.

To turn off the file system flush, set the environment variable `DIRXML_SKIP_FSYNC` to some value and restart eDirectory. The code only looks for the presence of this environment variable and does not regard the value associated with it. Alternatively, you can set the environment variable in the pre-ndsd start script, as shown below:

```
DIRXML_SKIP_FSYNC=true # Added manually to skip file system flush

export DIRXML_SKIP_FSYNC # Added manually to skip file system flush
```

To turn on the file system flu

sh, remove the environment variable setting and then restart eDirectory. If you have set the environment variables in the pre-ndsd script, remove them and then restart eDirectory.