Developing Custom Knowledge Scripts

NetIQ® AppManager®

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Legal Notice

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Contents

About this guide

The NetIQ AppManager Suite (AppManager Suite) is a comprehensive solution for managing, diagnosing, and analyzing performance, availability, and server health for a broad spectrum of operating environments, applications, and server hardware.

AppManager provides system administrators with a central, easy-to-use console to view critical server and application resources across the enterprise. With AppManager, administrative staffs can monitor computer and application resources, check for potential problems, initiate responsive actions, automate routine tasks, and gather performance data for real-time and historical reporting and analysis.

Intended audience

Developing Custom Knowledge Scripts is intended for system administrators and expert users interested in modifying existing Knowledge Scripts to provide different or additional information.

Knowledge Scripts referenced in the AppManager documentation and packaged with the product can be used as a basis for building your own Knowledge Scripts, provided that you are an authorized Beta site or licensed customer and you are not engaged in any competitive activities against NetIQ Corporation.

This guide assumes you are at least somewhat familiar with Visual Basic or Perl programming and common programming practices as well as system or operation management. All of the Knowledge Scripts discussed in this guide and used as examples are written in Summit BasicScript, VBScript, or Perl.

Conventions

This guide uses consistent conventions to help you identify items throughout the documentation. The following table summarizes these conventions.

Convention	Use
Bold	• Window and menu items • Technical terms, when introduced
Italics	• Book and installation kit titles • Variable names and values • Emphasized words
`Fixed Font`	• File and folder names • Commands and code examples • Text you must type • Text (output) displayed in the command-line interface

Using online help

AppManager provides task-based, reference, and context-sensitive online Help.

To access task-based Help or search for Help topics, click **Help Topics** on the Help menu. To view context-sensitive Help within dialog boxes, click **Help** or press **F1**.

You can get help on individual Knowledge Scripts in one of the following ways:

- On the **Values** tab of the Knowledge Script Properties dialog box, click **Help** or press **F1**.
- In the Knowledge Script pane of the Operator Console, highlight a Knowledge Script and press **F1**.
- In the Knowledge Script view of the Control Center Console, highlight a Knowledge Script and press **F1**.

Other information in the library

The library provides the following information resources:

- *Installation Guide*: Provides complete information about AppManager pre-installation requirements and step-by-step installation procedures for all AppManager components.
- *Control Center User Guide*: Provides complete information about managing groups of computers, including running jobs, responding to events, creating reports, and working with the Control Center Console. A separate guide is available for the AppManager Operator Console.
- *Administrator Guide*: Provides information about maintaining an AppManager management site, managing security, using scripts to handle AppManager tasks, and leveraging advanced configuration options.
- *Knowledge Script Guide*: Provides a brief description of what each AppManager Knowledge Script does.
- *Developing Custom Knowledge Scripts*: Provides an introduction to writing your own custom Knowledge Scripts.
- *Upgrade and Migration Guide*: Provides complete information on how to upgrade from a previous version of AppManager.
- *Management Guides*: Provide information about installing and monitoring specific applications with AppManager.

The AppManager library is available in Adobe Acrobat (PDF) format and is located in the `\Documentation` folder of the AppManager installation kit.

NetIQ Online Support and Extended Support Web sites provide other resources:

- Downloads, including hotfixes, service packs, and product upgrades.
- Documentation, including white papers and the most current information about version support for the systems and applications monitored by AppManager.

Note You can access NetIQ Support without a password or registration. To access the Extended Support site, you must be a registered AppManager customer.

In addition to the AppManager documentation, you may want to consult the documentation for your Windows or UNIX operating system, or other application- or system-specific documentation for reference and conceptual information. This background information can help you get the most out of your AppManager installation.

About Attachmate

Attachmate, owned by an investment group led by Francisco Partners, Golden Gate Capital and Thoma Cressey Equity Partners, enables IT organizations to extend mission critical services and assure they are managed, secure and compliant. Attachmate's leading solutions include host connectivity, systems and security management, and PC lifecycle management. Our goal is to empower IT organizations to deliver trusted applications, manage service levels, and ensure compliance by leveraging knowledge, automation and secured connectivity. For more information, visit www.attachmate.com.

NetIQ Solutions from Attachmate

Attachmate provides a wide selection of systems and security management solutions to help you manage and secure all your essential platforms, including Windows, Unix, Linux, and iSeries. These Knowledge-Based Service Assurance products and solutions include embedded knowledge and tools to implement industry best practices and to better ensure operational integrity, manage service levels and risk, and ensure policy compliance. Our modular, best-of-breed solutions for Performance and Availability Management, Security Management, Configuration and Vulnerability Management, and Operational Change Control integrate through an open, service-oriented architecture allowing for common reporting, analytics and dashboards. Attachmate offers the following systems and security management solutions:

- **Performance and Availability Management** These products offer rapid time-to-value solutions that enable you to align your IT operations with business priorities and optimize the delivery of your IT-based business services. This solution automates the complete IT service management lifecycle: assessment of requirements, definition of Service Level Agreements, management of day-to-day operations, and review of operational metrics.

- **Security Management** These easy-to-install-and-deploy products provide effective protection from and response to security-related threats. This solution provides powerful features, such as real-time security event monitoring, mapping of threat indicators, policy violation alerts, and expedited incident forensics and resolution. These products reduce the time required to identify and resolve security threats.
- **Configuration and Vulnerability Management** These products allow you to quickly and easily assess vulnerabilities, manage security risks, and assure policy compliance. This powerful solution measures and enforces compliance to configuration baselines based on your corporate policies, regulations, and evolving security threats. You can use the latest security knowledge, which is updated in real time, to resolve compliance and configuration issues.
- **Operational Change Control** These products enable IT organizations to control, manage, and audit operational changes to servers, Active Directory, and Group Policy with unprecedented levels of accountability. NetIQ's Operational Change Control (OCC) solutions enable enterprise customers to meet IT compliance and operational integrity needs in the most cost-effective manner, by delegating access control, managing changes according to policy, and alerting and reporting on change activities and entitlements.

Contacting NetIQ Solutions Support

Please contact us with your questions and comments. We look forward to hearing from you. For support around the world, please contact your local partner. For a complete list of our partners, please see our Web site. If you cannot contact your partner, please contact our Technical Support team.

Telephone:	713-418-5000 888-323-6768 (only in the United States and Canada)
Sales Email:	info@netiq.com
Support:	www.netiq.com/support
Web Site:	www.netiq.com

Chapter 1

AppManager, Knowledge Scripts, and the Developer's Console

This chapter provides an overview of the way in which AppManager uses Knowledge Scripts and an introduction to the Developer's Console. The following topics are covered:

- Configuring a Knowledge Script job in the AppManager Operator Console
- How AppManager processes the Knowledge Script
- The components of a Knowledge Script
- Developer's tools
- Editing Knowledge Scripts in the Developer's Console
- Different views in the Developer's Console
- Testing the sample script

Configuring a Knowledge Script job in the AppManager Operator Console

If you are going to develop your own Knowledge Scripts, you should already be familiar with the use of Knowledge Scripts in the AppManager environment. This section provides a brief review of the process, covering the steps that will be important for you to understand as a developer.

An AppManager agent (software developed by NetIQ) on a managed client (a managed computer) runs Knowledge Script jobs on that computer. These jobs are requested by an Operator Console user who:

- chooses the Knowledge Script that performs the task or tasks that the user wants performed, and
- sets the properties of the job—such as the frequency with which the job should run, thresholds that should not be exceeded, whether or not to raise events, and so forth.

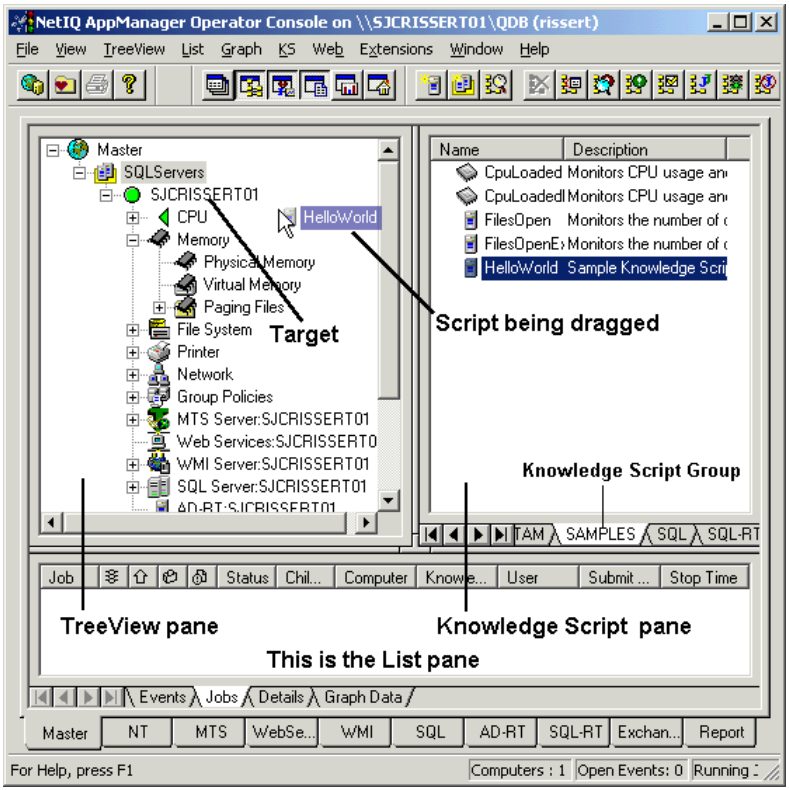
The user accomplishes these tasks in the AppManager Operator Console by:

1. selecting the desired script in the **Knowledge Script** pane,
2. dragging the script to the target object on which it should operate (a computer, a hardware component like a disk drive, an application, and so forth) in the **TreeView** pane,
3. dropping the script on the target object, which opens a **Properties** dialog box for the script, and
4. setting the job properties in the **Properties** dialog box.

When the user clicks **OK** to close the **Properties** dialog box, the Knowledge Script becomes a "job" and is run by the AppManager agent on the target computer.

Note In this book, the term **target computer** refers either to the computer that is itself the target object for a script, or to the computer that *contains* the target object (when the target object itself is a hardware device like a CPU, or a software application or service). Refer to Chapter 14, "Glossary," for more definitions of terms used in this book.

Visually, the process occurs like this:



Step 1. The user selects the Knowledge Script to be run and drags it to the target object in the Operator Console's **TreeView** pane. In the case below, the script is a sample script (`Samples_HelloWorld.qml`, in the `Samples` Knowledge Script Group) and the target object is a computer.

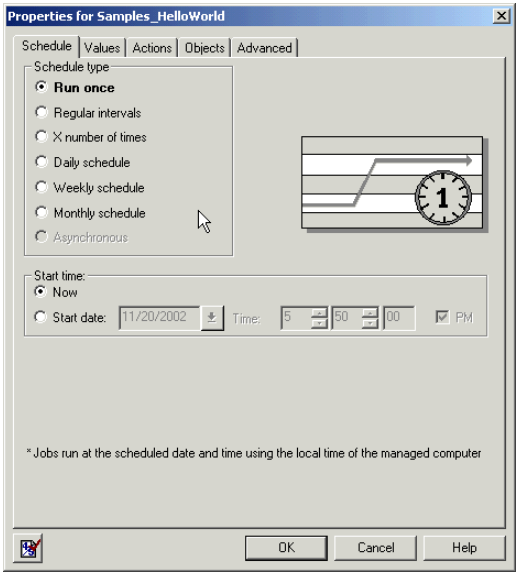
Note that, during the drag, the target object icon has changed from its normal state to a green disc. This indicates that it is legal to drop this particular script on this target object. At the same time, the icon for the CPU immediately below the target computer in the **TreeView** pane has changed from its normal state to a left-pointing green arrow,

indicating that it is legal to drop this script on a target object higher up in the **TreeView** pane.

Icon	Normal State	During Drag
Target object (a computer).		
CPU in the target computer, a component lower in the **TreeView** pane.		

Note The changing of icons to green, indicating where it is legal to drop this script, is a manifestation of "object type checking." Briefly, every Knowledge Script contains an "object definition" that determines which target objects are legal for this script. The Operator Console software will not permit you to drop a script on the wrong type of object.

Step 2. Given the green disc, the user drops the Knowledge Script on the target object. The Knowledge Script **Properties** dialog box then opens.



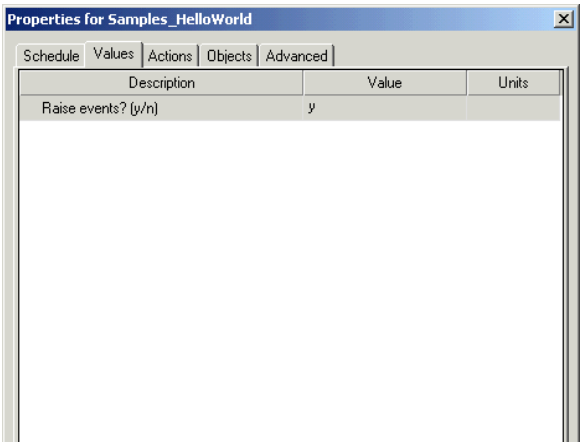
The **Schedule** tab allows the user to set the frequency with which the job is to be run. In this case the default is **Run once**. The user can set a different schedule, or accept the default.

Note The default schedule is not always the same. You, the script developer, choose the default for your script.

Perhaps the most important tab in the **Properties** dialog box is the **Values** tab. The *Script Parameters* in your script that you have chosen to be user-definable are listed in this tab. The user may elect to accept the default values or to change them.

Caution When an Operator Console user enters values for Script Parameters, the Operator Console does not do any input validation. Your code must always be written so that it can handle user input errors, including no input.

You, the developer, create the Script Parameters that users can give values to, and you choose the defaults for those Script Parameters as well—when you create your script. You also define the range of possible values for the Script Parameters. For example, in `Samples_HelloWorld.qml`, `DO_EVENT` can only take on two values, "`y`" or "`n`".

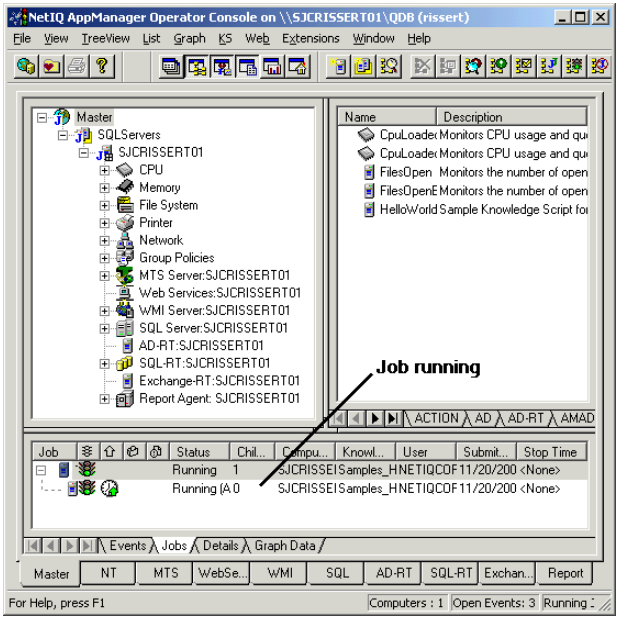


In the case of this script, there is only one Script Parameter that the user can set:

Script Parameter	Description	Possible Values	Default
`Raise events?`	Should the script raise events?	`y (yes)` or `n (no)`	`y`

In general, the user is not shown the name of the Script Parameter he or she is setting. When you create the Knowledge Script, you will associate a variable name with each Script Parameter so that you can access the user-specified value. The user will be shown a user-friendly description. For example, in `Samples_HelloWorld.qml`, the user will see `"Raise events? [y/n]"` while the variable name associated with this parameter is `DO_EVENT`.

Step 3. When the user clicks **OK** and closes the **Properties** dialog box, the job begins to run.



Recall the green disc that appeared when the script was being dragged and dropped. Once the job begins to run, the original icon reappears, with a blue capital J ("**J**" for job) superimposed. A **job** is, by definition, a Knowledge Script that has begun to run.

Note If an event has been raised by a script, the target object's icon will blink alternately with an error icon—a disc whose color indicates the severity of the error. Your script defines what that severity is.

How AppManager processes the Knowledge Script

In the process described above, the Knowledge Script is transformed by the AppManager infrastructure to generate a final script that the AppManager agents can run. In this transformation, AppManager:

1. Parses the XML elements of the Knowledge Script.
2. Leaves the code section as is.
3. Adds constants for the AppManager and Knowledge Script version numbers at the beginning of the code.
4. Gives the object type variable a value and adds it at the beginning of the code.
5. Converts the Script Parameters to variables with defined values (VBScript, Perl) or constants (Summit BasicScript), and adds them at the beginning of the code.

This transformation generates an executable script that is sent to the AppManager agent, along with scheduling information (not part of the generated script), as a job to be run.

The components of a Knowledge Script

Knowledge Script code is written in:

- Summit BasicScript (older scripts for managing Windows computers),
- VBScript (more recent scripts for managing Windows computers), or
- Perl (scripts for managing UNIX computers).

Each Knowledge Script written by you or others (as checked into the AppManager repository), is an XML file that consists of two qualitatively different components:

1. numerous non-code XML elements at the beginning of the script
2. an XML element that contains the code (the last element in the file).

Such scripts have a "`.qml`" extension (for "NetI**Q** **XML**").

Note Many older scripts have an "`.ebs`" extension. These scripts are not written in XML. However, if you open and then save such a script in the Developer's Console (see "Developer's tools" on page 30, below), it will be converted to an XML file with a `.qml` extension.

The non-code XML elements of the Knowledge Script

The non-code XML section that precedes the code element contains:

- All of the Script Parameters (thresholds, `DO_DATA`, `DO_EVENT`, etc.) for which the user can set values, along with their variable type, range (if any), and default value.
- The schedule for running the script, with a default value.
- The resource object type or types for the script.
- The names of action scripts to be executed, if any (usually chosen by the user).
- The name of the scripting language used.
- Several other elements, as discussed later.

Note You should not edit the non-code XML section directly. The Developer's Console includes a user interface (the **Script Properties** dialog box, opened from the **View** menu) for entering and modifying these non-code XML elements.

The code component of the Knowledge Script

This code component of the script is written by you. It is itself a large XML element, although you do not need to concern yourself with the XML tags. It will interact with the non-code XML elements in the script, so you must be aware of them. For example, some of the constants or variables in your script can have their values set by the user. These values will replace the defaults in the non-code XML <parameter> element if a user chooses to set them.

Note The Script Parameters that can be set by the user will become variables (or constants, in the case of Summit BasicScript) in your code.

Your Knowledge Script code can contain the following:

- Any logic allowed by the language you have chosen to use.
- Any built-in functions of the language you have chosen to use.
- Script Parameters to which a user can give values, for example `DO_EVENT`. You use these Script Parameters as constants or variables in your code *just as if* you had declared them and had assigned values to them. When the final agent-runnable script is generated, these Script Parameters will be included as defined *constants* in Summit BasicScript and as *variables* with values assigned in VBScript or Perl scripts.
- Any other variables or constants of your choice.
- Managed object methods (see the *Managed Object Reference Manual*). These methods are the "workhorses" of the scripts—you use them to get system information about managed hardware or process information about services and applications. In VBScript and Summit BasicScript, managed objects are COM objects that

contain methods that you can call. In Perl, managed objects are Perl modules.

- Callback functions (see Chapter 11, "AppManager Callbacks for Summit BasicScript and VBScript" and Chapter 12, "AppManager Callbacks for Perl"). These functions are called by your script to request information or action *from* the AppManager agent that is running the script. For example, you use a Callback function to raise an event.
- Exception handling.

A sample Knowledge Script

Here is a listing of the entirety of a very simple Knowledge Script called `Samples_HelloWorld.qml`, which can be found on your AppManager CD in `appmanager\documentation\development_tools\developer_guide\scripts`.

`Samples_HelloWorld.qml` is written in VBScript (the default language). It raises an event with a message of "Hello World!" every time the script executes (default = every 2 minutes).

The lines of asterisks (for example, `*******comment**********`) are *not* part of the script. They have been added to show you the boundaries of the non-code XML elements and the code element.

Note It is not necessary to try to understand this script at this time. It is here just so you can see what a complete Knowledge Script contains.

```
***************beginning of the XML file*****
**************the non-code XML elements**************
<PROLOGUE>
<![CDATA[
'### Copyright (c) 1995-2002 NetIQ Corp. All rights reserved.
'###
'### Samples_HelloWorld.qml
'### This script, that illustrates sending events,
'### is used as an example in the Developer Guide.
]]>
</PROLOGUE>
```

```
<KSID>
  <Type>Regular</Type>
  <Name>Samples_HelloWorld</Name>
  <Desc>Sample Knowledge Script for raising events.</Desc>
  <Version>
    <AppManID>4.0.15.1</AppManID>
    <KSVerID>1.0</KSVerID>
  </Version>
  <NeedPWD>0</NeedPWD>
  <AdminOnly>0</AdminOnly>
  <UnixOnly>0</UnixOnly>
  <DataSrcID>0</DataSrcID>
  <Platform>-1</Platform>
</KSID>

<ObjType v3style="1" fullpath="0" dropfolderlist="0">
  <Type name="NT_MachineFolder"></Type>
</ObjType>

<Schedule>
  <Default type="interval" runmode="sched">
    <Interval>
      <Hour>0</Hour>
      <Minute>0</Minute>
      <Second>120</Second>
    </Interval>
  </Default>
  <Allowed>
    <RunOnce>1</RunOnce>
    <IntervalIter>1</IntervalIter>
    <Daily>1</Daily>
    <Weekly>1</Weekly>
    <Monthly>1</Monthly>
  </Allowed>
</Schedule>

<DataSrc></DataSrc>

<Parameter>
  <Desc>Set the Event property to y to generate events.</Desc>
  <Param name="DO_EVENT">
    <Desc>Raise events? (y/n)</Desc>
    <Type>String</Type>
    <Size>1</Size>
    <Range>ynYN</Range>
```

```
    <Value>y</Value>
    <ReqInput>0</ReqInput>
    <Folder>0</Folder>
    <NoQuote>0</NoQuote>
  </Param>
  <Param name="AKPID">
    <Desc>Action, if any</Desc>
    <Value>AKP_NULL</Value>
    <ReqInput>0</ReqInput>
    <Folder>0</Folder>
    <NoQuote>0</NoQuote>
  </Param>
</Parameter>

<ActionDef>
  <Desc>Specify the action to take when events are raised.
The default is to take no action. </Desc>
</ActionDef>

*****end of the non-code XML elements****************
*****beginning of the VBScript XML element********
<ScriptDef>
  <Script language="VBScript">
<![CDATA[
*****beginning of the executable code********
Sub Main()
   Dim strShortMsg

   If DO_EVENT = "y" Then
      'Event message displayed in the List pane
      strShortMsg = "Hello World! "
      ' raise an event
      NQEXT.CreateEvent 2, strShortMsg, _
                        AKPID, "", 0, "", "", 0, 0
   End If
End Sub

*****end of the executable code*************
]]>
</Script>
</ScriptDef>
*****end of the VBScript XML element********
*****end of the XML file********************
```

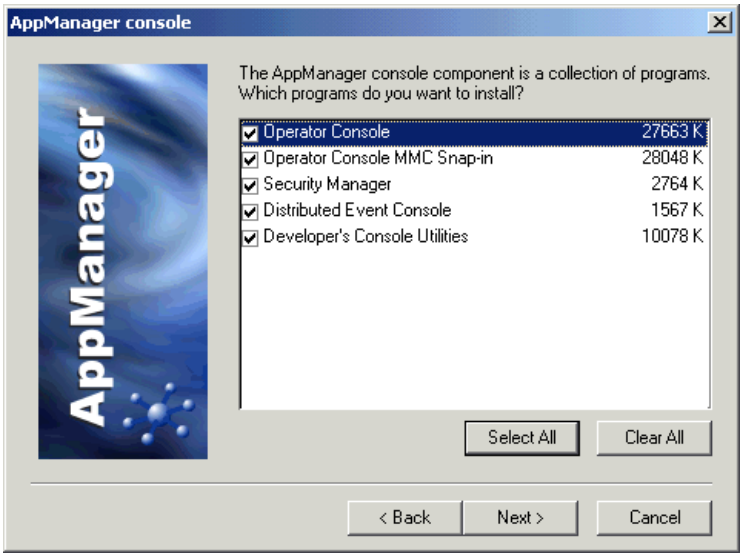
The final, generated script

When you look over the above script in its entirety, it is evident that this Knowledge Script file cannot be executed as it is because the non-code XML portions are not syntactically correct. Even the syntactically correct code cannot be executed because `DO_EVENT` is neither declared nor assigned a value.

After the Operator Console user has created a job by dragging and dropping a script on a target object (or objects) and then setting its properties, and before the script is executed, the AppManager infrastructure will generate a final script that the AppManager agent can run. In the generation process, some of the non-code XML elements in the Knowledge Script will be converted into actual code. For example, the user-set Script Parameters are converted and prepended to the beginning of the code section. The result is a **generated script**, which is a complete and executable script that is sent to the AppManager Agent (or Agents) to be run as a job. This was briefly described in "How AppManager processes the Knowledge Script" on page 23. You will see, in the next chapter, examples of each stage in the process of converting a Knowledge Script into a running job.

Developer's tools

When you purchase a Developer license, you receive a suite of tools and help files that you can use to create custom Knowledge Scripts. You install these tools and help files when you select the Developer's Console Utilities component in the setup program.



The main utilities installed are the Developer's Console, the Knowledge Script Editor, and the Icon Manager.

Developer's Console

Using this console, you can:

- Automatically generate values for non-code XML elements of your Knowledge Script, using the **Script Properties** dialog box.
- Enter the code in the executable part of the script.
- Check Knowledge Scripts out of and into the AppManager repository.
- Debug scripts written in VBScript.

The Developer's Console also allows you to convert older existing Knowledge Scripts (with a `.ebs` extension) to the newer `.qml` format. Simply open the `.ebs` script in the Developer's Console and then save it. It will be automatically converted to the newer XML format and saved with a `.qml` extension. Alternatively, you can convert entire directories of 3.x scripts by using the **Migrate** command on the **Tools** menu.

Caution After you migrate an `.ebs` file to a `.qml` file, you must be sure that the `<AppManID>` element in the new `.qml` file is set to version 4.0 or later (for example, `<AppManID>4.0</AppManID>`). You will need to edit the `.qml` file in a text editor to accomplish this—the `<AppManID>` element is not accessible through the **Script Properties** dialog box.

Knowledge Script Editor

You can use the Knowledge Script Editor to write and debug Summit BasicScript code directly (just the code, not the rest of the file).

Icon Manager

Use this utility to add custom icons and object types to the AppManager repository for customized discovery scripts (not covered in this book).

Editing Knowledge Scripts in the Developer's Console

Opening the Developer's Console

To open the Developer's Console, choose **Program Files > NetIQ > AppManager > Developer's Console > Developer Console** from the Windows **Start** menu.

You have several options for editing Knowledge Scripts:

- Create a new Knowledge Script.
- Edit an existing Knowledge Script.
- Copy an existing Knowledge Script, rename it, and then edit it to create a new script with modified behavior.

In all cases, the Knowledge Script you are editing must be checked *out* of the AppManager repository. After completing your edits, you must check the script *in* to the AppManager repository before you can run it as a job.

Opening Files

Choose **Open** from the **File** menu to open a `.qml` or `.ebs` file. The Developer's Console will automatically sense the language that the script is written in (from the XML `<Script>` element) and will open with the script in edit mode.

Warning You must save any script you are editing in the Console before you open another. If you use the **Open** command to open a different file, the current file will be closed automatically and you will lose your edits if you haven't saved the file.

Alternatively you can double-click a Knowledge Script file in Windows Explorer:

- If you double-click a file with a `.qml` extension in Windows Explorer, the Developer's Console will open automatically with that file in edit mode.
- If you double-click on a file with a `.qml` extension when the Developer's Console is already open, a new instance of the Console will open.
- If you double-click a file with an `.ebs` extension, the Developer's Console will *not* open. The Knowledge Script Editor, which is used uniquely for `.ebs` scripts, will open instead.

Checking out scripts for editing

If the Knowledge Script already exists in the AppManager repository and you want to edit it, you should check it out (use the right-click menu in the AppManager Operator Console) before editing. Checking it out will automatically open the Developer's Console with the script in edit mode. Then, choose **Check In Knowledge Script** from the **Tools** menu to check your script back in when you are finished with your edits.

Note If you have difficulty checking a script in from the Developer's Console, you can check it in from the AppManager Operator Console using the **Check In Knowledge Script...** command on the **KS** menu (or on the right-click menu). This will overwrite the previously checked-in version.

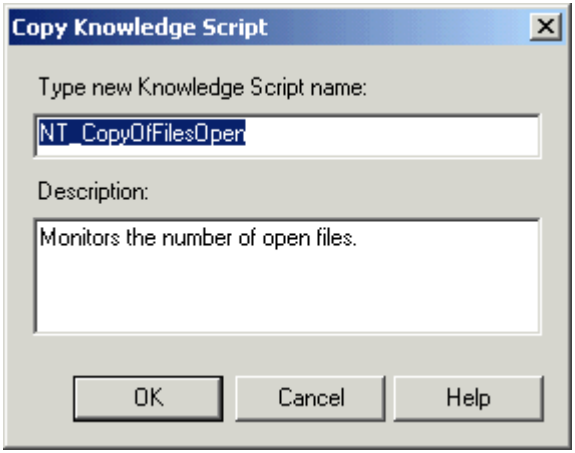
Copying, renaming, and checking in scripts

If you want to use an existing Knowledge Script as the basis of a new (modified) script, you should copy it and rename it before you do your modifications.

To copy an existing Knowledge Script and check it in with a new name, do the following:

1. In the **Knowledge Script** pane of the AppManager Operator Console, highlight the file you want to copy.

2 With the cursor on the highlighted file, open the right-click pop-up menu and choose **Copy Knowledge Script...**. The **Copy Knowledge Script** dialog box will open:



3 Rename your file as desired, change the description, and click **OK**.

4 The new Knowledge Script appears in the **Knowledge Script** pane of the AppManager Operator Console—it is *automatically checked in* to the AppManager repository.

To edit the new file, you will need to check it out to a directory of your choice. Then you must check it back in when you are finished with your modifications.

Saving and checking in scripts

To save and check in a script:

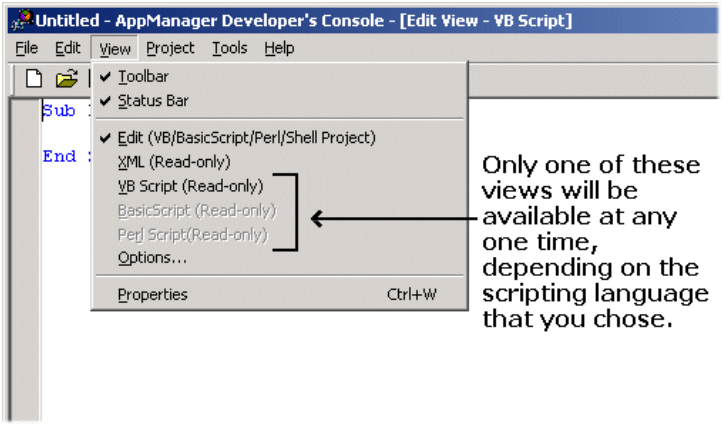
1 Choose **Save** or **Save As** from the **File** menu to save your script to any directory.

2 Choose **Check In Knowledge Script** from the **Tools** menu to check your script in to the AppManager repository. If the script has

never been checked in before, you will see it appear in the appropriate category in the AppManager Operator Console.

Different views in the Developer's Console

The screen below shows the **View** menu of the Developer's Console when the Console is opened to begin development of a new script in the default scripting language, VBScript.



In the central section of this menu are the views that you will use during development. The views are:

- **Edit**—This is the default view where you see only your code, which you can edit.
- **XML (Read-only)**—In this view, you see the entire XML file, the same way you would see it if you opened it in a text editor. You cannot edit the file in this view. (You are not supposed to edit the non-code XML portion—you change that through the **Script Properties** dialog box that opens when you select **Properties** from the **View** menu.)
- **VB Script/BasicScript/Perl (Read-only)**—In this view, you see the script as it will appear when it is run by the AppManager agent,

except that the values that the user can choose are still set to the script defaults and the object type values are not yet assigned.

The *generated script* that gets executed in the AppManager agent will look exactly like the script shown in this view except that the object type will be filled in.

Note Not all of the information in the non-code XML elements goes into the running script. For example, the information about the schedule is sent to the AppManager agent along with the script, but it is not part of the script.

Here is the sample script, `Samples_HelloWorld.qml`, that was listed earlier, as it appears in the different views:

Edit view

This is what you see in the **Edit** view:

```
Sub Main()
   Dim strShortMsg

   If DO_EVENT = "y" Then
      ' Event message displayed in the List pane
      strShortMsg = "Hello World! "
      ' raise an event
      NQEXT.CreateEvent 2, strShortMsg, _
                        AKPID, "", 0, "", "", 0, 0
   End If
End Sub
```

XML (Read-only) view

The complete listing that you saw in "A sample Knowledge Script" on page 26 is what appears in the **XML (Read-only)** view (except that the comment lines, such as `****the non-code XML elements******`, will not be present).

VB Script (Read-only) view

In the **VB Script (Read-only)** view, this is what you see:

```
'### Begin KSID Section
Const AppManID = "4.0.15.1"
Const KSVerID = "1.0"
'### End KSID Section

'### Begin Type Section
NT_MachineFolder = ""
'### End Type Section

'### Begin KPP Section
DO_EVENT="y"
AKPID="AKP_NULL"
'### End KPP Section

'### Begin KPV Section
Sub KS_INIT ()
End Sub
'### End KPV Section

'### Begin KPS Section
Sub Main()
Dim strShortMsg

If DO_EVENT = "y" Then
   'Event message displayed in the List pane
   strShortMsg = "Hello World! "
   ' raise an event
   NQEXT.CreateEvent 2, strShortMsg, _
       AKPID, "", 0, "", "", 0, 0
End If
End Sub
'### End KPS Section
```

Note that this is a script that the AppManager agent can run. It does not yet have the values that a user might choose. However, it does have the default values and you can run it as a job. Also note that the lengthy section of non-code XML elements has been replaced with a much shorter section of executable script.

Note The "KPV Section" that contains `Sub KS_INIT()` does nothing—it is reserved for future use.

Testing the sample script

If you want to run `Samples_HelloWorld.qml` to test what you have learned, you must first check it in to the AppManager repository, as follows:

1. Open the script in the Developer's Console. This script, and other sample scripts, are located on your AppManager CD, in `appmanager\documentation\development_tools\developer_guide\scripts`.
2. Check in the script by choosing **Check In Knowledge Script** from the **Tools** menu. The script should appear in the **Samples** tab of the **Knowledge Script** pane of the Operator Console.

Note If check-in fails using the **Tools** command, you can check in the file directly by using the right-click menu in the **Knowledge Script** pane of the Operator Console.

Once the Knowledge Script has been checked in, you can run it. You might find it interesting to explore the effect of changing schedules or adding actions to the script. You can do this either of two ways:

- with the **Script Properties** dialog box in the Developer's Console (in this case, you must check the script out and back in each time you modify it) or
- using the **Properties** dialog box that opens in the Operator Console after you have dropped the script on its target object.

Chapter 2

AppManager Architecture

The discussion in this chapter describes the AppManager architectural elements used in processing and running Knowledge Scripts. It should be helpful in understanding the more subtle aspects of writing scripts. Complete mastery of this material is, however, not essential for modifying existing scripts.

This chapter provides information about the life history of a Knowledge Script—from the time it was checked in to the AppManager repository as a completed script to the time it begins to run as a *job*.

The following topics are covered:

- A completed Knowledge Script
- AppManager architecture
- Running Knowledge Scripts
- Example
- Where each part of the running script came from

A completed Knowledge Script

After you have finished creating or modifying a script, you check it in to the AppManager repository. As you know (see "The final, generated script," on page 29), your checked-in Knowledge Scripts are not yet executable.

All pre-existing scripts are stored in various tables of the AppManager repository. You can find any script in your `\AppManager\qdb\kp`

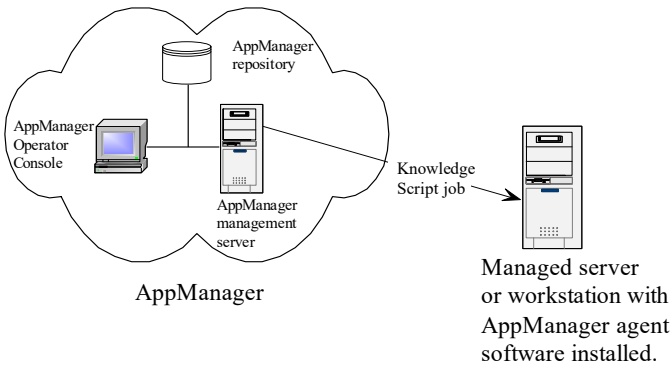
directory, where they are in subdirectories according to type. For example, WinNT scripts can be found in `\AppManager\qdb\kp\nt`.

Note The `qdb` in `\AppManager\qdb` is just the name of a directory—it does not reflect the contents of the AppManager repository. During the AppManager installation, scripts in the `kp` directory tree were checked in to the AppManager repository. Subsequently, any changes made (by checking scripts out, altering them, and checking them back in) affect the Knowledge Scripts stored in the AppManager repository, but those changes are *not* reflected in the `.qml` files in the `\AppManager\qdb\kp` directory tree *unless* you checked them out to that directory.

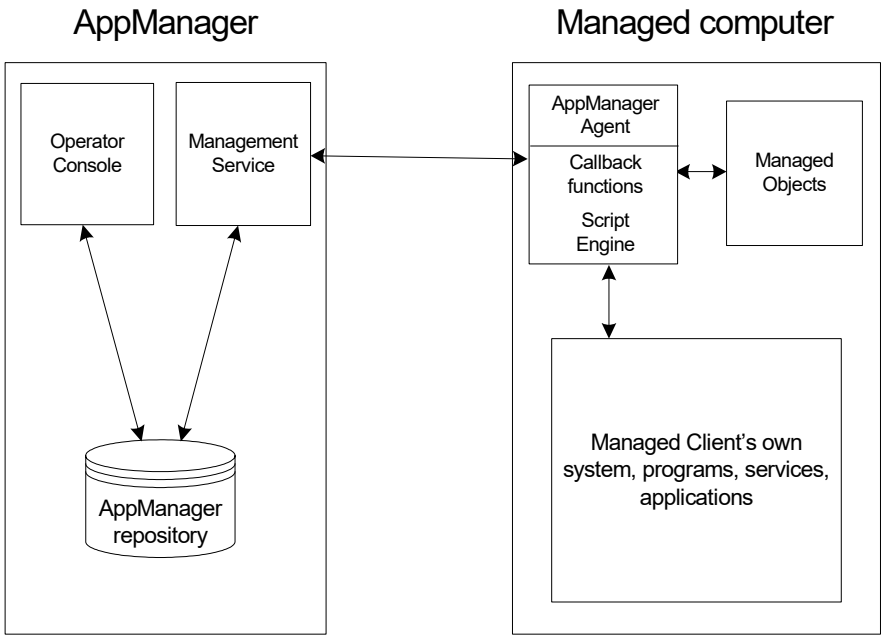
When a user creates a job from your Knowledge Script, AppManager retrieves the script from the repository and processes it through a series of steps to generate an executable script that the AppManager agent can run on the target computer. To understand this series of steps, you need to know a little about the AppManager architecture.

AppManager architecture

As discussed in Chapter 1, the Operator Console creates Knowledge Script jobs to be run by the AppManager agent on the target computer.



The following drawing shows a more detailed view of the AppManager architecture to explain how Knowledge Scripts are processed and run. The drawing does not represent the only possible AppManager configuration—for example, the three components shown as **AppManager** can be on the same server, as shown, but they do not need to be. Also, the components on the **Managed computer** have been simplified somewhat to facilitate discussion.



AppManager components

1 The Operator Console is the user interface for AppManager, and connects to the AppManager repository.

Note The AppManager repository is called "QDB" by default, although it can be given any name during installation.

2. The repository is very important—it is the center of the AppManager world. The repository server provides a central store of information including Knowledge Scripts, events, graphs, and jobs (instances of running Knowledge Scripts). The job tables include the various pieces of your scripts, and other information such as scheduling.

3. The Management Service is responsible for transferring jobs created by the user to the AppManager agents on managed systems. It is also responsible for forwarding the events and data generated by jobs from the agents back into the AppManager repository.

Managed computer components

1. The AppManager agent performs a variety of tasks:
   - It runs scripts (jobs).
   - It has a local repository where it stores scripts, schedules, and actions.
   - It communicates with the AppManager management server.

2. The managed objects are installed on the managed computer along with the AppManager agent, and are called by the scripts being run by the agent. They are COM objects or Perl modules containing methods that are specific to particular applications and are used to retrieve information about the monitored system or application that the script cannot obtain for itself.

Running Knowledge Scripts

These are the steps that the script undergoes when it is converted from a Knowledge Script stored in the AppManager repository to a job running on a target computer:

1. In the Operator Console, a user chooses a Knowledge Script, drags it, and drops it on the target object.

2. The **Properties** dialog box opens.

3. The user sets Script Parameters, execution schedule, actions, and so forth—or accepts the defaults. Then the user clicks **OK** to close the dialog box.

4. The Operator Console fills in values for the object types.

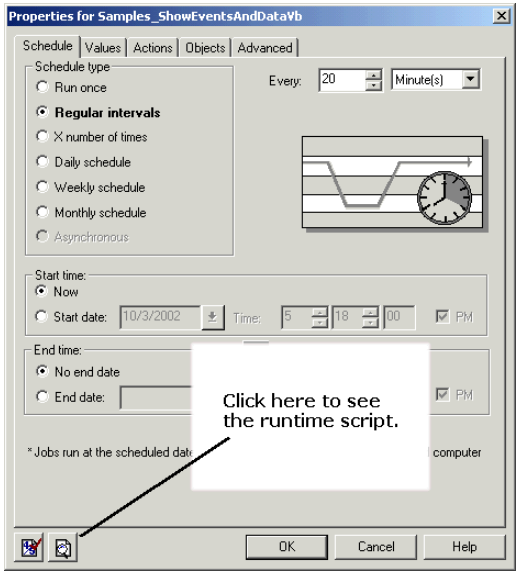
5. The Operator Console creates an instance of the script (a job) in the repository. The job is an instance of the script that includes the user defined Script Parameter values, the schedule, the object types, and so forth. This final script has all Script Parameters (including `AKPID`) and object types defined as *constants* in BasicScript and *variables* in VBScript and Perl.

6. The job is forwarded to the AppManager agent on the target computer to be run as a job. Scheduling information (not part of the script) is also sent to the agent, as is information about Actions to perform.

All of the information about the job is also held in the AppManager repository, along with pointers to any action scripts that are to be run on the AppManager management server.

Once the job starts to run, you can see the entire running script by double-clicking on the job's child. This will open the **Properties**

dialog box, where there is now a button you can click to see the running script:



Example

As an example, let's run the `Samples_HelloWorld.qml` script discussed in the previous chapter, accepting the defaults in the **Properties** dialog box: Here is the final script as it will run:

```
'### Begin KSID Section
Const AppManID = "4.0.15.1"
Const KSVerID = "1.0"
'### End KSID Section

'### Begin Type Section
NT_MachineFolder = "SJCRISSERT01"
'### End Type Section
'### Begin KPV Section
Sub KS_INIT ()
End Sub

'### End KPV Section
```

```
'### Begin KPP Section
DO_EVENT="y"
AKPID="AKP_NULL"
'### End KPP Section

Sub Main()
Dim strShortMsg

If DO_EVENT = "y" Then
   'Event message displayed in the List pane
   strShortMsg = "Hello World! "
   ' raise an event
   NQEXT.CreateEvent 2, strShortMsg, _
       AKPID, "", 0, "", "", 0, 0
End If
End Sub
```

Compare this script with the **VB Script (Read-only)** view in the Developer's console:

```
'### Begin KSID Section
Const AppManID = "4.0.15.1"
Const KSVerID = "1.0"
'### End KSID Section

'### Begin Type Section
NT_MachineFolder = ""
'### End Type Section

'### Begin KPP Section
DO_EVENT="y"
AKPID="AKP_NULL"
'### End KPP Section

'### Begin KPV Section
Sub KS_INIT ()
End Sub
'### End KPV Section

'### Begin KPS Section
Sub Main()
Dim strShortMsg

If DO_EVENT = "y" Then
   'Event message displayed in the List pane
   strShortMsg = "Hello World! "
```

```
   ' raise an event
   NQEXT.CreateEvent 2, strShortMsg, _
       AKPID, "", 0, "", "", 0, 0
End If
End Sub
'### End KPS Section
```

Comparing the two scripts, you will see *only one* difference in the code—a value has been filled in for the object type, `NT_MachineFolder = "SJCRISSERT01"`(the name of the target computer) in the running script.

If we had used the **Properties** dialog box to change the value of the DO_EVENT Script Parameter, rather than accepting the default, we would have seen the changed value in the "KPP section" of the running script as well.

Changes to the schedule will not appear in the running script, as scheduling information is not part of the final script. AppManager sends the scheduling information to the AppManager agent independently of the script.

Where each part of the running script came from

Apart from `Sub Main()`, everything in the running script was generated by AppManager from the other non-code XML elements of the Knowledge Script. Here is a brief view of where each section came from:

Running Script Section	Origin

`'### Begin KSID Section`
`Const AppManID = "4.0.15.1"`
`Const KSVerID = "1.0"`
`'### End KSID Section`
	The two constants came from the `<KSID></KSID>` non-code XML element.

`'### Begin Type Section`
`NT_MachineFolder = "SJCRISSERT01"`
`'### End Type Section`
	The name "`NT_MachineFolder`" came from the `<ObjType>` non-code XML element. The value ("`SJCRISSERT01`", which is the actual name of the target computer) was filled in by the Operator Console program.

`'### Begin KPV Section`
`Sub KS_INIT ()`
`End Sub`
`'### End KPV Section`
	This section is reserved for future use. At the present time, `Sub KS_INIT ()` does nothing.

`'### Begin KPP Section`
`DO_EVENT="y"`
`AKPID="AKP_NULL"`
`'### End KPP Section`
	These values came from the `<Parameter>` non-code XML elements. Any changes by the user during job creation would appear here.
	See the note below about `AKPID`.

`Sub Main()`
`Dim strShortMsg`
`If DO_EVENT = "y" Then`
`  strShortMsg = "Hello World! "`
`'Event message displayed in the List pane`
`' raise an event`
`  NQEXT.CreateEvent 2, strShortMsg, _`
`  AKPID, "", 0, "", "", 0, 0`
`End If`
`End Sub`
	This is the code section, exactly as it was written.

Anything that was in non-code XML elements that does not appear in the running script is used by AppManager in some other way. For example, all of the information about scheduling is forwarded to the AppManager agent but is not part of the script.

Note If a user added one action script during job creation, `AKPID` would have the value `AKPID= "1"`. If two jobs were added, it would be `AKPID= "1,2"`. These values are IDs for the action scripts to be run. AppManager can determine which action scripts need to be run from the IDs, although the running script itself has no knowledge of what

the action scripts are.

As with schedules, you do not need to write code to handle actions. You do, however, need to define `AKPID` in the **Parameters** section of the Developer's Console **Script Properties** dialog box and give it a default value of "`AKP_NULL`". If you want to define actions yourself, you must do it in this dialog box (in which case the Operator Console program will over-ride "`AKP_NULL`" as the value of `AKPID` when a job is created).

Chapter 3

Knowledge Script basics

This chapter covers the basics of creating a Knowledge Script, with the exception of writing the code—that will be discussed in detail in subsequent chapters.

Even if you are interested only in modifying or extending pre-existing scripts—in such cases you will find much of this work already done for you—this chapter will provide you with a basis for understanding how to use the Developer's Console to work with Knowledge Scripts.

The following topics are covered.

- Script elements
- Starting creation of a new script
- Setting default properties
- Where to go from here

Script elements

Apart from the code itself, there are a number of things that go into Knowledge Scripts. For example, you must name your script and assign an object type to it in ways that are consistent with the AppManager application framework. You must also choose values for a number of the non-code XML elements of the script.

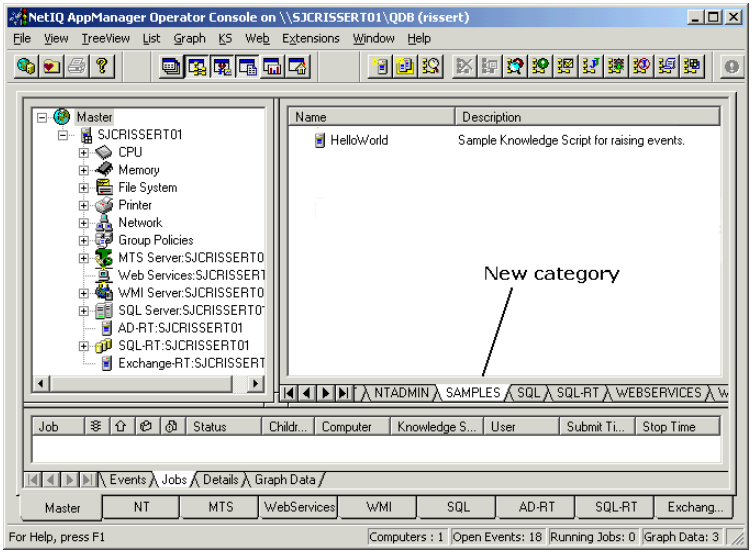
Naming scripts

Each Knowledge Script name is composed of two parts: a **prefix** that determines its Knowledge Script category and a **name** (as self-explanatory as possible) that will be displayed in the **Knowledge**

Script pane of the AppManager Operator Console. An underscore character separates the two parts.

For example, if you name a Knowledge Script `NT_DiskSpace`, the Knowledge Script is displayed in the Knowledge Script pane under the `NT` tab along with other NT-related Knowledge Scripts.

You can use an existing Knowledge Script category, or you create a new one. If you check in a Knowledge Script with a prefix that does not correspond to an existing category, a new category will be created. For example, if you create and check in a Knowledge Script named `Samples_HelloWorld.qml`, and there is no `Samples` category, it will be created with your script in it.



Assigning an object type

Each Knowledge Script is associated with one or more *resource object types*. An object type is used to determine which resource objects—such as computers, disk drives, databases, or network cards to which

the Knowledge Script can be applied. Internally, AppManager uses a *type checking* mechanism to ensure that each Knowledge Script is applied only to the resource objects it can manage.

Creating new resource object types, and the discovery scripts that must go with them, is a complex activity that should not be undertaken by anyone who is not an experienced programmer. It is not covered in this book.

You should be able to find an existing resource object type that you can use. For example, `NT_MachineFolder` is quite versatile for Windows. Similarly, for UNIX, `UNIX_MachineFolder` is widely applicable.

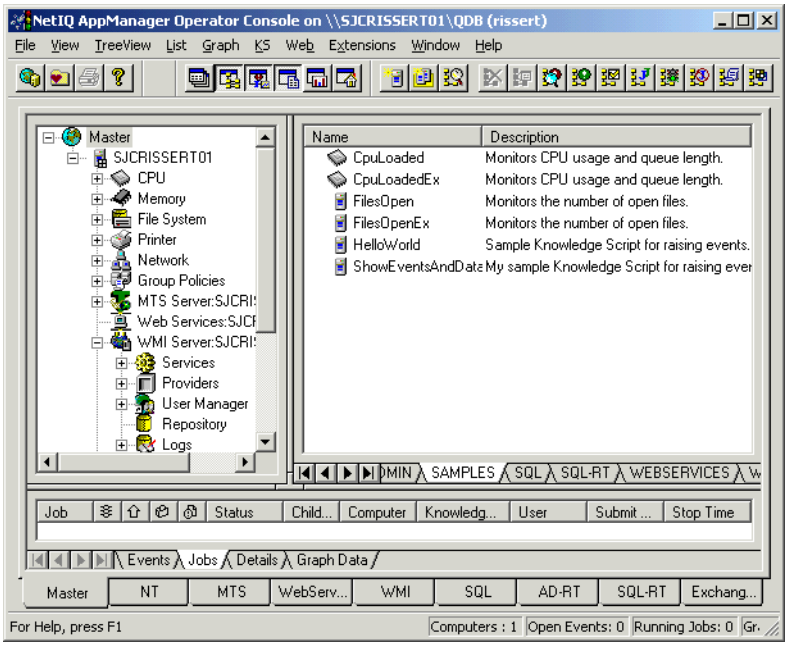
To see what object types already exist, do the following:

1. Choose **Properties** from the **View** menu in the Developer's Console.
2. Choose the **Object Types** tab in the **Script Properties** dialog box.
3. Click **Add to** open the **Add New Object Type** dialog box.

   Between the **Object group:** and **Objects:** lists, you can see all the existing object types.

This book is oriented towards script developers who are primarily interested in modifying or extending *existing* Knowledge Scripts. In such cases, the object type will *already* be defined and you do not have to worry about it.

Object types are associated with icons. If you look in the **Knowledge Script** pane of the Operator Console, you will see that each script exhibits its own icon— the object type for the script. At the same time, each object in the **TreeView** pane is also represented by the icon for its object type. In general (a few icons are used for more than one object type), when the script icon matches the **TreeView** object icon, you can drop the script on that object.



Deciding on user-definable Script Parameters

You do not need to decide on user-definable Script Parameters before you write your script, although you can do so. For example, `DO_DATA` and `DO_EVENT` are very commonly used to allow users to decide whether to collect data or raise events.

You should always define a Script Parameter named `AKPID`, used by event messages to call for execution of action scripts. In most scripts, you will leave it to the user to determine actions so you set `AKPID` to a default of "`AKP_NULL`" (no actions). Users do not see `AKPID` as a Script Parameter, even though that's where you defined it—they use the **Actions** tab of the Operator Console **Properties** dialog box to choose the actions. The AppManager program alters the `AKPID` Script Parameter in accordance with the user's choices.

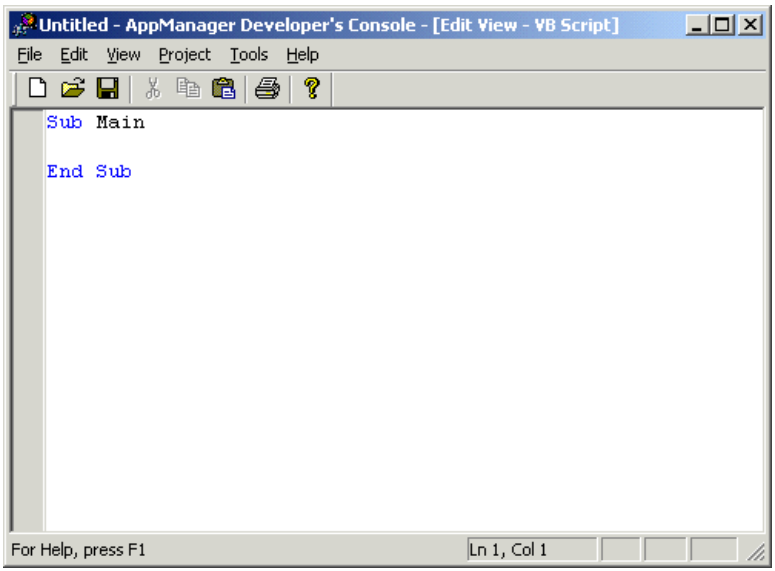
Other non-code XML elements

You will need to choose the scripting language before you begin writing code. You must also choose the type of Knowledge Script. There are four possibilities:

- Normal scripts, which can be either monitoring scripts (see Chapters 4 through 6 for more information) or report scripts (Chapter 10).
- Action scripts (see Chapters 7 through 9).
- Discovery scripts (not covered in this book).
- Install scripts (not covered in this book).

Starting creation of a new script

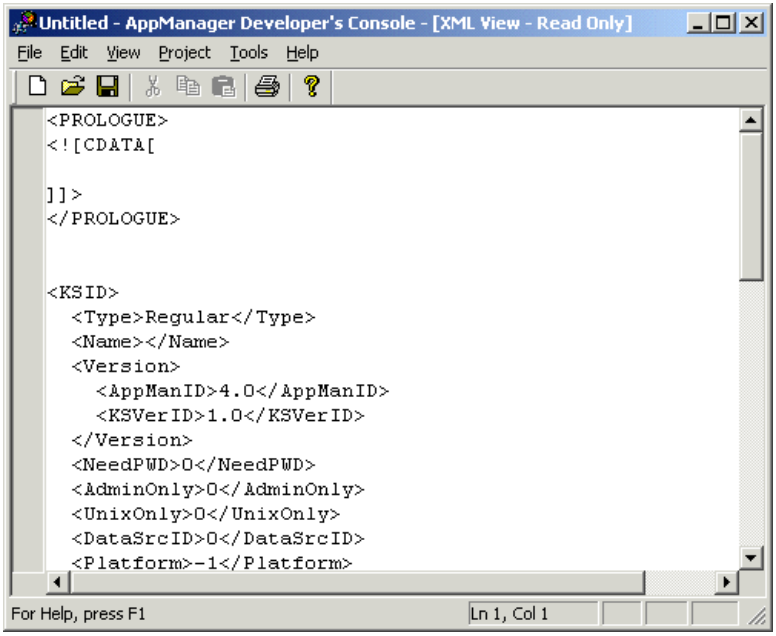
When you open the Developer's Console and choose **New** from the **File** menu, this is what you will see in the default **Edit View**:



You can begin to write your code immediately. Note, in the title bar of the Console window, that the default language is VBScript.

It appears that the new Knowledge Script is empty except for the two lines opening and closing the Main subroutine, where you will place your code. However, it is not empty—the non-code XML elements are there, even though they are not visible in the **Edit View**. Some of the non-code XML elements already have default values filled in, while others are empty, waiting for you to populate them through the **Script Properties** dialog box.

Choose **XML (Read-only)** from the **View** menu to see the entirety of the new Knowledge Script, including the header. If you have not yet opened the **Script Properties** dialog box and made any changes, this is what you will see:



The 6.0 agent can handle action scripts up to 256k bytes in length. Agents from previous versions of AppManager can only run action scripts up to 32k in length.

Listing of the new (empty) script

The table below shows the entire contents of the window above, with explanations. You will populate the non-code XML elements (all but the last three rows in the table) yourself through the **Script Properties** dialog box.

Script section	Description

`<PROLOGUE>`
`<![CDATA[`
 	
`]]>`
`</PROLOGUE>`
	You can enter comments here, such as the author's name, the date, copyright statements, and a brief description of the script.
	
	Here you edit the `.qml` file directly in a text editor, rather than through the **Script Properties** dialog box. This is the ***only*** place you should edit a non-code XML element without using the **Script Properties** dialog box.

`<KSID>`
`  <Type>Regular</Type>`
`  <Name></Name>`
`  <Version>`
`  <AppManID>4.0</AppManID>`
`  <KSVerID>1.0</KSVerID>`
`  </Version>`
`  <NeedPWD>0</NeedPWD>`
`  <AdminOnly>0</AdminOnly>`
`  <UnixOnly>0</UnixOnly>`
`  <DataSrcID>0</DataSrcID>`
`  <Platform>-1</Platform>`
`</KSID>`
	This section is already populated with some default values. The `<Type>` element is set to the default of "`Regular`", which means that the script is of "`Normal`" type, as opposed to "`Discovery`" or "`Action`" or "`Install`". `<AppManID>` is `4.0`, meaning that this script is consistent with AppManager 4.0 and later.
	The `<KSVerID>` element is incremented automatically every time you check a script out and then back in. It begins at 1.0 and is incremented to 1.1, 1.2, ...
	Note: To see the version number of any Knowledge Script selected in the **TreeView** pane of the Operator Console, open the right-click menu and choose **Version History**.
	A zero value for elements means "no" or "not required."

`<ObjType v3style="1"`
`fullpath="0"`
`dropfolderlist="0">`
`</ObjType>`
	This element will contain the "resource object type" or types, when you add them with the **Script Properties** dialog box.

Script section	Description

`<Schedule>`
`  <Default type="runonce" runmode="sched"></Default>`
`  <Allowed>`
`  <RunOnce>1</RunOnce>`
`  <IntervalIter>1</IntervalIter>`
`  <Daily>1</Daily>`
`  <Weekly>1</Weekly>`
`  <Monthly>1</Monthly>`
`  </Allowed>`
`</Schedule>`
	This section will contain the data for the schedule or schedules for running the Knowledge Script. You will populate this section through the **Script Properties** dialog box.

`<DataSrc></DataSrc>`	Reserved for future use.
`<Parameter></Parameter>`	When you use the **Script Properties** dialog box to add Script Parameters, their definitions will go here.
`<ActionDef></ActionDef>`	When you use the **Script Properties** dialog box to add actions, their definitions will go here.

`<ScriptDef>`
`  <Script language="VBScript">`
`<![CDATA[`
	XML element tags to open the code section. Identifies VBScript as the default script language.

`Sub Main`
 	
`End Sub`
	This is the section that will hold your code, as you write and edit it in the **Edit View**.

`]]>`
`</Script>`
`</ScriptDef>`
	XML element tags to close the code section.

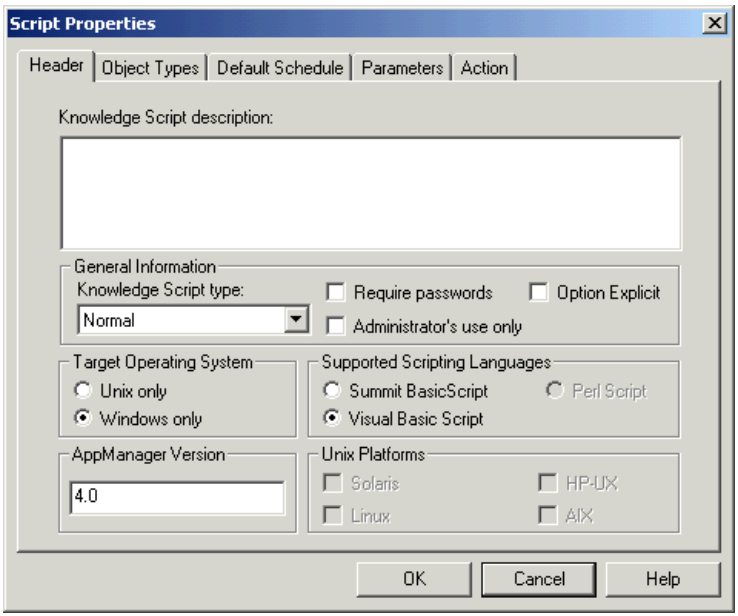
Setting default properties

You use the **Script Properties** dialog box to set default values for the job properties. The properties for a running script will be set by whoever creates a job with this Knowledge Script using the Operator Console. They will use a *different* dialog box to do this.

The different tabs of the Script Properties dialog box are shown below. The Help file for the Developer's Console describes their use in detail. They are shown here to get you thinking about what goes into the non-code XML elements of your Knowledge Scripts. See the Appendix, "Dialog Boxes," for a more detailed discussion.

The Header tab

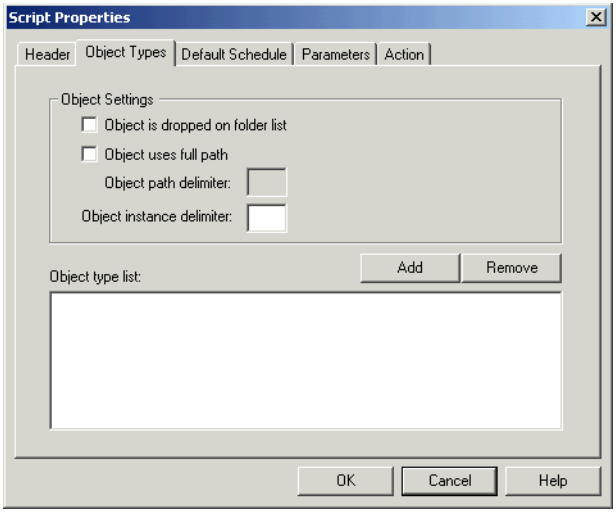
You use this tab to set general values such as a tool-tip description of the Knowledge Script, its type (Normal, Action, Discovery, Install), the operating system, the scripting language, and the AppManager version.



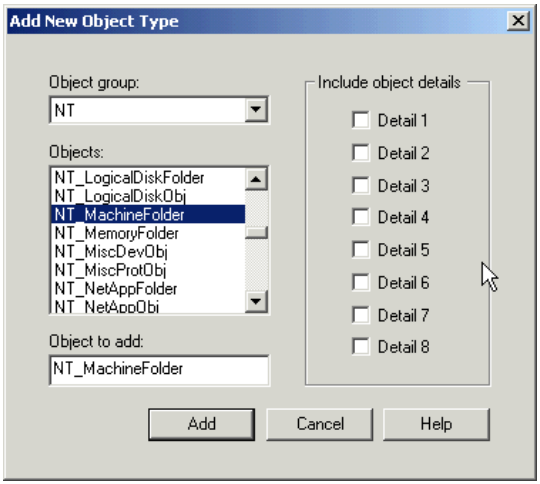
Refer to the Help file for the Developer's Console (choose **Contents** from the **Help** menu) for further information on the fields in the **Script Properties** dialog box.

The Object Types tab

In this tab you choose the resource object types for this script.

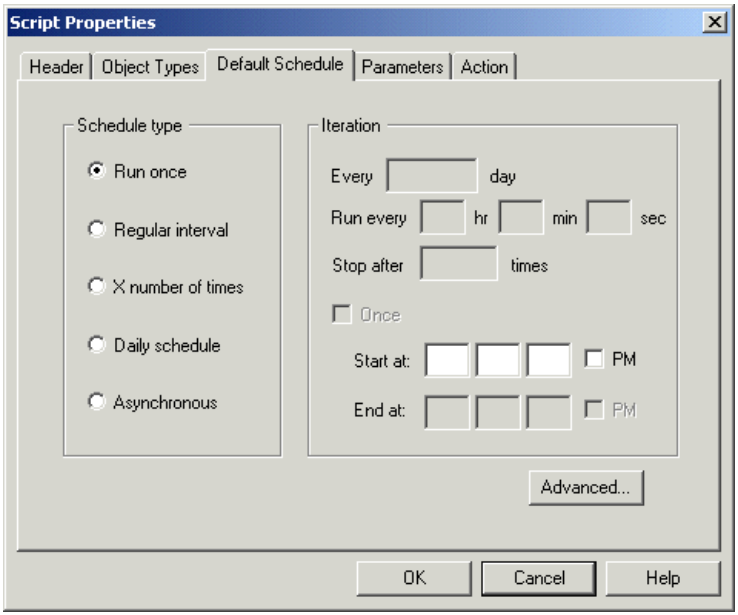


To add an object type, click the **Add** button. This will open the **Add New Object Type** dialog box.



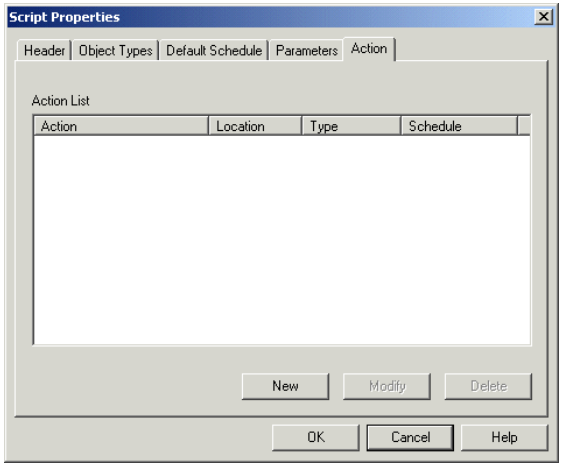
The Default Schedule tab

Every Knowledge Script job must run according to a set schedule. Use this tab to set the default schedule. If someone creates a job with this Knowledge Script and does not choose a different schedule, this default schedule will be used.



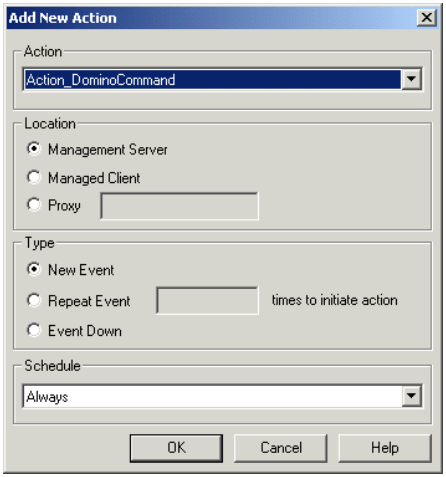
The **Advanced** tab allows you to place restrictions on the allowed schedules.

The Action tab



There are no actions at the outset. You add them with the **Add New Action** dialog box that opens when you click the **New** button.

Users can add actions themselves when they define the properties of a Knowledge Script job, with a nearly identical dialog box. Usually, you will leave it to users to define the actions, if any.



The Parameters tab

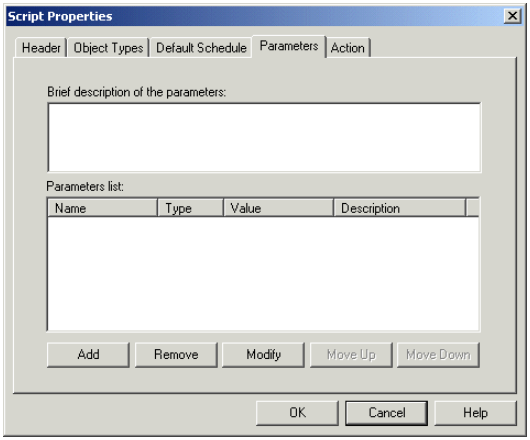
You select variables in your code whose values can be modified by an Operator Console user to change the behavior of the script. These variables are called "Script Parameters." You write your code *as if* these variables are already defined. However, you do not explicitly add them to your code—AppManager will do that for you when it generates the final script.

Examples of Script Parameters are user-selected thresholds and limits. You can also use Script Parameters to specify behavior in your script. For example, you can add a Script Parameter called `DO_EVENT` that can have the values `y or n`. If the user sets the value to `y` (yes), then your script will raise events.

You use the **Parameters** tab of the **Script Properties** dialog box to:

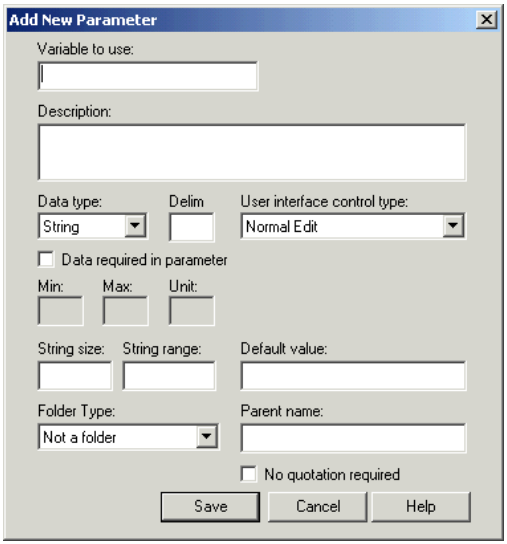
- Create a Script Parameter.
- Assign a variable name to the Script Parameter so that your code may use the user-defined value and act accordingly.
- Assign a description to the Script Parameter that the Operator Console user will see.
- Assign default values for the Script Parameters.

- Define the allowed values for the Script Parameter. For example, you can allow a user to give `DO_EVENT` the values `y` or `n`, but no other values.



The variables assigned to the Script Parameters that you define with the **Parameters** tab will become *constants* (Summit BasicScript) or *variables* (VBScript and Perl) in your script.

In a new script there are no Script Parameters at all. You use the **Add New Parameter**s dialog box to add Script Parameters one at a time.



Each Script Parameter has two names:

- The name of the constant (Summit BasicScript) or variable (VBScript and Perl) that you use in your code. Enter this in the **Variable to use:** field. The Operator Console user will not see this name.
- The name (really more of a description) that is visible to the user and that the user can set a value for. Enter this in the **Description:** field.

The script developer should always define a parameter with a variable name of `AKPID` (for VBScript and Summit BasicScript) or `$Akpid` (for Perl). The Operator Console user will never see this parameter.

Example of defining a Script Parameter

Assume that you have decided to use a variable called `CPU_THRESHOLD`, nominally set to `50`, in your script, and also assume that you want the

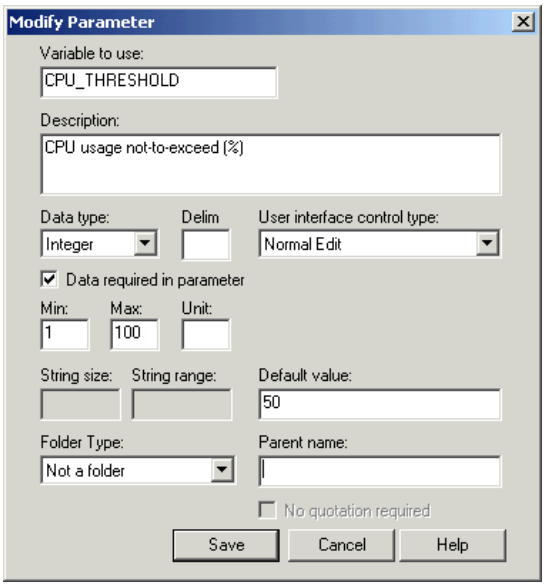
AppManager Operator Console user to have the ability to change the value of this variable if they want to.

If this constant were not user-definable, you would just define it in your code like this:

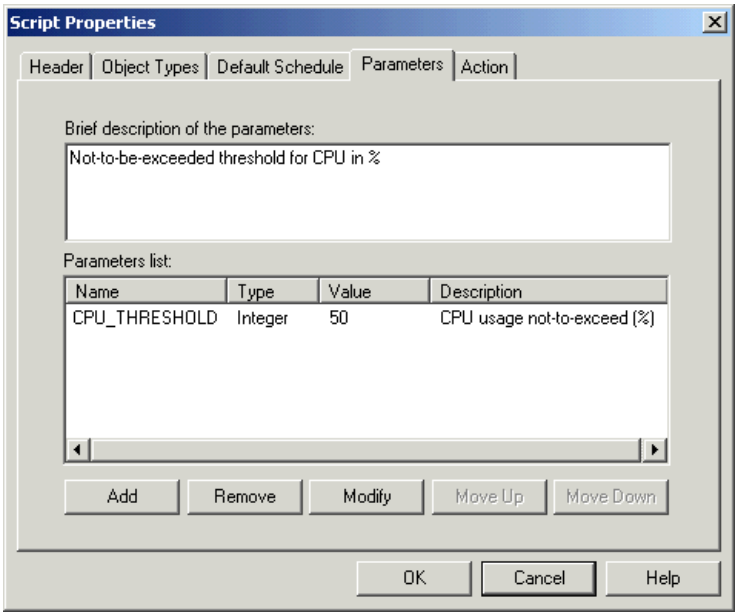
- `CPU_THRESHOLD = "50"` (VBScript variable)
- `Const CPU_THRESHOLD = "50"` (Summit BasicScript constant)
- `$CPU_THRESHOLD = 50;` (Perl variable)

Since `CPU_THRESHOLD` is going to be user-definable in your code, you *do not define it at all*—you leave the definition to AppManager—but you write your code *as if you had defined it*. Here is an example of the process for a Knowledge Script called `Samples_Test` written in VBScript.

Step 1, What the script developer does: In the Developer's Console, you open the **Script Properties** dialog box, select the **Parameters** tab, click **Add**, and add your variable:

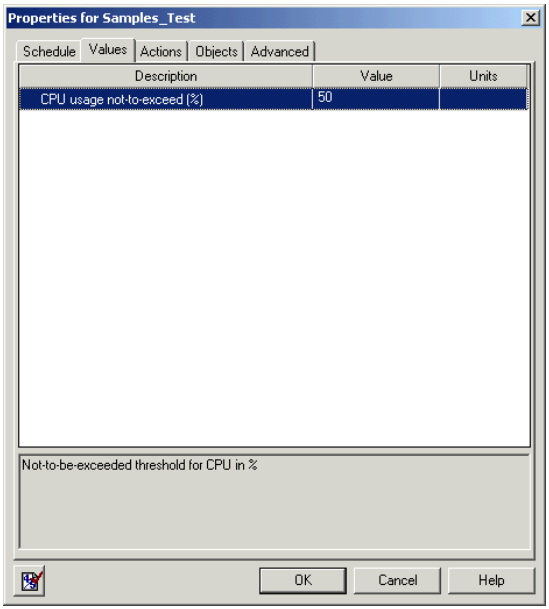


Returning to the **Parameters** tab, this is what you will see:

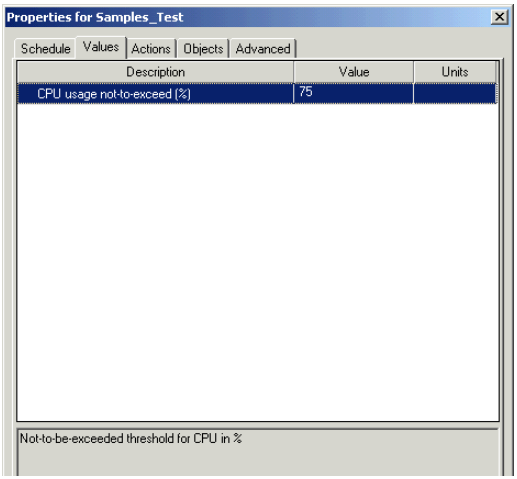


Step 2, What the Operator Console user does: When the Operator Console user drags the script to a target object (in this case a CPU), the **Properties for Samples_Test** dialog box opens and the user selects the **Values** tab.

Note The **Properties for Samples_Test** dialog box that the user sees in the AppManager Operator Console is similar to the **Script Properties** dialog box used by the script developer in the Developer's Console, but the two are *not* the same.

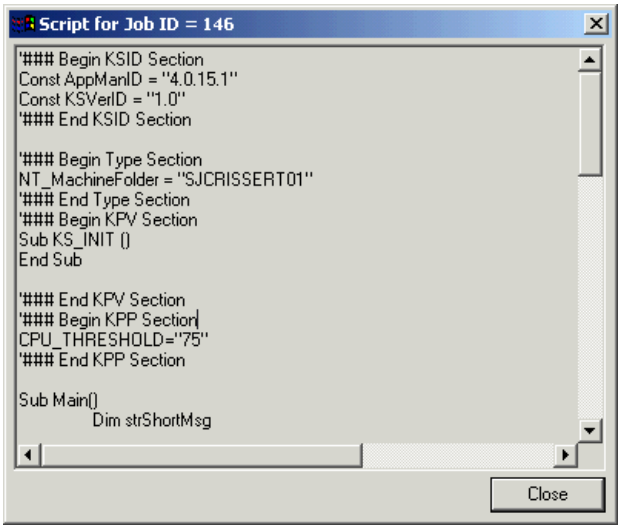


The user does not need to change the default value of 50, but in this case it is changed to 75.



After making this change in the value for `CPU usage not-to-exceed (%)`, the user clicks **OK** in the **Properties for Samples_Test** dialog box and a job is started.

Step 3, What the AppManager infrastructure does: In the process of starting the job, AppManager adds a definition for `CPU_THRESHOLD` to the beginning of the `Samples_Test` script. The running script now begins like this:



In summary:

1. The script developer used a variable called `CPU_THRESHOLD` in the script and used the Developer's Console **Script Properties** dialog box to:Create a Script Parameter.
   - Assign the variable named `CPU_THRESHOLD` to the Script Parameter.
   - Assign a description of "CPU usage not-to-exceed (%)." to the Script Parameter for the Operator Console user to see.
   - Assign a default value of 50 the Script Parameter

2. The Operator Console user created a job from the script after changing the value of `CPU usage not-to-exceed (%)` to `75`.

3. AppManager started the job after adding
   `CPU_THRESHOLD="75"`
   at the beginning of the script.

Where to go from here

This and prior chapters have provided an overview of the entire Knowledge Script. Beginning with the next chapter, the book will concentrate on the code portion of scripts. Examples will be given of scripts written in Summit BasicScript, VBScript, and Perl. If you plan to modify existing scripts, you will need to work in the scripting language in which the file was originally written. For the Windows environment, this could be either Summit BasicScript or VBScript. Therefore, if you will be developing scripts for Windows, you should study the chapters on *both* Summit BasicScript and VBScript.

Check in the sample scripts

All sample scripts used in this book can be found in your AppManager installation, or on your AppManager CD, in `documentation\development_tools\developer_guide\scripts`. It would be a good idea at this point to copy these files to a directory of your own choice and then check them into the AppManager repository (see "Editing Knowledge Scripts in the Developer's Console," on page 31.)

Note A Knowledge Script must be checked into the AppManager repository if it is to be visible in the **Knowledge Script** pane of the AppManager Operator Console. This does *not* mean that you will find it in your AppManager installation in the `NetIQ\AppManager\qdb\kp` directory. The files in this directory reflect only the files that were present when you first installed AppManager. Any new scripts, or alterations to existing scripts, that have been checked in will not be

copied to `NetIQ\AppManager\qdb\kp`, unless you put them there yourself.

Which scripting language to use

For scripts that are to be run by an AppManager UNIX agent, you have only one choice—Perl.

For scripts that are to be run by an AppManager Windows agent, you may use either Summit BasicScript or VBScript. The latter is recommended for new scripts, except in these situations:

- There are some managed objects (e.g., Active Directory) that cannot be called from VBScript because they require type declarations that are not available. For example, VBScript supports the Variant data type, but not the String data type.

  Such managed objects are being rewritten so that they use the Variant data type, but the process is not yet complete. You can determine which managed objects have this type problem in VBScript by writing a short script and using the debugger.

- Not all managed objects are "thread safe." If an AppManager agent is simultaneously running both BasicScript scripts and VBScript scripts that call the same managed objects, the different scripts can corrupt each other's data. This is discussed in detail in the *Managed Objects Reference Guide*.

If you will be modifying scripts in the UNIX environment, you should read the chapters on Perl, but not necessarily those on Summit BasicScript and VBScript.

Report scripts are always written in VBScript because they are run on a Windows computer, irrespective of whether the data they report on comes from Windows or UNIX computers.

Chapter 4

Modifying a monitoring script written in VBScript

This chapter dissects the code in a sample Knowledge Script called `Samples_FilesOpen.qml`. This script is then modified to become `Samples_FilesOpenEx.qml`. As this is your first introduction to the code portion of scripts, the code is relatively simple.

You should open each sample Knowledge Script in your Developer's Console where you can look at it in the various views and open its **Script Properties** dialog box.

You will also benefit from running the scripts in the AppManager Operator Console and experimenting with various **Properties** choices.

The following topics are covered in this chapter:

- Listing of the Samples_FilesOpen.qml script
- Preliminary discussion
- Syntax of the managed object methods
- Syntax of the Callback functions
- The program logic
- The modified script, Samples_FilesOpenEx.qml
- Performance Monitor counters

Listing of the Samples_FilesOpen.qml script

This sample Knowledge Script, `Samples_FilesOpen.qml`, is a complete script. You can check it in and run it as a job.

`Samples_FilesOpen.qml` checks for the number of files currently opened in the server, an indication of server activity. The script compares the result to the user-defined threshold. If the threshold is exceeded, the script generates an event and initiates any actions defined by the user.

After analyzing this script, you will learn how to modify it to return different information.
See "The modified script, Samples_FilesOpenEx.qml" on page 86.

Here is a listing of `Samples_FilesOpen.qml` running as a job. The sections at the beginning that are added by AppManager are included. Note that the Script Parameters are declared as *variables* in VBScript.

```
'### Begin KP-Version Section
Const AppManID = "4.5.78.0.8"
Const KSVerID = "1.0"
'### End KP-Version Section

'### Begin Type Section
NT_MachineFolder = "SJCRISSERT01"
'### End Type Section
'### Begin KPV Section
Sub KS_INIT ()
End Sub

'### End KPV Section
'### Begin KPP Section
DO_EVENT="y"
DO_DATA="n"
TH_FILES=10
Severity=5
AKPID="AKP_NULL"
'### End KPP Section

Dim NT
Dim SYSTEM
Const UNITNUMBER = "^^#"
Const ErrorSeverity = 35

Sub Main()
   Dim dblValue
   Dim strProgID
```

```
   If NQEXT.IterationCount() = 1 Then
     strProgID = NQEXT.GetProgID ("NetiQAgent.NT", AppManID)
      Set NT = CreateObject (strProgID)
      Set SYSTEM = NT.System
   End If

   ' Retrieve the counter value for the Server/Files Open
counter
  dblValue = SYSTEM.CounterValue("Server", "Files Open", "")
   If dblValue = -1 Then
      NQEXT.CreateEvent ErrorSeverity, _
         "Failed to retrieve the counter for Server/Files _
         Open.", "AKP_NULL", "", 0, "", "", 0, 0
      Exit Sub
   End If

   ' Check threshold and raise an event if the threshold is
   ' exceeded
   If DO_EVENT = "y" Then
      Dim strDetailMsg

      If dblValue > TH_FILES Then
         strDetailMsg = "# of files open is " & dblValue & _
                        "; >TH = " & TH_FILES
         NQEXT.CreateEvent Severity, "High number of files _
                           opened.", AKPID, "", 0, _
                           strDetailMsg, "", 0, 0
      End If
   End If

   ' Collect data
   If DO_DATA = "y" Then
      NQEXT.CreateData 1, "Files Opened" & UNITNUMBER, "",
"",_
                          dblValue, "# of files open = " & _
                          dblValue, 0
   End If
End Sub
```

Preliminary discussion

Recall from Chapter 2 the steps that the script undergoes when it is run:

1. A user chooses a script and drags it to the target object.
2. The **Properties** dialog box opens.
3. The user sets Script Parameters, the schedule, actions, etc.—or accepts the defaults—and closes the dialog box.
4. The Operator Console creates a job (an instance of the script along with the user configured Script Parameters, schedule, actions, etc.) in the AppManager repository.
5. The AppManager management server retrieves the job, the schedule, any action scripts, and so forth from the AppManager repository and forwards it all to the AppManager agent which will run the job. The final script has all Script Parameters and object types defined as constants with assigned values.

User-set Script Parameters

There are four Script Parameters that the user can alter when launching this script. These Script Parameters will become variables in the running script. The Script Parameters are:

Variable name used in the code	Description the Operator Console user will see	Value
`DO_DATA`	`Collect data? (y/n)`	If = "`y`", data will be collected.
`DO_EVENT`	`event? (y/n)`	If = "`y`", an event will be raised when threshold is exceeded.
`TH_FILES`	`Number of files open maximum threshold`	Threshold for maximum number of files open.

Variable name used in the code	Description the Operator Console user will see	Value
`Severity`	`Event severity level`	Severity level of event fired (if `DO_EVENT="y"`).
`AKPID`	The "description" of this variable is "`action taken`," but the user does not see it. It is hidden in the Operator Console.	Action script or scripts to run. If none, the Operator Console program will set it to the default (`AKP_NULL`). **NOTE:** The user does not see this Script Parameter in the Operator Console **Properties** dialog box, although you defined it in *your* **Script Properties** dialog box in the Developer's Console. If the user adds actions, the value of `AKPID` will be altered by the Operator Console program.

Object types

The object type for this script is:

```
<Type name="NT_MachineFolder"></Type>
```

When the script is dragged onto the target object the Operator Console will assign the appropriate value. AppManager will assign the machine name of the target computer to the variable `NT_MachineFolder` and will insert it in the code like this:

```
NT_MachineFolder = "SJCRISSERT01"
```

Here, `SJCRISSERT01` is the machine name of the target computer.

Actions

`AKPID` determines what action scripts, if any, are run. If there are to be action scripts, they will be run when an event is raised—`AKPID` is a parameter of the Callback function `CreateEvent()`. If no events are raised, no action scripts will be run.

Note Raising events is the mechanism used to launch action scripts. Other than calling an event with AKPID as a (required) parameter, you do not write code to run action scripts.

The default for `AKPID` in this script is "`AKP_NULL`" (no action), which is the default for `AKPID` in most scripts. If the user adds actions with the **Properties** dialog box when setting up the job, the value of `AKPID` will be changed to "`1,2,3,4,....n`" when the user adds `n` actions (`n >= 1`).

Functions called in the code

The code calls two types of functions:

- Callback functions, by which the script requests information or action *from* the AppManager agent running the job. See Chapter 11, "AppManager Callbacks for Summit BasicScript and VBScript."
- NetIQ managed object methods. Managed objects are COM objects whose methods are used to get basic information about hardware, applications, processes, and services on the managed computer. See the *Managed Object Reference Guide*.

Here are the functions called in the script, in order of their appearance:

Function or subroutine	Description
`NQEXT.IterationCount`	Callback function that determines the number of times that the calling Knowledge Script has run since it was last started or restarted.
`NQEXT.GetProgID`	Callback function that retrieves the versioned Prog ID of the `NetIQAgent.NT` COM object that is required by this Knowledge Script.
`SYSTEM.CounterValue()`	Method call to retrieve a Windows Performance Monitor counter.
`NQEXT.CreateEvent`	Callback function that raises an event.
`NQEXT.CreateData`	Callback function that sends data points back for logging and graphing.

Syntax of the managed object methods

Refer to the *Managed Objects Reference Guide* for more details.

System.CounterValue

The `CounterValue` function returns the current value of a specified Performance Monitor counter and (if applicable) instance.

Syntax

```
System.CounterValue ObjectName, CounterName, InstanceName
```

Parameter	Data type	Setting
`ObjectName`	String	Object name as it appears in the Performance Monitor **Add Counters** dialog box.
`CounterName`	String	Counter name as it appears in the Performance Monitor **Add Counters** dialog box.
`InstanceName`	String	Instance name as it appears in the Performance Monitor **Add Counters** dialog box. Use “” if the counter does not require an instance name.

`CounterValue` returns a double that is the current value of the counter specified by the input parameters. A return value of -1 indicates an error condition.

Syntax of the Callback functions

Refer to Chapter 11, “AppManager Callbacks for Summit BasicScript and VBScript,” for more details.

Long IterationCount

Returns the current iteration count.

Syntax

```
IterationCount
```

GetProgID

Retrieves version information for the managed object installed on the computer where the Knowledge Script is running. This is used to ensure that a particular version of a Knowledge Script calls a suitable version of a managed object.

Syntax

```
GetProgID progid, scriptver
```

Parameter	Data type	Setting
progid	String	Version independent MO COM progid
scriptver	String	The associated KS script version string

`GetProgID` returns the Prog ID as a string.

CreateEvent

Used by a Knowledge Script to send an event to the AppManager agent. The AppManager agent will apply additional rule processing and will determine whether to send a new event or a duplicated (collapsed) event to the AppManager management server.

Syntax

```
CreateEvent sev, evtmsg, akp, obj, val, agentmsg, evtsrc,
evtid, msgtype [, deletefile]
```

Parameter	Data type	Setting
sev	Long	The event severity. A value from 1 to 40.
evtmsg	String	The message to be displayed under the Message column in the Events tab.
akp	String	Name of the action script to launch as a response to this event. You would normally create an `AKPID` parameter as part of your script. When the job is dropped and you select an action, the UI will fill in the `AKPID` variable with the action name. You will just need to pass in the `AKPID` variable to the script.

Parameter	Data type	Setting
`obj`	String	Corresponding object name where the event is raised. This value will determine which object in the **TreeView** pane to blink. Format of the value passed in should be "`ObjectTypeName = ObjectValue`", e.g. "`UNIX_DiskObject = /mnt/cdrom`". The `ObjectValue` can normally be obtained by the drop object variable, e.g. `UNIX_MachineFolder.`
`val`	Double	The current value to raise the event. This parameter is currently not used. Set to `0.0`.
`agentmsg`	String	Either the detail message or a file name that contains the detail message. The detailed message is displayed in the Message tab of the Event Property dialog box. If this parameter contains the name of a file, make sure you set the msgtype parameter to 1.
`evtsrc`	String	Not used. Should always be empty.
`evtid`	Long	Not used. Should always be `0`.
`msgtype`	Long	Flag specifying whether the value passed in the agentmsg parameter is a file name or the detailed message itself. If it is a file name, then the contents of the file are read and passed in as the detailed message. Set to 0 to specify that the value in the agentmsg parameter is the detailed message. Set to 1 to specify that the value is the file name containing the detailed message.
`deletefile`	Long	Optional. Flag to tell the AppManager agent to delete the event detail message file after it is done reading the contents and passing the event to the MSU. This parameter is ignored if `msgtype != 1`. Set to `1`, which is default, to delete the file when `msgtype = 1`. Set to `0` to not delete the file. Be careful when setting this value to `0`, especially if your script generates a message file each time it wants to send an event because the files will never be removed.

`CreateEvent` returns nothing.

CreateData

Sends data points for dynamic data streams. This function allows you to collect data for data streams that may be instantiated at each iteration.

Syntax

```
CreateData streamId, legend, dynaleg, objlist, val, agentmsg,
msgtype [,schema] [,loglimit] [,lowWM] [,hiWM] [,deletefile]
```

Parameter	Data type	Setting
`streamId`	String	The data stream ID. For each unique stream ID in a script, it will generate a Data Source in the AppManager database. Subsequent calls to `CreateData` using the same stream ID will insert data points to the same Data Source.
`legend`	String	The data stream legend. This value will show up under the Legend column and in the graphs. The string length limit is 128 characters.
`dynaleg`	String	The data stream dynamic legend. Contains the dynamic information that can be used for reporting. If a portion of your legend changes often, then pass that text into this parameter. Otherwise leave it blank.
`objlist`	String	Corresponding object name where the data is collected on. This value is used for graphing and reporting. Format of the value passed in should be `"ObjectTypeName = ObjectValue"`, e.g. `"NT_DiskObject = D:\"`. The ObjectValue can normally be obtained by the drop object variable, e.g. `NT_MachineFolder`.
`val`	Double	The data point value.

Parameter	Data type	Setting
`agentmsg`	String	Either the data detail or a file name that contains the data detail. The data detail is basically an annotation of each data point, giving more information about the data point since the data point is just a numeric value. For example, the data point value may be 5 for the number of processes running, while the data detail may list the processes that are running. The detailed message is displayed in the Graph Data Detail dialog box for each data point. If this parameter contains the name of a file, make sure you set the msgtype parameter to 1.
`msgtype`	Long	Flag specifying whether the value passed in the `agentmsg` is a file name or the detailed message itself. If it is a file name, then the contents of the file are passed in as the detailed message. Set to 0 to specify that the value in the agentmsg parameter is the detailed message. Set to 1 to specify that the value is the file name containing the detailed message.
`schema`	String	Optional. XML schema for dynamic table creation in RDB. Default is an empty string.
`loglimit`	Long	Optional. The number of days to keep this data point in the database. Default is `-1`, keep forever. The data points can be removed from the database by other means.
`lowWM`	Double	Optional. Low watermark. Default is `-1.0`.
`hiWM`	Double	Optional. High watermark. Default is `-1.0`.
`deletefile`	Bool	Optional. Flag to tell the AppManager agent to delete the event detail message file after it is done reading the contents and passing the event to the MSU. This parameter is ignored if `msgtype != 1`. Set to `1`, which is default, to delete the file when `msgtype = 1`. Set to `0` to not delete the file. Be careful when setting this value to `0`, especially if your script generates a message file each time it wants to send an event because the files will never be removed.

`CreateData` returns nothing.

The program logic

`Samples_FilesOpen.qml` raises an event whenever the number of files that are open exceeds a threshold, `TH_FILES`, set by the user. The default is `TH_FILES = 200`.

The Windows NT/2000 managed object method `SYSTEM.CounterValue()` is used to obtain the number of open files.

Sub Main()

`IterationCount()` returns the number of times that the Knowledge Script job has run. If this is the first time that the script has been run, `IterationCount()` will return 1. In that case, the body of the `If NQEXT.IterationCount() = 1 Then` block will be executed in order to:

- Obtain the ID of the COM Object that contains the managed object method, `SYSTEM.CounterValue()`, that will be used in the Knowledge Script.
- Create the `NT.SYSTEM` object so that this method can be called.

```
If NQEXT.IterationCount() = 1 Then
     strProgID = NQEXT.GetProgID ("NetiQAgent.NT", AppManID)
      Set NT = CreateObject (strProgID)
      Set SYSTEM = NT.System
   End If
```

The Callback function `NQEXT.GetProgID()` constructs the COM object ID from the string "`NetIQAgent.NT`" and the value `AppManID`.

`AppManID` is the AppManager build number that is appropriate for this Knowledge Script. It is defined in the non-code XML section of the Knowledge Script, and appears in the header section of the final, generated script:

```
'### Begin KSID Section
Const AppManID = "4.0.15.1"
Const KSVerID = "1.0"
'### End KSID Section.
```

Note The COM ID will be of the form `NetIQAgent.NT.n`, where `n` is an integer. In general, `n` will not be equal to the actual value of `AppManID`. For example, in this script `AppManID=4.0.15.1`, while the ID of the COM object for AppManager 5 is `NetIQAgent.NT.4`. The Callback function `NQEXT.GetProgID()` translates the `AppManID` into the proper value for the COM ID.

The next section of the code calls `SYSTEM.CounterValue()` to get the number of open files. When the `ObjectName` parameter is set to "`Server`" and the `CounterName` parameter is set to "`Files Open`," `SYSTEM.CounterValue` returns the number of files that are currently open.

If the call to `SYSTEM.CounterValue` fails, it will return -1. In this case, the `If dblValue = -1 Then` block is executed. An event is raised indicating failure to obtain the counter value and the code exits.

```
' Retrieve the counter value for the Server/Files Open
counter
   dblValue = SYSTEM.CounterValue("Server", "Files Open", "")
   If dblValue = -1 Then
      NQEXT.CreateEvent ErrorSeverity, _
         "Failed to retrieve the counter for Server/Files _
         Open.", "AKP_NULL", "", 0, "", "", 0, 0
      Exit Sub
   End If
If the call to SYSTEM.CounterValue( ) succeeds, then an event
will be raised only if DO_EVENT = "Y" and the TH_FILES
threshold is exceeded.

' Check threshold and raise an event if the threshold is
   ' exceeded
   If DO_EVENT = "y" Then
      Dim strDetailMsg
      If dblValue > TH_FILES Then
         strDetailMsg = "# of files open is " & dblValue & _
                        "; >TH = " & TH_FILES
         NQEXT.CreateEvent Severity, "High number of files _
                           opened.", AKPID, "", 0, _
                           strDetailMsg, "", 0, 0
      End If
   End If
```

In this case, the event message will report the number of open files and the threshold that was exceeded under the **Message** heading in the **Event** pane of the Operator Console. If a user double-clicks on the event in the **Event** pane to open the **Event Properties** dialog box, and then chooses the **Message** tab, they will see the `strDetailMsg`.

The `CreateEvent()` parameters are:

Parameter	Setting
`Severity`	Event severity.
`"High number of files opened."`	Event message.
`AKPID`	Actions to execute, if any. Value of `AKPID` depends on whether the user requested actions. If not, it will have the default value of "`AKP_NULL`", which means no action.
`""`	Corresponding object name where the event is raised. An empty string is used here means to blink the `NT_MachineFolder` level.
`0`	The current value (to raise the event). Not used here.
`strDetailMsg`	The plain text message, defined in the line of code just before call to `CreateEvent()`.
`""`	Event source. Should always be empty.
`0`	Event ID. Should always be `0`.
`0`	Indicates that `strDetailMsg` is plain text, as opposed to a file.

The last block of code in the script handles data collection, provided that the user has set `DO_DATA` to "`y`" (the default is "`n`").

```
' Collect data
   If DO_DATA = "y" Then
      NQEXT.CreateData 1, "Files Opened" & UNITNUMBER, "",
"",_
                          dblValue, "# of files open = " & _
                          dblValue, 0
   End If
```

The `CreateData()` parameters are:

Parameter Value	Meaning
`1`	The ID of the data stream—becomes important when there is more than one stream.
`"Files Opened" & UNITNUMBER`	Text for the **Legend** heading in the **Graph Data** tab of the **List** pane = `Files Opened  #` `UNITNUMBER` is a defined constant: `const UNITNUMBER = "^^#"` where the carets represent spaces
`""`	Dynamic legend, contains dynamic information that can be used for reporting. Not used here.
`""`	Corresponding object name where the data is collected. Not used here.
`dblValue`	Current data point value.
`"# of files open = " & dblValue`	This is a message created (`agentmsg`) by the developer that appears in the data detail dialog box.
`0`	0 means that agentmsg is plain text (as opposed to a file).

The modified script, Samples_FilesOpenEx.qml

Here is the listing for `Samples_FilesOpenEx.qml`, a modified version of `Samples_FilesOpen.qml`. The modification, shown in bold, is very simple. The Performance Monitor counter value returned is changed from "Server", "Files Open" to "Server", "Files Opened Total."

Note There is no reason whatsoever why you could not modify this script to obtain *both* measures of served files. Go ahead and try it.

Microsoft defines "Files Opened Total" as "The number of successful open attempts performed by the server on behalf of clients (since the last reboot). Useful in determining the amount of file I/O, determining overhead for path-based operations, and for determining the effectiveness of open locks."

By comparison, "Files Open" is defined as "The number of files currently opened in the server. Indicates current server activity."

In other words, `Samples_FilesOpen.qml` checks for the number of files opened in the server that are *still open*. `Samples_FilesOpenEx.qml` checks for the number of files that have been opened in the server since your computer was last rebooted, *whether or not* they are still open.

```
Dim NT
Dim SYSTEM
Const UNITNUMBER = "^^#"
Const ErrorSeverity = 35

Sub Main()
   Dim dblValue
   Dim strProgID

   If NQEXT.IterationCount() = 1 Then
      strProgID = NQEXT.GetProgID ("NetiQAgent.NT", AppManID)
       Set NT = CreateObject (strProgID)
       Set SYSTEM = NT.System
   End If

   ' Retrieve the counter value for the Server/Files Open
counter
```

```
dblValue = SYSTEM.CounterValue("Server", _
                        "Files Opened Total", "")

   If dblValue = -1 Then
      NQEXT.CreateEvent ErrorSeverity, _
         "Failed to retrieve the counter for Server/Files _
         Open.", "AKP_NULL", "", 0, "", "", 0, 0
      Exit Sub
   End If

   ' Check threshold and raise an event if the threshold is
   ' exceeded
   If DO_EVENT = "y" Then
      Dim strDetailMsg

      If dblValue > TH_FILES Then
         strDetailMsg = "# of files open is " & dblValue & _
                        "; >TH = " & TH_FILES
         NQEXT.CreateEvent Severity, "High number of files _
                           opened.", AKPID, "", 0, _
                           strDetailMsg, "", 0, 0
      End If
   End If

   ' Collect data
   If DO_DATA = "y" Then
      NQEXT.CreateData 1, "Files Opened" & UNITNUMBER, "",
"",_
                          dblValue, "# of files open = " & _
                          dblValue, 0
   End If
End Sub
```

Performance Monitor counters

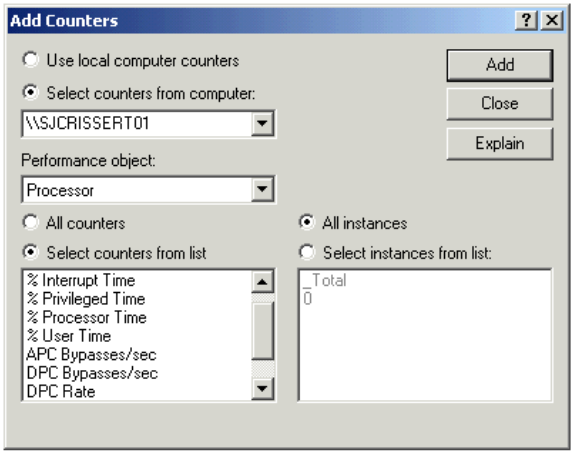
The managed object method `SYSTEM.CounterValue()`, used in this script to obtain Performance Monitor data, is a very powerful general method. You can use it in your own scripts to obtain a wide range of performance metrics.

To get an idea of the possibilities, do the following:

1. Choose `Programs > Administrative Tools > Performance` from the Windows `Start` menu to open the **Performance** window. (Alternatively, you can run `perfmon` from the command line.)

2. When the **Performance** window opens, right-click in the right-hand pane and choose **Add Counters...** from the pop-up menu.

   The **Add Counters** dialog will open



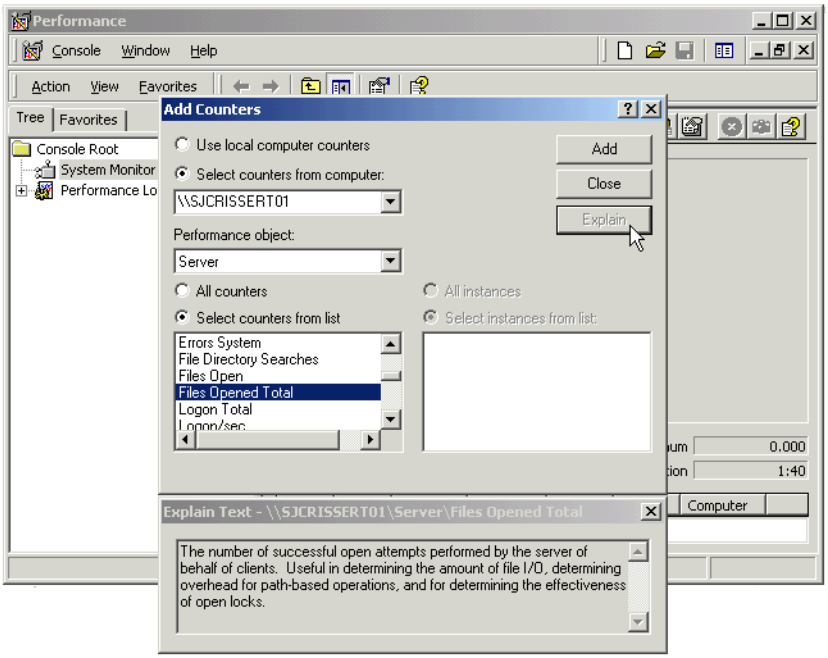
The counters are identified by three things:

- The Performance Object, which you choose from the **Performance Object** drop-down list.
- The counter itself, which you choose from the **Select counters from list** text box.

- The Instance (lower right in the picture).

When you call `SYSTEM.CounterValue()` from your scripts, the Performance Object name is the first parameter and the counter name is the second parameter. The third parameter is the instance, if any.

3 When you have highlighted a counter, click the **Explain** button to learn about the counter. For example:



Chapter 5

Modifying a monitoring script written in Summit BasicScript

This chapter dissects the code in a sample Knowledge Script called `Samples_CpuLoaded.qml`. This script is then modified to become `Samples_CpuLoadedEx.qml`.

You should open each sample Knowledge Script in your Developer's Console where you can look at it in the various views and open its **Script Properties** dialog box.

You will also benefit from running the scripts in the AppManager Operator Console and experimenting with various **Properties** choices.

The following topics are covered in this chapter:

- Listing of the NT_CpuLoaded.qml script
- Preliminary discussion
- Syntax of the managed object methods
- Syntax of the Callback functions
- The program logic
- The modified script, NT_CpuLoadedEx.qml

Listing of the NT_CpuLoaded.qml script

This sample Knowledge Script, `Samples_CpuLoaded.qml`, is the same as `NT_CpuLoaded.qml`, except for several minor changes and the addition of numerous comments. `Samples_CpuLoaded.qml` is a complete script. You can check it in and run it as a job.

`Samples_CpuLoaded.qml` checks the current values for CPU total processor time, CPU user time, and CPU queue length against the user-defined thresholds. If the thresholds are exceeded, the subroutine `CpuCheck()` generates events and initiates any actions defined by the user.

After analyzing this script, you will learn how to modify it to return more information. See "The modified script, NT_CpuLoadedEx.qml" on page 111.

Here is a listing of `Samples_CpuLoaded.qml` running as a job. The sections at the beginning that are added by AppManager are included. Note that the Script Parameters are declared as *constants* in Summit BasicScript.

```
'### Begin KP-Version Section
Const AppManID = "4.5.78.0.8"
Const KSVerID = "1.0"
'### End KP-Version Section

'### Begin Type Section
Const NT_CPUFolder = "CPU"
Const NT_CPUNumber = "0"
'### End Type Section
'### Begin KPV Section
Sub KS_INIT ()
End Sub

'### End KPV Section
'### Begin KPP Section
Const DO_EVENT="y"
Const DO_DATA="n"
Const DO_OVERALL="n"
Const TH_UTIL=90
Const TH_QLEN=2
Const Severity=5
Const PRM_KSERR=35
Const AKPID="AKP_NULL"
'### End KPP Section

Dim NT As Object
Dim CPU As Object
Const UNITPERCENT = "^^%"
```

```
' This sub routine checks for the processor time, user time,
' and queue length to see if they exceed the given
' thresholds for a given cpu, or the overall cpu
Sub CpuCheck(sCPUName As String)
Dim dUserTime#, dPrivilegeTime#, dTotalTime#, dQueueLen#
Dim sDetailMsg$, sObjectList$, sCPUMsg$
Dim lStreamID As Long

   If (sCPUName = "") Then
     ' Set the machine object as the resource. This will cause
      ' the machine object to blink if there is an event.
      sObjectList = "NT_CPUFolder = " + NT_CPUFolder
      lStreamID = 0
      sCPUMsg = "Overall CPU"
   Else
     ' Set the individual cpu name as the resource. This will
      ' cause the individual cpu object to blink if there is
      ' an event for each individual cpu
      sObjectList = "NT_CPUNumber = " + sCPUName
      lStreamID = Val(sCPUName)
      sCPUMsg = "CPU# " + sCPUName
   End If

   dTotalTime = CPU.UtilValue("PROCESSOR", sCPUName)
   dUserTime  = CPU.UtilValue("USER", sCPUName)
   If dTotalTime = -1 Or dUserTime = -1 Then
      ' A return value of -1 indicates a failure to
      ' retrieve the value of the counter
     MSActions PRM_KSERR, "Counter not found", "AKP_NULL", _
          sObjectList,"Processor or User counter not found _
            (Proc: " & Cstr(dTotalTime) & ", User: " & _
               Cstr(dUserTime) & ")"
      Exit Sub
   End If

   If dTotalTime > dUserTime Then
      dPrivilegeTime = dTotalTime - dUserTime
   Else
      dPrivilegeTime = 0
   End If

   If IterationCount() = 1 Then
      If DO_DATA = "y" Then
         DataHeader "PROCESSOR Utilization - " & sCPUMsg _
```

```
                        & UNITPERCENT, 0, lStreamID
      End if
   End If

   If DO_EVENT = "y" And dTotalTime > TH_UTIL Then
      dQueueLen = CPU.QueueLengthValue
      If dQueueLen = -1 Then
       MSActions PRM_KSERR, "Counter not found", "AKP_NULL",
_
              sObjectList, "The queue length counter could _
                      not be found"
         Exit Sub
      End If

      ' if TH_QLEN = -1 ignore query length value and raise
event
     ' else if query length value exceeds threshold value then
      ' raise event
      If TH_QLEN = -1 Then
         sDetailMsg = sCPUMsg + " utilization% is " & _
                        Format$(dTotalTime, "0.00") & _
                        "; >TH = " & Cstr(TH_UTIL)
        MSActions Severity, sCPUMsg & " Overloaded", AKPID, _
                       sObjectList, sDetailMsg
      Elseif dQueueLen > TH_QLEN Then
         sDetailMsg = sCPUMsg + " utilization% is " & _
                Format$(dTotalTime, "0.00") & "; >TH = " & _
           Cstr(TH_UTIL)  & "   AND" & chr$(10) & "CPU queue _
              length is " & Cstr(dQueueLen) & "; >TH = " & _
               Cstr(TH_QLEN)
        MSActions Severity, sCPUMsg & " Overloaded", AKPID, _
                      sObjectList, sDetailMsg
      End If
   End If

   If DO_DATA = "y" Then
      sDetailMsg = sCPUMsg + " utilization% is: " & chr$(10)
& _
          "Privileged " & Format$(dPrivilegeTime, "0.00") & _
          chr$(10) & "User " & Format$(dUserTime, "0.00") & _
           chr$(10) & "Total " & Format$(dTotalTime, "0.00")
      DataLog lStreamID, dTotalTime, sDetailMsg
   End If
End Sub
```

```
Sub Main()
   Dim sCPUName$, sProgID$
   Dim iNumberCPU As Integer

   If IterationCount() = 1 Then
      ' Retrieve the prog id of the NetIQ NT MO COM object
      sProgID = MCGetMOID ("NetiQAgent.NT", AppManID)
      Set NT = CreateObject (sProgID)
      Set CPU = NT.CPU
   End If

   iNumberCPU = ItemCount(NT_CPUNumber, ",")
   If iNumberCPU = 1 Or DO_OVERALL = "n" Then
      ' Check each individual CPU in the object list
      For I = 1 To iNumberCPU
         sCPUName = Item$(NT_CPUNumber, I,, ",")
         CpuCheck sCPUName
      Next I
   Else
      ' Just check the overall CPU usage
      CpuCheck ""
   End If
End Sub
```

Preliminary discussion

Recall from Chapter 2 the steps that the script undergoes when it is run:

1. A user chooses a script and drags it to the target object.
2. The **Properties** dialog box opens.
3. The user sets Script Parameters, the schedule, actions, etc.—or accepts the defaults—and closes the dialog box.
4. The Operator Console creates a job (an instance of the script along with the user configured Script Parameters, schedule, actions, etc.) in the AppManager repository.

5 The AppManager management server retrieves the job, the schedule, any action scripts, and so forth from the AppManager repository and forwards it all to the AppManager agent which will run the job. The final script has all Script Parameters and object types defined as constants with assigned values.

User-set Script Parameters

There are seven Script Parameters that the user can alter when launching this script. These Script Parameters will become constants in the running script. The Script Parameters are:

Variable name used in the code	Description the Operator Console user will see	Value
DO_DATA	Collect data? (y/n)	If = "y", event will be fired when thresholds are exceeded.
DO_EVENT	Event? (y/n)	If = "y", data will be collected.
DO_OVERALL	Overall load? (y/n)	If = "y", script will be run only to obtain the % usage of all CPUs aggregated together. If = "n", script will be run for each individual CPU.
TH_UTIL	%CPU maximum threshold	Threshold for maximum CPU % usage.
TH_QLEN	CPU queue length maximum threshold	Threshold for maximum CPU queue length.
Severity	Event severity level	Severity level of event fired (if DO_EVENT = "y").

Variable name used in the code	Description the Operator Console user will see	Value
PRM_KSERR	Severity for an unexpected KS error	Severity level to assign to errors in executing the Knowledge Script, that do not have anything to do with exceeded thresholds.
AKPID	The “description” of this variable is “action taken,” but the user does not see it. It is hidden in the Operator Console.	Action script or scripts to run. If none, the Operator Console program will set it to the default (AKP_NULL). **NOTE:** The user does not see this Script Parameter in the Operator Console **Properties** dialog box, although you defined it in *your* **Script Properties** dialog box in the Developer’s Console. If the user adds actions, the value of AKPID will be altered by the Operator Console program.

Object types

The object types for this script are:

```
<Type name="NT_CPUFolder"></Type>
<Type name="NT_CPUNumber"></Type>
```

When the script is dragged onto the target object, AppManager will assign the appropriate values:

- NT_CPUFolder will be assigned the name of the top-level folder.
- NT_CPUNumber will be assigned a comma-delimited string listing all the individual CPUs.

AppManager will insert these constants in the code of the final, generated script like this:

```
Const NT_CPUFolder = "CPU"
Const NT_CPUNumber = "0"
```

In this case, there is only one CPU in the CPU folder.

Actions

`Akpid` determines what action scripts, if any, are run. If there are to be action scripts, they will be run when an event is raised—`Akpid` is a parameter of the Callback function `CreateEvent()`. If no events are raised, no action scripts will be run.

Note Raising events is the mechanism used to launch action scripts. Other than calling an event with `Akpid` as a (required) parameter, you do not write code to run action scripts.

The default for `Akpid` in this script is "`AKP_NULL`" (no action), which is the default for `Akpid` in most scripts. If the user adds actions with the **Properties** dialog box when setting up the job, the value of `Akpid` will be changed to "`1,2,3,4,....n`" when the user adds `n` actions (`n >= 1`).

Functions called in the code

The code calls three types of functions:

- Summit BasicScript built-in functions. See the BasicScript documentation in `appmanager\documentation\development_tools\summit_basicscript\documentation`.
- Callback functions, by which the script requests information or action *from* the AppManager agent running the job. See Chapter 11, "AppManager Callbacks for Summit BasicScript and VBScript."
- NetIQ managed object methods. Managed objects are COM objects whose methods are used to get basic information about hardware, applications, processes, and services on the managed computer. See the *Managed Object Reference Guide*.

Here are the functions called in the script, in order of their appearance:

Function or subroutine	Description
`CPU.UtilValue`	Windows NT managed object that obtains information about CPU utilization.
`MSActions`	Callback function that reports events and initiates actions.
`IterationCount`	Callback function that determines the number of times that the calling Knowledge Script has run.
`DataHeader`	Callback function that sends the data header for logging and graphing data streams.
`CPU.QueueLengthValue`	Windows NT managed object that obtains information about the CPU queue length.
`CStr`	Summit BasicScript built-in function that converts an expression to a string.
`Chr$`	Summit BasicScript built-in function that returns the character whose value is its argument. In this script, `Chr$(10)` returns a carriage return.
`Format$`	Summit BasicScript built-in function that formats a string to a user's specification.
`DataLog`	Callback function that sends points back for logging and graphing.
`MCGetMOID`	Callback function that retrieves the versioned ProgID of the COM object that is required by this Knowledge Script.
`ItemCount`	Summit BasicScript built-in function that returns the number of items in a delimited text string list.
`Item$`	Summit BasicScript built-in function that returns a discrete item in a delimited text string list.

Syntax of the managed object methods

Refer to the *Managed Objects Reference Guide* for more details.

CPU.UtilValue

This function reports the percentage of CPU utilization for the entire system. You specify the type of CPU utilization to return (total, privileged time, or user time). On a multiprocessor, the value returned is the average CPU utilization for all system processors.

Syntax

```
CPU.UtilValue What, CpuInstance
```

Parameter	Data type	Setting
`What`	String	Type of CPU usage to monitor. Valid settings are (case sensitive): • `PROCESSOR` for utilization of both privileged and user CPU modes. • `PRIVILEGED` for utilization in privileged mode by the NT operating system. • `USER` for utilization in user mode by the application.
`CpuInstance`	String	Processor number. For a single processor system, this number should be "`0`". For the average of all processors, use an empty string ("`"`").

Returns a double representing the percentage of time that the specified processor(s) is busy. A return value of -1 indicates an error condition.

CPU.QueueLengthValue

Syntax

```
CPU.QueueLengthValue
```

This function has no parameters. It returns the length of the processor queue in number of threads, as a double representing the number of

process threads in the processor queue. A return value of -1 indicates an error condition.

Syntax of the Callback functions

Refer to Chapter 11, "AppManager Callbacks for Summit BasicScript and VBScript" for more details.

MSActions

Allows a Knowledge Script to report events and initiate actions.

Syntax

```
MSActions severity, shortmsg, akpid, objlist, detailmsg
[,detailmsg2, ....,detailmsg6] [, value]
```

Parameter	Data type	Setting
`severity`	Long	Severity of the event.
`shortmsg`	String	Event message displayed in the List pane.
`akpid`	String	Action name or identifier for the action to be taken.
`objlist`	String	Objects that report the event (their icons will be set to blinking in the Operator Console's **TreeView** pane).
`detailmsg`	String	Detail message from the AppManager agent(s) displayed in the event's Properties dialog. At least one detailmsg or an empty string is required. The maximum size of the string is 32K. To pass additional information beyond the 32K, you can specify up to 6 message strings, each with a maximum size of 32K, to define the entire detail message for an event. For example, if the message you want to return is 64K, the message would be stored in two strings: `MSActions Severity, "High", AKPID, "", detailmsg, detailmsg2`
`value`	Double	Optional. The current value to raise an event.

IterationCount

Returns a Long representing the current iteration count.

Syntax

```
IterationCount
```

This function has no parameters.

DataHeader

Sends the data header for logging and graphing data streams (short form).

Syntax

```
DataHeader legend, graph_id, stream_id [, objlist]
```

Parameter	Data type	Setting
`legend`	String	Graphing legend displayed in the List and Graph panes. For example, the legend for one data stream created by `NT_CpuResource` is User CPU. The string length limit is 128 characters.
`graph_id`	Long	Graph ID. This parameter is not currently used. It is always set to the value `0`.
`stream_id`	Long or String	Data stream identifier. This identifier should be unique for each data stream collected by a single Knowledge Script. The identifier does not need to be unique across Knowledge Scripts.
`objlist`	String	Optional. Matching object where the data is collected.

DataLog

Sends data points back for logging and graphing. This call is always used in conjunction with a `DataHeader` call.

Syntax

```
DataLog stream_id, data, datapointmsg
```

Parameter	Data type	Setting
`stream_id`	Long or String	Data stream identifier. This identifier should be the same identifier used in the associated `DataHeader` call for each data stream.
`data`	Double	Data point value.
`datapointmsg`	String	Detail message displayed in the Graph Data Detail dialog. The maximum size for this string is 32K.

MCGetMOID

Retrieves version information for the managed object installed on the computer where the Knowledge Script is running. This is used to ensure that a particular version of a Knowledge Script calls a suitable version of a managed object.

Syntax

```
MCGetMOID (programid, version)
```

Parameter	Data type	Setting
`programid`	String	Managed object program identifier. For example, `NetiQAgent.NT`.
`version`	String	Knowledge Script version (for example, `AppManID` or `KSVerID` parameter).

Returns a String representing the managed object version.

The program logic

The main work in this script is done by the `CpuCheck()` subroutine. This subroutine is called from `Main()` with an argument that depends on the value of `DO_OVERALL` and the number of CPUs. If there is only one CPU, or if `DO_OVERALL = "n"`, `CpuCheck` is called for each CPU individually (argument = name of CPU). If, on the other hand, there are multiple CPUs and `DO_OVERALL = "y"`, `CpuCheck` is called for all CPUs aggregated together (argument = “”).

`CpuCheck()` checks the current values for CPU total processor time, CPU user time, and CPU queue length against the user-defined thresholds. If the thresholds are exceeded, `CpuCheck()` generates events (and may initiate actions if the user defined any).

`CpuCheck()` requires `sCPUName` as an input parameter. `sCPUName` is a string that is defined in `Main()`. Its value is either the name of a CPU or an empty string, the latter signifying that `CpuCheck()` should check only the sum of all CPUs.

Sub Main()

`IterationCount()` returns the number of times that the Knowledge Script job has run. If this is the first time that the script has been run, `IterationCount()` will return 1. In that case, the body of the `If IterationCount() = 1 Then` block will be executed to:

- Obtain the ID of the COM Object that contains the managed objects that will be used in the Knowledge Script (`CPU.UtilValue` and `CPU.QueueLengthValue`).
- Create the NT.CPU object so that these two methods can be called.

```
If IterationCount() = 1 Then
   ' Retrieve the prog id of the NetIQ NT MO COM object
   sProgID = MCGetMOID ("NetiQAgent.NT", AppManID)
   Set NT = CreateObject (sProgID)
   Set CPU = NT.CPU
End If
```

The Callback function `MCGetMOID()` constructs the COM object ID from the string "`NetIQAgent.NT`" and the parameter `AppManID`.

`AppManID` is the AppManager build number that is appropriate for this Knowledge Script. It is defined in the non-code XML section of the Knowledge Script, and appears in the header section of the final, generated script that the AppManager agent runs:

```
'### Begin KSID Section
Const AppManID = "4.0.15.1"
Const KSVerID = "1.0"
'### End KSID Section.
```

Note The COM ID will be of the form `NetIQAgent.NT.n`, where `n` is an integer. In general, `n` will not be equal to the actual value of `AppManID`. For example, in this script `AppManID`=4.0.15.1, while the ID of the COM object for AppManager 5 is `NetIQAgent.NT.4`. The Callback function `MCGetMOID()` translates the `AppManID` into the proper value for the COM ID.

The object type `NT_CPUNumber` contains a comma-delimited string listing all the individual CPUs (the names of all the CPU objects on which the script was dropped—determined by the Operator Console when the script is dropped). The Summit BasicScript function `ItemCount()` returns the number of items in the list, given that the comma (",") is the delimiter, and assigns the value to `iNumberCPU`.

```
iNumberCPU = ItemCount(NT_CPUNumber, ",")
```

If there is only one CPU or if `DO_OVERALL` is set to "`n`", the `For I = 1 To iNumberCPU` loop is executed. This loop uses the Summit BasicScript function `Item$()` to step through the individual CPUs, calling the `CpuCheck()` subroutine on each one in turn:

```
If iNumberCPU = 1 Or DO_OVERALL = "n" Then
   ' Check each individual CPU in the object list
   For I = 1 To iNumberCPU
      sCPUName = Item$(NT_CPUNumber, I,, ",")
      CpuCheck sCPUName
   Next I
```

If there is more than one CPU and `DO_OVERALL` is set to "`y`", `CpuCheck()` is called with an empty string to check only the sum of all CPUs:

```
Else
   ' Just check the overall CPU usage
   CpuCheck ""
End If
```

Sub CpuCheck()

The parameter passed to this subroutine is either the name of the individual CPU or "". When an empty string is passed in, `CpuCheck` checks only the sum of all CPUs.

To fire an event, *both* the CPU total usage and the CPU queue length thresholds set by the user must be exceeded. An exception to this is that the CPU queue length is ignored if the user has set its threshold to -1.

The program will exit the `CpuCheck()` subroutine if any calls to the managed object methods `CPU.UtilValue` or `CPU.QueueLengthValue` fail (return -1).

The subroutine declares variables for the four quantities that will be checked (actually, only three will be checked—`dPrivilegeTime` will be calculated from `dTotalTime` and `dUserTime`):

```
    Dim dUserTime#, dPrivilegeTime#, dTotalTime#, dQueueLen#
```

Then, the subroutine creates:

- `sObjectList`, a string that is used to tell the Operator Console which object icon to blink when an event is raised.
- `lStreamID`, an ID for tagging any data streams that are created. `lStreamID=0` for the sum of all CPUs or `lStreamID=n` for individual CPU `n`.
- `sCPUMsg` for identifying the `CPU#` (or "`OVERALL CPU`") when returning messages.

```
If (sCPUName = "") Then
```

```
   ' Set the machine object as the resource. This will
   ' cause the machine object to blink
   ' if there is an event.
   sObjectList = "NT_CPUFolder = " + NT_CPUFolder
   lStreamID = 0
   sCPUMsg = "Overall CPU"
Else
   ' Set the individual cpu name as the resource.
   ' This will cause the individual cpu object
   ' to blink if there is an event for each individual cpu.
   sObjectList = "NT_CPUNumber = " + sCPUName
   lStreamID = Val(sCPUName)
   sCPUMsg = "CPU# " + sCPUName
End If
```

Next, `CpuCheck()` calls the NT.`CPU.UtilValue()` managed object to get the "total CPU time" for the processor or processors identified by `sCPUName`:

```
     dTotalTime = CPU.UtilValue("PROCESSOR", sCPUName)
```

Then, `CpuCheck()` calls the `NT.CPU.UtilValue()` managed object to get the "user CPU time" for the processor or processors identified by `sCPUName`:

```
     dUserTime = CPU.UtilValue("USER", sCPUName)
```

If `NT.CPU.UtilValue()` fails, it returns -1. Here, if either call to `NT.CPU.UtilValue()` fails, the Callback function `MSActions` returns an event with an error message and blinks the correct object icon. Then the subroutine exits:

```
If dTotalTime = -1 Or dUserTime = -1 Then
   ' A return value of -1 indicates a failure to
   ' retrieve the value of the counter
   MSActions PRM_KSERR, "Counter not found", "AKP_NULL", _
       sObjectList,"Processor or User counter not found _
          Proc: " & Cstr(dTotalTime) & ", User: " & _
            Cstr(dUserTime) & ")"
   Exit Sub
End If
```

If both `NT.CPU.UtilValue()` calls succeed, `dPrivilegeTime` is calculated from `dTotalTime` and `dUserTime`:

```
If dTotalTime > dUserTime Then
   dPrivilegeTime = dTotalTime - dUserTime
Else
   dPrivilegeTime = 0
End If
```

Next, the Callback function `IterationCount()` returns the number of times the Knowledge Script job has been run, including the current job. If this is the first time, and if the script is to collect data (`DO_DATA = "y"`), then a heading for the data to be collected is created with the Callback function `DataHeader`:

```
If IterationCount() = 1 Then
   If DO_DATA = "y" Then
      DataHeader "PROCESSOR Utilization - " & sCPUMsg _
                    & UNITPERCENT, 0, lStreamID
   End if
End If
```

Next, the `If DO_EVENT = "y" And dTotalTime > TH_UTIL Then` block is executed only if both these conditions are true:

- the CPU threshold is exceeded (`dTotalTime > TH_UTIL`), and
- events are to be sent (`DO_EVENT = "y"`).

```
If DO_EVENT = "y" And dTotalTime > TH_UTIL Then
   dQueueLen = CPU.QueueLengthValue
   If dQueueLen = -1 Then
      MSActions PRM_KSERR, "Counter not found", "AKP_NULL", _
            sObjectList, "The queue length counter could _
                  not be found"
      Exit Sub
   End If

  ' if TH_QLEN = -1 ignore query length value and raise event
  ' else if query length value exceeds threshold value then
  ' raise event
   If TH_QLEN = -1 Then
      sDetailMsg = sCPUMsg + " utilization% is " & _
                     Format$(dTotalTime, "0.00") & _
```

```
                    "; >TH = " & Cstr(TH_UTIL)
      MSActions Severity, sCPUMsg & " Overloaded", AKPID, _
                        sObjectList, sDetailMsg
   Elseif dQueueLen > TH_QLEN Then
      sDetailMsg = sCPUMsg + " utilization% is " & _
              Format$(dTotalTime, "0.00") & "; >TH = " & _
          Cstr(TH_UTIL)  & "   AND" & chr$(10) & "CPU queue _
            length is " & Cstr(dQueueLen) & "; >TH = " & _
            Cstr(TH_QLEN)
      MSActions Severity, sCPUMsg & " Overloaded", AKPID, _
                       sObjectList, sDetailMsg
   End If
End If
```

In the block of code above, the managed object `NT.CPU.QueueLengthValue` retrieves the CPU queue length and assigns it to `dQueueLength`, provided that the user is interested in the queue length `(TH_QLEN <> -1)`:

```
     dQueueLen = CPU.QueueLengthValue
```

If `QueueLengthValue` fails (returns -1) the Callback function `MSActions` returns an event with an error message and blinks the correct object icon. Then the program exits the `CpuCheck()` subroutine:

```
If dQueueLen = -1 Then
   MSActions PRM_KSERR, "Counter not found", "AKP_NULL", _
         sObjectList, "The queue length counter could _
                 not be found"
   Exit Sub
End If
```

If the user is uninterested in `dQueueLength` (`TH_QLEN` = -1), then the Callback function MSActions is used to raise an event with a message that the CPU threshold has been exceeded:

```
If TH_QLEN = -1 Then
   sDetailMsg = sCPUMsg + " utilization% is " & _
                Format$(dTotalTime, "0.00") & _
                "; >TH = " & Cstr(TH_UTIL)
   MSActions Severity, sCPUMsg & " Overloaded", AKPID, _
              sObjectList, sDetailMsg
```

If the user has asked to include the queue length threshold (`TH_QLEN <> -1`) and the queue length threshold has been exceeded (`dQueueLength > TH_QLEN`), then the Callback function MSActions is used to raise an event with a message that the CPU and queue length thresholds have been exceeded:

```
Elseif dQueueLen > TH_QLEN Then
   sDetailMsg = sCPUMsg + " utilization% is " & _
          Format$(dTotalTime, "0.00") & "; >TH = " & _
          Cstr(TH_UTIL)  & "   AND" & chr$(10) & "CPU queue _
          length is " & Cstr(dQueueLen) & "; >TH = " & _
          Cstr(TH_QLEN)
   MSActions Severity, sCPUMsg & " Overloaded", AKPID, _
                 sObjectList, sDetailMsg
End If
```

Finally, if the user has asked to collect data, then the Callback function `DataLog` is used to return the current values of CPU usage and queue length. This data is returned whether or not the thresholds have been exceeded:

```
If DO_DATA = "y" Then
   sDetailMsg = sCPUMsg + " utilization% is: " & chr$(10) & _
      "Privileged " & Format$(dPrivilegeTime, "0.00") & _
       chr$(10) & "User " & Format$(dUserTime, "0.00") & _
       chr$(10) & "Total " & Format$(dTotalTime, "0.00")
   DataLog lStreamID, dTotalTime, sDetailMsg
End If
```

The modified script, NT_CpuLoadedEx.qml

Now that you know how `Samples_CpuLoaded.qml` works, you can modify it to obtain more information. The expanded Knowledge Script is called `Samples_CpuLoadedEx.qml`.

In `Samples_CpuLoadedEx.qml`, the managed object method `CPU.TopUsageValue()` will be used to return information about the five processes that use the most CPU resources. The syntax of this method is:

```
CPU.TopUsageValue HowMany, AgtMsg, Flags
```

This function reports the total CPU consumption of all processes and, optionally, details about the processes consuming the most CPU. You can also use this function to check whether a particular application process is running or consuming an unexpected amount of CPU time (run-away process).

The function returns a double representing the overall CPU percentage used by all processes. A return value of -1 indicates an error condition.

The text string, `AgtMsg`, returns a list of process names and overall utilization numbers, sorted by the utilization percentage.

Parameter	Data type	Setting
`HowMany`	Long	Number of top CPU-consuming processes to include in the detail message (`AgtMsg`). If 0 is specified, all processes are returned. The default used in most Knowledge Scripts is 5, for example, to return details about the top 5 processes consuming the most CPU. Note that the return value for this function is the total CPU consumption (summation of all processes' CPU) irrespective of this setting.
`Flags`	Long	Set to 1 to return the detail message, `AgtMsg`, with details about top processes. If set to 0, no `AgtMsg` is returned.

Listing of Samples_CpuLoadedEx.qml

`Samples_CPULoadedEx.qml` is exactly the same as `Samples_CPULoaded.qml`, except that it calls `CPU.TopUsageValue()` to obtain the top five processes.

The new code is shown in bold and larger font:

```
Dim NT As Object
Dim CPU As Object
Const UNITPERCENT = "^^%"

' This sub routine checks for the processor time, user time,
' and queue length to see if they exceed the given
' thresholds for a given cpu, or the overall cpu
Sub CpuCheck(sCPUName As String)
Dim dUserTime#, dPrivilegeTime#, dTotalTime#, dQueueLen#
Dim sDetailMsg$, sObjectList$, sCPUMsg$
Dim lStreamID As Long


Dim sProcessNames As String
Dim lRetCode As Long


  If (sCPUName = "") Then
     ' Set the machine object as the resource. This will cause
      ' the machine object to blink if there is an event.
      sObjectList = "NT_CPUFolder = " + NT_CPUFolder
      lStreamID = 0
      sCPUMsg = "Overall CPU"
   Else
     ' Set the individual cpu name as the resource. This will
      ' cause the individual cpu object to blink if there is
      ' an event for each individual cpu
      sObjectList = "NT_CPUNumber = " + sCPUName
      lStreamID = Val(sCPUName)
      sCPUMsg = "CPU# " + sCPUName
   End If

   dTotalTime = CPU.UtilValue("PROCESSOR", sCPUName)
   dUserTime  = CPU.UtilValue("USER", sCPUName)
   If dTotalTime = -1 Or dUserTime = -1 Then
      ' A return value of -1 indicates a failure to
      ' retrieve the value of the counter
```

```
      MSActions PRM_KSERR, "Counter not found", "AKP_NULL", _
          sObjectList,"Processor or User counter not found _
            (Proc: " & Cstr(dTotalTime) & ", User: " & _
               Cstr(dUserTime) & ")"
      Exit Sub
   End If

   If dTotalTime > dUserTime Then
      dPrivilegeTime = dTotalTime - dUserTime
   Else
      dPrivilegeTime = 0
   End If

   If IterationCount() = 1 Then
      If DO_DATA = "y" Then
         DataHeader "PROCESSOR Utilization - " & sCPUMsg _
                        & UNITPERCENT, 0, lStreamID
      End if
   End If

   If DO_EVENT = "y" And dTotalTime > TH_UTIL Then
      dQueueLen = CPU.QueueLengthValue
      If dQueueLen = -1 Then
       MSActions PRM_KSERR, "Counter not found", "AKP_NULL",
_
              sObjectList, "The queue length counter could _
                      not be found"
         Exit Sub
      End If

      ' if TH_QLEN = -1 ignore query length value and raise
event
     ' else if query length value exceeds threshold value then
      ' raise event
      If TH_QLEN = -1 Then


lRetCode = CPU.TopUsageValue(5, sProcessNames, 1)

         sDetailMsg = sCPUMsg + " utilization% is " & _
                        Format$(dTotalTime, "0.00") & _
                        "; >TH = " & Cstr(TH_UTIL)  _


& chr$(10) & chr$(10) & “top 5 processes _
```

```
are: ” & sProcessNAMES


 MSActions Severity, sCPUMsg & " Overloaded", AKPID, _
                       sObjectList, sDetailMsg
      Elseif dQueueLen > TH_QLEN Then


lRetCode = CPU.TopUsageValue(5, sProcessNames, 1)

         sDetailMsg = sCPUMsg + " utilization% is " & _
                Format$(dTotalTime, "0.00") & "; >TH = " & _
           Cstr(TH_UTIL)  & "   AND" & chr$(10) & "CPU queue _
              length is " & Cstr(dQueueLen) & "; >TH = " & _
               Cstr(TH_QLEN) _


& chr$(10) & chr$(10) & “top 5 processes _
are: ” & sProcessNAMES


 MSActions Severity, sCPUMsg & " Overloaded", AKPID, _
                      sObjectList, sDetailMsg
      End If
   End If

   If DO_DATA = "y" Then
      sDetailMsg = sCPUMsg + " utilization% is: " & chr$(10)
& _
          "Privileged " & Format$(dPrivilegeTime, "0.00") & _
          chr$(10) & "User " & Format$(dUserTime, "0.00") & _
           chr$(10) & "Total " & Format$(dTotalTime, "0.00")
      DataLog lStreamID, dTotalTime, sDetailMsg
   End If
End Sub


Sub Main()
   Dim sCPUName$, sProgID$
   Dim iNumberCPU As Integer

   If IterationCount() = 1 Then
      ' Retrieve the prog id of the NetIQ NT MO COM object
      sProgID = MCGetMOID ("NetiQAgent.NT", AppManID)
      Set NT = CreateObject (sProgID)
```

```
      Set CPU = NT.CPU
   End If

   iNumberCPU = ItemCount(NT_CPUNumber, ",")
   If iNumberCPU = 1 Or DO_OVERALL = "n" Then
      ' Check each individual CPU in the object list
      For I = 1 To iNumberCPU
         sCPUName = Item$(NT_CPUNumber, I,, ",")
         CpuCheck sCPUName
      Next I
   Else
      ' Just check the overall CPU usage
      CpuCheck ""
   End If
End Sub
```

Chapter 6

Modifying a monitoring script written in Perl

This chapter dissects the code in a sample Knowledge Script called `Samples_HTTPHealth.qml`. This script sends an HTTP command to each URL in a user-specified list and reports when the Web server does not respond.

In the final section of this chapter, `Samples_HTTPHealth.qml` is modified to become `Samples_HTTPHealthEx.qml`. In this modified script, the user can elect to be informed if the Web server is unable to supply a particular HTML page of the user's choice.

You should open each sample Knowledge Script in your Developer's Console where you can look at it in the various views and open its **Script Properties** dialog box.

You will also benefit from running them in the AppManager Operator Console and experimenting with various **Properties** choices.

The following topics are covered in this chapter:

Listing of the Samples_HTTPHealth.qml script

Here is a listing of the code section of the script. The Script Parameters, included by AppManager as *variables*, are not shown.

```
# begin main script
use strict;
use NetIQ::Nqext;
use IO::Socket;
our $resmsg;
our @address_array;
our $address;
my $connection;
our $datavalue;
our $line;
our $idx;
format_list($AddressList);

$resmsg = "UNIX_MachineFolder = $UNIX_MachineFolder";

if ($AddressList eq ''){
  NetIQ::Nqext::CreateEvent($Severity, "The supplied address
                        list is empty", “AKP_NULL”, $resmsg,
                             0, "Enter a list of addresses
                             separated by a comma. E.g.
                          www.netiq.com,www.microsoft.com",
                             "", 0, 0);
}
$idx = 0;
@address_array = split (',',$AddressList);
foreach $address (@address_array){
   $datavalue = 100;
   $idx++;
   # Create a socket connection to the specified address
   $connection = IO::Socket::INET->new (Proto => "tcp",
                                        PeerAddr => $address,
                                     PeerPort => "http(80)");
   unless ($connection){
     NetIQ::Nqext::CreateEvent($Severity, "Failed to connect
                                to HTTP server $address",
                                $Akpid, $resmsg, 0, "Failed
                                to connect to HTTP server
                                $address", "", 0, 0);
      if ($Do_data eq "y"){
         NetIQ::Nqext::CreateData($idx . "$address", "HTTP
                                  health for $address", "",
                                  $resmsg, 0, "", 0);
      }
next;
   }
```

```
   # Send a head command to the specified address to see
   # if it is a valid web server
   $connection->autoflush (1);
   print $connection "HEAD /index.html HTTP/1.0\n\n";

   $line = <$connection>;
   unless ($line){
      if ($Do_event eq "y"){
         NetIQ::Nqext::CreateEvent($Severity, "Failed to
                                   connect to HTTP server
                                   $address", $Akpid,
                                   $resmsg, 0, "Failed to
                                   connect to HTTP server
                                   $address", "", 0, 0);
      }
      $datavalue = 0;
   }
   if ($Do_data eq "y"){
      NetIQ::Nqext::CreateData($idx . "$address", "HTTP
                               health for $address", "",
                               $resmsg, $datavalue, "", 0);
   }
   close ($connection);
}
### End main script

# get rid of extraneous commas, extra white spaces, etc.
sub format_list {
   my ($input) = @_;
   $input =~ s/\s+,/,/g;
   $input =~ s/,\s+/,/g;
   $input =~ s/^\s+//g;
   $input =~ s/\s+$//g;
   $input =~ s/,+/,/g;
   $input =~ s/^,//g;
   $input =~ s/,$//g;
   chomp($input);
   $_[0] = $input;
}
```

Preliminary discussion

Recall from Chapter 2 the steps that the script undergoes when it is run:

1. A user chooses a script and drags it to the target object.
2. The **Properties** dialog box opens.
3. The user sets Script Parameters, the schedule, actions, etc.—or accepts the defaults—and closes the dialog box.
4. The Operator Console creates a job (an instance of the script along with the user configured Script Parameters, schedule, actions, etc.) in the AppManager repository.
5. The AppManager management server retrieves the job, the schedule, any action scripts, and so forth from the AppManager repository and forwards it all to the AppManager agent which will run the job. The final script has all Script Parameters and object types defined as variables with assigned values.

User-set Script Parameters

There are four Script Parameters that the user can alter when launching this script. These Script Parameter will become variables (with values assigned) in the running script. The code must provide alternatives that depend on the values the user chose for these Script Parameters. The Script Parameters are:

Variable name used in the code	Description the Operator Console user will see	Value
`$Do_data`	`Collect data? (y/n)`	If = "y", data will be collected.
`$Do_event`	`Event? (y/n)`	If = "y", an event will be fired when threshold is exceeded.
`$AdressList`	`Web server address list (separated by commas and no spaces)`	Comma-delimited list of connections (URLs) to test.

Variable name used in the code	Description the Operator Console user will see	Value
`$Severity`	`Event severity level`	Severity level of event fired (if `DO_EVENT="y"`).
`$Akpid`	The "description" of this variable is "`action taken`," but the user does not see it. It is hidden in the Operator Console.	Action script or scripts to run. If none, the Operator Console program will set it to the default (`AKP_NULL`). **NOTE** The user does not see this Script Parameter in the Operator Console **Properties** dialog box, although you defined it in *your* **Script Properties** dialog box in the Developer's Console. If the user adds actions, the value of `Akpid` will be altered by the Operator Console program.

Object types

The object type for this script is:
`<Type name="UNIX_MachineFolder"></Type>`

When the script is dragged onto the target object the Operator Console will assign the appropriate value:

- `UNIX_MachineFolder` will be assigned the name of the target computer.

Actions

`$Akpid` determines what action scripts, if any, are run. If there are to be action scripts, they will be run when an event is raised—`$Akpid` is a parameter of the Callback function `CreateEvent()`. If no events are raised, no action scripts will be run.

Note Raising events is the mechanism used to launch action scripts. Other than calling an event with `$Akpid` as a (required) parameter, you do not write code to run action scripts.

The default for $Akpid in this script is "AKP_NULL" (no action), which is the default for $Akpid in most scripts. If the user adds actions with the **Properties** dialog box when setting up the job, the value of $Akpid will be changed to "1,2,3,4,....n" when the user adds n actions (n >= 1).

Functions called in the code

The code calls three types of functions:

- NetIQ Callback functions, by which the script requests information or action *from* the AppManager agent running the job. See Chapter 12, "AppManager Callbacks for Perl."
- Built-in Perl functions. See http://www.Perl.com.
- Socket functions. See http://www.perldoc.com/perl5.6.1/lib/IO/Socket.html and http://www.perldoc.com/perl5.6.1/lib/IO/Socket/INET.html.

Here are the functions called in the code, in order of their appearance:

Function or subroutine	Description
NetIQ::NQEXT::CreateEvent	Callback function that raises an event.
split	Built-in Perl function that splits a delimited string into a list (array) of strings.
IO::Socket::INET->new	Instantiates the class IO::Socket::INET to open a socket connection.
NetIQ::NQEXT::CreateData	Callback function that sends data points back for logging and graphing.
autoflush	A method of the IO::Socket::INET class that deletes cached data in a socket connection.
print	Built-in Perl function that (in this case) prints to the socket connection.
close	A method of the IO::Socket::INET class that closes the socket connection.
chomp	Built-in Perl function that removes a newline character from the end of a string.

Syntax of the Callback functions

Refer to Chapter 12, "AppManager Callbacks for Perl" for more details.

CreateData

Sends data points for dynamic data streams. This function allows you to collect data for data streams that may be instantiated at each iteration.

Syntax

```
NetIQ::Nqext::CreateData (streamId, legend, dynaleg,
objlist, val, agentmsg, msgtype [,schema] [,loglimit]
[,lowWM] [,hiWM] [,deletefile])
```

Parameter	Data type	Setting
`streamId`	Long, String	Data stream ID
`legend`	String	Data stream legend. The string length limit is 128 characters.
`dynaleg`	String	Dynamic legend, contains the dynamic information that can be used for reporting.
`objlist`	String	Corresponding object name where the data is collected.
`val`	Double	Current data point value.
`agentmsg`	String	Contains either a plain text or a message file name.
`msgtype`	Long	Related to agentmsg: 0 for plain text, 1 for message file.
`schema`	String	XML schema for dynamic table creation in RDB. Default is an empty string.
`loglimit`	Long	Datalog limit in # of days. Default is -1.
`lowWM`	Double	Low watermark. Default is -1.0.
`hiWM`	Double	High watermark. Default is -1.0.
`deletefile`	Bool	Used only when `msgtype=1`. Default is `TRUE`.

`CreateData` returns nothing.

CreateEvent

Used by a Knowledge Script to send an event to the AppManager agent. The AppManager agent will apply additional rule processing and will determine whether to send a new event or a duplicated (collapsed) event to the AppManager management server.

Syntax

```
NetIQ::Nqext::CreateEvent(sev, evtmsg, akp, obj, val,
agentmsg, evtsrc, evtid, msgtype [,deletefile])
```

Parameter	Data type	Setting
`sev`	Long	Event severity
`evtmsg`	String	Event message
`akp`	String	Action name
`obj`	String	Corresponding object name where the event is raised
`val`	Double	The current value (to raise the event)
`agentmsg`	String	Either a plain text detail message or a message file name
`evtsrc`	String	Event source
`evtid`	Long	Event ID
`msgtype`	Long	Agent message type: 0 for plain text, 1 to refer to a file
`deletefile`	Bool	Only used when msgtype=1. Default is `TRUE`

`CreateEvent` returns nothing.

The program logic

Recall that the running script will include the user-defined Script Parameters. For example, if the user accepts the defaults, the following will be pre-pended to the script's code (with the UNIX machine name filled in by AppManager):

```
#### Begin KSID Section
```

```
our $AppManID = "4.1u.6.0.1";
our $KSVerID = "1.0";
#### End KSID Section

#### Begin Type Section
our $UNIX_MachineFolder = "";
#### End Type Section

#### Begin KPP Section
our $Do_event="y";
our $Do_data="n";
our $AddressList="www.netiq.com";
our $Severity=8;
our $Akpid="AKP_NULL";
#### End KPP Section
```

The main script

The lines

```
use NetIQ::Nqext;
use IO::Socket;
```

include the libraries for the AppManager Callback functions and the socket functions that we need.

Then, after declaring variables, the code begins with

```
format_list($AddressList);
```

This is a call to the function `format_list`, which will be discussed after the main part of the script. This function strips all white space and extraneous commas from `$AddressList`, which is the list of URLs entered by the user.

Next, the `$resmsg` variable is assigned the "object type" string. This string is a `CreateEvent` parameter that identifies the source of the event and tells AppManager which icon in the **TreeView** pane should blink when an event has occurred.

```
$resmsg = "UNIX_MachineFolder = $UNIX_MachineFolder";
```

If the string variable that lists the URLs to test is empty, meaning that the user did not enter a list as they should have, an event is raised that reports this:

```
if ($AddressList eq ''){
  NetIQ::Nqext::CreateEvent($Severity, "The supplied address
                        list is empty", "AKP_NULL", $resmsg,
                             0, "Enter a list of addresses
                             separated by a comma. E.g.
                          www.netiq.com,www.microsoft.com",
                             "", 0, 0);
}
```

In the block of code immediately above, note two things:

- The action variable is `"AKP_NULL",` so that no action scripts will be run at this time (this event is created because of an error condition, not because the user-defined threshold has been exceeded).
- Even if the URL list is empty, script execution continues.

The URL list entered by the user, `$AddressList`, is a comma-delimited string of URLs. The next statement converts this string to an *array* of URLs:

```
@address_array = split (',',$AddressList);
```

The entire remainder of the main script is a `foreach` loop that steps through the array of URLs, one URL at a time. If the list is empty, the loop will not execute. At the beginning of each pass through the loop, `$datavalue` is set to `100` which represents a "healthy" URL. If the URL is later found to not be healthy, `$datavalue` will be reset to `0`. These values only have meaning if data is to be collected (`$Do_data = "y"`).

```
foreach $address (@address_array){
   $datavalue = 100;
   $idx++;
```

Now it is time to open a socket connection to `$address`. This is done by instantiating a new `IO::Socket::INET` connection with `$address` as a parameter in the constructor.

```
# Create a socket connection to the specified address
```

```
$connection = IO::Socket::INET->new (Proto => "tcp",
                                     PeerAddr => $address,
                                    PeerPort => "http(80)");
```

If creation of the socket fails, the constructor will return `undef`. We test for this. If `undef` is returned, then:

- An event is raised signaling failure.
- A datapoint with a value of 0 is sent to the data stream for that URL, but only if `$Do_data eq "y"`. The data stream ID is the URL preceded by its place in the list—for example, if the fourth URL in the list is `www.netiq.com`, its stream ID will be: `$idx . "$address" = 4www.netiq.com`.
- Execution returns to the beginning of the `foreach` loop.

```
unless ($connection){
  NetIQ::Nqext::CreateEvent($Severity, "Failed to connect
                              to HTTP server $address",
                              $Akpid, $resmsg, 0, "Failed
                              to connect to HTTP server
                              $address", "", 0, 0);

    if ($Do_data eq "y"){
       NetIQ::Nqext::CreateData($idx . "$address", "HTTP
                                health for $address", "",
                                $resmsg, 0, "", 0);
    }
    next;
}
```

If execution of the `foreach` loop continues at this point, we know that the socket connection to the remote computer hosting the Web server has been created successfully, but we still do not know if a connection to the Web server itself has succeeded. To test the Web server we send an HTTP `HEAD` command requesting the URLs `index.html` page. Before sending the `HEAD` command, we flush any cached data from the socket.

```
# Send a head command to the specified address to see
# if it is a valid web server
$connection->autoflush (1);
print $connection "HEAD /index.html HTTP/1.0\n\n";
```

If there is no response, it means that the Web server is absent or is not able to answer. In such a case, attempting to read the first line of the reply (i.e., `<$connection>`) will return `undef`. We assign the first line of the answer to $line and test it. Unless it is not `undef` (that is, unless it has contents), we raise an event reporting failure and also set `$datavalue` to `0`.

Note It isn't important that the Web server can serve the `index.html` page. If the Web server can respond, but cannot serve `index.html`, it will return an error message, not `undef`. This means that the Web server is "healthy," which is what we are looking for.

```
$line = <$connection>;
unless ($line){
   if ($Do_event eq "y"){
      NetIQ::Nqext::CreateEvent($Severity, "Failed to
                                connect to HTTP server
                                $address", $Akpid,
                                $resmsg, 0, "Failed to
                                connect to HTTP server
                                $address", "", 0, 0);
   }
   $datavalue = 0;
}
```

At this point in the script, the value of `$datavalue` is `100` for a successful connection to the Web server, or `0` for a failed connection. We send back a datapoint to the `$idx . "$address"` data stream, provided that `$Do_data eq "y"`. Then, the socket connection is closed and the main script is finished.

```
   if ($Do_data eq "y"){
      NetIQ::Nqext::CreateData($idx . "$address", "HTTP
                               health for $address", "",
                               $resmsg, $datavalue, "", 0);
   }

   close ($connection);
}

### End main script
```

Note This script raises events only upon failure of a connection to a

Web server on the list of URLs. If all connections succeed, the script does not send events. A connection is considered successful if the Web server responds to the `HEAD` command—it is not a requirement that the Web server can return the `index.html` page, only that it responds.

The format_list subroutine

This subroutine, which is called on the user-input list of URLs at the beginning of the main script, uses the regular expression operator to make sure that the string listing the URLs is properly formatted: a list of URLs, separated by commas, with no white space and no empty elements (an empty element is two successive commas with nothing between them).

```
# get rid of extraneous commas, extra white spaces, etc.
sub format_list {
   my ($input) = @_;
   $input =~ s/\s+,/,/g;
   $input =~ s/,\s+/,/g;
   $input =~ s/^\s+//g;
   $input =~ s/\s+$//g;
   $input =~ s/,+/,/g;
   $input =~ s/^,//g;
   $input =~ s/,$//g;
   chomp($input);
   $_[0] = $input;
}
```

Here is what each line does:

Line	Function
`$input =~ s/\s+,/,/g;`	Substitutes a comma for one or more white spaces followed by a comma.
`$input =~ s/,\s+/,/g;`	Substitutes a comma for a comma followed by one or more white spaces.
`$input =~ s/^\s+//g;`	Substitutes nothing for any white space at the beginning of the string.
`$input =~ s/\s+$//g;`	Substitutes nothing for any white space at the end of the string.

Line	Function
`$input =~ s/,+/,/g;`	Substitutes one comma for two or more consecutive commas.
`$input =~ s/^,//g;`	Substitutes nothing for a comma at the beginning of the string.
`$input =~ s/,$//g;`	Substitutes nothing for a comma at the end of the string.
`chomp($input);`	Deletes a newline character at the end of the string.

The modified script, Samples_HTTPHealthEx.qml

The code in `Samples_HTTPHealth.qml` checks to verify that the Web server at each URL in the user-supplied string `$AddressList` is responding. The Web server does not need to return a particular page to be considered healthy. The `HEAD` command is used to ask for the `index.html` page, but the script does not raise an event if the Web server reports failure to serve that page. An event is raised only if the Web server fails to respond at all.

In `Samples_HTTPHealth.qml`, the user can specify the name of a page in the Script Parameter `$Html_page` and the script will report a "health problem" if the Web server cannot return that page (only if another new user-defined Script Parameter, `$Do_OkEvent`, is set to `"y"`). In this case, it is not sufficient that the Web server simply responds—it must respond that it can serve the desired page.

The `HEAD` command in `Samples_HTTPHealth.qml`

```
print $connection "HEAD /index.html HTTP/1.0\n\n";
```

is changed to

```
print $connection "HEAD /$Html_page HTTP/1.0\n\n";
```

in the `Samples_HTTPHealthEx.qml` script.

In `Samples_HTTTPHealthEx.qml`, whenever `$Do_OkEvent` is set to `"y"`, the `HEAD` command must report success. If the `HEAD` command succeeds, the first line returned will be "`HTTP/1.1 200 OK`" (by comparison, a typical failure would return something like "`HTTP/1.1 500 Server Error`"). We assign the first line of the

returned message to $line and then test it. The condition in the statement

```
if ($line !~ /HTTP\/1\.1 200/)
```

will be true if the string "HTTP/1.1 200" is not found in the Web server response to the HEAD command.

Altered code

The portion of Samples_HTTPHealth.qml that is altered to produce Samples_HTTPHealthEx.qml is shown below. The new code is shown in a larger font and in bold.

```
   # Send a head command to the specified address to see
   # if it is a valid web server
   $connection->autoflush (1);
   print $connection "HEAD /$Html_page HTTP/
                      1.0\n\n";
  while (<$connection>){
     # Need to remove the ^M character
     # because it doesn't display well in
     # the operator console.
     s/\cM//;
     $line .= $_;
  }

   $line = <$connection>;
   unless ($line){
      if ($Do_event eq "y"){
         NetIQ::Nqext::CreateEvent($Severity, "Failed to
                                   connect to HTTP server
                                   $address", $Akpid,
                                   $resmsg, 0, "Failed to
                                   connect to HTTP server
                                   $address", "", 0, 0);
      }
      $datavalue = 0;
   }
   else {
     if ($line !~ /HTTP\/1\.1 200/) {
        if ($Do_OkEvent eq "y") {
            NetIQ::Nqext::CreateEvent($Severity,
```

```
                "Bad page, $Html_page, for
                $address", $Akpid, $resmsg,
                0, "This job successfully
                connected to HTTP server
                $address, however, the
                requested page,
                $Html_page, returned:
                \n$line", "", 0, 0);
        }
    }
}
```

There is one new feature in the `Samples_HTTPHealth.qml` code above that needs explanation. In the altered script, there is a new user-defined Script Parameter called `$Do_OkEvent`. If this Script Parameter is set to "`y`", then the script will raise an event when the `HEAD` command reports failure to serve `$Html_page`. Further, this event will supply the error message returned by the `HEAD` command as a message string. The error message returned by the `HEAD` command will contain `^M` (that is, `Ctrl + M`) characters. These characters will display poorly in the AppManager Console, so the script removes them with the code:

```
while (<$connection>){
     # Need to remove the ^M character
     # because it doesn't display well in
     # the operator console.
     s/\cM//;
     $line .= $_;
  }
```

This loop steps through each line in the message returned by the `HEAD` command and substitutes nothing for \cM characters. Note that the `$line` string is empty when the loop begins.

Chapter 7

Modifying an action script written in VBScript

In AppManager, "performing an action" means running an action Knowledge Script as a result of an event being raised in some other type of script.

This chapter describes an action script, `Action_WriteToFile`, that does what its name implies—it writes a message to a file. This Knowledge Script, written in VBScript, is similar to the Summit BasicScript action script, `Action_WriteMsgToFile`.

`Action_WriteMsgToFile` and `Action_WriteToFile` will write *either* of two messages to a file: a default message or a custom message. In the last part of this chapter, `Action_WriteToFile` will be modified so that the script can also write *both* of the custom and default messages. The modified script is called `Action_WriteToFileEx`.

This chapter covers the following topics:

- The program logic
- The modified script, Action_writeToFileEx.qml

Setting up to perform actions

Actions can be defined for "normal" (monitoring and report), discovery, and install scripts. It is not possible to define further actions for action scripts.

Actions for a Knowledge Script can be defined either:

- by the script developer, using the **Script Properties** dialog box in the Developer's Console, or
- by users of the AppManager Operator Console, using the **Properties** dialog box that opens when a script is dragged to a target object in the **TreeView** pane.

Script developers

When developing a monitoring, reporting, or discovery Knowledge Script, you should use the **Parameters** tab of the **Script Properties** dialog box in the Developer's Console to define a Script Parameter called `AKPID`. You should also give this Script Parameter the default value "`AKP_NULL`". You are not forced to do this, but trouble can arise if you do not.

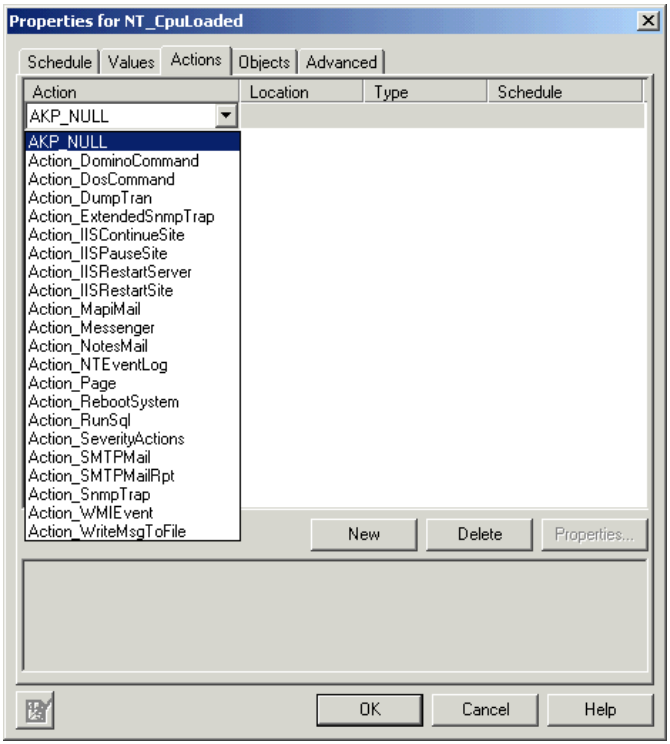
You, the script developer, can also define actions for your script using the **Script Properties** dialog box. This is hardly ever done by script developers, as it is difficult to predict what type of action a user will want performed. You should define actions rarely, if ever.

Note If you do, in fact, define actions yourself, you might think that setting a default value of "`AKP_NULL`" for `AKPID` is unnecessary. However, a user can *undo* your choices of actions when setting up a Knowledge Script job, so that a default value will be required in any case.

AppManager Operator Console users

When an AppManager Operator Console user drags a script to a target object in the **TreeView** pane, the **Properties** dialog box opens. For every type of Knowledge Script except action scripts, the dialog box will have an **Actions** tab. In this tab, users can add as many actions as they desire. In the rare event that the script writer associated actions with this script, the user can delete them.

Caution You must choose **Action** for the **Knowledge Script type** in the **Header** tab of the **Script Properties** dialog box of the Developer's Console. If you fail to make this choice for an action script, it will not be available as a new action to an Operator Console user in the **Action** tab of the Knowledge Script **Properties** dialog box:



Invoking actions

It is the responsibility of non-action scripts to invoke actions.

Action scripts are executed *only* when events are raised. More specifically, when:

- actions have been associated with a monitoring, discovery, install, or reporting Knowledge Script job,
- an event is raised by one of those scripts, and
- the event Callback's action parameter is set to `AKPID`.

When you are developing a script, you can choose to raise an event that does *not* call any action scripts that may be chosen by a user. In the Callback function that raises the event (`CreateEvent` in VBScript, `MSActions` in Summit BasicScript), you set the action parameter to "`AKP_NULL`" rather than `AKPID`.

Thus, for any given event, you can choose to have *all* action scripts executed or *none*. If you set the action parameter of `CreateEvent` or `MSActions` to `AKPID`, all actions chosen by a user will be executed. If the parameter is set to "`AKP_NULL`" no action script will be executed.

Note There is no mechanism for you to associate several different actions with a script and choose *which one* should be executed when a particular event is raised.

Events without actions

In general, you want to generate events without invoking actions when your script detects an error condition that you feel the user should be aware of. For example, if the user enters an invalid script parameter, the script should raise an event, but not invoke an action.

Monitoring scripts should invoke actions only if the conditions or thresholds that the user wants to monitor have been met or exceeded.

Ending actions

It is the responsibility of the action script itself to signal the end of an action.

Toward the end of your action script, your code should signal the completion of the action script by raising an event with the action parameter set to "`AKP_COMPLETE`." For example, in the `Action_WriteToFile` script, the final statement in the code is:

```
NQEXT.CreateEvent 2, "", "AKP_COMPLETE", "", 0, "", "", 0, 0
```

An event that sets the `AKPID` parameter to "`AKP_COMPLETE`" will cause the **Message** in the **Action** tab of the **Event Properties** dialog box to read:

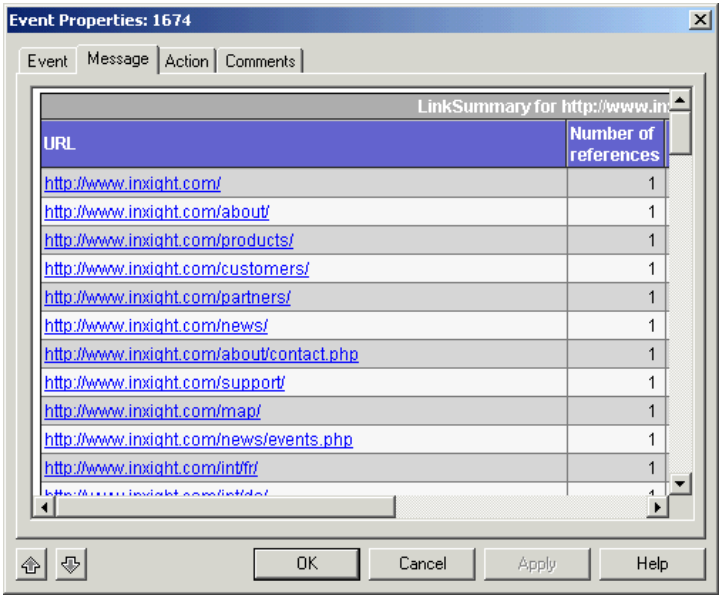
- "Action Complete" if the event message (second parameter in the event parameter list) is an empty string, as it is in the example immediately above, or
- the event message, if it is *not* an empty string.

If you do not raise an event with the action parameter set to "`AKP_COMPLETE`", the **Message** in the **Action** tab of the **Event Properties** dialog box will continue to read "<Location> Action in Progress," even though the action has, in fact, completed.

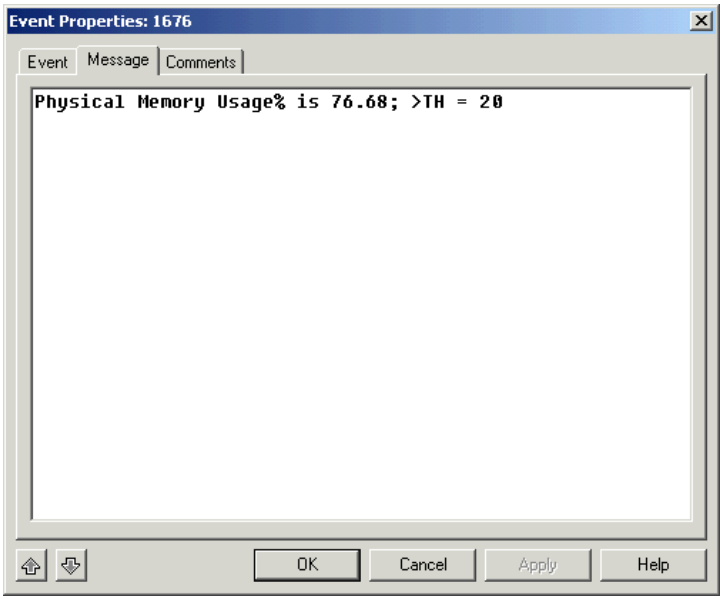
Note Any event raised with an action parameter *other than* "`AKP_COMPLETE`" will create a *new* event.

XML messages

Beginning with AppManager 5.0, you can write custom event messages for your monitoring scripts in XML format. AppManager will parse these XML messages to create formatted tables in the **Message** pane of the **Event Properties** dialog box. Here is an example from an event raised by the `WebServices_LinkSummary` Knowledge Script.



By comparison, the screen below shows an event message that is not in XML format.



The importance of XML messages in this chapter is this: You must take the XML format possibility into account in your action scripts. The event message will be passed to the action script—since this message may be in either plain text or in XML format, the action script will need to take this into consideration. The `Action_WriteToFile` and `Action_WriteToFileEx` examples in this chapter show how to do this.

Listing of the Action_WriteToFile.qml script

Here is a listing of the code section of `Action_WriteToFile.qml`. The Script Parameters, included by AppManager as *variables*, are not shown.

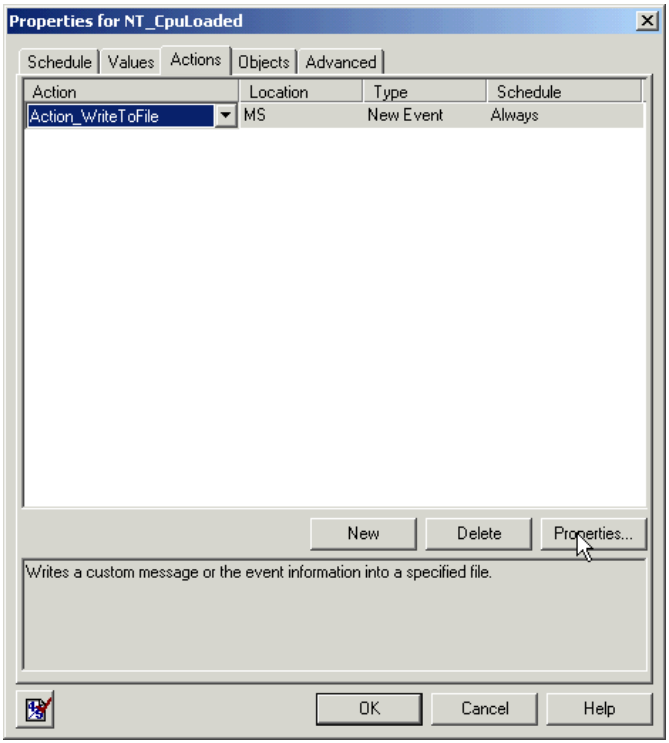
```
Const MIN_MC_VERSION = "4.5"
Dim strAgtVersion ' The NetIQmc agent version

' Function converts the detail message from XML into
' normal text if needed
Function PreProcessForXML (strXMLMsg)
   Dim strProcessedMsg
   Dim lngRetCode

   NQEXT.GetVersion "netiqmc.exe", strAgtVersion
   ' Conversion of XML text to normal text is only supported
   ' in AppManager agent version 5.0 and higher
   If (strAgtVersion >= MIN_MC_VERSION) Then
      lngRetCode = NQEXT.EventXMLToPlainText(strXMLMsg, _
                                             strProcessedMsg)
      Select Case lngRetCode
         Case 0
            PreProcessForXML = strProcessedMsg

         Case -1 'Malformed XML Doc
            NQEXT.CreateEvent 2, "EventXMLToPlainText _
               Failed.", "AKP_COMPLETE", "The XML is a _
               malformed XML document", 0, "", "", 0, 0
            PreProcessForXML = strXMLMsg

         Case -2 'Not event XML Doc
            PreProcessForXML = strXMLMsg

         Case -3 ' Miscellaneous
            NQEXT.CreateEvent 2, "EventXMLToPlainText _
              Failed.", "AKP_COMPLETE", "XML Translation _
              failed with unknown reason", 0, "", "", 0, 0
            PreProcessForXML = strXMLMsg

         Case Else
            PreProcessForXML = strXMLMsg
      End Select
   Else
```

```
      PreProcessForXML = strXMLMsg
   End If
End Function


Sub Main
   Dim objFso, objFile
   Dim strMessage
   Dim lngIoMode

   Const ForReading = 1
   Const ForWriting = 2
   Const ForAppending = 8

   ' Check to see if we would like to append to the file _
   ' or overwrite it
   If Append = "y" Then
      lngIoMode = ForAppending
   Else
      lngIoMode = ForWriting
   End If

   If Filename = "" Then
      NQEXT.CreateEvent 2, "No file name was specified to _
             write to.","AKP_COMPLETE", "", 0, "", "", 0, 0
      Exit Sub
   End If

   On Error Resume Next
   Set objFso = CreateObject("Scripting.FileSystemObject")
   If Err.Number <> 0 Then
      NQEXT.CreateEvent 2, "Failed to create file system _
           object: " & Err.Description, "AKP_COMPLETE", _
                 "", 0,"", "", 0, 0
      Exit Sub
   End If

   ' Open the text file or create it if necessary
   Set objFile = objFso.OpenTextFile(Filename, _
                                     lngIoMode, True)
   If Err.Number <> 0 Then
      NQEXT.CreateEvent 2, "Failed to create file: " _
          & Filename & " Error: " & Err.Description, _
          "AKP_COMPLETE", "", 0, "", "", 0, 0
      Exit Sub
```

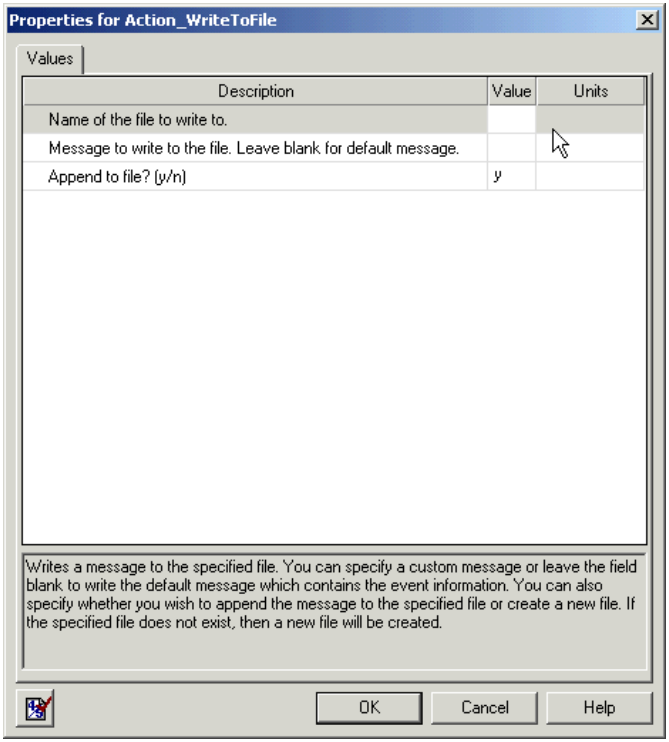
```
   End If
   On Error Goto 0

   If Message = "" Then
      ' No message was supplied so use the default message
      objFile.WriteLine("JobID = " + JobID)
      objFile.WriteLine("KSName = " + KPName)
      objFile.WriteLine("Object Name = <" + ObjList + ">")
      objFile.WriteLine("EventMsg = " + EventMsg)
      objFile.WriteLine("LongMsg = " + _
                        PreProcessForXML (AgentMsg))
   Else
      ' Use the messaged that was supplied
      objFile.WriteLine(Message)
   End If
   objFile.Close
   NQEXT.CreateEvent 2, "", "AKP_COMPLETE", _
                     "", 0, "", "", 0, 0
End Sub
```

User-set Script Parameters

Users can set action script properties when the "calling script" is dragged and dropped. As an example, assume you drag the Knowledge Script `NT_CPULoaded` (the "calling script") to a target CPU in the AppManager Operator Console **TreeView** pane. In the **Properties** dialog box, you select the **Actions** tab and add the `Action_WriteToFile` script as your action for `NT_CPULoaded`.



After you have chosen `Action_WriteToFile` as your action, click the **Properties** button. This opens the **Properties** dialog box for `Action_WriteToFile`:



Here you must enter values for the Script Parameters required by `Action_WriteToFile`. The Script Parameters are:

Variable name used in the code	Description the Operator Console user will see	Value
`Filename`	`Name of the file to write to.`	The name of the file to write to. If this Script Parameter is not given a value, the action will abort.

Variable name used in the code	Description the Operator Console user will see	Value
`Message`	`Message to write to the file. Leave blank for default message.`	An optional custom message.
`Append`	`Append to the file? (y/n)`	If = "`y`", the new message (custom or default) will be appended to whatever is already in the file. If = "`n`", the file will be overwritten with the message.

Parameters supplied by AppManager

For action scripts, unlike other types of scripts, AppManager adds a number of variables (constants in Summit BasicScript action scripts) to the beginning of the script when it is run. The variables have to do with the event that caused the action script to be launched.

You can use these AppManager-added variables in your script, but you cannot see them in any of the Developer's Console views. You simply have to know that they are there and what they are:

AppManager-added variable	Description
JobID	The JobID of the "calling script" (the script that raised the error that caused the action script to execute).
Severity	The severity of the calling script event that caused execution of the action script.
MachineName	The name of the machine running the calling script whose event caused execution of the action script.
KPName	The Knowledge Script name of the "calling script" (the script that raised the error that caused the action script to execute).

AppManager-added variable	Description
ObjList	The `obj` parameter of the calling script event that caused execution of the action script.
EventMsg	The `evtmsg` parameter (event message) of the calling script event that caused execution of the action script.
AgentMsg	The `agentmsg` parameter (optional long message) of the calling script event that caused execution of the action script.

Note These variables are added when the action script is run on either the management server or the managed client.

Functions called in the code

The code calls two types of functions:

- Callback functions, by which the script requests information or action *from* the AppManager agent running the job. See Chapter 11, "AppManager Callbacks for Summit BasicScript and VBScript."
- Methods of VBScript objects such as the file system and error objects. Refer to Microsoft's online documentation for VBScript, http://msdn.microsoft.com/library/default.asp?url=/library/en-us/script56/html/vtoriVBScript.asp.

Here are the functions and objects called in the script, in order of their appearance:

Function or subroutine	Description
`NQEXT.GetVersion`	Callback function that retrieves the version number of the AppManager agent or component where the action is running.
`NQEXT.EventXMLToPlainText`	Callback function that converts XML event messages to plain text.
`NQEXT.CreateEvent`	Callback function that raises an event.

Function or subroutine	Description
`CreateObject("Scripting.FileSystemObject")`	VBScript function that creates the file system object needed to open files and write to them.
`Err.Number`	Method that obtains the number of any error thrown by the VBScript Error object.
`Err.Description`	Method that obtains a text description of any error thrown by the VBScript Error object.
`objFso.OpenTextFile`	Method of the VBScript file system object.
`objFile.WriteLine`	Method of the VBScript text file object.
`objFile.Close`	Method of the VBScript text file object.

Syntax of the Callback functions

Refer to Chapter 11, "AppManager Callbacks for Summit BasicScript and VBScript" for more details.

GetVersion

Obtains the latest version string for the specified file name.

Syntax

```
GetVersion file, verstr
```

Parameter	Data type	Setting
`file`	String	Name of NetIQ file, or any other file.
`verstr`	String	The returned version string (passed by reference).

`GetVersion` returns nothing.

EventXMLToPlainText

Converts event messages in XML format to plain text. AppManager 5.0 only.

Syntax

```
EventXMLToPlainText XMLMsg, ProcessedMsg
```

Parameter	Data type	Setting
`XMLMsg`	String	Message in XML format.
`ProcessedMsg`	String	The message after translation to plain text. (passed by reference).

`EventXMLToPlainText` returns 0 for success, -1 for malformed XML, -2 if the message is not XML, or -3 if translation failed for some other reason. Any other value represents failure for an unknown reason.

CreateEvent

Used by a Knowledge Script to send an event to the AppManager agent. The AppManager agent will apply additional rule processing and will determine whether to send a new event or a duplicated (collapsed) event to the AppManager management server.

Syntax

```
CreateEvent sev, evtmsg, akp, obj, val, agentmsg, evtsrc,
evtid, msgtype [,deletefile]
```

Parameter	Data type	Setting
`sev`	Long	The event severity. A value from 1 to 40.
`evtmsg`	String	The message to be displayed under the Message column in the Events tab.

Parameter	Data type	Setting
akp	String	Name of the action script to launch as a response to this event. You would normally create an AKPID parameter as part of your script. When the job is dropped and you select an action, the UI will fill in the AKPID variable with the action name. You will just need to pass in the AKPID variable to the script.
obj	String	Corresponding object name where the event is raised. This value will determine which object in the **TreeView** pane to blink. Format of the value passed in should be "ObjectTypeName = ObjectValue", e.g. "UNIX_DiskObject = /mnt/cdrom". The ObjectValue can normally be obtained by the drop object variable, e.g. UNIX_MachineFolder.
val	Double	The current value to raise the event. This parameter is currently not used. Set to 0.0.
agentmsg	String	Either the detail message or a file name that contains the detail message. The detailed message is displayed in the Message tab of the Event Property dialog box. If this parameter contains the name of a file, make sure you set the msgtype parameter to 1.
evtsrc	String	Not used. Should always be empty.
evtid	Long	Not used. Should always be 0.
msgtype	Long	Flag specifying whether the value passed in the agentmsg parameter is a file name or the detailed message itself. If it is a file name, then the contents of the file are read and passed in as the detailed message. Set to 0 to specify that the value in the agentmsg parameter is the detailed message. Set to 1 to specify that the value is the file name containing the detailed message.
deletefile	Long	Optional. Flag to tell the AppManager agent to delete the event detail message file after it is done reading the contents and passing the event to the MSU. This parameter is ignored if msgtype != 1. Set to 1, which is default, to delete the file when msgtype = 1. Set to 0 to not delete the file. Be careful when setting this value to 0, especially if your script generates a message file each time it wants to send an event because the files will never be removed.

CreateEvent returns nothing.

The program logic

The function `PreProcessForXML` is at the beginning of the file. This is used to convert any custom messages in XML to plain text. This function is discussed after `Sub Main` is analyzed.

Sub Main

Recall that there are three user-definable Script Parameters used as constants in the script: `Filename`, `Message`, and `Append`.

`Sub Main` begins with this code:

```
Dim objFso, objFile
Dim strMessage
Dim lngIoMode

Const ForReading = 1
Const ForWriting = 2
Const ForAppending = 8

' Check to see if we would like to append to the file _
' or overwrite it
If Append = "y" Then
   lngIoMode = ForAppending
Else
   lngIoMode = ForWriting
End If
```

The declared variables are:

Variable	Description
`objFSO`	The VBScript file system object.
`objFile`	The VBScript text file object.
`lngIoMode`	Variable to hold the file I/O constant that represents the user's choice of appending to the file or overwriting it.

The constants `ForWriting` and `ForAppending` will be used as input parameters to the VBScript `FileSystemObject` method

`OpenTextFile`, to determine whether to overwrite the contents of the file or append to its existing contents.

Note The constant `ForReading` is included for completeness, but is not used.

Then, with the overwrite/append constants defined, the script chooses the appropriate constant and assigns it to `lngIoMode`:

- If the user kept the default for `Append` (=“y”), `lngIoMode` is set to `ForAppending`.
- If the user changed the value of `Append` to “n”, `lngIoMode` is set to `ForWriting`.

The next section of code checks to see if `Filename` is defined (the user should have given this Script Parameter a value).

```
If Filename = "" Then
   NQEXT.CreateEvent 2, "No file name was specified to _
             write to.","AKP_COMPLETE", "", 0, "", "", 0, 0
   Exit Sub
End If
```

If `Filename` is not defined, the Callback function `CreateEvent` is called to create an event that:

- Transmits the message “`No file name was specified .....`”
- Sets the action variable to “`AKP_COMPLETE`,” indicating that the action script is ending.

Then `Sub Main`, and the script, exits.

The next section of code is going to call `CreateObject` to create a VBScript object and then call one of the object’s methods. Either of these calls could result in an error. A VBScript run-time error will be reported to the operating system and will end execution, *unless* the script handles the errors. For this reason, the code is written to handle the errors.

```
   On Error Resume Next
   Set objFso = CreateObject("Scripting.FileSystemObject")
```

```
If Err.Number <> 0 Then
   NQEXT.CreateEvent 2, "Failed to create file system _
        object: " & Err.Description, "AKP_COMPLETE", _
              "", 0,"", "", 0, 0
   Exit Sub
End If
```

The statement, `On Error Resume Next`, enables error handling by the script and informs VB to continue execution on the line that follows an error's occurrence.

`Set objFso = CreateObject("Scripting.FileSystemObject")` creates the `FileSystemObject` of the `Scripting` type library and assigns it to the object variable `objFso`.

If the object creation succeeds, no error will be thrown and `Err.Number` will be equal to 0. If an error occurs, `Err.Number` will be non-zero. The next line of code tests for this. If an error occurred, the Callback function `CreateEvent` is called to create an event that:

- Transmits the message "`Failed to create file system object`" along with the VBScript error description `Err.Description.`
- Sets the action variable to "`AKP_COMPLETE`," indicating that the action script is ending.

Then `Sub Main`, and the script, is exited.

Assuming that the `FileSystemObject` was created successfully, the code goes on to open a text file (actually a text file object) for overwriting or appending, depending on the value of `lngIoMode`.

```
' Open the text file or create it if necessary
Set objFile = objFso.OpenTextFile(Filename, _
                                  lngIoMode, True)
If Err.Number <> 0 Then
   NQEXT.CreateEvent 2, "Failed to create file: " _
       & Filename & " Error: " & Err.Description, _
       "AKP_COMPLETE", "", 0, "", "", 0, 0
   Exit Sub
End If
On Error Goto 0
```

The last parameter of the `OpenTextFile` method call, when `True`, tells the method to create a new file if it does not already exist.

Once again, if the `OpenTextFile` fails (`Err.Number` is non-zero), an event is raised with a failure message and the action variable set to "`AKP_COMPLETE.`" Then `Sub Main` is exited.

The last statement, `On Error Goto 0`, disables error handling for the subsequent code.

At this point a file is opened for overwriting or appending, and all that remains to be done is to write the desired message to the file. Two text file object (`objFile`) methods will be called in the remaining code, `objFile.WriteLine` and `objFile.Close`. Neither of these two methods are likely to throw errors, so the script does not bother with further error handling.

```
If Message = "" Then
   ' No message was supplied so use the default message
   objFile.WriteLine("JobID = " + JobID)
   objFile.WriteLine("KSName = " + KPName)
   objFile.WriteLine("Object Name = <" + ObjList + ">")
   objFile.WriteLine("EventMsg = " + EventMsg)
   objFile.WriteLine("LongMsg = " + _
                     PreProcessForXML (AgentMsg))
Else
   ' Use the message that was supplied
   objFile.WriteLine(Message)
End If
```

Note This code uses the AppManager-added variables discussed in "Parameters supplied by AppManager" on page 145.

There are two possible messages that can get written to the file:

1. The contents of user-defined Script Parameter `Message`.
2. In the case that `Message` is empty, a "default message" that was created by the action script writer (*in* the script).

`WriteLine` writes a string plus a newline character, so the default message is written out line-by-line:

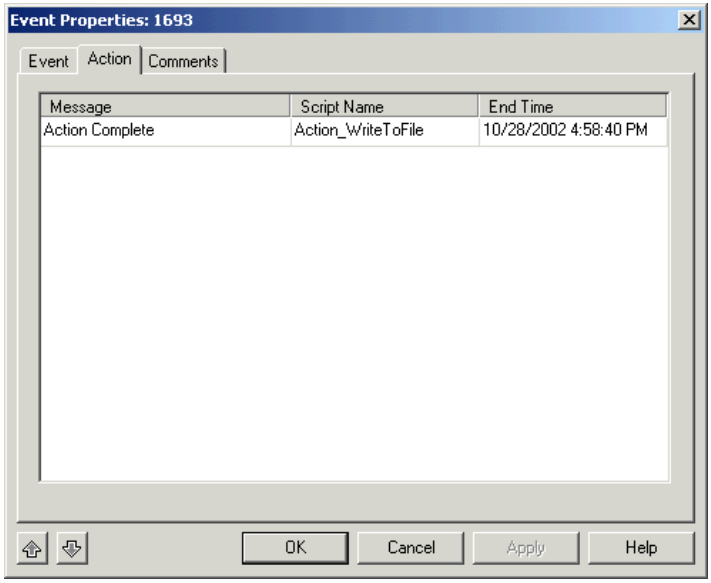
Message Line	Description
`"JobID = " + JobID`	The JobID of the “calling script” (the script that raised the error that caused the action script to execute). This is provided by the AppManager infrastructure.
`"KSName = " + KPName`	The Knowledge Script name of the “calling script” (the script that raised the error that caused the action script to execute). This is provided by the AppManager infrastructure.
`"Object Name = <" + ObjList + ">"`	The `obj` parameter of the calling script event that caused execution of the action script.
`"EventMsg = " + EventMsg`	The `evtmsg` parameter (event message) of the calling script event that caused execution of the action script.
`"LongMsg = " + PreProcessForXML (AgentMsg)`	The `agentmsg` parameter (optional long message) of the calling script event that caused execution of the action script. **NOTE:** This message, defined by the author of the calling script, *may* have been written in XML format. Therefore, the `PreProcessForXML` function is used to convert it to plain text, if necessary.

Finally, the text file object is closed, a “success” event is raised, and the `Main` subroutine exits.

This `CreateEvent` call differs from all the previous calls in this script. The previous calls were all in response to an error or failure and their `evtmsg` parameter (the second parameter) contained an error message. In this case, since the action completed successfully, you should pass in an empty string, "", instead of an error message. As a result, the user will see "Action Complete" for the action status in the Event Properties window.

```
objFile.Close
   NQEXT.CreateEvent 2, "", "AKP_COMPLETE", _
                      "", 0, "", "", 0, 0
End Sub
```

Note Do not confuse "`Action Complete`" with "`AKP_COMPLETE`". "`AKP_COMPLETE`" signals to AppManager that your script has completed. "`Action Complete`" is written to the **Event Properties** dialog box only when the script has completed *successfully*.



Function PreProcessForXML

Beginning with AppManager 5.0, Knowledge Script developers can create monitoring script event messages in XML. AppManager will parse these XML messages to create formatted tables in the **Message** pane of the **Event Properties** dialog box.

We do not want messages that we write to a text file to contain XML tags, so we want some way of stripping these tags before writing the message to the file.

The Callback function `NQEXT.EventXMLToPlainText` converts a NetIQ XML-formatted message to plain text. The AppManager agent

on the computer running the script containing this function must be version 5.0 or later.

The optional long message for any particular monitoring script may or may not be written in XML. Since we have no way of knowing which it is, we must call `NQEXT.EventXMLToPlainText` for every such message. The `Action_WriteMessageToFile` script includes a function that checks the AppManager agent version number, calls the Callback function `NQEXT.EventXMLToPlainText,` and handles any errors returned by the Callback.

`NQEXT.EventXMLToPlainText(strXMLMsg)` takes one parameter, the message text to convert.The function begins by checking that the AppManager version number is greater than or equal to 4.5 (this is the version number for AppManager 5.0). If the version number is less than 4.5, the function simply returns the name of the input text, without attempting conversion, and then exits.

```
Const MIN_MC_VERSION = "4.5"
Dim strAgtVersion ' The NetIQmc agent version

' Function converts the detail message from XML into
' normal text if needed
Function PreProcessForXML (strXMLMsg)
   Dim strProcessedMsg
   Dim lngRetCode

   NQEXT.GetVersion "netiqmc.exe", strAgtVersion
   ' Conversion of XML text to normal text is only supported
   ' in AppManager agent version 5.0 and higher
   If (strAgtVersion >= MIN_MC_VERSION) Then
```

If the version number is sufficient, `NQEXT.EventXMLToPlainText` is called to convert the input message, `strXMLMsg`, to plain text output, `strProcessedMsg`.

Since `NQEXT.EventXMLToPlainText` can return several different values, a `Select` block is used to handle the alternatives.

```
lngRetCode = NQEXT.EventXMLToPlainText(strXMLMsg, _
                                        strProcessedMsg)
      Select Case lngRetCode
```

```
        Case 0
           PreProcessForXML = strProcessedMsg

        Case -1 'Malformed XML Doc
           NQEXT.CreateEvent 2, "EventXMLToPlainText _
              Failed.", "AKP_COMPLETE", "The XML is a _
              malformed XML document", 0, "", "", 0, 0
           PreProcessForXML = strXMLMsg

        Case -2 'Not event XML Doc
           PreProcessForXML = strXMLMsg

        Case -3 ' Miscellaneous
           NQEXT.CreateEvent 2, "EventXMLToPlainText _
             Failed.", "AKP_COMPLETE", "XML Translation _
             failed with unknown reason", 0, "", "", 0, 0
           PreProcessForXML = strXMLMsg

        Case Else
           PreProcessForXML = strXMLMsg
     End Select
```

Return value	Meaning	Result
0	The input message was in the proper XML format and was successfully converted.	The `PreProcessForXML` function returns the converted text, `strProcessedMsg`.
-1	The input message is in XML format, but it is not well-formed XML. Conversion failed.	The `PreProcessForXML` function returns the input text, `strXMLMsg`.
-2	The input message is not in XML format. Conversion failed.	The `PreProcessForXML` function returns the input text, `strXMLMsg`.
-3	The input message is in XML format, but something unknown caused conversion to fail.	The `PreProcessForXML` function returns the input file, `strXMLMsg`.
Any other integer	Conversion failed for some other reason.	The `PreProcessForXML` function returns the input file, `strXMLMsg`.

In two cases, -1 and -3, where the input file is XML but could not be converted, `CreateEvent` is used to raise an event and return an error message. In the other cases, where the message is not XML, no event is raised.

Note In the event that the optional long message is indeed in XML, but the conversion by `NQEXT.EventXMLToPlainText` fails, the Sub Main line of code

```
objFile.WriteLine("LongMsg = " + _
                  PreProcessForXML (AgentMsg))
```

will print the XML message to the text file.

The modified script, Action_writeToFileEx.qml

In the `Action_WriteToFile` script, the message written to file is either a "default" (defined by the script writer, *in* the script) or a user-supplied message. This is the code to make this choice:

```
If Message = "" Then
   ' No message was supplied so use the default message
   objFile.WriteLine("JobID = " + JobID)
   objFile.WriteLine("KSName = " + KPName)
   objFile.WriteLine("Object Name = <" + ObjList + ">")
   objFile.WriteLine("EventMsg = " + EventMsg)
   objFile.WriteLine("LongMsg = " + _
                       PreProcessForXML (AgentMsg))
Else
   ' Use the message that was supplied
   objFile.WriteLine(Message)
End If
```

In many cases, a user may want to write *both* of these messages. The `Action_WriteToFileEx` script is a modification of the `Action_WriteToFile` script that does this. A new user-definable Script Parameter has been added, `PrependMsg`. If the user sets this Script Parameter to "`y`" (default = "`n`"), that means that the user's message should be written first, followed by the default message.

Then, the code immediately above is altered (new code shown in larger font and bold) like this:

```
If Message = "" Or PrependMsg = “y” Then
   ' No message was supplied so use the default message
   objFile.WriteLine(Message)
   objFile.WriteLine("JobID = " + JobID)
   objFile.WriteLine("KSName = " + KPName)
   objFile.WriteLine("Object Name = <" + ObjList + ">")
   objFile.WriteLine("EventMsg = " + EventMsg)
   objFile.WriteLine("LongMsg = " + _
                     PreProcessForXML (AgentMsg))
Else
   ' Use the message that was supplied
   objFile.WriteLine(Message)
End If
```

With this simple modification, the first part of the `If` block will write *both* messages if `PrependMsg = “y,”` irrespective of the value of `Message`. If `PrependMsg = “y”` and `Message` is empty, an empty line will be written before the default message.

The `Else` block, where only `Message` is written, will be reached only if `Message` has a value and `PrependMsg = “n.”`

Note This script will behave exactly like `Action_WriteToFile` if `PrependMsg = “n,”` except for an extra blank line before the default message.

Chapter 8

Modifying an action script written in Summit BasicScript

This chapter presumes that you have read all of the introductory material in the previous chapter. If you have not already done so, please read Chapter 7 through the end of the section titled "XML Messages."

This chapter describes an action script, `Action_Messenger`, that sends a message using the Windows Message Service. This Knowledge Script, written in Summit BasicScript, is very similar to the AppManager action script of the same name.

`Action_Messenger` will send *either* of two messages: a default message or a custom message. In the last part of this chapter, the script will be modified so that the script can also send *both* the custom and the default messages. The modified script is called `Action_MessengerEx`.

This chapter covers the following topics:

- Listing of the Action_Messenger.qml script
- User-set Script Parameters
- Parameters supplied by AppManager
- Functions called in the code
- Syntax of the Callback functions
- The program logic
- The modified script, Action_MessengerEx.qml

Listing of the Action_Messenger.qml script

Here is a listing of the code section of `Action_Messenger.qml`. The Script Parameters, included by AppManager as *constants*, are not shown.

```
Const QUO = chr$(34)    ' a double quote
Const NL = chr$(10)   ' newline
Const MAX_RETRY = 5  ' maximum number of times to retry
                     ' sending the message

Declare Function NetMessageBufferSend Lib "netapi32.dll" _
(ByVal pszServer As String, ByVal pszRecipient As String,_
ByVal pszSender As String, ByVal pbBuffer As String, _
ByVal cbBuffer As Long) As Long

Const V3GSP1 = "3.0.370.0"
Const MIN_MC_VERSION = "4.5"
Dim sAgtVersion$   ' The NetIQmc agent version

Function PreProcessForXML (sXMLMsg As String) As String

   Dim sProcessedMsg As String
   Dim lRetCode As Long

   If (sAgtVersion >= MIN_MC_VERSION) Then
      lRetCode = EventXMLToPlainText(sXMLMsg, sProcessedMsg)
      Select Case lRetCode
         Case 0
            PreProcessForXML = sProcessedMsg

         Case -1 'Malformed XML Doc
            MSActions 2, "EventXMLToPlainText Failed.", _
                      "AKP_COMPLETE", "", "The XML is a _
                      malformed XML document"
            PreProcessForXML = sXMLMsg

         Case -2 'Not event XML Doc
            PreProcessForXML = sXMLMsg

         Case -3 ' Miscellaneous
            MSActions 2, "EventXMLToPlainText Failed.", _
                     "AKP_COMPLETE", "", "XML Translation _
                     failed with unknown reason"
```

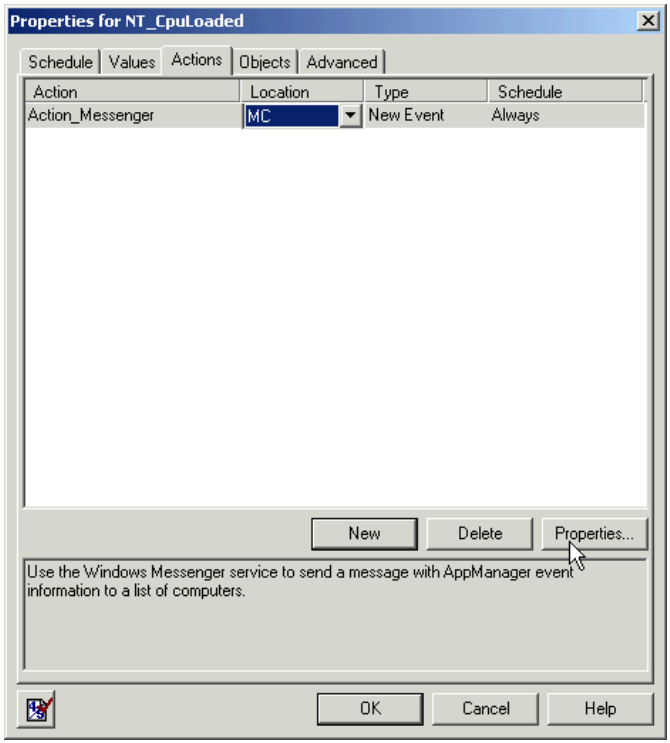
```
            PreProcessForXML = sXMLMsg

         Case Else
            PreProcessForXML = sXMLMsg
      End Select
   Else
      PreProcessForXML = sXMLMsg
   End If
End Function

Sub Main()
   Const vbUnicode = 64
   Dim lResult As Long
   Dim lMsgLen As Long
   Dim lRetry As Long
   Dim sTargetName As String
   Dim sMessage As String
   Dim sHostname As String
   Dim sErrMsg As String
   Dim bError As Boolean

   'Get MC version
   sAgtVersion = ""
   MCVersion "netiqmc.exe", sAgtVersion

   sErrMsg = "Obj/Err: "
   bError = False

   If Message = "" Then
      ' No message was supplied so use the default message
      sMessage = "JobID = " + JobID + NL + _
                 "KSName = " + KPName + NL + _
                 "MC MachineName = " + MachineName + NL + _
                 "Object Name = <" + ObjList + "> " + NL + _
                "EventMsg = " + EventMsg + NL + "LongMsg = _
                 " + PreProcessForXML (AgentMsg) + NL
   Else
      ' Use the messaged that was supplied
      sMessage = Message
   End If

   For I = 1 To ItemCount(Recipient, ",")
      sTargetName = Item$(Recipient, I,, ",")
      lMsgLen = Len(sMessage)
      lRetry = 0
```

```
      'Truncate message if too long
      If lMsgLen > 1024 Then
         lMsgLen  = 1024
         sMessage = Mid(sMessage, 1, lMsgLen) & "..."
      End If

      sHostname = GetMachName
resend:
      If sAgtVersion < V3GSP1 Then
      lResult = NetMessageBufferSend ( _
                        StrConv("",vbUnicode), _
                        StrConv(sTargetName,vbUnicode), _
                        StrConv(sHostname,vbUnicode),_
                        StrConv(sMessage,vbUnicode), _
                        Len(StrConv(sMessage,vbUnicode)))
      Else
         lResult = MCNetMessageBufferSend ("", _
                                           sTargetName, _
                                           sHostname,_
                                           sMessage)
      End If

      If lResult <> 0 Then
         lRetry = lRetry + 1
         If (lRetry < MAX_RETRY) Then
            MCSleep 100
            GoTo resend
         End If

         If (bError = True) Then
            sErrMsg = sErrMsg & ","
         Else
            bError = True
         End If
        sErrMsg = sErrMsg & sTargetName & "/" & CStr(lResult)
      End If
   Next I

   If bError=True Then
      MSActions 2, sErrMsg, "AKP_COMPLETE", "", ""
      MSActions 2, "Action_Messenger failed", "AKP_NULL", _
                "", sErrMsg
   Else
      MSActions 2, "", "AKP_COMPLETE", "", ""
   End If
```

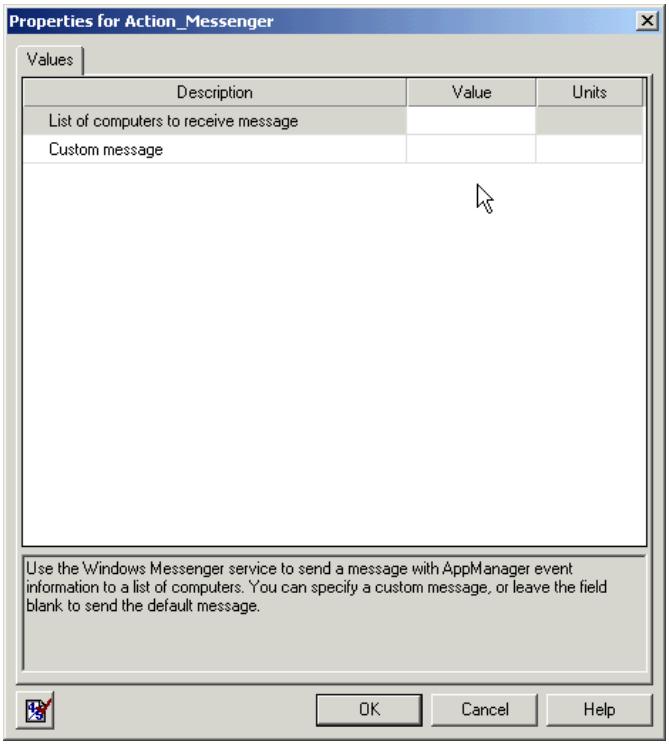
```
   Exit Sub
End Sub
```

User-set Script Parameters

Users can set action script properties when the "calling script" is dragged and dropped. As an example, assume you drag the Knowledge Script `NT_CPULoaded` (the "calling script") to a target CPU in the AppManager Operator Console **TreeView** pane. In the **Properties** dialog box, you select the **Actions** tab and add the `Action_Messenger` script as your action for `NT_CPULoaded`.



After you have chosen `Action_Messenger` as your action, you click the **Properties** button. This opens the **Properties** dialog box for `Action_Messenger`:



Here you must enter values for the Script Parameters used in the `Action_Messenger` code. The Script Parameters are:

Variable name used in the code	Description the Operator Console user will see	Value
`Recipient`	`List of computers to receive message`	A comma-delimited list of the computers that should receive the Windows Message Service message (required).
`Message`	`Custom Message`	A custom message (optional).

Parameters supplied by AppManager

For action scripts, unlike other types of scripts, AppManager adds a number of constants (variables in VBScript action scripts) to the beginning of the script when it is run. The variables have to do with the event that caused the action script to be launched.

You can use these AppManager-added variables in your script, but you cannot see them in any of the Developer's Console views. You simply have to know that they are there and what they are:

AppManager-added constant	Description
JobID	The JobID of the "calling script" (the script that raised the error that caused the action script to execute).
Severity	The severity of the calling script event that caused execution of the action script.
MachineName	The name of the machine running the calling script whose event caused execution of the action script.
KPName	The Knowledge Script name of the "calling script" (the script that raised the error that caused the action script to execute).
ObjList	The `obj` parameter of the calling script event that caused execution of the action script.
EventMsg	The `evtmsg` parameter (event message) of the calling script event that caused execution of the action script.
AgentMsg	The `agentmsg` parameter (optional long message) of the calling script event that caused execution of the action script.

Note These variables are added when the action script is run on either the management server or the managed client.

Functions called in the code

The code calls three types of functions:

- Windows API functions (see http://msdn.microsoft.com/library/default.asp?url=/library/en-us/winprog/winprog/windows_api_reference.asp).
- Callback functions, by which the script requests information or action *from* the AppManager agent running the job. See Chapter 11, "AppManager Callbacks for Summit BasicScript and VBScript."
- Built-in functions of Summit BasicScript. See the BasicScript documentation in `appmanager\documentation\development_tools\summit_basicscript\documentation`.

Here are the functions called in the script, in order of their appearance:

Function or subroutine	Description
`EventXMLToPlainText`	Callback function that converts XML event messages to plain text.
`MCVersion`	Callback function that retrieves the version number of the AppManager agent or component where the action is running.
`ItemCount`	Summit BasicScript built-in function that returns the number of items in a delimited text string list.
`Item$`	Summit BasicScript built-in function that returns a discrete item in a delimited text string list.
`Len`	Summit BasicScript built-in function that returns the number of characters in a string.
`Mid`	Summit BasicScript built-in function that finds a sub-string within a string.
`GetMachName`	Callback function that returns the name of the computer running this script.

Function or subroutine	Description
`NetMessageBufferSend`	A Win32 API function that sends a message through the Windows Messenger Service. Must be declared before being used.
`MCNetMessageBufferSend`	Callback function equivalent to the Win32 API function `NetMessageBufferSend`. Only works with AppManager agents later than 3.0.370.0.
`StrConv`	Summit BasicScript built-in function that converts a string to a different format, such as `UNICODE`.
`MCSleep`	Callback function that requests the AppManager agent to sleep for the specified interval during execution of the Knowledge Script.
`Cstr`	Summit BasicScript built-in function that converts an expression to a string.
`MSActions`	Callback function that reports events and initiates actions.

Syntax of the Callback functions

Refer to Chapter 11, "AppManager Callbacks for Summit BasicScript and VBScript" for more details.

EventXMLToPlainText

Converts event messages in XML format to plain text (AppManager 5.0 only).

Syntax

```
EventXMLToPlainText XMLMsg, ProcessedMsg
```

Parameter	Data type	Setting
`XMLMsg`	String	Message in XML format.
`ProcessedMsg`	String	The message after translation to plain text. (passed by reference).

`EventXMLToPlainText` returns 0 for success, -1 for malformed XML, -2 if the message is not XML, or -3 if translation failed for some other reason. Any other value represents failure for an unknown reason.

GetMachName

Returns the machine name (host name) of a managed computer as a string.

Syntax

```
GetMachName
```

Parameters

None.

MCNetMessageBufferSend

Sends a message using the Windows Messenger Service. Essentially the same as the Win32 API function `NetMessageBufferSend`.

Syntax

```
MCNetMessageBufferSend ("", TargetName, Hostname, Message)
```

Parameter	Data type	Description
`ServerName`	String	Name of the remote server on which the function is to execute. If this parameter is empty, the local computer is used.
`TargetName`	String	Name of computer to which the message is sent.
`Hostname`	String	Name of computer from which the message is sent.
`Message`	String	Message to be sent.

Note The Win32 API function `NetMessageBufferSend` has a fifth parameter, the length of `Message` in bytes.

MCSleep

Requests the AppManager agent to sleep for an interval during execution of the calling Knowledge Script.

Syntax

```
MCSleep intv
```

Parameter	Data type	Description
`intv`	Long	Sleep interval in msec.

Returns 1 when sleep completes, -1 if sleep aborts.

MCVersion

Requests the AppManager agent to obtain the version string for the specified component file name.

Syntax

```
MCVersion component, verstr [,fullpath]
```

Parameter	Data type	Description
`component`	String	Component file name.
`verstr`	String	The returned corresponding version string (passed by reference).
`fullpath`	Bool	If `TRUE`, component contains the full path to the filename; if `FALSE`, the component's location is relative to the AppManager\bin directory. By default, this value is `FALSE`.

`MCVersion` returns nothing.

MSActions

Allows a Knowledge Script to report events and initiate actions.

Syntax

```
MSActions severity, shortmsg, akpid, objlist, detailmsg
[,detailmsg2, ...., detailmsg6] [,value]
```

Parameter	Data type	Setting
`severity`	Long	Severity of the event.
`shortmsg`	String	Event message displayed in the **List** pane.
`akpid`	String	Action name or identifier for the action to be taken.
`objlist`	String	Objects that report the event (their icons will be set to blinking in the Operator Console's **TreeView** pane).
`detailmsg`	String	Detail message from the AppManager agent(s) displayed in the event's Properties dialog. At least one `detailmsg` is required. The maximum size of the string is 32K. To pass additional information beyond the 32K, you can specify up to 6 message strings, each with a maximum size of 32K, to define the entire detail message for an event. For example, if the message you want to return is 64K, the message would be stored in two strings: `MSActions Severity, "High", AKPID, "", detailmsg, detailmsg2` **Note:** Within your Knowledge Script, the variable name you use for the detail message string can vary. For example, in viewing sample scripts you may see names such as `detailmsg`, `agtmsg`, `agentmsg`, or `longm`.
`value`	Double	Optional. The current value to raise an event.

`MSAction` returns nothing.

The program logic

The Win32 API function `NetMessageBufferSend` is declared at the beginning of the file. This must be done so that it can be called in the code that follows.

```
Declare Function NetMessageBufferSend Lib "netapi32.dll" _
(ByVal pszServer As String, ByVal pszRecipient As String,_
ByVal pszSender As String, ByVal pbBuffer As String, _
ByVal cbBuffer As Long) As Long
```

The function `PreProcessForXML` is at the beginning of the file, right after the declaration of `NetMessageBufferSend`. `PreProcessForXML` is used to convert any custom messages in XML to plain text. This function will be discussed after `Sub Main` is analyzed.

Sub Main

Recall that there are two user-definable Script Parameters used as constants in the script: `Recipient` and `Message`.

- `Recipient` is a comma-delimited string that lists all the computers that should receive the Messenger Service message.
- `Message`, an optional Script Parameter, is a string—if the user does not enter a value, `Message` will be an empty string.

Global constants and variables are:

```
Const QUO = chr$(34)    ' a double quote
Const NL = chr$(10)   ' newline
Const MAX_RETRY = 5  ' maximum number of times to retry
                     ' sending the message
Const V3GSP1 = "3.0.370.0"
Const MIN_MC_VERSION = "4.5"
Dim sAgtVersion$   ' The NetIQmc agent version
```

`Sub Main` begins with this code:

```
   Const vbUnicode = 64
   Dim lResult As Long
   Dim lMsgLen As Long
   Dim lRetry As Long
```

```
Dim sTargetName As String
Dim sMessage As String
Dim sHostname As String
Dim sErrMsg As String
Dim bError As Boolean
'Get MC version
sAgtVersion = ""
MCVersion "netiqmc.exe", sAgtVersion
```

The declared variables are:

Variable	Description
`lResult`	Variable to store the value returned by the API function `NetMessageBufferSend` (or the Callback function `MCNetMessageBufferSend`).
`lMsgLen`	The number of characters in `sMessage`.
`lRetry`	The number of attempts to send `sMessage` to a given computer.
`sTargetName`	Name of a computer to which `sMessage` should be sent.
`sMessage`	The message to be sent by the Windows Messenger Service.
`sHostname`	Name of the computer running the script (sending the message).
`sErrMsg`	Error message for event if message delivery fails for one or more computers.
`bError`	Will become `True` if message delivery fails for one or more computers.

The Callback function `MCVersion` is used to get the AppManager agent version number, which is returned as `sAgtVersion` (passed by reference).

The next section of code prepares for error reporting if the API function `NetMessageBufferSend` fails. Upon failure, `bError` will be reset to `True` and `sErrMsg` will become the basis for an error message string. This error handling is internal to the script—it has nothing to do with error handling or reporting by Summit BasicScript or the Win32 API.

```
sErrMsg = "Obj/Err: "
bError = False
```

The code now forms the message (`sMessage`) to be sent to the target computers. The variable `Message` contains the message supplied by the user, or an empty string if the user chose not to provide a message.

```
If Message = "" Then
   ' No message was supplied so use the default message
   sMessage = "JobID = " + JobID + NL + _
              "KSName = " + KPName + NL + _
              "MC MachineName = " + MachineName + NL + _
              "Object Name = <" + ObjList + "> " + NL + _
              "EventMsg = " + EventMsg + NL + "LongMsg = _
              " + PreProcessForXML (AgentMsg) + NL
Else
   ' Use the messaged that was supplied
   sMessage = Message
End If
```

There are two possible messages that can get sent by the messenger:

1. The contents of user-defined Script Parameter `Message`.
2. In the case that `Message` is empty, a "default message" that was created by the action script writer (*in* the script).

Because of the `+ NL` inclusions in `sMessage`, the default message is written out line-by-line:

Message Line	Description
"JobID = " + JobID	The JobID of the "calling script" (the script that raised the error that caused the action script to execute). This is provided by the AppManager infrastructure.
"KSName = " + KPName	The Knowledge Script name of the "calling script" (the script that raised the error that caused the action script to execute). This is provided by the AppManager infrastructure.
"MC MachineName = " + MachineName	The name of the computer that is sending the message. This is provided by the AppManager infrastructure.
"Object Name = <" + ObjList + ">"	The `obj` parameter of the calling script event that caused execution of the action script.

Message Line	Description
"EventMsg = " + EventMsg	The `evtmsg` parameter (event message) of the calling script event that caused execution of the action script.
"LongMsg="+ PreProcessForXML (AgentMsg)	The `agentmsg` parameter (optional long message) of the calling script event that caused execution of the action script. **NOTE:** This message, defined by the author of the calling script, *may* have been written in XML format. Therefore, the `PreProcessForXML` function is used to convert it to plain text, if necessary.

Now that the message has been determined, the code steps through each computer in the list of recipients (recall that `Recipient` is a comma-delimited string that lists all the computers that should receive the Messenger Service message). Two built-in functions of Summit BasicScript are used for the loop:

- `ItemCount` returns the number of computers in the list (requires delimiter, in this case a comma, as one input parameter).
- `Item$` returns the name of individual computer number `I`.

```
For I = 1 To ItemCount(Recipient, ",")
   sTargetName = Item$(Recipient, I,, ",")
   lMsgLen = Len(sMessage)
   lRetry = 0
   'Truncate message if too long
   If lMsgLen > 1024 Then
      lMsgLen  = 1024
      sMessage = Mid(sMessage, 1, lMsgLen) & "..."
   End If
```

The Windows Messenger service will only accept messages of 1024 characters or less. The Summit BasicScript function `Len` returns the length of `sMessage` and assigns it to `lMsgLen`. If `lMsgLen` is, in fact, greater than 1024, then `sMessage` will be truncated. The truncation is achieved by using Summit BasicScript function `Mid` to find the substring in `sMessage` that begins with the first character and is 1024 characters long.

Once `sMessage` is truncated, we have the exact message we want to send. We are in a loop where we have the name of one of the

computers on the list of recipients. The next step is to send the message. There is a Callback function (`MCNetMessageBufferSend`) that can be used to send the message, provided that the AppManager agent version number is later than `V3GSP1 (= 3.0.370.0`). If the agent is an earlier version, we use the Win32 API function `NetMessageBufferSend`, which requires that the input strings are in `UNICODE`. Both `NetMessageBufferSend` and `MCNetMessageBufferSend` require the name of the computer sending the message (`sHostname`).

We are prepared to re-send this message up to `MAX_RETRY` (= 5 in this code) times.

```
      sHostname = GetMachName
resend:
      If sAgtVersion < V3GSP1 Then
      lResult = NetMessageBufferSend ( _
                        StrConv("",vbUnicode), _
                        StrConv(sTargetName,vbUnicode), _
                        StrConv(sHostname,vbUnicode),_
                        StrConv(sMessage,vbUnicode), _
                        Len(StrConv(sMessage,vbUnicode)))
      Else
         lResult = MCNetMessageBufferSend ("", _
                                           sTargetName, _
                                           sHostname,_
                                           sMessage)
      End If
```

Both `MCMessageBufferSend` and `NetMessageBufferSend` return 0 in `lResult` if they are successful. We test for success. If the function fails, we sleep for 100 milliseconds, go to the `resend:`label, and try again—up to `MAX_RETRY` attempts.

```
      If lResult <> 0 Then
         lRetry = lRetry + 1
         If (lRetry < MAX_RETRY) Then
            MCSleep 100
            GoTo resend
         End If
```

At this point, we are still in the `If lResult <> 0 Then` block. If we reach the next statement, `If (bError = True) Then`, it means that all

MAX_RETRY (= 5 in this script) attempts to send have failed for this computer.

If this is the *first* time we have reached this point, bError will be False and we change it to True (it will remain True for the rest of the script).

If this is not the first time we have reached this point, bError will be True and a comma will be added to sErrMsg.

Then, the name of the destination computer for which the message sending function failed is added to ErrMsg, along with the error number returned by the function.

The For I = 1 To ItemCount(Recipient, ",") loop continues until the list of destination computers is exhausted.

```
        If (bError = True) Then
           sErrMsg = sErrMsg & ","
        Else
           bError = True
        End If
       sErrMsg = sErrMsg & sTargetName & "/" & CStr(lResult)
     End If
  Next I
```

At this point in the script, if one or more message deliveries fails, bError will be True and sErrMsg will have a comma-separated list of all the target computers for which delivery failed.

If the message delivery has succeeded for all computers on the delivery list, then bError will be False.

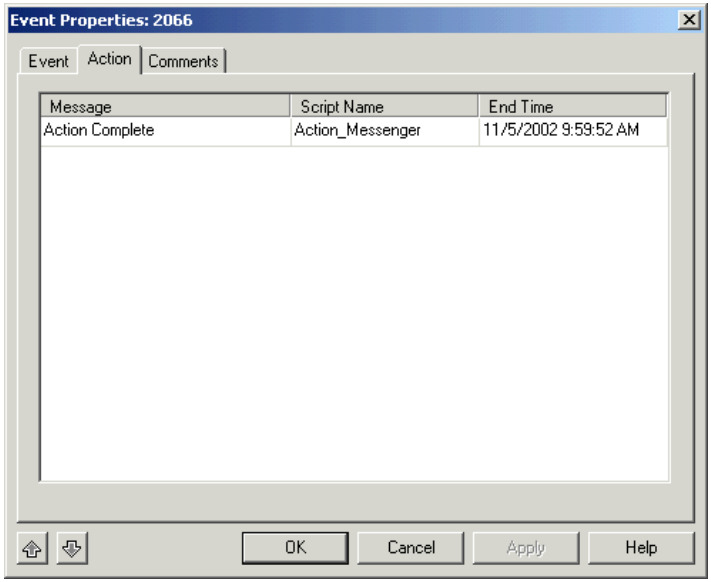
When bError is True, two events are raised:

- An "AKP_COMPLETE" event, with the list of unsuccessful deliveries, is sent to complete the action.
- An "AKP_NULL" event is sent to the Operator Console to report a failure of Action_Messenger.

If bError is False, all deliveries have succeeded and we raise only one event. This event reports "Action Complete" as an Event Property because the second parameter of MSActions is an empty string.

```
   If bError=True Then
      MSActions 2, sErrMsg, "AKP_COMPLETE", "", ""
      MSActions 2, "Action_Messenger failed", "AKP_NULL", _
                "", sErrMsg
   Else
      MSActions 2, "", "AKP_COMPLETE", "", ""
   End If
   Exit Sub
End Sub
```

Note Do not confuse "Action Complete" with "`AKP_COMPLETE`." The latter signals to AppManager that your script has completed. The former is written to the **Event Properties** dialog box when the script has completed *successfully*.



Function PreProcessForXML

Beginning with AppManager 5.0, Knowledge Script developers can create monitoring script event messages in XML. AppManager will parse these XML messages to create formatted tables in the **Message** pane of the **Event Properties** dialog box.

We do not want messages to contain XML tags, so we want some way of stripping these tags.

The Callback function `EventXMLToPlainText` converts a NetIQ XML-formatted message to plain text. The AppManager agent on the computer running the script containing this function must be version 5.0 or later.

The optional long message for any particular monitoring script may or may not be written in XML. Since we have no way of knowing which it is, we must call `EventXMLToPlainText` for every such message. The `Action_Messenger` script includes a function that checks the AppManager agent version number, calls the Callback function `EventXMLToPlainText,` and handles any errors returned by the Callback.

`EventXMLToPlainText(strXMLMsg)` takes one parameter, the name of the message text to convert. The function begins by checking that the AppManager version number is greater than or equal to 4.5 (this is the version number for AppManager 5.0). If the version number is less than 4.5, the function simply returns the name of the input text, without attempting conversion, and then exits.

Note The `PreProcessForXML` function does not obtain the agent version itself. `Sub Main` obtains a value for the global variable `strAgtVersion` before it calls `PreProcessForXML`.

```
Const MIN_MC_VERSION = "4.5"
Dim sAgtVersion$   ' The NetIQmc agent version

Function PreProcessForXML (sXMLMsg As String) As String

   Dim sProcessedMsg As String
   Dim lRetCode As Long
```

```
   If (sAgtVersion >= MIN_MC_VERSION) Then
```

If the version number is sufficient, `EventXMLToPlainText` is called to convert the input message, `strXMLMsg`, to plain text output, `strProcessedMsg`.

Since `EventXMLToPlainText` can return several different values, a `Select` block is used to handle the alternatives.

```
 lRetCode = EventXMLToPlainText(sXMLMsg, sProcessedMsg)
      Select Case lRetCode

         Case 0
            PreProcessForXML = sProcessedMsg

         Case -1 'Malformed XML Doc
            MSActions 2, "EventXMLToPlainText Failed.", _
                      "AKP_COMPLETE", "", "The XML is a _
                      malformed XML document"
            PreProcessForXML = sXMLMsg

         Case -2 'Not event XML Doc
            PreProcessForXML = sXMLMsg

         Case -3 ' Miscellaneous
            MSActions 2, "EventXMLToPlainText Failed.", _
                     "AKP_COMPLETE", "", "XML Translation _
                     failed with unknown reason"
            PreProcessForXML = sXMLMsg

         Case Else
            PreProcessForXML = sXMLMsg

      End Select
```

If the agent is an older one, the input string is returned without calling the `EventXMLToPlainText` function.

```
Else
      PreProcessForXML = sXMLMsg
   End If
End Function
```

Return value	Meaning	Result
0	The input message was in the proper XML format and was successfully converted.	The `PreProcessForXML` function returns the converted file, `strProcessedMsg`.
-1	The input message is in XML format, but it is not well-formed XML. Conversion failed.	The `PreProcessForXML` function returns the input file, `strXMLMsg`.
-2	The input message is not in XML format. Conversion failed.	The `PreProcessForXML` function returns the input file, `strXMLMsg`.
-3	The input message is in XML format, but something unknown caused conversion to fail.	The `PreProcessForXML` function returns the input file, `strXMLMsg`.
Any other integer	Conversion failed for some other reason.	The `PreProcessForXML` function returns the input file, `strXMLMsg`.

In two cases, -1 and -3, where the input file is XML but could not be converted, `CreateEvent` is used to raise an event and return an error message. In the other cases, where the message is not XML, no event is raised.

Note In the event that the optional long message is indeed in XML, but the conversion by `EventXMLToPlainText` fails, the default message will include the unconverted XML message.

The modified script, Action_MessengerEx.qml

In the `Action_Messenger` script, the message is either a "default" (defined by the script writer, *in* the script) or a user-supplied message. This is the code to make this choice:

```
 If Message = "" Then
    ' No message was supplied so use the default message
    sMessage = "JobID = " + JobID + NL + _
               "KSName = " + KPName + NL + _
               "MC MachineName = " + MachineName + NL + _
               "Object Name = <" + ObjList + "> " + NL + _
               "EventMsg = " + EventMsg + NL + "LongMsg = _
               " + PreProcessForXML (AgentMsg) + NL
Else
   ' Use the messaged that was supplied
   sMessage = Message
End If
```

In many cases, a user may want to send *both* of these messages. The `Action_MessengerEx` script is a modification of the `Action_Messenger` script that does this. A new user-definable Script Parameter has been added, `PrependMsg`. If the user sets this Script Parameter to "`y`" (default = "`n`"), that means that the user's message should be written first, followed by the default message. Then, the code immediately above is altered (new code shown in larger font and bold) like this:

```
If Message = "" Or PrependMsg = "y" Then
  ' Prepend the custom message to the
  ' default message
  sMessage = Message + NL + _
                "JobID = " + JobID + NL + _
                "KSName = " + KPName + NL + _
                "MC MachineName = " + MachineName + NL + _
                "Object Name = <" + ObjList + "> " + NL + _
               "EventMsg = " + EventMsg + NL + "LongMsg = _
                " + PreProcessForXML (AgentMsg) + NL
Else
   ' Use the messaged that was supplied
   sMessage = Message
End If
```

With this simple modification, the first part of the `If` block will send *both* messages if `PrependMsg = "y,"` irrespective of the value of `Message`. If `PrependMsg = "y"` and `Message` is empty, an empty line will be added before the default message.

The `Else` block, where only `Message` is written, will be reached only if `Message` has a value and `PrependMsg = "n."`

Note This script will behave exactly like `Action_Messenger` if `PrependMsg = "n,"` except for an extra blank line before the default message.

Chapter 9

Modifying an action script written in Perl

In AppManager, "performing an action" means running an action Knowledge Script as a result of an event being raised in some other type of script.

This chapter describes an action script, `Action_UXCommand.qml`, that does what its name implies—it runs a non-interactive UNIX command (no user input is allowed) at the command line. This Knowledge Script, written in Perl for UNIX, is similar in function to `Action_DOSCommand.qml` for Windows.

Both `Action_DOSCommand.qml` and `Action_UXCommand.qml` are very powerful Knowledge Scripts, even though they are quite short. You can use them to run entire programs at the command line.

In the last part of this chapter, `Action_UXCommand.qml` will be extended so that the script can also write to a log file. The modified script is called `Action_UXCommandEx.qml`.

This chapter covers the following topics:

- The program logic
- The modified script, Action_UXCommandEx.qml

Setting up to perform actions

Actions can be defined for "normal" (monitoring and report), discovery, and install scripts. It is not possible to define further actions for action scripts.

Actions for a Knowledge Script can be defined either:

- by the script developer, using the **Script Properties** dialog box in the Developer's Console.
- by users of the AppManager Operator Console, using the **Properties** dialog box that opens when a script is dragged to a target object in the **TreeView** pane.

Script developers

When developing a monitoring, reporting, or discovery Knowledge Script, you should use the **Parameters** tab of the **Script Properties** dialog box in the Developer's Console to define a Script Parameter with a variable name of `$Akpid`. You should also give this Script Parameter the default value "`AKP_NULL`". You are not forced to do this, but trouble can arise if you do not.

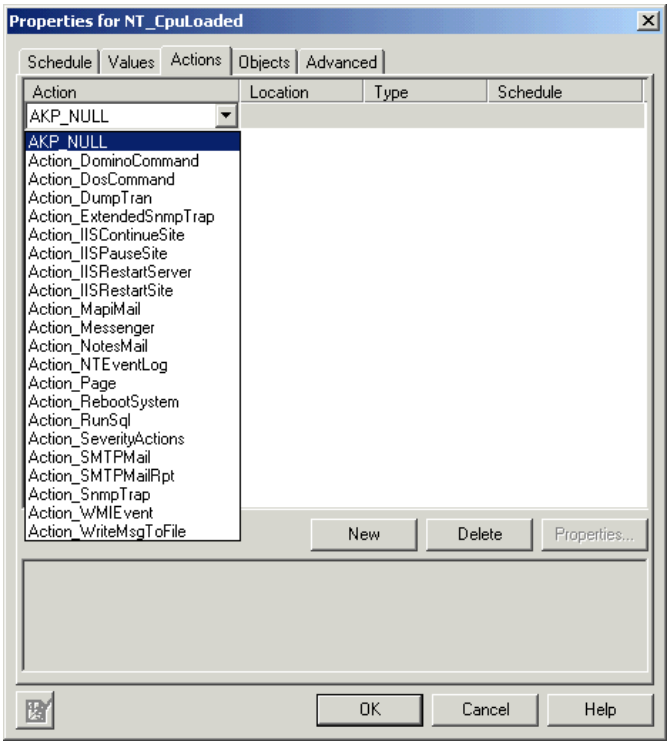
You, the script developer, can also define actions for your script using the **Script Properties** dialog box. This is hardly ever done by script developers, as it is difficult to predict what type of action a user will want performed. You should define actions rarely, if ever.

Note If you do, in fact, define actions yourself, you might think that setting a default value of "`AKP_NULL`" for `$Akpid` is unnecessary. However, a user can *undo* your choices of actions when setting up a Knowledge Script job, so that a default value will be required in any case.

AppManager Operator Console users

When an AppManager Operator Console user drags a script to a target object n the **TreeView** pane, the **Properties** dialog box opens. For every type of Knowledge Script except action scripts, the dialog box will have an **Actions** tab. In this tab, users can add as many actions as they desire. In the rare event that the script writer associated actions with this script, the user can delete them.

Caution You must choose **Action** for the **Knowledge Script type** in the **Header** tab of the **Script Properties** dialog box of the Developer's Console. If you fail to make this choice for an action script, it will not be available as a new action to an Operator Console user in the **Action** tab of the Knowledge Script **Properties** dialog box:



Invoking actions

It is the responsibility of non-action scripts to invoke actions.

Action scripts are executed *only* when events are raised. More specifically, when:

- actions have been associated with a monitoring, discovery, install, or reporting Knowledge Script job,
- an event is raised by one of those scripts, and
- the event Callback's action parameter is set to `$Akpid`.

When you are developing a script, you can choose to raise an event that does *not* call any action scripts that may be chosen by a user. In the `NetIQ::Nqext::CreateEvent` Callback function that raises the event, you set the action parameter to "`AKP_NULL`" rather than `$Akpid`.

Thus, for any given event, you can choose to have *all* action scripts executed or *none*, depending on the value you use for the action parameter. If you set this parameter of `NetIQ::Nqext::CreateEvent` to $Akpid, all actions chosen by a user will be executed. If the parameter is set to "`AKP_NULL`" no action script will be executed.

Note There is no mechanism for you to associate several different actions with a script and choose *which one* should be executed when a particular event is raised.

Events without actions

In general, you want to generate events without invoking actions when your script detects an error condition that you feel the user should be aware of. For example, if the user enters an invalid script parameter, the script should raise an event, but not invoke an action.

Monitoring scripts should invoke actions only if the conditions or thresholds that the user wants to monitor have been met or exceeded.

Ending actions

It is the responsibility of the action script itself to signal the end of an action.

Toward the end of your action script, your code should signal the completion of the action script by raising an event with the action parameter set to "`AKP_COMPLETE`." For example:

```
NetIQ::Nqext::CreateEvent(25, "", AKP_COMPLETE",
                          $resmsg, 0, "", "", 0, 0);
```

An event that sets the `$Akpid` parameter to "`AKP_COMPLETE`" will cause the **Message** in the **Action** tab of the **Event Properties** dialog box to read:

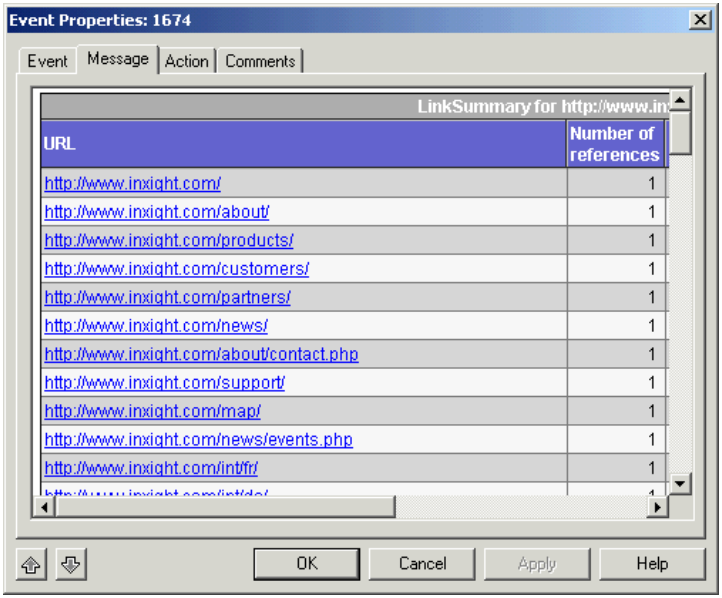
- "Action Complete" if the event message (second parameter in the event parameter list) is an empty string, as it is in the example immediately above, or
- the event message, if it is *not* an empty string.

If you do not raise an event with the action parameter set to "`AKP_COMPLETE`", the **Message** in the **Action** tab of the **Event Properties** dialog box will continue to read "<Location> Action in Progress," even though the action has, in fact, completed.

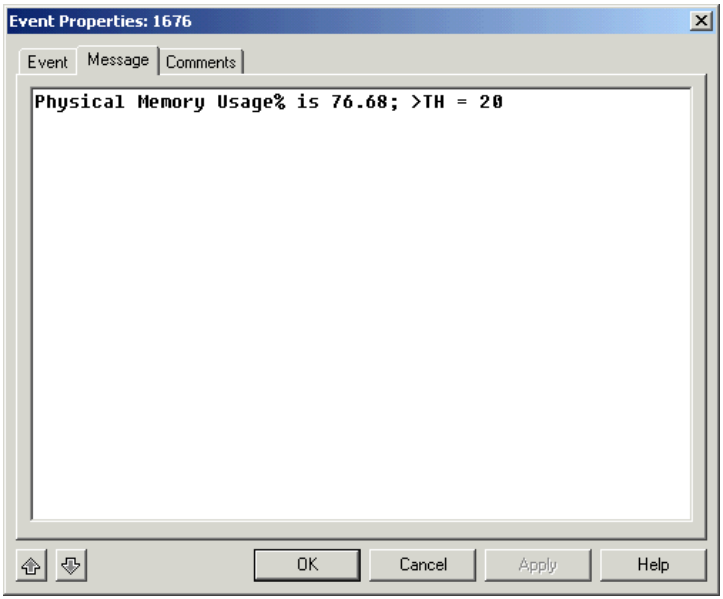
Note Any event raised with an action parameter *other than* "`AKP_COMPLETE`" will create a *new* event.

XML messages

Beginning with AppManager 5.0, you can write custom event messages for your monitoring scripts in XML format. AppManager will parse these XML messages to create formatted tables in the **Message** pane of the **Event Properties** dialog box. Here is an example from an event raised by the `WebServices_LinkSummary` Knowledge Script.



By comparison, the screen below shows an event message that is not in XML format.



The importance of XML messages in this chapter is this: You must take the XML format possibility into account in your action scripts. The event message will be passed to the action script—since this message may be in either plain text or in XML format, the action script will need to take this into consideration. It is not necessary to do this for the sample script in this chapter, but it often arises (see, for example, "Function PreProcessForXML" on page 155).

Listing of the Action_UXCommand.qml script

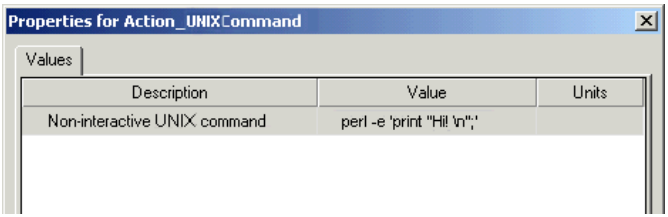
Here is a listing of the code section of `Action_UXCommand.qml`. The Script Parameters, included by AppManager as *variables*, are not shown.

```
#main
   use strict;
   use NetIQ::Nqext;
   our $msg;
   our $resmsg = "";

   NetIQ::Nqext::ExecCmd("$Cmd",2);
   $msg = "Action Completed";

   NetIQ::Nqext::CreateEvent(22, $msg,
                             "AKP_COMPLETE",
                             $resmsg, 0, "",
                             "", 0, 0);
#end of main
```

User-set Script Parameters

Users can set action script properties when the "calling script" is dragged and dropped. As an example, assume you drag the `UNIX_TopCpuProcs` Knowledge Script (the "calling script") to a target UNIX CPU in the AppManager Operator Console **TreeView** pane. In the **Properties** dialog box, you select the **Actions** tab and add the `Action_UXCommand.qml` script as your action for `UNIX_TopCpuProcs`.

After you have chosen `Action_UXCommand.qml` as your action, you click the **Properties** button. This opens the **Properties** dialog box for `Action_UXCommand.qml`:



Here you must enter a value for the one Script Parameter required by `Action_UXCommand.qml`:

Variable name used in the code	Description the Operator Console user will see	Value
`$cmd`	`Non-interactive UNIX command`	Non-interactive UNIX command (no user input allowed).

Parameters supplied by AppManager

For action scripts, unlike other types of scripts, AppManager adds a number of variables to the beginning of the script when it is run. The variables have to do with the event that caused the action script to be launched.

You can use these AppManager-added variables in your script, but you cannot see them in any of the Developer's Console views. You simply have to know that they are there and what they are.

AppManager-added variable	Description
$JobID	The JobID of the “calling script” (the script that raised the error that caused the action script to execute).
$Severity	The severity of the calling script event that caused execution of the action script.
$MachineName	The name of the machine running the calling script whose event caused execution of the action script.
$KPName	The Knowledge Script name of the “calling script” (the script that raised the error that caused the action script to execute).
$ObjList	The `obj` parameter of the calling script event that caused execution of the action script.
$EventMsg	The `evtmsg` parameter (event message) of the calling script event that caused execution of the action script.
$AgentMsg	The `agentmsg` parameter (optional long message) of the calling script event that caused execution of the action script.

Note These variables are added when the action script is run on either the management server or the managed client.

Functions called in the code

The code calls two AppManager Callback functions, by which the script requests information or action *from* the AppManager agent running the job.

Here are the Callback functions called in the script, in order of their appearance:

Function or subroutine	Description
`NetIQ::NQEXT::ExecCmd`	Callback function that runs a non-interactive command.
`NetIQ::NQEXT::CreateEvent`	Callback function that raises an event.

Syntax of the Callback functions

Refer to Chapter 12, "AppManager Callbacks for Perl," for more details.

ExecCmd

The Perl language allows invocation of external commands by using back quotes (``) to substitute the output of the enclosed command. The NetIQ UNIX agent does not support this. Instead, use the `NetIQ::Nqext::ExecCmd` to instruct the agent to execute an external command on behalf of the Knowledge Script.

Syntax

```
NetIQ::Nqext::ExecCmd (cmd [, flag])
```

Parameter	Data type	Description
`cmd`	String	The non-interactive command.
`flag`	Long	Optional. 0: the Callback returns the `stdout`. 1: the Callback returns the temporary file name containing the `stdout`. 2: the Callback returns the `stdout` along with the `stderr`. 3: the Callback returns the temporary file name containing both the `stdout` and `stderr`. Default is 0. **NOTE:** If `flag == 1 or 3`, then the Knowledge Script must remove the temporary file after it is used.

Return value

String. Depending on the flag passed in, this Callback will either return the `stdout` and/or `stderr` results or a filename containing the `stdout/ stderr` results from executing the external command.

CreateEvent

Used by a Knowledge Script to send an event to the AppManager agent. The agent will apply additional rule processing and will determine whether to send a new event or a duplicated (collapsed) event to the AppManager management server.

Syntax

```
NetIQ::Nqext::CreateEvent(sev, evtmsg, akp, obj, val,
agentmsg, evtsrc, evtid, msgtype [,deletefile])
```

Parameter	Data type	Description
`sev`	Long	The event severity. A value from 1 to 40.
`evtmsg`	String	The message to be displayed under the Message column in the Events tab.
`akp`	String	Name of the action script to launch as a response to this event. You would normally create a Script Parameter and associate it with a variable named $Akpid as part of your script. When the job is dropped and you select an action, the UI will fill in the $Akpid variable with the action name. You will just need to pass in the $Akpid variable to the script.
`obj`	String	Corresponding object name where the event is raised. This value will determine which object in the **TreeView** pane to blink. Format of the value passed in should be "ObjectTypeName = ObjectValue", e.g. `"UNIX_DiskObject = /mnt/cdrom"`. The ObjectValue can normally be obtained by the drop object variable, e.g. the machine name.
`val`	Double	The current value to raise the event. This parameter is currently not used. Set to 0.0.

Parameter	Data type	Description
`agentmsg`	String	Either the detail message or a file name that contains the detail message. The detailed message is displayed in the Message tab of the Event Property dialog box. If this parameter contains the name of a file, make sure you set the msgtype parameter to 1.
`evtsrc`	String	Reserved for future use. Set to “”.
`evtid`	Long	Reserved for future use. Set to 0.
`msgtype`	Long	Flag specifying whether the value passed in the agentmsg parameter is a file name or the detailed message itself. If it is a file name, then the contents of the file are read and passed in as the detailed message. Set to 0 to specify that the value in the agentmsg parameter is the detailed message. Set to 1 to specify that the value is the file name containing the detailed message.
`deletefile`	Long	Optional. Flag to tell the AppManager agent to delete the event detail message file after it is done reading the contents and passing the event to the MSU. This parameter is ignored if msgtype != 1. Set to 1, which is default, to delete the file when msgtype = 1. Set to 0 to not delete the file. Be careful when setting this value to 0, especially if your script generates a message file each time it wants to send an event because the files will never be removed.

`CreateEvent` returns nothing.

The program logic

The `Action_UNIXCommand` is a very simple, yet very powerful Knowledge Script. Using `Action_UNIXCommand`, you can run *anything* that can be run on the command line that does not require user interaction. This could, for example, include Perl script or shell scripts, as long as the computer running `Action_UNIXCommand` can access the Perl or shell script.

Note Even though `NetIQ::Nqext::ExecCmd` can return the `stdout` and/or `stderr`, this script contains no code to test whether execution on the command line succeeds. That is because the user will decide

what command to run and the script developer does not know what that will be.

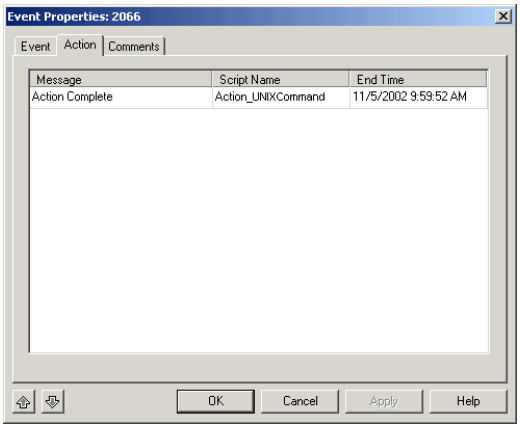
The code does just two things:

1. It calls `NetIQ::Nqext::ExecCmd`. The Script Parameter `$cmd` is the user-defined string that is the command to run.
2. It calls `NetIQ::Nqext::CreateEvent` to inform the AppManager console that the script has been run (the action is complete).

```
#main
   use strict;
   use NetIQ::Nqext;
   our $msg;
   our $resmsg = "";

   NetIQ::Nqext::ExecCmd("$Cmd",2);
   $msg = "Action Completed";

   NetIQ::Nqext::CreateEvent(22, $msg,
                             "AKP_COMPLETE",
                             $resmsg, 0, "",
                             "", 0, 0);
#end of main
```

This `CreateEvent` call differs from calls in response to an error or failure, where the `evtmsg` parameter (the second parameter) contains an error message. In this case, since the action completed successfully, you should pass in an empty string ("") instead of an error message. As

a result, the user will see "Action Complete" for the action status in the Event Properties window:



The modified script, Action_UXCommandEx.qml

It was noted previously that `Action_UXCommand` does not provide any error handling, and does not report on the success or failure of the command that is run on the command line. It is impossible to provide for error handling in `Action_UXCommand` because we have no idea what command a user will choose to execute. `Action_UXCommandEx` partially compensates for the lack of error handling by writing to a log file. The log file will not tell us if the command line command succeeded, but it will at least tell us why the action script was run.

In `Action_UXCommandEx.qml`, we add the ability to write to a file. This includes the addition of two new Script Parameters: `$LogToFile` and `$filename`. `$LogToFile` can take the values "`y`" or "`n`" (default). When the value is "`y`", the script will write to a log file. In this case, `$filename`, the path and name of the file to be written, must also be provided.

Recall that the running script will include the user-defined Script Parameters as variables with defined values. For example, if the user accepts the defaults, the following will be pre-pended to the script's code (with the UNIX machine name filled in by AppManager):

```
#### Begin KSID Section
our $AppManID = "4.5.78.0.8";
our $KSVerID = "1.0";
#### End KSID Section

#### Begin Type Section
our $UNIX_MachineFolder = "";
#### End Type Section

#### Begin KPP Section
our $Cmd="rm /tmp/foo";
our $LogToFile="n";
our $Filename="";
#### End KPP Section

### Begin KPS Section
```

Following this is the code portion of the Knowledge Script. The changes from `Actions_UXCommand.qml` are shown in bold and in a larger font.

```
#main
   use strict;
   use NetIQ::Nqext;
   our $msg;
   our $resmsg = "";

   our $file_ok = 0;

   # Check to see
   if ($LogToFile eq 'y') {
      if ($Filename eq '') {
         NetIQ::Nqext::CreateEvent(22, "No file
                                   name was
                                   specified",
                              "AKP_COMPLETE",
                                   $resmsg,
                            0, "", "", 0, 0);
      }

      $file_ok = open (LOG, ">>$Filename");

      unless ($file_ok) {
         NetIQ::Nqext::CreateEvent(22, "Failed to
                                 open file
                                      $Filename for
                                  writing.",
                                      "AKP_COMPLETE",
                                 $resmsg,
                                     0, "", "", 0, 0);
      }
   }

   NetIQ::Nqext::ExecCmd("$Cmd",2);
   $msg = "Action Completed";

   if ($file_ok) {
     print LOG "Job ID = $JobID\n";
     print LOG "Severity = $Severity\n";
     print LOG "Object List = $ObjList\n";
```

```
      print LOG "Machine Name = $MachineName\n";
     print LOG "KP Name = $KPName\n";
     print LOG "Event Msg = $EventMsg\n";
     print LOG "Agent Msg = $AgentMsg\n";
     print LOG "Command = $Cmd\n";
     close (LOG);
   }

   NetIQ::Nqext::CreateEvent(22, $msg, "AKP_COMPLETE",
                             $resmsg, 0, "", "", 0, 0);

#end of main
### End KPS Section
```

Chapter 10

Modifying a report script written in VBScript

This chapter describes how to modify a report script to customize it. All report scripts are exclusively run on Windows computers and are always written in VBScript.

Unlike other types of scripts, report scripts are written with the expectation that they will be customized by the user for a wide variety of different reporting needs. Report scripts are quite complex and contain a very large number of Script Parameters (typically more than 70). Changing the values of these Script Parameters offers a great deal of flexibility. Therefore, modifying a report script will most likely involve changing its value set (Script Parameters) rather than changing its code.

The first part of this chapter shows how to copy a basic report script (`ReportAM_AvgValueByDay`), change its value set, and rename it as a specialized report script (`MyReports_AvgMemByDay).`

There are a few situations in which you will need to make minor alterations to the code or to the non-code XML elements of a report script in order to accomplish your goals. In the second part of this chapter, the report script `MyReports_AvgMemByDay` is modified to report over a time period (`MyReports_AvgMemByMonth)` that is not available simply by changing the value of Script Parameters.

The following topics are covered in this chapter:

- About report scripts
- Discovering the Report agent
- Altering the value set of an existing script
- Modifying the code of an existing script

About report scripts

Report scripts are similar to other types of Knowledge Scripts (for example, monitoring scripts) insofar as they provide a similar framework for implementing the script. In creating both types of scripts, you can use the Developer Console to define header information, define the type of object on which the script can run, set a default schedule, define Script Parameters for the script, and define actions associated with events raised by the script.

Report scripts differ, though, in the nature of the logic. The logic of a monitoring script is generally geared toward calling the appropriate managed object to extract system or application data from a performance object and then measuring that data against a threshold. The logic of a report script is geared toward getting raw information from a database via a stored procedure, using COM objects to manipulate that information into some meaningful form, and presenting it in a graphical context like a table or chart.

Report scripts employ a number of COM objects that help you retrieve, manipulate, and display data:

- The `ADODataSource` object is used to connect to a SQL database, query the database, and return a recordset.
- The `filter` objects (`CROSSTAB, HISTOGRAM, STATISTICS, TIMEFILTER, PERCENT`) are used to manipulate the data in the recordset returned by `ADODataSource`, for example, to provide an average hourly value of the data.
- The `Report` object is used to format the data returned by the filter objects, generate an HTML report, and render the charts in a report.

By employing the filter objects, the manipulation of data has been moved from the stored procedure to the client side of the transaction, freeing up your SQL Server resources.

Specific information about the properties and methods for the COM objects used in report scripts can be found in the

`appManager\documentation\development_tools` directory on your AppManager CD. There you will find information about the following objects:

- `AMChart`
- `AMLayout`
- `Report` (including `ADODataSource` and the `filter` objects)
- `NetIQOLE` (used to run AppManager from the command line)

What approach do I take?

You have two options for modifying a report script:

- Make a copy of an existing script and use the Properties dialog box to set the default Script Parameter values to meet your specific purpose.
- Modify the properties and logic of an existing script.

Discovering the Report agent

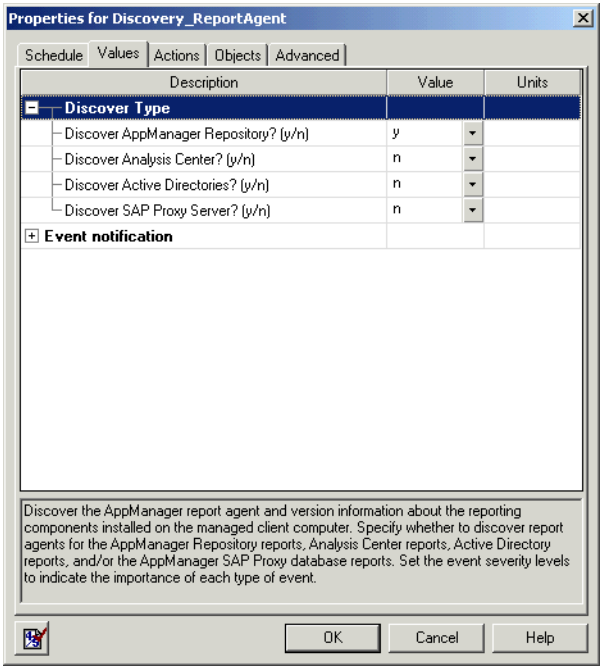
Before you begin to work with report scripts, make sure that the scripts you want are visible in the **Scripts** pane of the AppManager Console. There are four groups of report scripts:

- AppManager repository ("`ReportAM`")
- Analysis Center ("`ReportAC`")
- Active Directories ("`ReportADSI`")
- SAP Proxy Server ("`ReportSAP`")

All users should be able to see the `ReportAM` Knowledge Script Group. If you are part of an Active Server domain, you should also be able to see the `ReportADSI` group. To see the `ReportAC`, you must have installed NetIQ Analysis Center, and to see the `ReportSAP` group, a SAP Proxy Server must be reporting to your AppManager repository.

Before any of these Knowledge Script Groups will be visible in the **Scripts** pane of your Operator Console, you must discover them. Do

this by dragging the `Discovery_ReportAgent` script to your computer's icon in the **TreeView** pane. The **Properties for Discovery_ReportAgent** dialog box will open. Select the **Values** tab and enter "`y`" for each group you want to discover:



Running the `Discovery_ReportAgent` script with all values = "y" will discover all the report script groups that are available to you. You will get an event with a message informing you of failure for the groups that are not available.

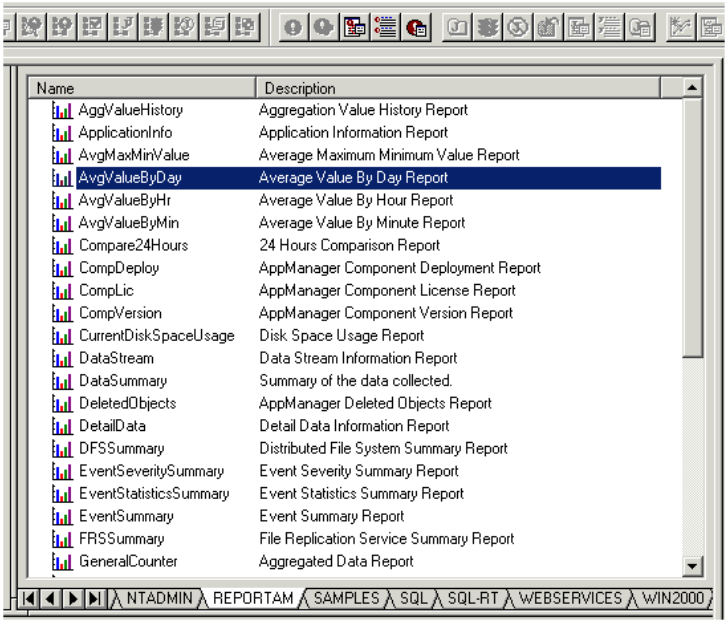
Altering the value set of an existing script

Say, for example, you want a report to give you the average daily value for physical memory usage by a group of your SQL Servers. (This presumes that you have SQL Servers organized into one or more Server Groups and are using the `NT_MemUtil` script to collect memory usage data from those servers.) You can make a copy of `ReportAM_AvgValueByDay`, and set new default values for the **Data source** Script Parameters to specify which data is included in the report, and the method by which that data is aggregated.

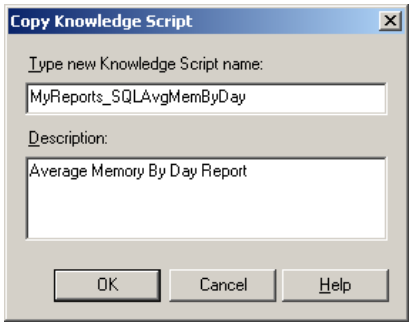
Making a copy of the script

First, make a copy of `ReportAM_AvgValueByDay`:

1 Open the AppManager Console and select the **ReportAM** tab in the **Scripts** pane.



2 Right-click `ReportAM_AvgValueByDay`, and click **Copy Knowledge Script**.



3 Type a new name and description for the script (by default, the new script is named `ReportAM_CopyOfAvgValueByDay`).

To	Do this
Display the script in the same tab as the original	Keep the `ReportAM_` prefix.
Create a new tab for your custom report script	Use a new prefix. For example, `MyReports_`. This example uses `MyReports_SQLAvgMemByDay` as the new name for the script.

In this case, rename the script as `MyReports_AvgMemByDay`, and change the description to "Average Memory By Day Report."

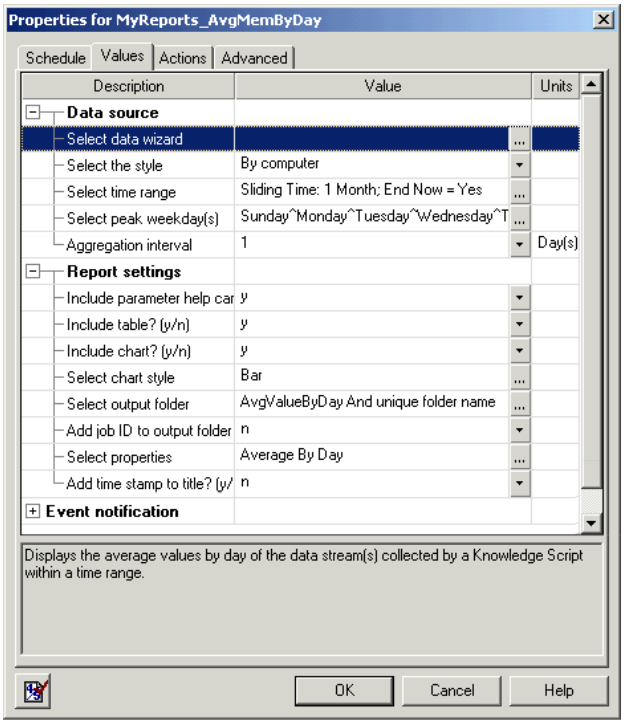
4 Click **OK**.

Selecting the data streams for the new report

After you've made a copy of the script, configure it to report on a specific set of data streams:

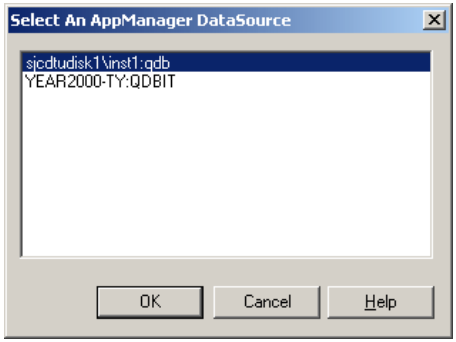
1 In the Knowledge Script pane, double-click the icon for the new script `MyReports_SQLAvgMemByDay`. The **Properties for MyReports_AvgMemByDay** dialog box will open.

2 Choose the **Values** tab.

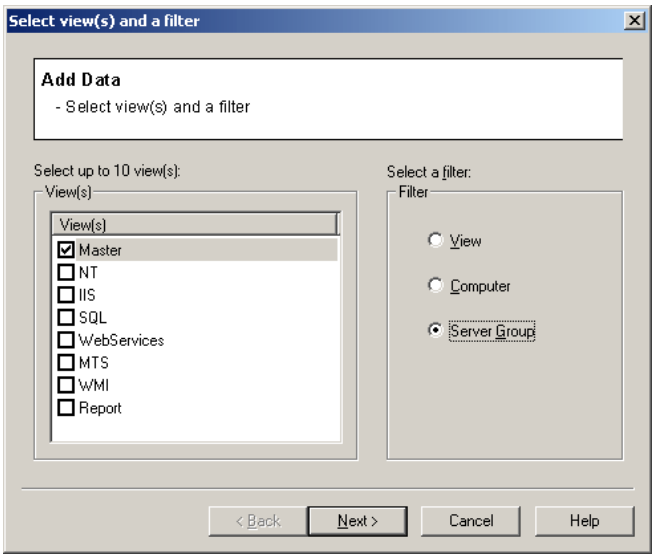


3 Under **Data Source**, click the **Browse [...]** button next to the **Select data wizard** Script Parameter.

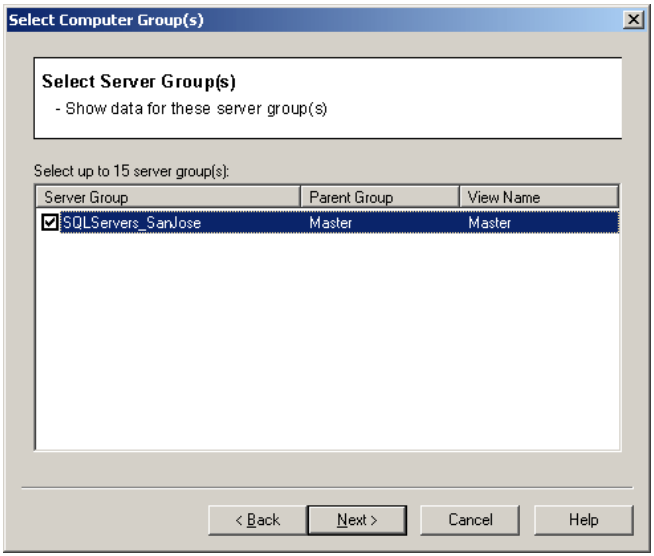
4 In the **Select An AppManager DataSource** browser, select the AppManager repository that holds the data for your SQL Server group, and click **OK**.



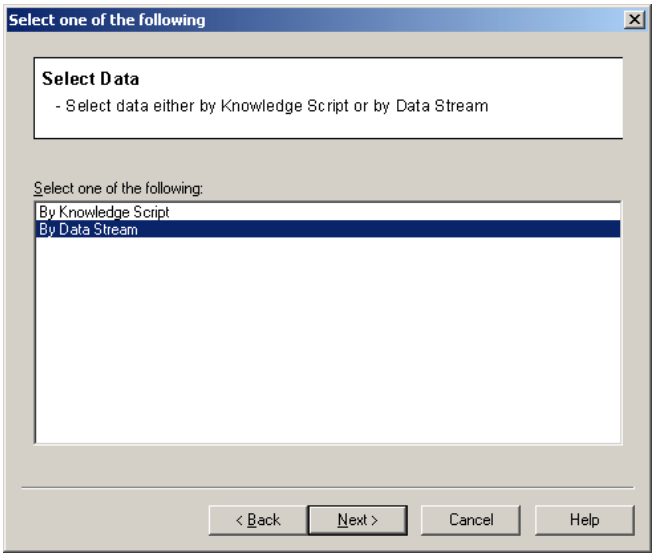
5 On the first page of the data wizard, select the **Master** view and the **Server Group** filter, and click **Next**.



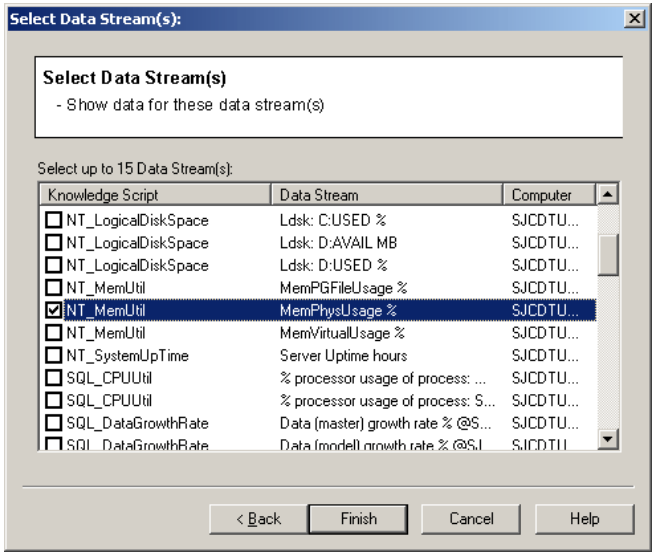
6 Select the Server Group for which you want reports, and click **Next**.



7 Select **By Data Stream**, and click **Next**.



8 Select `NT_MemUtil - MemPhysUsage %`, and click **Finish**.

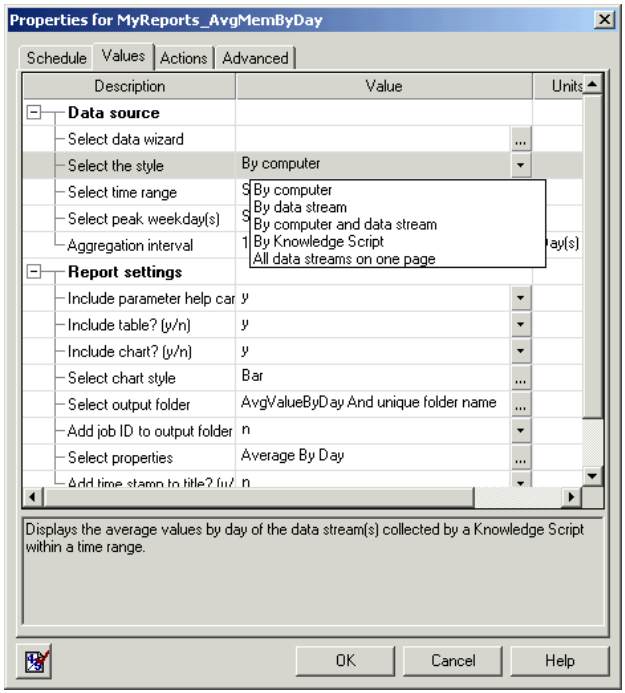


When you run the script, it will query the AppManager repository for the information in this data stream as it was collected from all computers in your Server Group.

The selections you make using the data wizard are used to provide values for some of the Script Parameters in the stored procedure used by this script.

Selecting the way data is presented in the new report

You select the style of data presentation with the **Values** tab **Properties for MyReports_AvgMemByDay** dialog box.



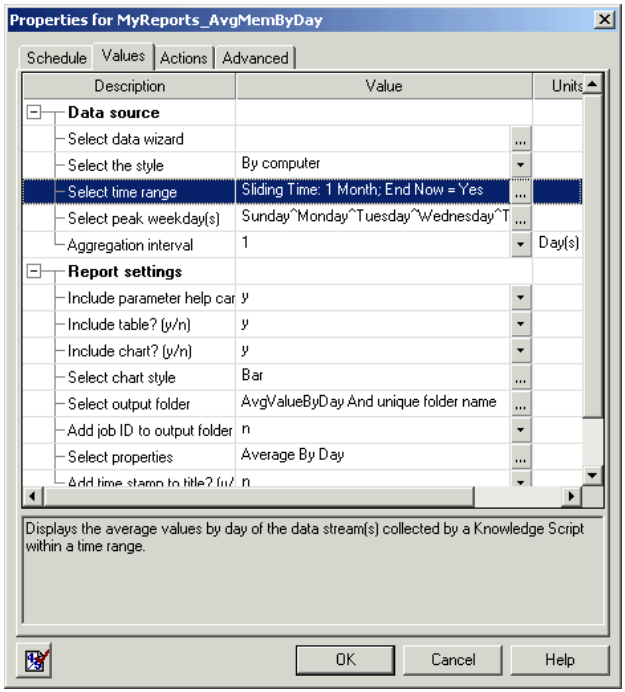
Configure the **Select the style** Script Parameter to accommodate the way you intend to use the report. For example, if you want a separate page of the report devoted to each computer, use the **By computer** style. If you want to make a comparison of memory use across all computers in the group, use the **All data streams on one page** style.

For this example, select **All data streams on one page**.

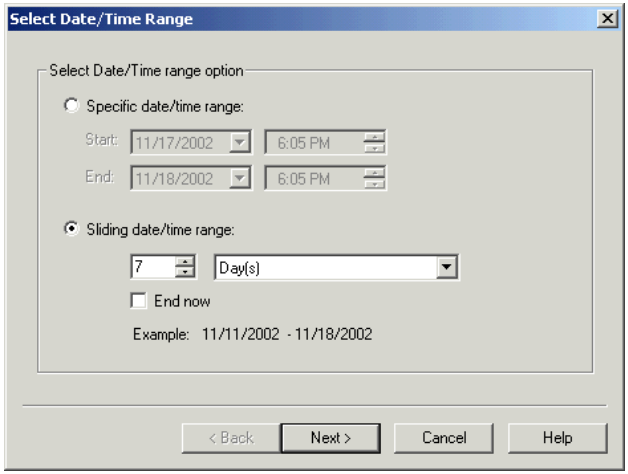
The style of presentation you select for the report is used to provide a value for one of the Script Parameters in the stored procedure used by this script.

Selecting the time range for the new report

You select the time range of data presentation with, once again, the **Values** tab of the **Properties for MyReports_AvgMemByDay** dialog box.



For this example, we're going to configure the report to include a week's worth of data.



Configure the **Select time range** Script Parameter to use a **Sliding date/time range** of **7 Days**.

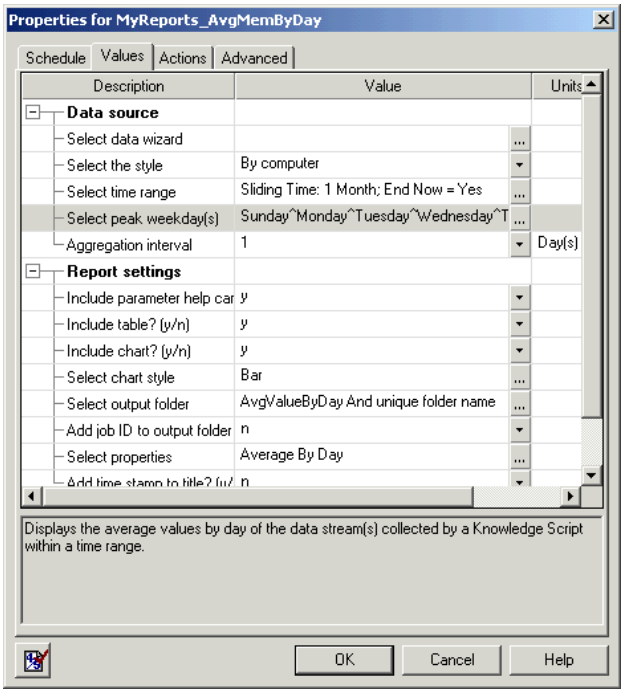
Do not use the **End now** Script Parameter.

With this configuration, each time the report runs, it will include seven whole days' worth of data (for example, if you run the report each Saturday, it will include data from midnight of the previous Saturday to 11:59:59 P.M. Friday).

The time range setting is used to provide a value for one of the Script Parameters in the stored procedure used by this script.

Selecting days of the week to include in the report

Again, you use the **Values** tab of the **Properties for MyReports_AvgMemByDay** dialog box to select the days of the week.



For this example, use the default setting for the **Select peak weekday(s)** Script Parameter. The default setting includes all seven days of the week.

The settings for this Script Parameter are used to pass information to the `TIMEFILTER` object via the `DayOfWeekFilter` property. The `TIMEFILTER` object helps determine which data returned by the stored procedure is used in the report. The `DayOfWeekFilter` property is used to specify data from particular weekdays.

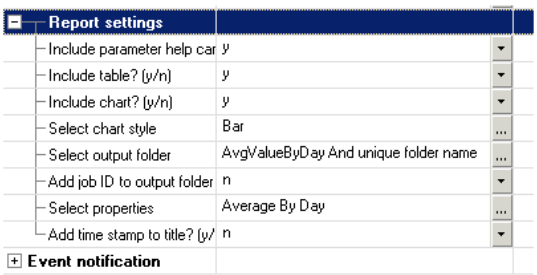
Selecting the aggregation interval

You select the aggregation interval with the **Values** tab of the same **Properties for MyReports_AvgMemByDay** dialog box (see the preceding graphic). For this example, use the default setting for the **Aggregation interval** Script Parameter. The default setting is **1** day.

The setting for this Script Parameter is used to pass information to the `TIMEFILTER` object via the `TimePeriodPerPoint` property. The `TIMEFILTER` object helps determine which data returned by the stored procedure is used in the report. The `TimePeriodPerPoint` property is used to determine the time range by which data is grouped (in this case, 1 day).

Modifying the Report settings and Event Script Parameters

Using the same dialog box, you can set both report settings and event notification Script Parameters. Use the following Script Parameters to



include or exclude a parameter help card, table, and chart:

- **Include parameter help card?**
- **Include table?**
- **Include chart?**

Note The "parameter help card" is a table of the script value settings that you can optionally add to your report.

Use the **Select chart style** Script Parameter to set the graphical properties for charts in the report (for example, rotation, series style, and threshold indicator).

Use the **Select output folder** Script Parameter to set the type of output folder (unique, unique with specified prefix, specific name), and the output path.

Use the **Select properties** Script Parameter to set grouping properties and the title and description of the report.

See the *Reporting Guide* for more information about these Script Parameters.

The same dialog box allows you to modify the event notification Script Parameters to raise events associated with generation of the report, and to change event severity levels.

See the *Reporting Guide* for more information about these Script Parameters.

Saving your new report script

Once you have defined the Script Parameter settings for your new report, click **OK** to close the **Properties** dialog box and save the settings.

You can now drop the report script and have it generate exactly the report you want without having to configure any of the Script Parameters.

Modifying the code of an existing script

Another method for creating a custom report script is to modify the non-code XML elements or code of an existing script.

In the following example, we'll modify the script we created in the previous example, `MyReports_SQLAvgMemByDay`, to create a report that gives us an average *monthly* value for physical memory usage by a group of SQL Servers. The aggregation interval value in the **Values** tab of the **Properties for MyReports_AvgMemByDay** dialog box is restricted to days by default. Looking through the various scripts in the `ReportAM` group, we see that there are report scripts for average values by minute, hour, and day but not for longer intervals. If we want to aggregate data for a week or a month, we will have to modify an existing script.

This new report uses the average daily values collected during a month to figure the month's average, regardless of how many daily averages are collected (for example, if you collect 15 days worth of data one month, and 30 days the next, the monthly averages are based on 15 values and 30 values respectively).

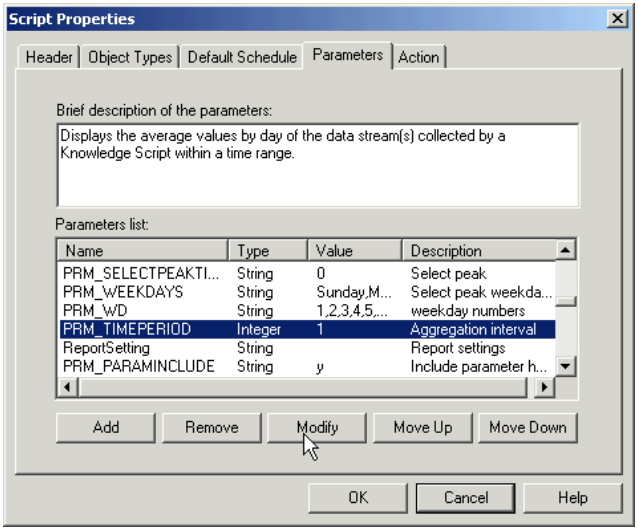
In order to modify your example script from reporting on daily averages to reporting on monthly averages, you need to make minor modifications to several different parts of the script, including:

- The non-code XML elements
- The script properties
- The script logic
- The Values tab in the UI

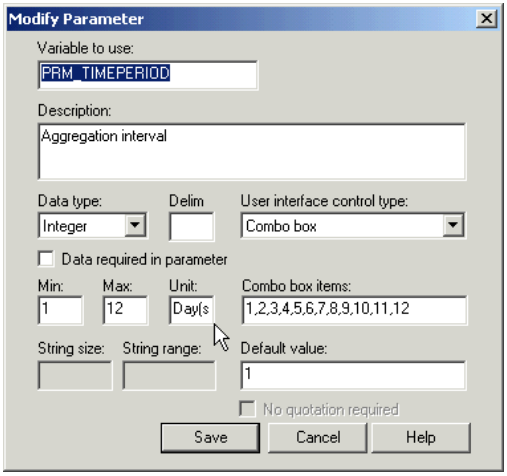
Modifying the non-code XML elements of the script

The only change that you must make to the non-code XML elements of the script is to change the aggregation interval from days to months. To do this:

1. Open the script `MyReports_SQLAvgMemByDay` in the Developer's Console.
2. Choose **Properties** from the **View** menu.
3. Choose the **Parameters** tab and highlight the Script Parameter called `PRM_TIMEPERIOD`.



4 Click Modify.



5 In the **Units** field, change Day(s) to Month(s) and then click **Save**.

6 In the **Script Properties** dialog box, click **OK**.

7 **Save** the script as `MyReports_SQLAvgMemByMonth`.

Note In the procedure we just completed, we changed the basic *units* of a Script Parameter—this is a modification to the script. In the first part of the chapter, we changed the *values* of Script Parameters, but did not alter the script itself.

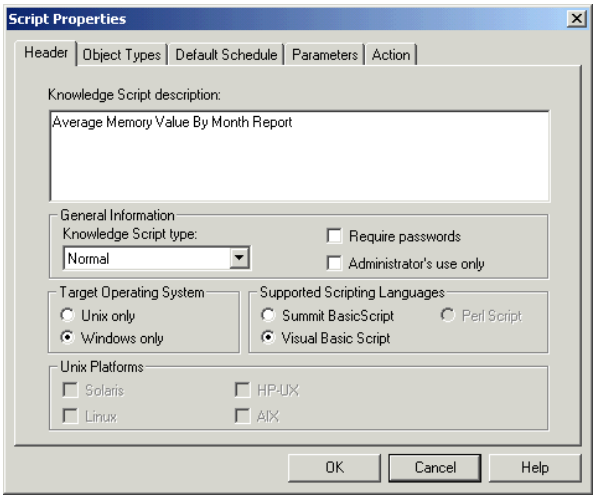
Modifying the script properties

A number of other script properties must be modified to change the text that appears in the report.

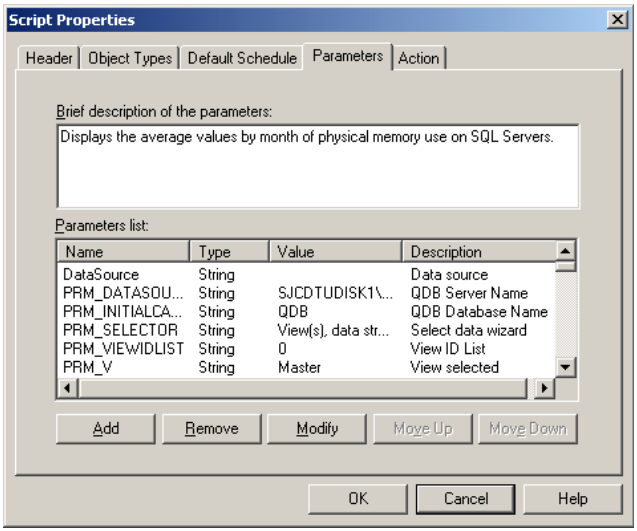
1 Open `MyReports_SQLAvgMemByMonth` in the Developer's Console.

2 Click **View > Properties**.

3 On the Header tab, change the Knowledge Script description to **Average Memory Value By Month Report**.



4 On the Parameters tab, change the Script Parameters description to **Displays the average values by month of physical memory use on SQL Servers**.



5. Select the Script Parameter `PRM_CHARTTITLE`, then click **Modify**.
6. In the **Default value** field, type **Average By Month**, then click **Save**.
7. Select the Script Parameter `PRM_FOLDERDISPLAY`, then click **Modify**.
8. In the **Default value** field, type **AvgValueByMonth And unique folder name**, then click **Save**.
9. Select the Script Parameter `PRM_LAYOUTFOLDER`, then click **Modify**.
10. In the **Default value** field, type **AvgValueByMonth**, then click **Save**.
11. Select the Script Parameter `PRM_FOLDERPREFIX`, then click **Modify**.
12. In the **Default value** field, type **AvgValueByMonth**, then click **Save**.
13. Select the Script Parameter `PRM_INDEXREPORTTITLE`, then click **Modify**.
14. In the **Default value** field, type **SQL Average Memory By Month**, then click **Save**.
15. Select the Script Parameter `PRM_INDEXDESCRIPTION`, then click **Modify**.
16. In the **Default value** field, type **Displays the average value by month of physical memory use on SQL Servers**, then click **Save**.
17. Click **OK** to close the Script Properties dialog box.

Modifying the code

After modifying the Script Parameters, you need to make some changes to the VBScript portion of the script.

To properly manipulate the data for this report, you need to create an additional instance of the `STATISTICS` object and the `TIMEFILTER` object.

Adding variables

Two new local variables must be added to the main routine.

Local variables are declared just after the main routine is declared:

```
Sub Main()
    Dim  Detailmsg
    Dim  ReportObj
    Dim  IncludeType
    Dim  CrossTableObj
    Dim  StatsFilterObj
    Dim  TimeFilterObj
    Dim  DataSourceObj
    Dim  Displaytype
```

Add the following two variables:

```
Dim StatsFilterOjb2
Dim TimeFilterObj2
```

Manipulating data

The next modification to the script logic involves setting up the filter objects that manipulate the data that is returned by the `ADODataSource` object.

As the script is currently written, the filter objects are set up to return average daily values. You need to make an additional calculation that takes the average daily values for a month and finds their average value. This second calculation is why you created additional variables for the `STATISTICS` and `TIMEFILTER` objects.

Find the following section of the code:

```
Set CrossTableObj = CreateObject("NETIQFILTERS.CROSSTAB")
Set StatsFilterObj = CreateObject("NETIQFILTERS.STATISTICS")
Set TimeFilterObj = CreateObject("NETIQFILTERS.TIMEFILTER")

With TimeFilterObj
.TimePeriodPerPoint  = PRM_TIMEPERIOD * 24 * 3600
If (PRM_PEAKHRSTART <> "") And (PRM_PEAKHREND <> "") Then
  .AddTimeofDayFilter CDate(PRM_PEAKHRSTART),
CDate(PRM_PEAKHREND)
End If
.SetDaysOfTheWeekFilter intWDSun, intWDMon, intWDTue, _
intWDWed, intWDThu, intWDFri, intWDSat
.PreFilter           = CrossTableObj
End With

With StatsFilterObj
.Output("AVG")      = True
.Grouping           = True
.PreFilter          = TimeFilterObj
End With
```

This section of the code is used to calculate the average value per day of the data returned in the recordset.

The first three lines create the `CROSSTAB`, `STATISTICS`, and `TIMEFILTER` objects.

The next section of code, from `With TimeFilterObj` to the first `End With` statement, prepares the TimeFilter object and its properties and methods to manipulate data passed from the `CROSSTAB` object.

The `TimePeriodPerPoint` property defines the time period by which data is grouped. In this case, it's one day (24 hours x 3600 seconds).

The next few lines are an `If` statement that checks to see if the daily peak time range option is in effect, and if it is, what the daily time range is.

The next line checks to see which days of the week are included in the report.

The next line identifies the `CROSSTAB` object as the first filter used on the recordset. The `CROSSTAB` object changes a row-oriented recordset to a column-oriented recordset. Once the data is reoriented, it is then passed to the `TIMEFILTER` object.

At this point, the `TIMEFILTER` object is prepared to give each data point collected during the same day the same time stamp.

The next section of code, from `With StatsFilterObj` to the next `End With` statement, prepares the `STATISTICS` object and its properties to manipulate data passed from the `TIMEFILTER` object.

The `Output` property determines which type of data is included in the report. In this case, it is an average value of the daily values.

The `Grouping` property groups like types of data so that calculations can be performed. For example, the `Grouping` property groups all data labeled June 1, 2002 so that an average can be found for that data, and groups all data labeled June 2, 2002 so that an average can be found for that data.

After the `End With` statement, add the following bit of logic:

```
With TimeFilterObj2
.MonthAggregate  = True
.PreFilter       = StatsFilterObj
End With

With StatsFilterObj2
.Output("AVG")   = True
.Grouping        = True
.PreFilter       = TimeFilterObj2
End With
```

The first new section of code, from `With TimeFilterObj2` to the next `End With` statement, prepares the `TIMEFILTER` object to take the last output of the `STATISTICS` object (average daily values) and aggregate those values by month (give all values for the same month the same time stamp).

The next section, from `With StatsFilterOjb2` to the next `End With` statement, prepares the `STATISTICS` object to take the last output of

the TIMEFILTER object (values aggregated by month) and find an average of each set of monthly values.

The following lines of code implement the filtering of data, and use the last output of the STATISTICS object (monthly average values) to create the charts and tables in the report:

```
If (PRM_DISPLAYTYPE <> "All data streams on one page") Then
   .Filter = StatsFilterObj
   bHasData = .MakeDrillDownReportV1
(DataSourceObj.RecordSet, IncludeType)
Else
   StatsFilterObj.Recordset = DataSourceObj.Recordset
            bHasData = .MakeChartAndTable _
(StatsFilterObj.Recordset, IncludeType)
End If
```

Releasing references to the two additional objects you created

Because you created two additional objects for this report (StatsFilterObj2 and TimeFilterObj2), you will need to release the references to those objects. Just before the end of the main routine are the following lines of code that release references to the other objects used for this report:

```
Set DataSourceObj = Nothing
Set CrossTableObj = Nothing
Set StatsFilterObj = Nothing
Set TimeFilterObj = Nothing
Set ReportObj = Nothing
```

Add the following two lines to this section:

```
Set StatsFilterObj2 = Nothing
Set TimeFilterObj2 = Nothing
```

Saving the new report script

Once you've made the modifications to the script, save it as MyReports_SQLAvgMemByMonth, and check it in to the AppManager repository.

Setting a new time range

The last modification you need to make to this script is made through the user interface:

1. In the Knowledge Script pane of the Operator Console, right-click `MyReports_SQLAvgMemByMonth`, then click **Properties**.
2. In the Select time range Script Parameter, click the **Browse [...]** button.
3. Select **Sliding date/time range**.
4. Set the time range to **3 Months** (or any number of months that suits your reporting needs).
5. Click **Next**, then set the daily time range as needed.
6. Click **Finish**.
7. Click **OK** to close the **Properties** dialog box.

Your new script is now configured to report on the average monthly values for physical memory use by computers on which you are running SQL Server.

Chapter 11

AppManager Callbacks for Summit BasicScript and VBScript

This chapter describes the Callback functions that you can use in AppManager Knowledge Scripts written in either Summit BasicScript or VBScript.

The syntax for calling these functions differs for the two languages. In Summit BasicScript, you simply call the function with the syntax shown in this chapter. In VBScript, you must call the functions via the **NQEXT** COM object. For example:

- In Summit BasicScript:
  ```
  bVar = DynaDataLog(stream_id, legend, value, agentmsg)
  ```
- In VB Script:
  ```
  bVar = NQEXT.DynaDataLog(stream_id, legend, value,
  agentmsg)
  ```

Note String length limits. The AppManager agent cannot return a message or data string to the management server that exceeds 2.0MB for AppManager version 4.3 or 5.0MB for AppManager versions 5.0 and later. In addition, Summit BasicScript has an intrinsic string limit of 32 KB.

The following functions are discussed:

- AbortScript
- AbortScriptEx
- CreateData
- CreateDataEx
- CreateEvent
- CreateEventEx

- DataHeader
- DataLog
- DynaCollectData
- DynaDataLog
- GetAgentInfo
- GetContextEx
- GetJobID
- GetKPInterval
- GetMachName
- GetProgID
- GetSecurityContext
- GetSiteKey
- GetTempFileName (VBScript only)
- GetVersion
- Item (VBScript only)
- ItemCount (VBScript only)
- IterationCount
- LongDataHeader
- LongDataLog
- LongDynaDataLog
- MCAbort
- MCEnterCS
- MCExitCS
- MCGetMOID
- MCVersion
- MCWaitForObject (Summit BasicScript only)
- MCWaitForObjectEx (Summit BasicScript only)

- MSActions
- MSLongActions
- NQSleep
- QTrace
- WaitForObject

Most Callback functions can be used in both Summit BasicScript and VBScript. The code examples for these functions are written in Summit BasicScript.

AbortScript

Requests the AppManager agent to abort the current KS execution.

It is recommended not to use this API. Instead, it is advised to use Createevent and Exit call.

Syntax

```
AbortScript [objlist, abortmsg, sev [,raise_err]]
```

Parameters and settings

Parameter	Data type	Description
`objlist`	String	Object name.
`abortmsg`	String	Abort event detailed message.
`sev`	Long	Abort event severity. Currently, this sev passed is ignored. See note under Remarks.
`raise_err`	Bool	Optional. When `True` (default), sets the job status to `Error`. When `False`, sets the job status to `Stop`.

Return value

None.

Remarks

When used by itself without any arguments, the AppManager agent will simply abort the script execution without sending an event. If you specify any of the parameters, you are requesting the AppManager agent to construct and send an event to the AppManager management server.

Note Currently, there is an AppManager client resource monitor registry setting ("Admin\AdminEvtSev") that overrides any value that you assign to sev. "Admin\AdminEvtSev" is normally set to 40, and the abort event severity will therefore be 40, no matter what value you give to sev.

If “Admin\AdminEvtSev” value is changed in the registry and the value is set in the range 1-40, then the abort event severity will have the same severity number set in the registry.

If “Admin\AdminEvtSev” value is set to severity other than the range 1-40, then the abort event severity will be 40 by default.

Example

This function is used to abort the script when there is an error:

```
With Err
   'Assemble Error statement
   strErrStatement = "Number: " & CStr(.Number) & ";  _
   Description: " & Trim(.Description) & "; Comment: " & _
   Trim(strAddComment) & "; Source: " & .Source

   'Log Error Statement into Error Log File
   resmsg = "REPORT_AGENT = " & REPORT_AGENT
   NQEXT.CreateEvent (PRM_SEVERITYFAIL, PRM_CREATEFAILED,  _
   AKPID, resmsg, 0, strErrStatement, "NetIQ AppManager  _
   AMAdmin", 1002, 0, False)
   With objrLayout
      .LogMessage strErrStatement
      .HasData  = False
   End With
   NQEXT.AbortScript resmsg, strErrStatement

   'Clear Error Object Properties
   .Clear
End With
```

AbortScriptEx

Requests the AppManager agent to abort the current KS execution.

It is recommended not to use this API. Instead, it is advised to use Createevent and Exit call.

Syntax

```
AbortScriptEx [KBid, MetadataXML, objlist, abortmsg, sev
[,raise_err]]
```

Parameters and settings

Parameter	Data type	Description
`KBid`	String	The Knowledge Base ID reported in the Knowledge Script
`MetadataXML`	String	Knowledge Base information about the Knowledge Script.
`objlist`	String	Object name.
`abortmsg`	String	Abort event detailed message.
`sev`	Long	Abort event severity. Currently, this sev passed is ignored. See note under Remarks.
`raise_err`	Bool	Optional. When `True` (default), sets the job status to `Error`. When `False`, sets the job status to `Stop`.

Return value

None.

Remarks

When used by itself without any arguments, the AppManager agent will simply abort the script execution without sending an event. If you specify any of the parameters, you are requesting the AppManager agent to construct and send an event to the AppManager management server.

Note Currently, there is an AppManager client resource monitor registry setting ("Admin\AdminEvtSev") that overrides any value that you assign to sev."Admin\AdminEvtSev" is normally set to 40, and the abort event severity will therefore be 40, no matter what value you give to sev.

If "Admin\AdminEvtSev" value is changed in the registry and the value is set in the range 1-40, then the abort event severity will have the same severity number set in the registry.

If "Admin\AdminEvtSev" value is set to severity other than the range 1-40, then the abort event severity will be 40 by default.

Example

Here is an example taken from the **AD_DatabaseSize** Knowledge Script:

```
...
' Initialize variables
    If IsNull(strObjectList) Then strObjectList = ""
    If IsNull(strDetailMessage) Then strDetailMessage = ""
    If IsNull(lngSeverity) Then lngSeverity = 5
    If IsNull(bRaiseError) Then bRaiseError = False
    If Len(strObjectList) = 0 Then strObjectList =
gstrResourceObject

    ' Abort script
    Err.Clear
    If Len(strKBID) > 0 Or Len(strMetaDataXML) > 0 Then
        ' Abort script using AbortScriptEx callback
        NQEXT.AbortScriptEx strKBID, strMetaDataXML, _
            strObjectList, strDetailMessage, lngSeverity,
CBool(bRaiseError)
        Select Case Err.Number
        Case 0 ' The operation completed successfully.
            ' Trace flow
           Trace TRACE_ALWAYS, "ABORT SCRIPT" & vbNewline & _
                ERR_MESSAGE & ": " & strDetailMessage
            Exit Sub
       ...
```

CreateData

CreateData behaves the same as DynaDataLog, except that it provides more configuration information for the data header and data points.

Syntax

```
CreateData streamId, legend, dynaleg, objlist, val, agentmsg,
msgtype [,schema] [,loglimit] [,lowWM] [,hiWM] [,deletefile]
[,logOnHeaderCreate]
```

Parameters and settings

Parameter	Data type	Description
`streamId`	String	The data stream ID. For each unique stream ID in a script, it will generate a Data Source in the AppManager database. Subsequent calls to `CreateData` using the same stream ID will insert data points to the same Data Source. The string length limit is 64 characters.
`legend`	String	The data stream legend. This value will show up under the Legend column and in the graphs. The string length limit is 128 characters.
`dynaleg`	String	The data stream dynamic legend. Contains the dynamic information that can be used for reporting. If a portion of your legend changes often, then pass that text into this parameter. Otherwise leave it blank.
`objlist`	String	Corresponding object name where the data is collected on. This value is used for graphing and reporting. Format of the value passed in should be `"ObjectTypeName = ObjectValue"`, e.g. `"NT_DiskObject = D:\"`. The `ObjectValue` can normally be obtained by the drop object variable, e.g. `NT_MachineFolder`.
`val`	Double	The data point value.

Parameter	Data type	Description
`agentmsg`	String	Either the data detail or a file name that contains the data detail. The data detail is basically an annotation of each data point, giving more information about the data point since the data point is just a numeric value. For example, the data point value may be 5 for the number of processes running, while the data detail may list the processes that are running. The detailed message is displayed in the Graph Data Detail dialog box for each data point. If this parameter contains the name of a file, make sure you set the msgtype parameter to 1.
`msgtype`	Long	Flag specifying whether the value passed in the `agentmsg` is a file name or the detailed message itself. If it is a file name, then the contents of the file are passed in as the detailed message. Set to 0 to specify that the value in the `agentmsg` parameter is the detailed message. Set to 1 to specify that the value is the file name containing the detailed message.
`schema`	String	Optional. XML schema for dynamic table creation in RDB. Default is an empty string.
`loglimit`	Long	Optional. The number of days to keep this data point in the database. Default -1, keep forever. The data points can be removed from the database by other means.
`lowWM`	Double	Optional. Low watermark. Default is -1.0.
`hiWM`	Double	Optional. High watermark. Default is -1.0.
`deletefile`	Bool	Optional. Flag to tell the AppManager agent to delete the event detail message file after it is done reading the contents and passing the event to the MSU. This parameter is ignored if `msgtype != 1`. Set to `TRUE`, which is default, to delete the file when `msgtype = 1`. Set to `FALSE` to not delete the file. Be careful when setting this value to `FALSE`, especially if your script generates a message file each time it wants to send an event because the files will never be removed.
`logONHeaderCreate`	Bool	Optional. If omitted, defaults to `True`. If `True`, data point logged when data header created.

Return value

None.

Remarks

DynaDataLog sends data points for dynamic data streams. This function allows you to collect data for data streams that may be instantiated at each iteration.

Example

Here is an example taken from the **Exchange2000_QueueStatus** Knowledge Script:

```
...
Dim   resname
Const UNITNUMBER = "^^#"
...
Sub Main ()
...
Dim gpocount
Dim detailmsg
...
resname = "NT_GroupPolicyFolder    = " & NT_GroupPolicyFolder
...
retval = OBJ.GetGroupPolicy(computer, gpolist, gpocount, _
                            errormsg)
...
detailmsg  = "List of GPO linked to the machine :"
For j = 1 To NQEXT.ItemCount(gpolist,",")
   gpo = NQEXT.Item(gpolist,j,",")
   If (j < NQEXT.ItemCount(gpolist,",")) Then
      detailmsg = detailmsg & Chr(10) & cstr(j) & ") " & _
                        gpo
    End If
Next
...
If (DO_DATA = "y") Then
   NQEXT.CreateData 0, "Group Policy list" & UNITNUMBER, "",_
        resname, gpocount, detailmsg, 0
End If
```

CreateDataEx

CreateData behaves the same as DynaDataLog, except that it provides more configuration information for the data header and data points.

Syntax

```
CreateDataEx KBid, MetadataXML, streamId, legend, dynaleg,
objlist, val, agentmsg, msgtype [,schema] [,loglimit]
[,lowWM] [,hiWM] [,deletefile] [,logOnHeaderCreate]
[,logtime]
```

Parameters and settings

Parameter	Data type	Description
`KBid`	String	The Knowledge Base ID reported in the Knowledge Script
`MetadataXML`	String	Knowledge Base information about the Knowledge Script.
`streamId`	String	The data stream ID. For each unique stream ID in a script, it will generate a Data Source in the AppManager database. Subsequent calls to `CreateData` using the same stream ID will insert data points to the same Data Source. The string length limit is 64 characters.
`legend`	String	The data stream legend. This value will show up under the Legend column and in the graphs. The string length limit is 128 characters.
`dynaleg`	String	The data stream dynamic legend. Contains the dynamic information that can be used for reporting. If a portion of your legend changes often, then pass that text into this parameter. Otherwise leave it blank.
`objlist`	String	Corresponding object name where the data is collected on. This value is used for graphing and reporting. Format of the value passed in should be `"ObjectTypeName = ObjectValue"`, e.g. `"NT_DiskObject = D:\"`. The `ObjectValue` can normally be obtained by the drop object variable, e.g. `NT_MachineFolder`.

Parameter	Data type	Description
`val`	Double	The data point value.
`agentmsg`	String	Either the data detail or a file name that contains the data detail. The data detail is basically an annotation of each data point, giving more information about the data point since the data point is just a numeric value. For example, the data point value may be 5 for the number of processes running, while the data detail may list the processes that are running. The detailed message is displayed in the Graph Data Detail dialog box for each data point. If this parameter contains the name of a file, make sure you set the msgtype parameter to 1.
`msgtype`	Long	Flag specifying whether the value passed in the `agentmsg` is a file name or the detailed message itself. If it is a file name, then the contents of the file are passed in as the detailed message. Set to 0 to specify that the value in the `agentmsg` parameter is the detailed message. Set to 1 to specify that the value is the file name containing the detailed message.
`schema`	String	Optional. XML schema for dynamic table creation in RDB. Default is an empty string.
`loglimit`	Long	Optional. The number of days to keep this data point in the database. Default -1, keep forever. The data points can be removed from the database by other means.
`lowWM`	Double	Optional. Low watermark. Default is -1.0.
`hiWM`	Double	Optional. High watermark. Default is -1.0.
`deletefile`	Bool	Optional. Flag to tell the AppManager agent to delete the event detail message file after it is done reading the contents and passing the event to the MSU. This parameter is ignored if `msgtype != 1`. Set to `TRUE`, which is default, to delete the file when `msgtype = 1`. Set to `FALSE` to not delete the file. Be careful when setting this value to `FALSE`, especially if your script generates a message file each time it wants to send an event because the files will never be removed.

Parameter	Data type	Description
`logOnHeaderCreate`	Bool	Optional. If omitted, defaults to `True`. If `True`, data point logged when data header created.
`logtime`	Long	Optional. Time at which the data point was created.

Return value

None.

Remarks

DynaDataLog sends data points for dynamic data streams. This function allows you to collect data for data streams that may be instantiated at each iteration.

Example

Here is an example taken from the **AD_ServerHealth** Knowledge Script:

```
...

' Initialize variables
    If IsNull(strKBID) Then strKBID = ""
    If IsNull(strMetaDataXML) Then strMetaDataXML = ""
    If IsNull(strDynamicLegend) Then strDynamicLegend = ""
    If IsNull(strObjectList) Then strObjectList = ""
    If IsNull(strDetailMessage) Then strDetailMessage = ""
    If IsNull(lngMessageType) Then lngMessageType = 0
    If IsNull(strSchema) Then strSchema = ""
    If IsNull(lngLogLimit) Then lngLogLimit = -1
    If IsNull(dblLowWatermark) Then dblLowWatermark = -1.0
    If IsNull(dblHighWatermark) Then dblHighWatermark = -1.0
    If IsNull(bDeleteFile) Then bDeleteFile = True
    If IsNull(bLogOnHeaderCreate) Then bLogOnHeaderCreate =
True
    If IsNull(lngLogTime) Then lngLogTime = 0
    If Len(strObjectList) = 0 Then strObjectList =
gstrResourceObject

    ' Create data
```

```
    Err.Clear
    If Len(strKBID) > 0 Or Len(strMetaDataXML) > 0 Or
lngLogTime > 0 Then
        ' Create data using NQCreateDataEx callback
        NQEXT.CreateDataEx strKBID, strMetaDataXML, _
            strStream, strLegend, strDynamicLegend,
strObjectList, _
            dblValue, strDetailMessage, lngMessageType,
strSchema, _
           lngLogLimit, dblLowWatermark, dblHighWatermark, _
            CBool(bDeleteFile), CBool(bLogOnHeaderCreate),
lngLogTime
        Select Case Err.Number
        Case 0 ' The operation completed successfully.
            ' Trace flow
            Trace TRACE_NORMAL, _
                "Stream: " & strStream & vbNewline & _
                "Legend: " & strLegend & vbNewline & _
                "Value: " & FormatNumber(dblValue, 2)
            Exit Sub
        Case 438 ' "Object doesn't support this property or
method"
            ' Continue and try again using NQEXT::CreateData
...
```

CreateEvent

Used by a Knowledge Script to send an event to the AppManager agent. The AppManager agent will apply additional rule processing and will determine whether to send a new event or a duplicated (collapsed) event to the AppManager management server.

Syntax

```
CreateEvent sev, evtmsg, akp, obj, val, agentmsg, evtsrc,
evtid, msgtype [,deletefile]
```

Parameters and settings

Parameter	Data type	Description
`sev`	Long	The event severity. A value from 1 to 40.
`evtmsg`	String	The message to be displayed under the Message column in the Events tab.
`akp`	String	Name of the action script to launch as a response to this event. You would normally create an `AKPID` parameter as part of your script. When the job is dropped and you select an action, the UI will fill in the `AKPID` variable with the action name. You will just need to pass in the `AKPID` variable to the script.
`obj`	String	Corresponding object name where the event is raised. This value will determine which object in the **TreeView** pane to blink. Format of the value passed in should be "`ObjectTypeName = ObjectValue`", e.g. "`UNIX_DiskObject = /mnt/cdrom`". The `ObjectValue` can normally be obtained by the drop object variable, e.g. `UNIX_MachineFolder`.
`val`	Double	The current value to raise the event. This parameter is currently not used. Set to 0.0.
`agentmsg`	String	Either the detail message or a file name that contains the detail message. The detailed message is displayed in the Message tab of the Event Property dialog box. If this parameter contains the name of a file, make sure you set the `msgtype` parameter to 1.

Parameter	Data type	Description
`evtsrc`	String	Not used. Should always be empty.
`evtid`	Long	Not used. Should always be 0.
`msgtype`	Long	Flag specifying whether the value passed in the agentmsg parameter is a file name or the detailed message itself. If it is a file name, then the contents of the file are read and passed in as the detailed message. Set to 0 to specify that the value in the `agentmsg` parameter is the detailed message. Set to 1 to specify that the value is the file name containing the detailed message.
`deletefile`	Long	Optional. Flag to tell the AppManager agent to delete the event detail message file after it is done reading the contents and passing the event to the MSU. This parameter is ignored if `msgtype != 1`. Set to `TRUE`, which is default, to delete the file when `msgtype = 1`. Set to `FALSE` to not delete the file. Be careful when setting this value to `FALSE`, especially if your script generates a message file each time it wants to send an event because the files will never be removed.

Return value

None.

Example

Here is an example taken from the **Exchange2000_QueueStatus** Knowledge Script:

```
...
Severity = 10
AKPID = AKP_NULL
Dim   resname
...
Sub Main ()
...
Dim shortmsg
...
Dim detailmsg1
...
resname = "NT_GroupPolicyFolder  = " & NT_GroupPolicyFolder
...
shortmsg  = "Number of Group Policies  : " & cstr(gpocount) _
                  & " exceeds threshold."
If (DO_EVENT = "y") And (gpocount > Threshold) Then
   detailmsg1 = "Total number of Group Policies associate _
        with the machine = " & cstr(gpocount) & Chr(10) & _
         "Threshold of number of GPOs = " & Threshold & _
          Chr(10) & detailmsg

    NQEXT.CreateEvent Severity, shortmsg, AKPID, resname, _
                      0.0, detailmsg1, "", 1000, 0
End If
```

CreateEventEx

Used by a Knowledge Script to send an event to the AppManager agent. The AppManager agent will apply additional rule processing and will determine whether to send a new event or a duplicated (collapsed) event to the AppManager management server.

Syntax

```
CreateEventEx KBid, MetadataXML, Stream, sev, evtmsg, akp,
obj, val, agentmsg, evtsrc, evtid, msgtype [,ProxyEvent]
[,deletefile]
```

Parameters and settings

Parameter	Data type	Description
`KBid`		The Knowledge Base ID reported in the Knowledge Script
`MetadataXML`		Knowledge Base information about the Knowledge Script.
`sev`	Long	The event severity. A value from 1 to 40.
`evtmsg`	String	The message to be displayed under the Message column in the Events tab.
`akp`	String	Name of the action script to launch as a response to this event. You would normally create an `AKPID` parameter as part of your script. When the job is dropped and you select an action, the UI will fill in the `AKPID` variable with the action name. You will just need to pass in the `AKPID` variable to the script.
`obj`	String	Corresponding object name where the event is raised. This value will determine which object in the **TreeView** pane to blink. Format of the value passed in should be "`ObjectTypeName = ObjectValue`", e.g. "`UNIX_DiskObject = /mnt/cdrom`". The `ObjectValue` can normally be obtained by the drop object variable, e.g. `UNIX_MachineFolder`.
`val`	Double	The current value to raise the event. This parameter is currently not used. Set to 0.0.

Parameter	Data type	Description
`agentmsg`	String	Either the detail message or a file name that contains the detail message. The detailed message is displayed in the Message tab of the Event Property dialog box. If this parameter contains the name of a file, make sure you set the `msgtype` parameter to 1.
`evtsrc`	String	Not used. Should always be empty.
`evtid`	Long	Not used. Should always be 0.
`msgtype`	Long	Flag specifying whether the value passed in the agentmsg parameter is a file name or the detailed message itself. If it is a file name, then the contents of the file are read and passed in as the detailed message. Set to 0 to specify that the value in the `agentmsg` parameter is the detailed message. Set to 1 to specify that the value is the file name containing the detailed message.
`ProxyEvent`	Bool	If true, calls the `CreateProxyEvent` method, which creates the event on a proxy machine rather than on the agent.
`deletefile`	Bool	Optional. Flag to tell the AppManager agent to delete the event detail message file after it is done reading the contents and passing the event to the MSU. This parameter is ignored if `msgtype != 1`. Set to `TRUE`, which is default, to delete the file when `msgtype = 1`. Set to `FALSE` to not delete the file. Be careful when setting this value to `FALSE`, especially if your script generates a message file each time it wants to send an event because the files will never be removed.

Return value

None.

Example

Here is an example taken from the **AD_ServerHealth** Knowledge Script:

```
...

  ' Initialize variables
    If IsNull(strKBID) Then strKBID = ""
    If IsNull(strMetaDataXML) Then strMetaDataXML = ""
    If IsNull(strAction) Then strAction = ""
    If IsNull(strObjectList) Then strObjectList = ""
    If IsNull(strDetailMessage) Then strDetailMessage = ""
    If IsNull(lngMessageType) Then lngMessageType = 0
    If IsNull(bProxyEvent) Then bProxyEvent = False
    If IsNull(bDeleteFile) Then bDeleteFile = True
    If Len(strAction) = 0 Then strAction = "AKP_NULL"
    If Len(strObjectList) = 0 Then strObjectList =
gstrResourceObject

    ' Create event
    Err.Clear
    If Len(strKBID) > 0 Or Len(strMetaDataXML) > 0 Or
CBool(bProxyEvent) Then
        ' Create event using CreateEventEx callback
        NQEXT.CreateEventEx strKBID, strMetaDataXML, _
            lngSeverity, strEventMessage, strAction,
strObjectList, _
            -1.0, strDetailMessage, "", 0, lngMessageType, _
            CBool(bProxyEvent), CBool(bDeleteFile)
        Select Case Err.Number
        Case 0 ' The operation completed successfully.
            ' Trace flow
            Trace TRACE_NORMAL, strEventMessage & vbNewline
& strDetailMessage
            Exit Sub
        Case 438 ' "Object doesn't support this property or
method"
           ' Continue and try again using NQEXT::CreateEvent
...
```

DataHeader

Sends the data header for logging and graphing data streams (short form). A `DataHeader` call is made in the first execution interval of a job for each data stream to be collected. Each data header provides an appropriate description of the information collected in the data stream. Most Knowledge Scripts that collect data include this call.

Syntax

```
DataHeader legend, graph_id, stream_id [,objlist]
```

Parameters and settings

Parameter	Data type	Description
`legend`	String	Graphing legend displayed in the **List** and **Graph** panes. For example, the legend for one data stream created by `NT_CpuResource` is `User CPU`. The string length limit is 128 characters.
`graph_id`	Long	Graph ID. This parameter is not currently used. It is always set to the value 0 (see example).
`stream_id`	Long or String	Data stream identifier. This identifier should be unique for each data stream collected by a single Knowledge Script. The identifier does not need to be unique across Knowledge Scripts. The string length limit is 64 characters.
`objlist`	String	Optional. Matching object where the data is collected.

Return value

None.

Remarks

The data stream identifier `stream_id` is used to link `DataLog` calls for individual data points to the appropriate `DataHeader` that describes the data stream. The `stream_id` parameter should be unique for each

data stream collected by a single Knowledge Script. The identifier does not need to be unique across Knowledge Scripts.

To allow your custom Knowledge Scripts to collect data, you need to include calls to both `DataHeader` and `DataLog`.

The `DataHeader` function initiates the collection of a data stream. You must include this function call once for each data stream collected by each job before sending any data points. Therefore, you should add the `DataHeader` call so that it runs in the **first** execution interval.

Once a data stream is initiated with the `DataHeader` call, the `DataLog` function sends the actual data point value back to the management server at each interval. The `DataLog` function needs to be called for each data stream being collected. Each `DataLog` call is associated with one `DataHeader` call through the same `streamid`.

Example

In the **NT_LogicalDiskSpace** script, the `DataHeader` call initiates the collection of two data streams (used percentage and available MB) for each logical disk when the user elects to collect data (`DO_DATA = "y"`):

```
If IterationCount() = 1 And DO_DATA = “y” Then
   DataHeader “Ldsk: “& objname & “USED%”, 0, I
   DataHeader “Ldsk: “& objname & “AVAIL MB”, 0, I+1000
End If
```

Once `DataHeader` is used to establish the data stream, the `DataLog` call is used to collect a data point value for each data stream at each interval the job is run:

```
If DO_DATA = "y" Then
   . . .
   DataLog I, Dutil, datapoint
   DataLog I+1000, Dfree, datapoint
   . . .
End If
```

DataLog

Sends data points back for logging and graphing. Most Knowledge Scripts that collect data include this call. This call is always used in conjunction with a `DataHeader` call.

Syntax

```
DataLog stream_id, data, datapointmsg  [,logtime]
```

Parameters and settings

Parameter	Data type	Description
`stream_id`	Long or String	Data stream identifier. This identifier should be the same identifier used in the associated DataHeader call for each data stream. The string length limit is 64 characters.
`data`	Double	Data point value.
`datapointmsg`	String	Detail message from the AppManager agent(s) displayed in the Graph Data Detail dialog. The maximum size for this string is 32K.
`logtime`	Long	Optional. Time at which the data point was created.

Return value

None.

Remarks

The data stream identifier `stream_id` is used to link `DataLog` calls for individual data point collection to their associated `DataHeader` calls. The `stream_id` parameter should be unique for each data stream collected by a single Knowledge Script. The identifier does not need to be unique across Knowledge Scripts.

Example

This code sample shows three data streams sent via the `DataLog` routine. Each has a separate message consisting of the data stream ID (see `DataHeader`), the data value and a message (defined in a separate routine):

```
If DO_DATA = "y" Then
   Dim Msg0$
   Dim Msg1$
   Dim Msg2$
   Msg0 = OBJ.PhysUsageAgtMsg(True)
   Msg1 = OBJ.VirtualUsageAgtMsg(True)
   Msg2 = OBJ.PGFileUsageAgtMsg(True)
   DataLog 0, Dval0, Msg0
   DataLog 1, Dval1, Msg1
   DataLog 2, Dval2, Msg2
End If
```

DynaCollectData

This function works the same as "DynaDataLog" on page 255 except that it provides more parameters to specify configuration information for the data header and data point.

Syntax

```
DynaCollectData streamId, legend, dynaleg, objlist, val,
agentmsg, msgtype [,schema] [,loglimit] [,lowWM] [,hiWM]
[,deletefile] [,logOnHeaderCreate] [,logtime]
```

Parameters and settings

Parameter	Data type	Description
`StreamId`	Long, string	Data stream ID. The string length limit is 64 characters.
`Legend`	String	Data stream legend. The string length limit is 128 characters.
`Dynaleg`	String	Dynamic legend, contain the dynamic information that can be used for reporting.
`objlist`	String	Corresponding object name where the data is collected.
`val`	Double	Current data point value.
`agentmsg`	String	Contain either a plain text or a message file name.
`msgtype`	Long	Related to agentmsg, 0 for plain text, 1 for message file.
`schema`	String	Optional. This parameter should not be used. Default is an empty string.
`Loglimit`	Long	Optional. Datalog limit in # of days. Default is -1.
`LoWM`	Double	Optional. Low watermark. Default is -1.0.
`HiWM`	Double	Optional. High watermark. Default is -1.0.
`deletefile`	Bool	Optional. Used only when msgtype=1, default is `True`.

Parameter	Data type	Description
`logOnHeaderCreate`	Bool	Optional. If omitted, defaults to `True`. If `True`, data point logged when data header created.
`logtime`	Long	Optional. Time at which the data point was created.

Return value

Boolean. `True` if the data point is returned successfully, `False` otherwise.

Remarks

The data stream identifier `stream_id` can be a numeric identifier or a data stream name. The `stream_id` parameter should be unique for each data stream collected by a single Knowledge Script. The identifier does not need to be unique across Knowledge Scripts.

Example

The following code fragment is from **Oracle_CallsPerTransaction**:

```
If DO_DATA = "y" Then
  DynaCollectData gTargetObjs(lIndex).m_sDBName & _
  gTargetObjs(lIndex).m_sVer ,"Calls Per Transaction " & _
  gTargetObjs(lIndex).m_sDBName & "@" & _
  gTargetObjs(lIndex).m_sVer , _
  "",sResName,dblResult,"",0
End If
```

DynaDataLog

Sends data points for dynamic data streams. This function allows you to collect data for data streams that may be instantiated at each iteration. For example, the Knowledge Script `Exchange_MTAQueueLen` can dynamically enumerate new Exchange connectors at each interval. This extension creates a data stream for each connection and continues to collect data for each stream by stream name.

Syntax

```
DynaDataLog stream_id, legend, value, agentmsg [, objlist]
[,logtime]
```

Parameters and settings

Parameter	Data type	Description
`stream_id`	Long or String	Data stream identifier. The identifier can be a numeric identifier or a stream name. The string length limit is 64 characters.
`legend`	String	Graph legend displayed in the **List** and **Graph** panes. For example, the legend for one data stream created by `NT_CpuResource` is User CPU. The string length limit is 128 characters.
`value`	Double	Data point value.
`agentmsg`	String	Detail message from the AppManager agent(s) displayed in the Graph Data Detail dialog. The maximum size for this string is 32K.
`objlist`	String	Optional. Matching object where the data is collected.
`logtime`	Long	Optional. Time at which the data point was created.

Return value

Boolean. `True` if the data point is returned successfully, `False` otherwise.

Remarks

The data stream identifier `stream_id` can be a numeric identifier or a data stream name. The `stream_id` parameter should be unique for each data stream collected by a single Knowledge Script. The identifier does not need to be unique across Knowledge Scripts.

Note Unlike the `DataLog` extension, `DynaDataLog` does not require a `DataHeader` call to establish a data stream.

Example

This code fragment illustrates the use of `DynaDataLog` to return data for dynamically discovered instances of MTA connectors:

```
If DO_DATA = "y" Then
  AgtMsg = AgtMsg & dval & chr$(9) & chr$(9) & Inst & Chr$(10)
  rc = DynaDataLog (Inst & " QueueLen", Inst & " QueueLen", _
  dval, dval & chr$(9) & chr$(9) & Inst & Chr$(10) )
End If
In VB Script, these lines are modified to call the function
through the NQEXT object:
If DO_DATA = "y" Then
  AgtMsg = AgtMsg & dval & chr(9) & chr(9) & Inst & Chr(10)
  rc = NQEXT.DynaDataLog (Inst & " QueueLen", Inst & " -
    QueueLen", dval, dval & chr(9) & chr(9) & Inst & Chr(10) )
End If
```

GetAgentInfo

This function will provide the current AppManager agent information to the script, including the framework type, the agent version, and the path of the installation directory.

Syntax

```
GetAgentInfo prodtype, agtver, installdir
```

Parameters and settings

Parameter	Data type	Description
`prodtype`	String	The returned framework type, either "`OM`" or "`AM`"
`agtver`	String	The returned agent version string
`installdir`	String	The returned product install path

Return value

None.

Example

Here is an example taken from the **AMAdmin_DeleteGlobalParams** Knowledge Script:

```
...
' Check that the agent supports server-side job configuration
Sub AssertAgentVersion()
   Dim prodType As String
   Dim agentVer As String
   Dim installDir As String

   GetAgentInfo prodType,agentVer,installDir

   If agentVer < MIN_MC_VERSION Then
      MCAbort "", "This MC does not support server-side _
               job configuration.", 10, True, False
   End If
End Sub
...
```

GetContextEx

Returns the value for a specified custom context. This function can be used to get custom properties you have stored as a name-value pair in the repository using the AppManager Security Manager. Only one custom name-value property pair can be entered in a single `GetContextEx` call.

Syntax

```
GetContextEx label_name, label_value,
             sublabel_name, sublabel_value,
             val1_name, val1_value
```

Parameters and settings

Parameter	Data type	Description
`label_name`	String	Label context name (can not be empty). Currently, the predefined name is label. This parameter must be set to "label" in your script.
`label_value`	String	Label context value stored in the AppManager repository (can not be empty). Enter the Label value exactly as it has been entered in the Label field in the Security Manager.
`sublabel_name`	String	Sub-label context name (can not be empty). Currently, the predefined name is sub-label. This parameter must be set to "sub-label" in your script.
`sublabel_value`	String	Custom Sub-label context value stored in the AppManager repository (can not be empty). Enter the Sub-Label value exactly as it has been entered in the Sub-Label field in the Security Manager.
`val1_name`	String	Value 1 context name. Currently, the predefined name is val1. This parameter must be set to `"val1"` in your script.
`val1_value`	String	Context property value stored in the AppManager repository. Use an empty string (`""`) to return the current value. When this parameter is not an empty string, it is used as a filter to further qualify the output context value.

Return value

Variant. Returns the context value.

Remarks

This function allows you to retrieve custom information you have stored in the AppManager repository using the Security Manager. Within your Knowledge Scripts, the `GetContextEx()` function uses the label and sub-label you enter to locate the appropriate custom context value. For information about entering the custom values into the repository, see the *AppManager User Guide*.

Example

Assume the following information has been entered using the Security Manager:

- **Label**: `MyApplication`
- **Sub-Label**: `email_address`
- **Value 1:** `admin@tgif.com`

To use the custom values:

- Modify the `NeedKPW` parameter in the `KP-Status` section of the customized Knowledge Script to look up a value in the KPW table. For example:

  ```
  'NeedKPW = 1      ' Look up the value in the KPW table
  ```

- Add the `GetContextEx()` function to look up valid custom values in the repository. For example:

  ```
  GetContextEx("label", "MyApplication", "sub-label",
  "email_address", "val1", email)
  ```

The following code fragment illustrates how to use this call in BasicScript:

```
Sub Main()
   Dim email As String
   email = ""        'Get the current value
   If AdminEmail = "" Then
      dreturn = GetContextEx("label", "MyApplication", _
      "sub-label", "email_address", "val1", email)
   Else
      email = AdminEmail
   End If
End Sub
```

If the user doesn't specify an email address in the Knowledge Script Properties dialog, the `GetContextEx` call looks up the email address stored in the repository and the `email` parameter returns the value `"admin@tgif.com"`.

GetJobID

Gets the job ID for the running Knowledge Script.

Syntax

```
GetJobID
```

Parameters and settings

None.

Return value

Long.

Example

The following BasicScript code fragment comes from the **NT_ServiceDown** Knowledge Script:

```
...
JobId = GetJobId       'Get Job Id for ntserdown.ini file
For I = 1 To NumServ
   Servname = Item$(RealServices, I,, ",")
   RegSrv Servname, JobId, I  'RegSrv registers each service
                              'in ntserdown.ini
Next I
...
```

GetKPInterval

Returns the execution interval, in seconds, for the running Knowledge Script.

Syntax

```
GetKPInterval
```

Parameters and settings

None.

Return value

The execution interval, in seconds.

Example

Here is an example taken from the **Domino_UserSessions** Knowledge Script:

```
...
Dim Time_Out As Long

Time_Out = TIMEOUT
If (Time_Out > GetKPInterval()) Then
   resmsg = "MC Abort"
   longmsg = "Please enter a timeout that is less than _
               KP interval" & Chr$(13) & Chr$(10)
   longmsg = longmsg & "Current condition: Timeout " & _
             CStr(Time_Out) & "(sec) > KP Interval " & _
             CStr(GetKPInterval()) & "(sec)"
    MCAbort  resmsg, longmsg
End If
...
```

GetMachName

Returns a managed computer machine name (host name). This is useful for including the name of the computer causing an event in a message.

Syntax

```
GetMachName
```

Parameters

None.

Returns

Name of managed computer.

Example

The following BasicScript code fragment comes from the **NT_RemoteServiceDown** Knowledge Script:

```
If IterationCount() = 1 Then
   NumServ = ItemCount(Services, ",")
   If NumServ = 0 Then
      Err.Description = "No Service is given"
      Err.raise 4002
   End If
   NumMach = ItemCount(MachineList, ",")
   If NumMach = 0 Then
      Machines = GetMachName()
      NumMach = 1
   Else
      Machines = MachineList
   End If
End If
```

GetProgID

Requests the AppManager agent to return the versioned Prog ID that matches the version of the current script. For example, a version 4.0 KS may call this function to construct and return the version 4.0 prog ID for the NT MO, such as "NetIQAgent.NT.4"

Syntax

```
GetProgID progid, scriptver
```

Parameters and settings

Parameter	Data type	Description
progid	String	Version independent MO COM progid
scriptver	String	The associated KS script version string

Return value

LPTSTR. The versioned Prog ID.

Example

Here is an example taken from the **Win2000_GroupPolicyCount** Knowledge Script:

```
...
<Version>
    <AppManID>4.5.78.0.</AppManID>
    <KSVerID>1.1</KSVerID>
</Version>

If NQEXT.IterationCount() = 1 Then
   progid = NQEXT.GetProgId ("NetiQAgent.NT", AppManID)
   Set NT = CreateObject (progid)
   Set OBJ = NT.GroupPolicy
End If
```

GetSecurityContext

Return the value for the specified KPW.

Syntax

```
GetSecurityContext label_val, sublabel_val, name, value
```

Parameters and settings

Parameter	Data type	Description
`label_val`	String	Label value
`sublabel_val`	String	Sub-label value
`name`	String	Value name
`value`	String	The returned value for the specified name

Return value

Boolean. `True` if the operation succeeds, `False` otherwise.

GetSiteKey

Gets the QDB site key for the current job. The agent uses this information to associate jobs to a particular site.

Syntax

```
GetSiteKey
```

Parameters and settings

None.

Return value

QDB key as unique 32-character hexadecimal string.

Remarks

The Windows agent in particular can be registered in any number of QDBs, so it is important to know that events for job from QDB should go to same QDB. Each QDB has a Site table. In that table, this unique key is stored. GetSiteKey returns this QDB site key for the running job created in that QDB.

Example

The following example taken from the Discovery_AMHealth Knowledge Script:

```
Function GetSite(Byval strLR, byref strSiteData, byref
strGetSiteError)
  Dim objRS
  Dim strSQL
  Dim strCNX
  ...
  If bUseKey Then
    strSiteData = NQExt.GetSiteKey()
    GetSite = 0
    Exit Function
  End If
  ...
```

GetTempFileName (VBScript only)

Requests the AppManager agent to construct a temp file name based on the input criteria. The file name is concatenated from path, prefix string, and a hex string formed from the unique ID, and a ".tmp" extension.

Syntax

```
GetTempFileName path, prefix, uniqid
```

Parameters and settings

Parameter	Data type	Description
`path`	String	Temp file path
`prefix`	String	File name prefix string
`uniqid`	Long	An unique ID

Return value

LPTSTR. The constructed temp file name and path.

GetVersion

Asks the AppManager agent to obtain the version string for the specified file name. It can be used to retrieve the version of a NetIQ file or any file on the system. If file is simply a file name (with no path specified), the AppManager agent will pre-append the NetIQ install path.

Syntax

```
GetVersion file, verstr
```

Parameters and settings

Parameter	Data type	Description
`file`	String	NetIQ or any file name
`verstr`	String*	The returned corresponding version string (passed by reference).

Return value

None.

Remarks

When looking up the version, the AppManager agent will automatically perform the wildcard operation and retrieve the latest version. For example, if the specified component is qsqla.dll and there exists both qsqla3.dll and qsqla4.dll, MC will return the version of qsqla4.dll.

Example

Here is an example taken from the **IIS_CacheHitRatio** Knowledge Script:

```
Dim NT As Object
Dim OBJ As Object
Dim IIS As Object
Private IISVersion As Long
Private Counter As String  ' delay counter value until version
' is found
...
Sub Main()
   Dim progid As String
   Dim IISprogid As String
   ...
   progid = MyGetProgId ("NetiQAgent.NT")
   Set NT = CreateObject(progid)
   Set OBJ = NT.System
   IISprogid = MyGetProgID ("NetiQAgent.IIS")
   Set IIS = CreateObject(IISprogid)
   IISVersion = IIS.GetVersion()
   ...
   If (IISVersion < 5) Then
      Counter = "Cache Hits %"
   Else
      Counter = "URI Cache Hits %"
```

Item (VBScript only)

Executes the Summit BasicScript built-in function Item.

Syntax

```
Item list, idx, delim
```

Parameters and settings

Parameter	Data type	Description
`list`	Long	A list of strings.
`idx`	Long	Returned string index within the list.
`delim`	String	String delimiter.

Return value

Returns the string at the specified index position within the input list.

Example

Here is an example taken from the **WIN2000_GroupPolicyCount** Knowledge Script:

```
...
<Script language="VBScript">
...
Dim   NT
Dim   OBJ' Keep the reference count of this DLL
...
Sub Main ()
   Dim gpolist
   Dim computer
   Dim errormsg
   Dim gpocount
   Dim progid
   Dim j
   Dim detailmsg
   Dim retval
   ...
   progid = NQEXT.GetProgId ("NetiQAgent.NT", AppManID)
   Set NT = CreateObject (progid)
   Set OBJ = NT.GroupPolicy
   ...
   computer = ""
   retval = OBJ.GetGroupPolicy(computer, gpolist, _
                               gpocount, errormsg)
   ...
   detailmsg = "List of GPO linked to the machine:"
   For j = 1 To NQEXT.ItemCount(gpolist,",")  'There is an
                              ' extra comma after the list
      gpo = NQEXT.Item(gpolist,j,",")
      If (j < NQEXT.ItemCount(gpolist,",")) Then
          detailmsg = detailmsg & Chr(10) & cstr(j) & ") " _
                      & gpo
      End If
   Next
```

ItemCount (VBScript only)

Executes the Summit BasicScript built-in function `ItemCount`.

Syntax

```
ItemCount list, delim
```

Parameters and settings

Parameter	Data type	Description
`list`	Long	A list of strings.
`delim`	String	String delimiter.

Return value

Long. Number of strings in the input list.

Example

Here is an example taken from the **WIN2000_GroupPolicyCount** Knowledge Script:

```
...
<Script language="VBScript">
...
Dim   NT
Dim   OBJ' Keep the reference count of this DLL
...
Sub Main ()
   Dim gpolist
   Dim computer
   Dim errormsg
   Dim gpocount
   Dim progid
   Dim j
   Dim detailmsg
   Dim retval
   ...
   progid = NQEXT.GetProgId ("NetiQAgent.NT", AppManID)
   Set NT = CreateObject (progid)
   Set OBJ = NT.GroupPolicy
   ...
   computer = ""
   retval = OBJ.GetGroupPolicy(computer, gpolist, _
                              gpocount, errormsg)
   ...
   detailmsg = "List of GPO linked to the machine:"
   For j = 1 To NQEXT.ItemCount(gpolist,",")  ' List ends
                                              ' with extra comma
      gpo = NQEXT.Item(gpolist,j,",")
      If (j < NQEXT.ItemCount(gpolist,",")) Then
         detailmsg = detailmsg & Chr(10) & cstr(j) _
                     & ") " & gpo
      End If
   Next
```

IterationCount

Determines the number of times the calling Knowledge Script has run. Most Knowledge Scripts that collect data include this call.

Syntax

```
IterationCount
```

Parameters and settings

None.

Return value

Long representing the current iteration count.

Example

This routine is called to check the current iteration count for a Knowledge Script. The first time a Knowledge Script runs, the iteration count is 1. If the iteration count is 1, the `DataHeader` call is made to allow the Knowledge Script to collect a data stream.

The following BasicScript example from **NT_CpuResource** illustrates this function with four `DataHeader` calls (four data streams):

```
If IterationCount() = 1 Then
   ...
   If DO_DATA = "y" Then
      DataHeader "USER Cpu" & UNITPERCENT, 0, 0
      DataHeader "Number of Processes" & UNITNUMBER, 0, 1
      DataHeader "All Threads" & UNITNUMBER, 0, 2
      DataHeader "Interrupts" & UNITNUMBER, 0, 3
   End If
End If
```

LongDataHeader

Requests the AppManager agent to send a data header to the AppManager management server. You can use this function to specify all the listed configuration information, such as high/low watermark, etc.

Syntax

```
LongDataHeader legend, graphId, streamId, logLimit, color,
style, MinVal, MaxVal, loWM, hiWM [,objlist]
```

Parameters and settings

Parameter	Data type	Description
`legend`	String	Legend name. The string length limit is 128 characters.
`graphId`	Long	Graph ID.
`streamId`	Variant	Data stream ID. The string length limit is 64 characters.
`logLimit`	Long	Datalog limit in # of days.
`color`	Unused	
`style`	Unused	
`minVal`	Double	Minimum allowed data point value.
`MaxVal`	Double	Maximum allowed data point value.
`loWM`	Double	Low watermark.
`hiWM`	Double	High watermark.
`objlist`	String	Optional. Matching object where the data is collected.

Return value

None.

Remarks

The previous Callback function, DataHeader, just uses the default values for these configurations.

Example

Here is an example taken from the **NT_CpuLoaded.qml**:

```
Dim NT As Object
Dim OBJ As Object
Dim resmsg$
Dim resarg$
...
Sub Main()
   Dim Duser#, Dpriv#, Dtotal#
   Dim progid$
   ...
   progid = MyGetProgId ("NetiQAgent.NT")
   Set NT = CreateObject(progid)
   Set OBJ = NT.CPU
   ...
   resarg = ""
   ...
   Dpriv = OBJ.UtilValue("PRIVILEGED", resarg)
   Duser = OBJ.UtilValue("USER", resarg)
   If Dpriv = -1 Or Duser = -1 Then
      Err.Description = "Failed on CPU MO."
      Err.raise 4101  'raise error to terminate this KS
   End If
   ...
   Dtotal = Dpriv + Duser
   ...
   If DO_DATA = "y" Then
      If IterationCount() = 1 Then
        LongDataHeader OBJ.UtilLegend("PROCESSOR", resarg),_
                0, 0, CpuUtil_DataPoints, 0, 0, 0, 0, 0, 0
     End If
     ...
      longm = "Privileged " & Format$(Dpriv, "0.00") & _
            chr$(10) & "User " & Format$(Duser, "0.00") & _
            chr$(10) & "Total " & Format$(Dtotal, "0.00")
      DataLog 0, Dtotal, longm
   End If
End Sub
```

LongDataLog

This function requests the AppManager agent to send a data point to management server. Unlike "DataLog" on page 251, the AppManager agent will read the detail message from the specified file and return the message as part of data point. This function is useful for returning detail messages larger than 32 KB.

Syntax

```
LongDataLog streamId, value, msgfile [,deletefile]
[,logtime]
```

Parameters and settings

Parameter	Data type	Description
`streamId`	Long, string	Data stream ID. The string length limit is 64 characters.
`value`	Double	Current data point value.
`msgfile`	String	The name of file that contains the detail message for the current data point.
`deletefile`	Bool	Optional. `True` to delete the file after it is read. `False` to retain.
`logtime`	Long	Optional. Time at which the data point was created.

Return value

None.

Example

This code fragment from the **AD_NumberOfComputers** Knowledge Script reads the detail message from `strOutFile`:

```
...
If DO_DATA = "y" Then
   LongDataLog streamid, NumUsers, strOutFile
End If
...
```

LongDynaDataLog

This functions works the same as "DynaDataLog" on page 255 except the AppManager agent reads the detail message from a specified file and returns the message as part of data point. This function is useful for returning detail messages larger than 32 KB.

Note `LongDynaDataLog` does not require a `DataHeader` call to establish a data stream.

Syntax

```
LongDynaDataLog streamId, legend, value, msgfile
[,deletefile] [,objlist] [,logtime]
```

Parameters and settings

Parameter	Data type	Description
`streamId`	Long, string	Data stream ID. The string length limit is 64 characters.
`legend`	String	Legend name. The string length limit is 128 characters.
`value`	Double	Data point value.
`msgfile`	String	The name of file that contains the detail message for the current data point.
`deletefile`	Bool	Optional. `True` to delete the file after it is read. `False` to retain.
`objlist`	String	Optional. Matching object where data is collected on.
`logtime`	Long	Optional. Time at which the data point was created.

Return value

None.

Remarks

The data stream identifier `stream_id` can be a numeric identifier or a data stream name. The `stream_id` parameter should be unique for each data stream collected by a single Knowledge Script. The identifier does not need to be unique across Knowledge Scripts.

Example

This code fragment from **Win2000_DiskQuotaStatus** constructs the stream ID and reads the detail message from `overlimitF`:

```
...
If DO_DATA_OVERLIMIT = "y" Then
   brc = LongDynaDataLog(MachName & "/" & drive & "/  _
           #overlimit", "Number users on " & drive & " _
           over quota limit" & UNIT, overlimit, overlimitF _
           & "2")
End If
...
```

MCAbort

Allows a Knowledge Script to abort its current operation. When invoked, a severity 40 event is raised on the resource objects specified and the Knowledge Script job is signaled to terminate the current operation. The AppManager agent and other jobs are not affected.

It is recommended not to use this API. Instead, it is advised to use Createevent and Exit call.

Syntax

```
MCAbort objlist, agentmsg [,sev] [,toretevt] [,raise_err]
```

Parameters and settings

Parameter	Data type	Description
`objlist`	String	Objects that report the event (represented by icons in the Operator Console's **TreeView** pane).
`agentmsg`	String	Message to accompany the aborted operation event.
`sev`	Long	Currently, this sev passed is ignored. See Remarks.
`toretevt`	Bool	Optional. `True` to generate an event, `False` to not generate an event.
`raise_err`	Bool	Optional. Sets the job status to error or stop. `True` to set job status to `Error`, `False` to set it to `Stop`. Default is `True`.

Return value

None.

Remarks

Currently, there is an AppManager client resource monitor registry setting ("Admin\AdminEvtSev") that overrides any value that you assign to sev. "Admin\AdminEvtSev" is normally set to 40, and the

abort event severity will therefore be 40, no matter what value you give to sev.

If "Admin\AdminEvtSev" value is changed in the registry and the value is set in the range 1-40, then the abort event severity will have the same severity number set in the registry.

If "Admin\AdminEvtSev" value is set to severity other than the range 1-40, then the abort event severity will be 40 by default.

Example

The following BasicScript code fragment is from the **General_AsciiLog** Knowledge Script:

```
...
   If ErrorCode = -1 Then
      MCAbort resname, ErrorMsg
   End If
   If ErrorCode = -2 Then
      ...
```

MCEnterCS

Enter the AppManager agent-defined **critical section**.

Syntax

```
MCEnterCS
```

Parameters and settings

None.

Return value

Long. Returns 0 if the lock was acquired; 1 if the job was stopped while waiting for the job (in which case, the job did not acquire the lock).

Example

The following BasicScript code fragment comes from **ARCserve_CanceledJobs**:

```
...
If IterationCount() = 1 Then
   Dim i%
   On Error GoTo ErrorOut
   progid = MyGetProgId ("NetiQAgent.ARCserve")
   Set ASMO = CreateObject(progid)
   ...
   Filter=0
   If DO_ERR="y" Then Filter=1
      If DO_WARN="y" Then Filter=Filter+2
         MCEnterCS
         ErrorCode=ASMO.PreProcess(FileName, ErrorMsg, _
                                   StartOffset, FileCreateTime)
         MCExitCS
         If ErrorCode = -1 Then
            MCAbort resname, ErrorMsg
         End If
         ...
```

MCExitCS

Exit the AppManager agent-defined **critical section**.

Syntax

```
MCExitCS
```

Parameters and settings

None.

Return value

None.

Example

The following BasicScript code fragment comes from **ARCserve_CanceledJobs**:

```
...
If IterationCount() = 1 Then
   Dim i%
   ...
   Filter=0
   If DO_ERR="y" Then Filter=1
      If DO_WARN="y" Then Filter=Filter+2
         MCEnterCS
         ErrorCode=ASMO.PreProcess(FileName, ErrorMsg, _
                                   StartOffset, FileCreateTime)
         MCExitCS
         If ErrorCode = -1 Then
            MCAbort resname, ErrorMsg
         End If
         ...
```

MCGetMOID

Retrieves version information for the managed object installed on the computer where the Knowledge Script is running. This extension is used to ensure that a particular version of a Knowledge Script calls a suitable version of a managed object.

For example, if the input parameters specify `NetiQAgent.NT` and `3.0.346`, the returned string would be `NetiQAgent.NT.3` and the appropriate DLL (for example, `qnta3.dll`) is loaded into memory.

Note A managed object may have multiple program ID entries in the registry. For example, when upgrading from 3.0 to 4.0, there may be three program ID entries in the registry, `NetiQAgent.NT`, `NetiQAgent.NT.3`, and `NetiQAgent.NT.4`. However, the version independent program ID (`NetiQAgent.NT`) always corresponds to the latest versioned program ID (for example, `NetiQAgent.NT.4`).

Syntax

```
MCGetMOID programid, version
```

Parameters and settings

Parameter	Data type	Description
`programid`	String	Managed object program identifier. For example, `NetiQAgent.NT`.
`version`	String	Knowledge Script version (for example, AppManID or KSVerID parameter).

Return value

String representing the managed object version.

Example

The following code fragment illustrates the call in BasicScript:

```
Function MyGetProgID (progid As String) As String
   Dim version As String
   MCVersion "netiqmc.exe",version
   If version < "3.0" Then
      MyGetProgID = progid
   else
      MyGetProgID = MCGetMOID (progid, AppManID)
   End If
End Function
Dim NT As Object
Dim  progid As String
Sub Main()
   If IterationCount() = 1 Then
      progid = MyGetProgId ("NetiQAgent.NT")
      Set NT = CreateObject(progid)
   End If
   ...
End Sub
```

MCVersion

Requests the AppManager agent to obtain the version string for the specified component file name.

Syntax

```
MCVersion component, verstr [,fullpath]
```

Parameters and settings

Parameter	Data type	Description
`component`	String	Managed object component file name.
`verstr`	String	The returned corresponding version string.
`fullpath`	Bool	Optional. If `True`, component contains the full path to the filename; if `False`, the component's location is relative to the AppManager\bin directory. Default is `False`

Return value

None.

Remarks

The AppManager agent will automatically perform the wildcard operation and retrieve the latest version. For example, if the specified component is qsqla.dll and there exists both `qsqla3.dll` and `qsqla4.dll`, the AppManager agent will return the latter.

Example

The following code example from the **Discovery_SQL** Knowledge Script gets the latest version for the dynamic link library used in monitoring SQL Server:

```
‘ Get the qsqla.dll version
version = “”
MCVersion “qsqla.dll”, version
```

MCWaitForObject (Summit BasicScript only)

Simulates the Win32 API function `WaitForMultipleObjects` to wait for objects to be signalled before continuing execution.

Syntax

```
MCWaitForObject waitall, obj1 [, obj2, obj3, ...., obj10]
```

Parameters and settings

Parameter	Data type	Description
`waitall`	Boolean	Set to `True` to wait for all objects. Set to `False` to wait for one or more specific objects (`objn`).
`obj`*n*	Long	Object to wait for. You must identify at least one object. You can wait for up to 10 objects. For example: `MCWaitForObject(True, obj1, obj2, ..., obj10)`

Return value

Long. The number of objects signaled or the object index.

Remarks

If the `waitall` parameter is `True`, this call waits until all objects are signalled, then returns the number of objects signalled. If the `waitall` parameter is `False`, this call returns when any specified object is signalled and the return value indicates which object in the input parameter list has been signalled. For example, if you use the following call:

```
ret = MCWaitForObject(False, obj1, obj2, obj3)
```

when the second object (`obj2`) is signalled, `MCWaitForObject` returns the value `2`.

Unlike the `WaitForMultipleObjects` function in the Win32 API, the `MCWaitForObject` caller thread will not block other Knowledge Script

threads on the managed computer, allowing for parallel processing of all running jobs.

Example

The following BasicScript code segment illustrates waiting for any of five objects to be signalled before returning (return value dependent on the object signalled):

```
ret = MCWaitForObject(False, h1, h2, h3, h4, h5)
```

The following BasicScript code fragment is from **General_PingMachine**:

```
...
ret = MCWaitForObject (True, pInfo.hProcess)
If (ret = 0) Then
   retmsg = "Failed to wait process with " & ret
   GoTo MyExit
End If
...
```

MCWaitForObjectEx (Summit BasicScript only)

Simulates the Win32 API function `WaitForMultipleObjects` to wait for objects to be signaled before continuing execution. This function allows you to specify a maximum waiting period.

Syntax

```
MCWaitForObjectEx waitall, waitinterval, obj1 [, obj2, obj3,
                                                  ....., obj10]
```

Parameters and settings

Parameter	Data type	Description
`waitall`	Boolean	Set to `True` to wait for all objects. Set to `False` to wait for one or more specific objects (`objn`).
`waitinterval`	Long	Maximum number of milliseconds to wait for objects to be signaled.
`obj`*n*	Long	Object to wait for. You must identify at least one object. You can wait for up to 10 objects.

Return value

Long. The number of objects signaled or the object index. If the wait interval expires or objects are not signaled, the function returns a value of -1.

Remarks

If the `waitall` parameter is `True`, this call waits until all objects are signalled, then returns the number of objects signalled. If the `waitall` parameter is `False`, this call returns when any specified object is signalled and the return value indicates which object in the input parameter list has been signalled. For example, if you want to wait 10 seconds for two processes you can use a call such as:

```
ret = MCWaitForObjectEx (True, 10000, Process1, Process2)
```

The wait interval is specified in milliseconds. For example, you would set the interval to 10000 to wait for 10 seconds. When the second object (`pFlag.hProcess2`) is signalled, `MCWaitForObjectEx` returns the value `2`. If this job is waiting for objects to be returned when a user stops another job, all the jobs this agent is running stop until this wait interval expires. If the object will never come back because of some other problem, then all the jobs would be stuck. Therefore you should use one of these options:

- Use a reasonably short interval of a few minutes or less.
- Use the WaitForObject function in a VB script.

Unlike the `WaitForMultipleObjects` function in the Win32 API, the `MCWaitForObjectEx` caller thread will not block other Knowledge Script threads on the managed computer, allowing for parallel processing of all running jobs.

Example

The following code segment illustrates waiting for all three objects to be signalled before returning (return value 3) in BasicScript:

```
ret = MCWaitForObjectEx(True,100,h1,h2,h3)
```

The following BasicScript code segment illustrates waiting for any of five objects to be signalled before returning (return value dependent on the object signalled):

```
ret = MCWaitForObjectEx(False,100,h1,h2,h3,h4,h5)
```

MSActions

Allows a Knowledge Script to report events and initiate actions. Knowledge Scripts that trigger events include this call.

Note If you are writing your Knowledge Script in VB Script and using `NQEXT`, you cannot pass multiple detail message strings using `NQEXT.MSActions` or `NQEXT.CreateEvent`. To pass long messages, either concatenate the strings or write them to a file, then use the `NQEXT.MSLongActions` call to return the contents of the file.

Syntax

```
MSActions severity, shortmsg, akpid, objlist, detailmsg
 [, detailmsg2, detailmsg3, .....,detailmsg6] [, value]
```

Parameters and settings

Parameter	Data type	Description
`severity`	Long	Severity of the event.
`shortmsg`	String	Event message displayed in the **List** pane.
`akpid`	String	Action name or identifier for the action to be taken.
`objlist`	String	Objects that report the event (represented by blinking icons in the Operator Console's **TreeView** pane).

Parameter	Data type	Description
`detailmsg`	String	Detail message from the AppManager agent(s) displayed in the event's Properties dialog. At least one detailmsg is required. The maximum size of the string is 32K. To pass additional information beyond the 32 K, you can specify up to 6 message strings, each with a maximum size of 32K, to define the entire detail message for an event. For example, if the message you want to return is 64K, the message would be stored in two strings: `MSActions Severity, "High", AKPID, "", detailmsg, detailmsg2` **Note:** Within your Knowledge Script, the variable name you use for the detail message string can vary. For example, in viewing sample scripts you may see names such as detailmsg, agtmsg, agentmsg, or longm.
`value`	Double	Optional. The current value to raise an event.

Return value

None.

Remarks

One key part of building custom Knowledge Scripts is the ability to generate events and initiate actions requested by the user. To allow your custom Knowledge Scripts to trigger events and actions, you need to include the special `MSActions` call in the main script logic.

The `MSActions` call controls how events are displayed in the Operator Console and the information stored in the AppManager repository.

You need to include an `MSActions` call for each event to be raised. Therefore, if a Knowledge Script is intended to trigger different events for different conditions (for example, a severe event when a check fails and an information event when successful), you need to include multiple `MSActions` function calls.

Example 1

For example, in the **NT_FilesOpen** Knowledge Script:

```
...
If Dval1 > TH_FILES Then
  longm = "NT # of files open is " & Cstr(Dval1) & "; _
           >TH = " & Cstr(TH_FILES)
  MSActions Severity, "No of Files Open High", AKPID, _
            "", longm
End If
```

The following BasicScript example illustrates the use of multiple detail messages added to the MSActions call (although in this case they are not necessary because the messages passed are less than 32K):

```
detailmsg1 = "CPU load is " & Cstr(Dval1) & _
            "; The Threshold is for CPU usage" & Cstr(TH_USE)
MSActions 5, " CPU Load", AKPID, resource, _
  detailmsg1,"detail2","detail3"
```

Note If you are writing your Knowledge Script in VB Script and using `NQEXT`, you cannot pass multiple detail message strings using `NQEXT.MSActions` or `NQEXT.CreateEvent`. To pass long messages, either concatenate the strings into a single message, or write the strings to a file, then use the `NQEXT.MSLongActions` call to return the contents of the file.

Example 2

As illustrated in this BasicScript example from **NT_LogicalDiskSpace**, the `MSActions` call is used to trigger an event when the disk space used or free space available exceeds a threshold:

```
If DO_EVENT = "y" Then
   If Dutil > TH_UTIL Or Dfree < TH_FREE Then
      Dim eventmsg$
      Dim detailmsg$
      Dim resname$
      eventmsg = "Disk " & objname & " Full"
      detailmsg = "Disk " & objname

      If Dutil > TH_UTIL Then
       detailmsg = detailmsg & " Used % is " & CStr(TH_UTIL)
      End If

      If Dfree < TH_FREE Then
         detailmsg = detailmsg & "Free space MB is “ _
                                          & Str(TH_FREE)
      End If

      resname = "NT_LogicalDiskObj = " & objname
     MSActions Severity, eventmsg, AKPID, resname, detailmsg

   End If
End If
```

MSLongActions

This function works the same as "MSActions" on page 291 except the AppManager agent will read the event detail message from the specified file.

Syntax

```
MSLongActions sev, shortmsg, akp, objlist, msgfile
              [, deletefile] [, value]
```

Parameters and settings

Parameter	Data type	Description
`severity`	Long	Severity of the event.
`shortmsg`	String	Event message displayed in the **List** pane.
`akpid`	String	Action name or identifier for the action to be taken.
`objlist`	String	Objects that report the event (represented by blinking icons in the Operator Console's **TreeView** pane).
`msgfile`	String	The name of file that contains the detail message for the current event
`deletefile`	Boolean	Optional. `True` to delete the file after it is read and `False` to retain
`value`	Double	Optional. The current value to raise an event.

Return value

None.

Example

This code fragment from **BackupExec_FailedJobs** reads the detail message from `Fname2`:

```
If DO_EVENT = "y" And Dtotal > TH_USAGE Then
   MSLongActions SEVERITY, "The total number of failed _
                 backup jobs exceeds the threshold", _
                 AKPID, resname, strFilename
End If
```

NQSleep

Requests the AppManager agent to sleep for the specified interval on behalf of the KS.

Syntax

```
NQSleep intv [, noabort]
```

Parameters and settings

Parameter	Data type	Description
`intv`	Long	Sleep interval in msec
`noabort`	Bool	Optional. Request AppManager agent not to abort sleep in any condition. Default is `False`

Return value

Long. 1=sleep completes, -1=sleep aborted

Remarks

The parameter `noabort` requests the AppManager agent not to abort the sleep—even if the current script is being stopped.

Example

```
Sub Main()
   Dim szAdminCmd, LogDirName, FileUTC
   Dim LatestJobID, JobFileName, JobDetailFile
   ...
   JobDetailFile = JobFileName & "." & FileUTC & ".t"
   '5 retrys, if after 5 secs file still doesn't exist
   'call it quits
   Cnt = 0
   Do
      NQEXT.NQSleep (5000)
      Cnt = Cnt + 1
   Loop While FSO.FileExists(JobDetailFile) = False And _
                                             Cnt < 5
   ...
```

QTrace

Records a Knowledge Script trace message to a log file. This trace message is stored in the log file `mctrace.log` in the temporary directory located under the AppManager installation directory on the managed computer.

Syntax

```
QTrace msg
```

Parameters and settings

Parameter	Data type	Description
`msg`	String	Trace message to be logged.

Return value

None.

Remarks

For example, if your AppManager installation directory is `C:\NetIQ\AppManager` on the managed computer and the management server is `Tango`, the path to the trace log is `C:\NetIQ\Temp\NetIQ_debug\Tango\mctrace.log`.

Example

In the **Action_DosCommand** Knowledge Script, this function is used to log the result of the command as follows:

```
...
Sub Main()
   Dim pInfo As PROCESS_INFO
   Dim sInfo As STARTUPINFO
   Dim sNull As String, errmsg$
   Dim success As Boolean, allowed As Boolean
   Dim ret&

   ...
   success = CreateProcess (sNull, DOScmd, 0&, 0&, _
        0&, NORMAL_PRIORITY_CLASS, _
        0&, sNull, sInfo, pInfo)

   QTrace "CreateProcess <" & DOScmd & "> return " & success
   ...
End Sub
```

WaitForObject

Requests the AppManager agent to check the input object handle status on the behalf of current script.

Syntax

```
WaitForObject hobj, intv [, noabort]
```

Parameters and settings

Parameter	Data type	Description
`hobj`	Long	Input object handle to be waited on
`intv`	Long	Sleep interval in msec
`noabort`	Bool	Optional. Request MC not to abort sleep in any condition. Default is `False`

Return value

Long. 1=object signalled, 0=timer expired, -1=wait aborted.

Remarks

Set `noabort` if you do not want the wait to be interrupted by a user stop job request.

Example

Here is an example taken from the **Async_FilesChanged** Knowledge Script:

```
Sub Main()
   ...
   Set gObjNtFiles = CreateObject("NetIQAgent.NtFiles")
   ...
   hEvent = gobjNtFiles.GetEvent()

   ret = NQEXT.WaitForObject(hEvent, 0)
   If ret <> 1 Then
      If ret = 0 Then
         ' timeout
        NQEXT.AbortScript gsResName, "WaitForObject timeout"
         Exit Sub
      ElseIf ret = -1 Then
         ' job stop
         Exit Sub
      Else
        NQEXT.AbortScript gsResName, "WaitForObject error: _
                          " & CStr(ret)
         Exit Sub
      End If
   End If
   ...
End Sub
```

Chapter 12

AppManager Callbacks for Perl

This chapter describes the calls made to the AppManager agent from Knowledge Scripts written in Perl. A call can be a function that returns a result, or a subroutine that does not return a result.

These Perl Callbacks are defined in the Perl module `NetIQ::Nqext`. The module must be loaded before any Callbacks are made. To load the module, include this statement:

```
use NetIQ::Nqext;
```

The following Callbacks are described:

- GetMSFqdn( )
- GetQdbId( )
- GetScriptInterval( )
- GetSecurityContext( )
- GetSecurityContextEx( )
- GetTempFileName( )
- GetTreeViewName( )
- GetVersion( )
- ImportData( )
- ImportHugeData_pl( )
- IterationCount( )
- WriteLog( )
- Uname( )

AbortScript( )

Instructs the AppManager agent to abort execution of the Knowledge Script.

It is recommended not to use this API. Instead, it is advised to use Createevent and Exit call.

Syntax

```
NetIQ::Nqext::AbortScript ([objlist, abortmsg, sev
[,raise_err]])
```

Parameters

Parameter	Data type	Description
`objlist`	String	Object name. This parameter uses the syntax: *`<objtypename> = <objname>`* For example, `UNIX_CPUObj = 0`.
`abortmsg`	String	Event detail message indicating execution of the script was aborted.
`sev`	Long	Abort event severity. Currently, this sev passed is ignored. See note under Remarks.
`raise_err`	Long	Optional. Default is 1. Defines job status as Error (1) or Stopped (0).

Return value

None.

Remarks

When used without arguments, the AppManager agent aborts the script without raising an event.

If you specify any one of the parameters `objlist`, `abortmsg`, or `severity`, the agent will send an event to the AppManager management server.

Note Currently, there is an AppManager client resource monitor registry setting ("Admin\AdminEvtSev") that overrides any value that you assign to sev. "Admin\AdminEvtSev" is normally set to 40, and the abort event severity will therefore be 40, no matter what value you give to sev.

If "Admin\AdminEvtSev" value is changed in the registry and the value is set in the range 1-40, then the abort event severity will have the same severity number set in the registry.

If "Admin\AdminEvtSev" value is set to severity other than the range 1-40, then the abort event severity will be 40 by default.

Use `raise_err` to define the job status as Error (when set to 1) or Stopped (when set to 0).

Example

```
use NetIQ::Nqext;
# if the file doesn't exist, then exit the script and stop
# the job
if (!(-e "$File_path")) {
NetIQ::Nqext::AbortScript ($objlist, _
         "Cannot open $File_path -- file does not exist.");
die;
}
```

AbortScriptEx( )

Its functionality is same as AbortScript, but AbortScriptEx requires two more input parameters for KB.

Syntax

```
AbortScriptEx [eventuid] [agentmsgxml] [objlist],
[abortmsg], [sev], [raise_err]
```

Parameters

Parameter	Data type	Description
`eventuid`	String	UID for KB
`agentmsgxml`	String	Agent message in XML format

CounterValue( )

Requests the AppManager agent to retrieve the counter value for the specified object, counter, and instance.

Syntax

```
NetIQ::Nqext::CounterValue (object, counter, instance)
```

Parameters

Parameter	Data type	Description
`object`	String	Name of the object.
`counter`	String	Name of the counter.
`instance`	String	Name of the instance.

Return value

Double. Returns the counter value for the specified object, counter, and instance. If the counter does not exist or there was an error retrieving the counter value, then -1 is returned.

Example

```
use NetIQ::Nqext;
...
$value = NetIQ::Nqext::CounterValue ("UX Processor",
                                     "%User Time", "");
if ($value = -1) {
# Raise some kind of error event about not able to find the
# counter value
...
}
else if ($value > $threshold) {
# Raise an event about % user time is too high
...
}
```

CreateData( )

Requests the AppManager agent to create a data point or a data source.

Syntax

```
NetIQ::Nqext::CreateData (streamId, legend, dynaleg,
objlist, val, agentmsg, msgtype [,schema] [,loglimit]
[,lowWM] [,hiWM] [,deletefile])
```

Parameters

Parameter	Data type	Description
`streamId`	String	The data stream ID. For each unique stream ID in a script, it will generate a Data Source in the AppManager database. Subsequent calls to nqext_CreateData using the same stream ID will insert data points to the same Data Source. The string length limit is 64 characters.
`legend`	String	The data stream legend. This value will show up under the Legend column and in the graphs.
`dynaleg`	String	The data stream dynamic legend. Contains the dynamic information that can be used for reporting. If a portion of your legend changes often, then pass that text into this parameter. Otherwise leave it blank.
`objlist`	String	Corresponding object name where the data is collected on. This value is used for graphing and reporting. Format of the value passed in should be "ObjectTypeName = ObjectValue", e.g. "NT_DiskObject = D:\". The ObjectValue can normally be obtained by the drop object variable, e.g. NT_MachineFolder.
`val`	Double	The data point value.
`agentmsg`	String	Either the data detail or a file name that contains the data detail. The data detail is basically an annotation of each data point, giving more information about the data point since the data point is just a numeric value. For example, the data point value may be 5 for the number of processes running, while the data detail may list the processes that are running. The detailed message is displayed in the Graph Data Detail dialog box for each data point. If this parameter contains the name of a file, make sure you set the msgtype parameter to 1.
`msgtype`	Long	Flag specifying whether the value passed in the `agentmsg` is a file name or the detailed message itself. If it is a file name, then the contents of the file are passed in as the detailed message. Set to 0 to specify that the value in the agentmsg parameter is the detailed message. Set to 1 to specify that the value is the file name containing the detailed message.
`schema`	String	Optional. XML schema for dynamic table creation in RDB. Default is an empty string.

Parameter	Data type	Description
`loglimit`	Long	Optional. The number of days to keep this data point in the database. Default -1, keep forever. The data points can be removed from the database by other means.
`lowWM`	Double	Optional. Low watermark. Default -1.0.
`hiWM`	Double	Optional. High watermark. Default -1.0.
`deletefile`	Long	Optional. Flag to tell the AppManager agent to delete the event detail message file after it is done reading the contents and passing the event to the MSU. This parameter is ignored if msgtype != 1. Set to 1, which is default, to delete the file when msgtype = 1. Set to 0 to not delete the file. Be careful when setting this value to 0, especially if your script generates a message file each time it wants to send an event because the files will never be removed.

Return value

None.

Example

```
use NetIQ::Nqext;
...
$cpu_usage0 = nqGetCpuUsage (0);
$cpu_usage1 = nqGetCpuUsage (1);
...
# Create a data stream for cpu 0
NetIQ::Nqext::CreateData ("CPU_0", "% CPU Usage", "CPU 0",
"UNIX_CPUObject = 0", cpu_usage, "CPU usage = $cpu_usage",0);

# Create a data stream for cpu 1
NetIQ::Nqext::CreateData ("CPU_1", "% CPU Usage", "CPU 1",
"UNIX_CPUObject = 1", cpu_usage, "CPU usage = $cpu_usage",0);
...
```

CreateDataEx( )

Request the agent to create a data point or a data source. It is a new callback for agent 6.0 and above. All parameters are same as CreateData except datauid and agentmsgxml.

Syntax

```
CreateDataEx datauid, agentmsgxml, streamId, legend,
dynaleg, objlist, val, agentmsg, msgtype, [schema,]
[loglimit,] lowWM,]  [hiWM,] [deletefile]
```

Parameters

Parameter	Data type	Description
datauid	String	UID for KB
agentmsgxml	String	Agent message in XML format

CreateEvent( )

Requests the AppManager agent to raise an event.

Syntax

```
NetIQ::Nqext::CreateEvent(sev, evtmsg, akp, obj, val,
agentmsg, evtsrc, evtid, msgtype [, deletefile])
```

Parameters

Parameter	Data type	Description
`sev`	Long	The event severity. A value from 1 to 40.
`evtmsg`	String	The message to be displayed under the Message column in the Events tab.
`akp`	String	Name of the action script to launch as a response to this event. You would normally create an AKPID parameter as part of your script. When the job is dropped and you select an action, the UI will fill in the AKPID variable with the action name. You will just need to pass in the AKPID variable to the script.
`obj`	String	Corresponding object name where the event is raised. This value will determine which object in the **TreeView** pane to blink. Format of the value passed in should be "`ObjectTypeName = ObjectValue`", e.g. "`UNIX_DiskObject = /mnt/cdrom`". The `ObjectValue` can normally be obtained by the drop object variable, e.g. `UNIX_MachineFolder`.
`val`	Double	The current value to raise the event. This parameter is currently not used. Set to 0.0.
`agentmsg`	String	Either the detail message or a file name that contains the detail message. The detailed message is displayed in the Message tab of the Event Property dialog box. If this parameter contains the name of a file, make sure you set the msgtype parameter to 1.
`evtsrc`	String	Reserved for future use. Set to “”.
`evtid`	Long	Reserved for future use. Set to 0.

Parameter	Data type	Description
`msgtype`	Long	Flag specifying whether the value passed in the agentmsg parameter is a file name or the detailed message itself. If it is a file name, then the contents of the file are read and passed in as the detailed message. Set to 0 to specify that the value in the agentmsg parameter is the detailed message. Set to 1 to specify that the value is the file name containing the detailed message.
`deletefile`	Long	Optional. Flag to tell the AppManager agent to delete the event detail message file after it is done reading the contents and passing the event to the MSU. This flag is ignored if msgtype != 1. Set to 1, which is default, to delete the file when msgtype = 1. Set to 0 to not delete the file. Be careful when setting this value to 0, especially if your script generates a message file each time it sends an event because the files will never be removed.

Return value

None.

Remarks

If called by a script running on a 1.0 agent, the agent simply raises the event to the MSU. If called by a script running on a 2.0 agent, the agent will apply an additional rule process to determine whether to send a new event or duplicated (collapsed) event to the AppManager management server.

Example

```
use NetIQ::Nqext;
use NetIQ::Oracle;
...
$sp = NetIQ::Oracle::GetLogSpace (...);
...
# Create an event with severity 5 and message "Log space ..."
NetIQ::Nqext::CreateEvent (5, "Log space dangerously low",
               $akpid, "UNIX_MachineFolder = MyServer", 0,
             Log space is $sp", "NetIQ :: Oracle", 1000, 0);
...
```

CreateEventEx( )

Request the agent to raise an event. It is new callback for the agent 6.0 and above. All parameters are same as CreateEvent except datauid and agentmsgxml

Syntax

```
CreateEventEx eventuid, agentmsgxml, sev, evtmsg, akp, obj,
val, agentmsg, evtsrc, evtid, msgtype, [deletefile],
[eventType]
```

Parameters

Parameter	Data type	Description
`eventuid`	String	UID for KB
`agentmsgxml`	String	Agent message in XML format

ExecCmd( )

The Perl language allows invocation of external commands by using back quotes (` `) to substitute the output of the enclosed command. The AppManager UNIX agent does not support this.

`ExecCmd` instructs the agent to execute an external command on behalf of the Knowledge Script.

Syntax

```
NetIQ::Nqext::ExecCmd (cmd [, flag])
```

Parameters

Parameter	Data type	Description
`cmd`	String	The non-interactive command.
`flag`	Long	Optional. 0: the Callback returns the stdout. 1: the Callback returns the temporary file name containing the stdout. 2: the Callback returns the stdout along with the stderr.3: the Callback returns the temporary file name containing both the stdout and stderr.Default is 0

Return value

String. Depending on the flag passed in, this Callback will either return the `stdout` and/or `stderr` results or a filename containing the `stdout`/ `stderr` results from executing the external command.

Remarks

If `flag ==` 1 or 3, then the Knowledge Script must remove the temporary file after it is used.

Example

A Perl script statement invoking an external command should be changed from

```
$a = `cmd`;
```

to

```
$a = NetIQ::Nqext::ExecCmd("cmd");
A Perl script statement that reads from a pipe should be
changed from
open (F, "cmd |");
...
close F;
to
$f = NetIQ::Nqext::ExecCmd("cmd", 1);
open (F, $f);
...
close F:
unlink $f;
```

ExportData( )

Requests the AppManager agent to save the specified string-based scalar script variable along with the value in memory for referencing in subsequent job iterations. If the variable already exists, the value is updated.

Syntax

```
NetIQ::Nqext::ExportData (name, val)
```

Parameters

Parameter	Data type	Description
`name`	String	Variable name for storing `val`.
`val`	String	Script variable value.

Return value

None.

Remarks

Note that `ExportData` can only work with string scalar variables. For any numeric scalar variables, you will need to convert it into a string before calling `ExportData` to store it. For array and hash variables, use `ExportHugeData_pl`.

Scripts can use the `ImportData` Callback to retrieve the stored value, so that you can define a global variable at the AppManager agent scope, and update and retrieve its value.

Note If either the agent or the job is stopped and restarted, exported data may not persist.

Example

```
use NetIQ::Nqext;
...
```

```
our $Persist_Var3;  # not recommended
...
my $var1 = 5;
my $var2 = "6";
...
sub save_data {
   my $tmp = "$var1";
   NetIQ::Nqext::ExportData ("var1", $tmp);
   NetIQ::Nqext::ExportData ("var2", $var2);
}

sub load_data {
   $var1 = NetIQ::Nqext::ImportData ("var1");
   $var2 = NetIQ::Nqext::ImportData ("var2");
}
...
# import the data at the start of the script
load_data ();

# $var1 increments by 1 every iteration while $var2
# increments by 2.
$var1 += 1;
$var2 += 2;
$Persist_Var3 = $Persist_Var3 + $var1 + $var2;

save_data();
...
```

ExportData_pl( )

Request the agent to save the name of the specified string-based scalar script variable along with the value in memory for referencing in subsequent job iterations. If the variable already exists, this call will simply update the value. Scripts can use the ImportData_pl callback to retrieve the stored value.

Syntax

```
ExportData_pl (name, val)
```

Parameters

Parameter	Data type	Description
`name`	String	Variable name to store the value under.
`value_ref`	Reference to Scalar, Hash or Array	Reference to perl data.

Note that the variables persisted can only be accessed by the same job. For example, if you run two jobs with the same script, the script will not be able to access the value of the other one.

Also note that only ExportHugeData_pl saves the values to a file. If the agent is restarted, values saved via ExportData or ExportData_pl will be lost since they are only stored in memory.

It is actually possible to persist Perl variable values across job iterations by declaring the variable with the `our` keyword in the global script scope. However, this method of persisting variables across iteration may not be supported in future releases of the UNIX agent, so it is strongly recommended that scripts call Export*Data* and Import*Data* to persist the variables across job iteration.

Example:

```
use NetIQ::Nqext;
our %P_history;
…
ExportData_pl('P_history', \%P_history);
```

ExportHugeData_pl( )

Instructs the AppManager agent to export a scalar, array, or hash variable associated with the label name.

Syntax

```
NetIQ::Nqext::ExportHugeData_pl (name, val_ref)
```

Parameters

Parameter	Data type	Description
`name`	String	The label for this variable. You should use the variable name without the `$`, `@`, or `%` prefix.
`val_ref`	Reference to a variable	The reference to the variable that must be persistent. In Perl, the reference to variable `$v` is specified as `\$v`.

Return value

None.

Remarks

This Callback is based on the Perl `Storable` module, which can import huge variables. Unlike `ImportData` and `ExportData`, which store the values in memory, `ImportHugeData_pl` and `ExportHugeData_pl` store values on disk, and are therefore slower.

Example

```
use NetIQ::Nqext;
our %P_history;
...
ExportHugeData_pl('P_history', \%P_history);
```

GetAgentOwner( )

Request the user account the agent is running under.

Syntax

```
String GetAgentOwner()
```

Return Value

Returns the UNIX account name that owns the agent process. This is typically used when the KS behaves differently when run by "root" instead of an ordinary user. If an error occurs, it returns NULL, which is interpreted by Perl as an empty string "".

Example:

```
Use NetIQ::Nqext
…
my $agentOwner;
my $swapoutput;
if ($agentVersion >= 6) {
    $agentOwner = NetIQ::Nqext::GetAgentOwner();
    if ($agentOwner eq "") {
       NetIQ::Nqext::AbortScript $resmsg,
"AgentCallbackNqext::GetAgentOwner()failed",
$Sev_fail;
    }
}

if (($agentOwner == 0) || ($agentVersion < 6)) {
   $swapoutput = NetIQ::Nqext::ExecCmd("/usr/sbin/
swapinfo");
} else {
   $swapoutput = NetIQ::Nqext::ExecCmd(
   "$ENV{'NQMAGT_HOME'}/bin/sudo /usr/sbin/swapinfo");
}
…
```

GetDataFileName( )

Requests the name of the file that is used by ExportHugeData_pl and ImportHugeData_pl.

Syntax

```
String GetDataFileName()
```

Return Value

Returns the name of the file that is used by ImportHugeData_pl.

Example:

```
Use NetIQ::Nqext
…
my $dataFileName;
…
$dataFileName = NetIQ::Nqext::GetDataFileName ();
…
```

GetJobID( )

Queries the AppManager agent for the AppManager repository job ID that the calling script is running under.

Syntax

```
NetIQ::Nqext::GetJobID()
```

Parameters

None.

Return value

Long. Returns the AppManager repository job ID of the calling script.

Example

```
use NetIQ::Nqext;
...
my $jobid;
...
$jobid = NetIQ::Nqext::GetJobID ();
...
```

GetMachName( )

Queries the AppManager agent for the agent's computer name.

Syntax

```
NetIQ::Nqext::GetMachName()
```

Return value

String. The agent machine name.

Example

```
use NetIQ::Nqext;
...
my $machine_name;
...
$machine_name = NetIQ::Nqext::GetMachName ();
...
```

GetMSFqdn( )

Request the agent to return the fully qualified domain name of the MS that the job came from.

Syntax

```
String GetMSFqdn ()
```

Return Value

Returns the fully qualified domain name of the MS that submitted the job to the agent.

Example

```
Use NetIQ::Nqext
…
$myms = NetIQ::Nqext::GetMSFqdn ();
…
```

GetQdbId( )

Request the agent to return the UUID of the QDB that created the job running the script. This callback is only available in version 2.0 of the Unix agent.

Syntax

```
String GetQdbId ()
```

Return Value

Returns the UUID of the QDB, e.g. e50394dd-75bd-4762-92e5-62bdc874d971

Example

```
Use NetIQ::Nqext
…
$qdbid = NetIQ::Nqext::GetQdbId ();
…
```

GetScriptInterval( )

Queries the AppManager agent for the current job interval.

Syntax

```
NetIQ::Nqext::GetScriptInterval()
```

Parameters

None.

Return value

Long. Returns the number of seconds between job iterations.

Example

```
use NetIQ::Nqext;
...
my $intv;
...
$intv = NetIQ::Nqext::GetScriptInterval ();
...
```

GetSecurityContext( )

Request the agent to return the security contexts for the given label and sub-label pair. This callback is only available in version 2.0 (or later) of the Unix agent.

Syntax

```
Array GetSecurityContext (label, sublabel)
```

Parameters

Parameter	Data type	Description
`Label`	String	The name of the label for the security context.
`Sublabel`	String	The name of the sub-label for the security context.

Security contexts are sensitive data that scripts may need to access to be able to retrieve certain data or perform certain actions. For example, an Oracle Knowledge Script may need to log onto the Oracle server to be able to determine the available free space in an Oracle database. To log onto the Oracle server, the script will need a valid Oracle user name and password. This information can be stored as a security context instead of passing in the sensitive information as a parameter. The security contexts are normally encrypted and encoded. When scripts call the GetSecurityContext callback, the return values are normally encrypted and encoded. Scripts generally should never decode and decrypt the security context. They normally should pass this context into their MO and allow the MO to process the security context. Security contexts are keyed by a label and sub-label. They are entered via the Security Manager in AM 5.0 or during the installation of the managed component. The return value should be freed with an assignment of the return values to an empty array, e.g. `@values = {};`.

Return Value

Returns an array of 3 values, each of which is limited to 512 bytes. The values returned are not all necessarily valid depending on what was entered.

Example

```
Use NetIQ::Nqext

Use NetIQ::Oracle

…
$values = @ {NetIQ::Nqext::GetSecurityContext (“Oracle”,
“DB1”)};


$user = $values[0];

$pwd = $values[1];


@values = ();

NetIQ::Oracle::Logon (“DB1”, $user, $pwd);
    …
```

GetSecurityContextEx( )

Request the agent to return the security contexts for the given label and sub-label pair. This callback is only available in version 2.0 (or later) of the Unix agent.This version differs from `GetSecurityContext`( ) in that it can hold arbitrarily large values in the return array.

Syntax

```
Array GetSecurityContextEx (label, sublabel)
```

Parameters

Parameter	Data type	Description
`Label`	String	The name of the label for the security context.
`Sublabel`	String	The name of the sub-label for the security context.

GetTempFileName( )

Instructs the AppManager agent to construct a temporary file name based on input criteria. The file name is concatenated from the `path` and `prefix` strings, and a hex string based on `uniqid`.

Syntax

```
NeqIQ::Nqext::GetTempFileName (path, prefix, uniqid)
```

Parameters

Parameter	Data type	Description
`path`	String	Path for created temp file.
`prefix`	String	File name prefix string.
`uniqid`	Long	A unique ID.

Return value

String. Returns the full path of the temporary file that was created.

Remarks

The file that is created is guaranteed to be a unique file. Therefore, scripts that call `GetTempFileName` should delete the file after it is used.

Example

```
use NetIQ::Nqext;
...
$fname = NetIQ::Nqext::GetTempFileName ();
$cmd = "ps -ef | grep nqmagt > $fname";
$stdout_result = ExecCmd ($cmd);
If (-s "fname") {
   open(RESULT_FILE, $fname);
   ...
   close(RESULT_FILE);
   unlink($fname);
}
...
```

GetTreeViewName( )

Request the name for this host presented in the Operator Console, if available.[1]

Syntax

```
String GetTreeViewName ()
```

Return Value

Returns the "tree view" name of the agent's host in the Application Manager Operator Console. If the name is unavailable, NULL is returned instead, which is interpreted as "" by Perl.

Example

```
Use NetIQ::Nqext
…
my $treeViewName = NetIQ::Nqext::GetTreeViewName ();
…
```

1. There is no example of use in the UnixAgent KS's, but it appears to be of use to MO writers.

GetVersion( )

Request the agent to return the version number of the agent. This callback is only available in version 2.0 of the Unix agent.

Syntax

```
String GetVersion ()
```

Return Value

Returns the version number of the agent currently running the script. The format of the version number will be “2.0”, “2.1”, etc.

Example

```
Use NetIQ::Nqext
…
$ver = NetIQ::Nqext::GetVersion ();
if ($ver > “2.0”)
{
# do something
…
}
…
```

ImportData( )

Requests the AppManager agent to retrieve the value stored under the specified variable name by an `ExportData` call.

Along with ExportData, Knowledge Script writers can define a global variable at the agent scope, update and retrieve its value.

Syntax

```
NetIQ::Nqext::ImportData (name)
```

Parameters

Parameter	Data type	Description
`name`	String	Script variable name.

Return value

String.

Remarks

`ExportData` can only work with string scalar variables. Numeric scalar variables must be converted to a string before calling `ExportData`. However, when you import the variables into the script using `ImportData`, you do not need to do any conversion from string to a numeric value because Perl will handle that for you.

For array and hash variables, use `ExportHugeData_pl` and `ImportHugeData_pl`.

Note If either the AppManager agent or the job is stopped and restarted, exported data may not persist.

Example

```
use NetIQ:Nqext;
...
our $Persist_Var3; # not recommended
...
my $var1 = 5;
my $var2 = "6";
...
sub save_data {
   my $tmp = "$var1";
   NetIQ::Nqext::ExportData ("var1", $tmp);
   NetIQ::Nqext::ExportData ("var2", $var2);
}

sub load_data {
   $var1 = NetIQ::Nqext::ImportData ("var1");
   $var2 = NetIQ::Nqext::ImportData ("var2");
}
...
# import the data at the start of the script
load_data ();

# $var1 increments by 1 every iteration while $var2
# increments by 2.
$var1 += 1;
$var2 += 2;
$Persist_Var3 = $Persist_Var3 + $var1 + $var2;

save_data ();
...
```

ImportHugeData_pl( )

Instructs the AppManager agent to import a scalar, array, or hash variable associated with the label name.

Syntax

```
NetIQ::Nqext::ImportHugeData_pl (name)
```

Parameters

Parameter	Data type	Description
name	String	The label for this variable. You should use the variable name without the `$`, `@`, or `%` prefix.

Return value

Reference. Returns a Reference to the imported variable.

Remarks

This Callback is based on the Perl `Storable` module which can import huge variables. Unlike `ImportData` and `ExportData`, which store values in memory, `ImportHugeData_pl` and `ExportHugeData_pl` store values on disk, and are therefore slower.

Example

To import a hash:

```
...
%P_file = %{ NetIQ::Nqext::ImportHugeData_pl('P_file') };
...
```

IterationCount( )

Queries the AppManager agent for the current job iteration value.

Syntax

```
NetIQ::Nqext::IterationCount()
```

Parameters

None.

Return value

Long. The number of iterations the job has run since it was started, including the current job.

Example

```
use NetIQ::Nqext;
...
if (NetIQ::Nqext::IterationCount () == 1) {
   InitializeMyObject ();
}
...
```

WriteLog( )

Request the agent to log a debug message into the `nqmlog` debug message file.

Syntax

```
NetIQ::Nqext::WriteLog (severity, funcname, message)
```

Parameters

Parameter	Data type	Description
`severity`	Long	A value from 1 to 4. 1 being the most severe which will always log into the log file and 4 being the least severe. Whether the message will be logged into the file or not depends on the debug log level in the Unix agent configuration file.
`funcname`	String	Name of the function or script that is logging the debug message.
`message`	String	The debug message.

Return value

None

Remarks

The debug message is stored in the `nqmlog` message file, which is shared with the Unix agent proper as well as any other scripts that call this callback. Therefore, try to log only the most critical errors that may help you debug your problems, or do not log anything at all from the script.

Example

```
Use NetIQ::Nqext
…
$ret_code = DoSomething ();
if ($value != 0)
{
# some thing is wrong
NetIQ::Nqext::WriteLog (1, "MyScript", "Call to DoSomething
returned code %ret_code");
# Handle error
…
}
…
```

Uname( )

Request the agent for operating system information.

Syntax

```
Int  Uname(sysname, nodename, release, version, machine)
```

Parameters

Parameter	Data type	Description
sysname	String	Name of the operating system
nodename	String	Name of this node
release	String	Current release of operating system
version	String	Current version of this release
machine	String	Name of hardware type

Return Value

Returns the status of the call: 0 – ok, -1 – error. If 0 is returned, all of the arguments will contain their described values.

Example

```
   Use NetIQ::Nqext

our ($ret, $sysname, $nodename, $release, $version,
$machine);

$ret = NetIQ::Nqext::Uname ($sysname, $nodename, $release,
$version, $machine);
```

Chapter 13

Testing and debugging

This chapter describes how to open the debuggers for Knowledge Scripts. The following topics are covered:

- Debugging Knowledge Scripts
- Where to debug scripts
- The prepend and append files
- Setting debuggers for VBScript and BasicScript
- Debugging Summit BasicScript scripts
- Debugging VBScript scripts
- Debugging Perl scripts

Debugging Knowledge Scripts

The emphasis in this book is on modifying existing Knowledge Scripts. This means that the changes you make to your scripts will be easily isolated in the event that the scripts do not run properly. Under such circumstances, you are unlikely to need to do difficult debugging.

In the event that you do need to debug your scripts with a debugging program, tools are provided to help you do this. Prior to debugging, you should check the script's syntax:

- You can check the syntax of scripts written in VBScript or Perl in the Developer's Console. Choose the **VBScript Syntax Check** or **Perl Syntax Check** commands on the **Tools** menu.
- You can check the syntax of scripts written in Summit BasicScript in the Knowledge Script Editor. Choose the **Syntax Check** command on the **Run** menu.

Where to debug scripts

Summit BasicScript Knowledge Scripts must be debugged on the computer where the Knowledge Script Editor is installed. This is probably the same computer that hosts the Developer's Console. An AppManager agent must be installed on this computer, so that the managed object methods needed by the scripts are installed and registered. The Knowledge Script Editor includes a debugging program, but only for Summit BasicScript.

VBScript Knowledge Scripts must also be debugged on a computer with an AppManager agent installed, so that the managed object methods are available. You will also need to install a Microsoft Windows Script Host on this system—this can be run in debug mode (with parameter `= //D`) and you can download it from:

```
http://microsoft.com/scripting.
```

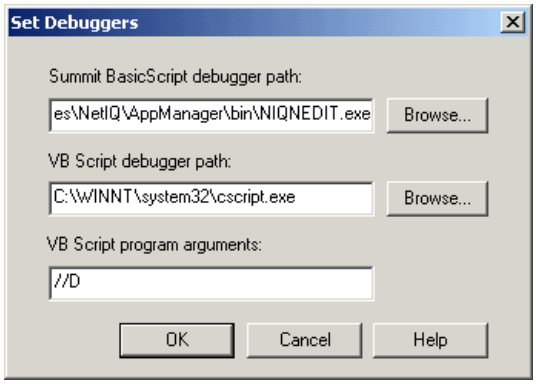
Perl scripts must be debugged on a computer that has the Perl interpreter installed. This can be a Windows machine. If you are debugging a script that calls methods from NetIQ Perl modules (most Perl scripts do not require NetIQ modules), they must be available—in this case, you will need to debug the Perl script on a UNIX host that has the AppManager UNIX agent installed and any Perl modules that the script may be calling.

For maximum convenience, you should install the Perl interpreter on the computer that hosts both the AppManager Operator Console and the Developer's Console. Then you can debug most Perl scripts on the same system where you develop them.

Setting debuggers for VBScript and BasicScript

If you set the appropriate debuggers for Summit BasicScript and VBScript in the Developer's Console, you will be able to launch them automatically. To set them (you must obtain and install the Windows Script Debugger first), choose **Set Debuggers...** in the **Tools** menu

of the Developer's Console. This will open the **Set Debuggers** dialog box:



If you have used the default installations, the paths to the debuggers will be:

Scripting Language	Debugger	Default Path to Debugger
Summit BasicScript	NetIQ Knowledge Script Editor	`C:\Program Files\NetIQ\AppManager\bin\niqnedit.exe`
VBScript	Microsoft Script Host	`C:\WINNT\system32\cscript.exe` **NOTE** To use this Script Host in debug mode, it must be launched with either the `//D` or `//X` parameter.

The Microsoft Windows Script Host requires a command line argument, either `//D` or `//X`, to run in debug mode. You must enter one of these arguments in the third field of the **Set Debugger**s dialog box. If you use the //D parameter, the debugger will only open if an error occurs. Using the //X parameter starts the debugger and puts a breakpoint on the first executable line of script code.

The prepend and append files

Prepend files

Knowledge Scripts can call two different types of methods that are not defined in the script: managed object methods and Callback functions. If you are debugging your script on a computer with the appropriate managed objects installed, you can debug without worrying about them. Note that the managed objects can be registered on a computer where an AppManager agent is not present.

Callback functions are available only in the AppManager agent running the script. When you are debugging, your script will be run by the debugger program, not by the agent. Therefore, the script you are debugging will not be able to access the Callback functions. Execution will stop when the debugger reaches a function it cannot call.

Three *prepend* files, one for each scripting language, contain simplified versions of the standard Callback functions. When these files are added to the beginning of your script, the script can call the simplified Callback functions in lieu of the real Callback functions, and therefore run in the debugger. The simplified Callback functions "return" a message box saying that the function was called successfully (or print to `stdout` in Perl scripts)

For example the Summit BasicScript prepend file (`PrependFile.ebs`) contains a subroutine definition for every Callback. Here is the code for MSActions:

```
Sub MSActions( sevlevel As Long, shortmsg As String, _
               AKPName As String, objlist As String, _
               agtmsg As String)
   If OutputMode = WINDOW_MODE Then
      MsgBox "Call back function MSActions with parameters:_
             " & Chr(13) & Chr(10) & "Severity: " & _
             sevlevel & Chr(13) & Chr(10) & _
             "shortmsg: " & shortmsg & Chr(13) & Chr(10) & _
             "AKPName: " & AKPName & Chr(13) & Chr(10) & _
             "objlist: " & objlist & Chr(13) & Chr(10) & _
             "agtmsg: " & agtmsg
```

```
   ElseIf OutputMode = FILE_MODE Then
      Print #1, "Call back function MSActions with _
                 parameters: "
      Print #1, "    Severity: " & sevlevel
      Print #1, "    shortmsg: " & shortmsg
      Print #1, "    AKPName: " & AKPName
      Print #1, "    objlist: " & objlist
      Print #1, "    agtmsg: " & agtmsg
   End If
End Sub
```

Append files

VBScript is the default (and only script type) that can be newly created using the Developer Console. When you open the Developer Console, an empty `Main` subroutine is created as would be needed for a VBScript Knowledge Script. However, if you simply add content and then press F5 to initiate debug, the `Main` subroutine will never be called.

To correct this problem, pressing F5 will add the contents of an append file (`AppendFile.vbs`) at the end of the code to call `Main`. `AppendFile.vbs` might, for example, contain code like this:

```
' Execute main until the maximum iteration count is reached
Do While ((NQEXT.m_IterationCount <=
NQEXT.ScheduleXNumberOfTimes) Or _
          (NQEXT.ScheduleXNumberOfTimes < 0))
Main

If ((NQEXT.m_IterationCount >= NQEXT.ScheduleXNumberOfTimes)
And _
          Not (NQEXT.ScheduleXNumberOfTimes < 0)) Then
Exit Do
End If

NQEXT.NextIteration
Loop
```

Location of files

The AppManager installation program puts the `prepend` and `append` files in the `...\NetIQ\AppManager\bin` directory in your AppManager installation. The files are:

```
PrependFile.ebs
PrependFile.vbs
AppendFile.vbs
PrependFile.pl
```

Debugging Summit BasicScript scripts

If you have set the debugger path correctly, simply press F5 when you want to debug a script written in BasicScript. The contents of the BasicScript prepend file (`PrependFile.ebs`) will be added to the beginning of your code and the composite of the two will be opened in the Knowledge Script Editor debugger.

Caution You cannot save changes you make in the code during debugging. You must check out the script, make the same changes in the Developer Console, and check the script back in.

Debugging VBScript scripts

If you have set the debugger path correctly, simply press F5 when you want to debug a script written in VBScript. The contents of the VBScript prepend file (`PrependFile.vbs`) will be added to the beginning of your code, the contents of of the VBScript append file (`Appendfile.vbs`) will be added to the end of your code, and the composite file will be opened in the Microsoft Script Debugger.

Caution Changes you make in the code during debugging will not be reflected the original script or the script in the repository. You must check out the script, make the same changes in the Developer Console, and check the script back in.

Debugging Perl scripts

There is no automated method for debugging Perl scripts as there is with VBScript and BasicScript.

To debug a Perl script, do this:

1. Create a new file in a text editor. Name it `mergedebug.pl`, for example.
2. Copy the contents of `PrependFile.pl` and paste them into `mergedebug.pl`.
3. Open the Perl script in the Developer's Console and select the **Perl (Read-only)** view.
4. Copy the entirety of the contents in the **Perl (Read-only)** view and paste them into `mergedebug.pl` at the end.
5. Comment out the line "`use NetIQ::Nqext;`" in `mergedebug.pl` and save the file.

Then you can debug your script in any Perl debugger, For example, you can run

```
perl -d mergedebug.pl
```

at the command line to use the Perl interpreter in debug mode.

When you have found the errors, check out the faulty script, make the necessary code modifications using the Developer's Console, and check the script back in.

Chapter 14

Glossary

action A response to an event. For example, an e-mail message may be sent in response to a particular computer or service going down. In AppManager, actions are typically handled by action Knowledge Scripts.

action schedule A schedule for specifying when an action Knowledge Script can run.

AppManager agent A Windows NT service (`NetIQmc` and `NetIQccm`) that runs on a managed computer and receives requests from the management server to run or stop a Knowledge Script job. The agent communicates back to the management server, on an exception-basis, any relevant output from a Knowledge Script. See also *managed client*.

AppManager management server A Windows NT service (NetIQms) that allows AppManager agents on managed clients (servers and workstations) to communicate with the AppManager repository database.

AppManager Operator Console The main user interface that allows you to view, configure, and control the execution of Knowledge Scripts on the systems and applications you manage.

AppManager Operator Web Console A Web interface that allows you to view and manage computer resources from virtually any location using a Web browser. Includes the Report View which allows you to view reports and the Chart Console which allows you to generate and view charts of graph data.

AppManager report agent An optional component installed with the AppManager agent which enables the AppManager agent to run Report Scripts and generate AppManager reports. See also *AppManager agent*.

AppManager reports HTML files that can be read and printed using the Report Viewer available from the Operator Web Console.

AppManager repository An SQL Server database that stores all AppManager data and relevant information about your managed environment. The combination of a repository and a management server constitutes a management site. You can only have one repository for each management server.

AppManager Report Viewer A view available from the Operator Web Console that displays AppManager reports.

corrective action An automated response to an event that corrects the problem found. For example, a corrective action might be to automatically restart a service when the service is detected down. In AppManager, most corrective actions are handled by Action Knowledge Scripts.

data points Numeric information collected by a Knowledge Script during a monitoring period and stored in the AppManager repository.

data stream Series of data points collected by a Knowledge Script over time.

developer An individual who is modifying or creating Knowledge Scripts.

event An alert or notification that some condition or activity you are using AppManager to monitor or keep watch for has occurred on a managed system.

generated script The final script that is generated by AppManager to run as a job.

job An instance of a Knowledge Script running on the AppManager agent that is resident on a managed client (a server or workstation you are monitoring).

Knowledge Script A script (written in VBScript, Summit BasicScript, or Perl) that is encapsulated in an XML file along with other settings, such as parameters for the script, a schedule, and so forth. This script is run on the servers and workstations in your environment to check the health and availability of those systems, collect data for trend analysis, and initiate corrective or responsive actions.

Knowledge Script Group A pre-configured set of Knowledge Script Group members; each member is an instance of a Knowledge Script. A Knowledge Script Group can be used to create a monitoring policy or to start ad hoc jobs.

Knowledge Script Group member An instance of a Knowledge Script which is used to create a monitoring job or a policy-based job.

managed client A server or workstation computer set up to be monitored by AppManager. See also *AppManager agent*.

managed objects COM or OLE objects that are installed on a server or workstation when the AppManager agent is installed on that system.

management service A Windows NT service (`NetIQms`) that runs on a single Windows NT server. This service manages event-driven communication between the AppManager console programs (Operator Console, Operator Web Console, Security Manager, and Distributed Event Console) and the servers and workstations you are monitoring. Once installed, the computer on which the service is running becomes a management server.

monitoring job An instance of a Knowledge Script running on a server or workstation and monitoring particular resources.

monitoring policy Automatically monitors resources on a managed computer as they change using policy-based jobs; a monitoring policy is implemented through one or more Knowledge Script Groups. See also *Knowledge Script Group*.

parameter A variable used when calling a method, function, or subroutine. Not to be confused with a *Script Parameter*.

process An object created when a program is run.

Properties dialog box The dialog box that opens in the AppManager Operator Console when a user drags a Knowledge Script to a target object in the **TreeView** pane.

report scripts Scripts that generate reports based on graph data in the AppManager repository.

repository host The computer where AppManager data is stored.

Script Parameters Variables or constants in Knowledge Script code that can have their values changed by a user. The developer defines these parameters in the *Script Properties dialog box* and a user alters them using the *Properties dialog box*.

Script Properties dialog box The dialog box that opens in the AppManager Developer's Console when a developer chooses **Properties** from the **View** menu.

server group A logical grouping of servers and workstations you manage. A server group is represented by a folder in the **TreeView** pane and can contain individual machines or other server groups.

target computer Refers either to the computer that is itself the target object for a script, or to the computer that *contains* the target object (when the target object itself is a hardware device like a CPU, or a software application or service).

thread An object that executes instructions.

threshold A level, point, condition, or value that, when exceeded, generates an event or notification that the boundary specified has been passed.

user An individual who is using the AppManager Operator Console to run Knowledge Scripts.

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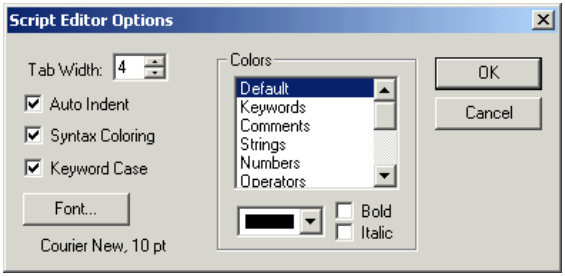
Appendix A

Dialog Boxes

Script Editor Options dialog box

You use the **Script Editor Options** dialog box (choose **View > Options**) to set text display options for the text displayed in the **Edit** and **Read-only** views.

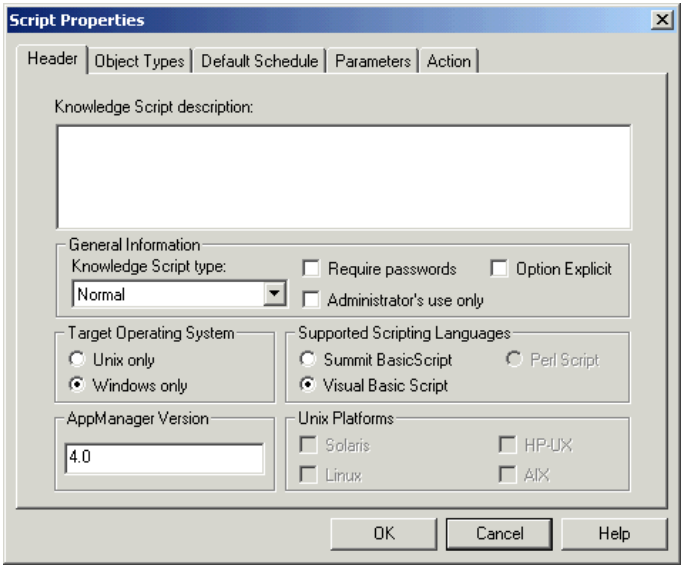


Item	Description
Tab Width	Specify the width for tabs in the Edit and Read-only views. The default tab width is four points.
Auto Indent	If this option is selected, any new line that you insert by pressing Enter is automatically moved to the same indent as the previous line. If this option is not selected, any new lines you enter will begin at the left margin. Auto indent is selected by default.

Item	Description
Syntax Coloring	Select this option to turn on syntax coloring in the Edit view, and VB Script and BasicScript (Read-only) views. This option does not apply to the XML (Read-only) view. If you deselect this option, all text appears in black, and the Keyword Case option becomes inactive. Syntax coloring is selected by default.
Keyword Case	Select this option to capitalize the first letter of keywords displayed in the Edit or Read-only views (for example, with this option selected the keyword “for” appears as “For”). Keyword case is selected by default.
Font	Click this button to display a dialog where you can specify the displayed font, style (such as bold or italic), and size of text displayed in the Edit and Read-only views. The default font is 10 pt. Courier New
Colors Bold Italic	You can use the options in the Colors group box to apply colors and font styles to syntax elements (such as comments, operators, and strings) in the Edit view, and VB Script and Summit Basic (Read-only) views. Syntax coloring is applied by default. To view the current color of an element, select the element in the list. The color of the element is displayed in the drop-down list. If bold or italic style is applied, the appropriate option is selected. To change the color or style of a syntax element, select the element in the list, then select a color from the drop-down list, and the style options that you want to apply to that element. Operators are the only syntax element that appear in boldface type by default.

Header tab, Script Properties dialog box

Use the **Header** tab in the **Script Properties** dialog box (choose **View > Properties > Header**) to enter or modify the Header information for your Knowledge Script.

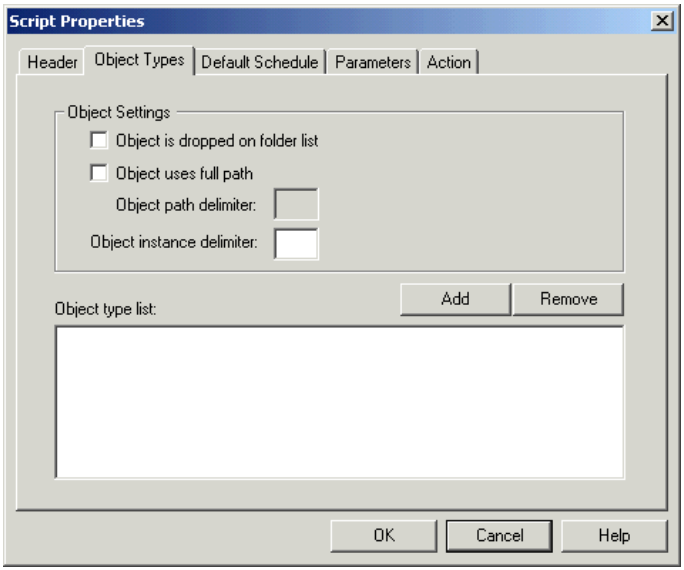


Item	Description
Knowledge Script description	Short description of what this Knowledge Script does. This text is displayed in the Knowledge Script pane when you click **KS > Show Description**.
Knowledge Script type	Type of operation this Knowledge Script performs: • **Normal** indicates the Knowledge Script performs a normal monitoring or reporting task. • **Action** indicates the Knowledge Script performs an action. • **Discovery** indicates the Knowledge Script discovers resources. • **Install** indicates the Knowledge Script performs remote installation.
Require passwords	Indicates whether the Knowledge Script requires secure information, such as a password or login information. Secure information is stored separately from the Knowledge Script in the AppManager repository if you check this option.
Option Explicit	Adds the Option Explicit statement tothe beginning of VBScripts to force variable definition.
Administrator's use only	Indicates whether the Knowledge Script requires the user to be part of the AppManager administrator group.
Target Operating System: Unix only	Selecting this option deletes BasicScript and VB Script implementations of the Knowledge Script. You can then write the programming logic in Perl. You will also have to redefine the properties for the script. The script can then be used by agents on UNIX computers. When you select Unix only, you should be sure to choose the target platforms in the bottom panel.
Target Operating System: Windows only	Selecting this option deletes Perl implementations of the Knowledge Script. You can then write the programming logic in VBScript. You will also have to redefine the properties for the script. The script can then be used by agents on Windows computers.

Item	Description
Supported scripting languages	Indicates the scripting languages supported in the Knowledge Script. For scripts used on Windows computers: • Select Summit BasicScript to write the main script logic using the BasicScript scripting language. • Select Visual Basic Script to write the main script logic using the VBScript scripting language. For scripts used on UNIX computers: • Select Perl Script to write the main script logic using the Perl scripting language.
AppManager Version	Enter the AppManager version for the script. Only decimal numbers and periods are allowed.
Target Platforms	Enabled only when you select Unix as the OS. Check all Unix platforms that the script will run on.

Object Types tab, Script Properties dialog box

Use the **Object Types** tab of the **Script Properties** dialog box (choose **View > Properties > Object Types**) to enter or modify the resource object type information for your Knowledge Script. For new Knowledge Scripts, the object type list is empty until you click **Add** and add the object types you want to use.



Item	Description
Object is dropped on folder list	Indicates whether the object can be dropped on a folder list.

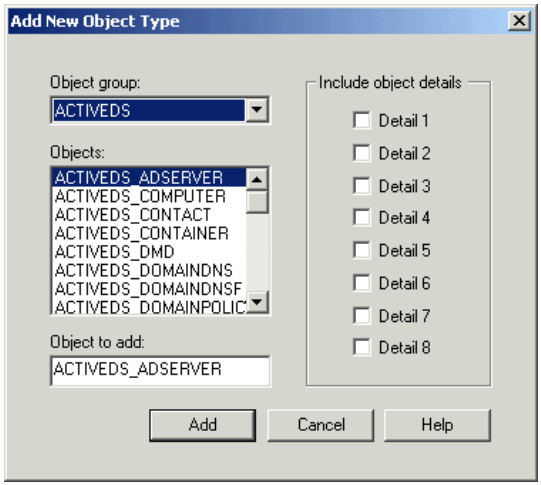
Item	Description

Object uses full path	Indicates whether the object requires a full path to identify a target. For example, if a Knowledge Script is dropped on the "master" database for the SQL Server `TULSA`, the full object name path might look like this:
	`SQL Server:TULSA:Databases:master:10`
	The last part of the path, `10`, represents the object id in the AppManager repository. You can then use the object id to construct the resource name. For example:
	`resname = "SQLT_DatabaseObj = #" & 10`
	In this line, the # sign indicates that the resource is being identified by object id, not by object name. You can then pass this information to MSActions to more efficiently raise an event. For example:
	`MSActions severity, eventmsg, AKPID, resname, detailmsg`

Object path delimiter	Specifies the character used as a delimiter between object paths (if using the full path for an object). For example, if you specify a '\' character as the delimiter: `<computer>\<folder>\0`
Object instance delimiter	Specifies the character used as a delimiter between individual objects in a list. For example, if you select the object type NT_CPUNumber and use a comma as the instance delimiter, if you drop the script on a computer with 2 CPUs (0 and 1) the code generated for the script looks like this: `Const NT_CPUNumber = "0,1"`
Object type list	Lists the object types currently defined for the script.

Add New Object Type dialog box

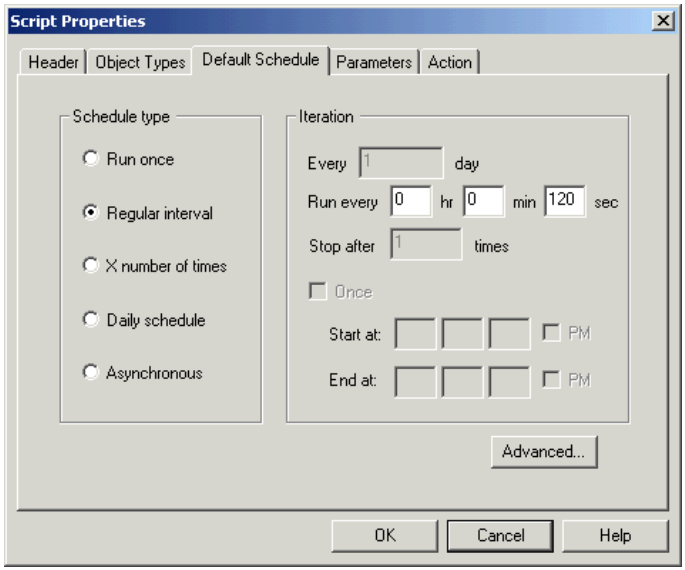
Use the **Add New Object Type** dialog box (choose **View > Properties > Object Types > Add**) to select the object types that are applicable for this Knowledge Script.



Item	Description
Object group	Lists the categories of object types available.
Object types	Lists the object types with the selected group.
Object to add	Displays your current object selection that will be added when you click Add.
Include object details	Allows you to select which, if any, object details are included in the Knowledge Script. The detail information available is specific to each object type and is optional.

Default Schedule tab, Script Properties dialog box

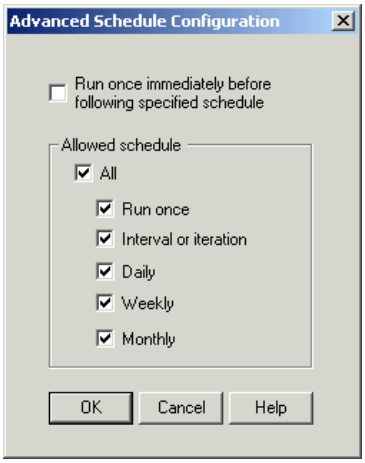
Use the **Default Schedule** tab of the **Script Properties** dialog box (choose **View > Properties > Default Schedule**) to set or modify the default schedule information for your Knowledge Script.



Item	Description
Schedule type	Defines the type of schedule the script should use by default: • Run once • Regular interval • X number of times • Daily schedule • Asynchronous
Iteration	Defines the default interval period, number of iterations, or start and end times.

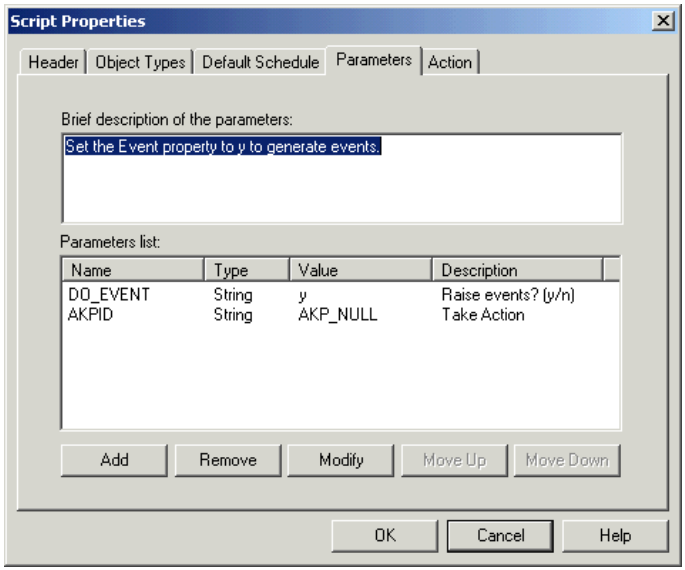
Advanced Schedule Configuration dialog box

Use the **Advanced Schedule Configuration** dialog box (choose **View > Properties > Default Schedule > Advanced**) to configure the schedule choices that are available for this Knowledge Script. If you uncheck an allowed schedule, users will not be able to select the corresponding schedule when setting Knowledge Script properties for this Knowledge Script.



Parameters tab, Script Properties dialog box

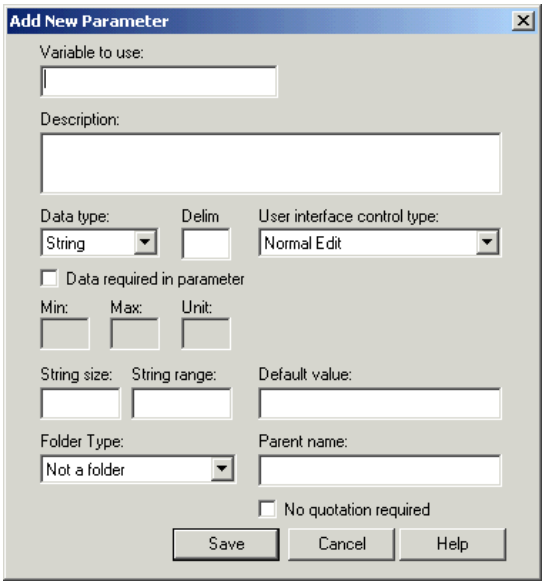
Use the **Parameters** tab of the **Script Properties** dialog box (choose **View > Properties > Parameters**) to enter or modify the parameters and default values for your Knowledge Script.



Item	Description
Brief description of the parameters	Provides the information displayed in the Values tab about what the script does and how to set the parameters.
Parameter list	Lists the variable name, data type and default for the parameters currently defined for the script.

Add/Modify Parameter dialog box

Use the **Add/Modify Parameter** dialog box (choose **View > Properties > Parameters > Add** or **Modify**) to define information for the parameters to be included in the Values tab.

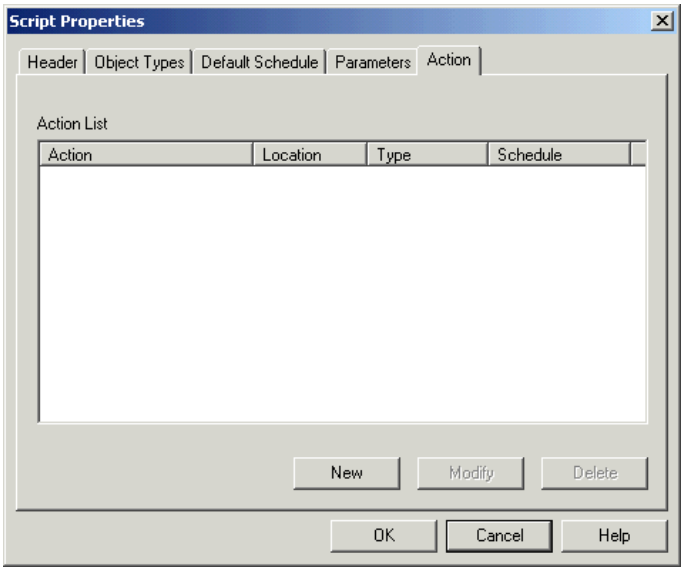


Item	Description
Variable name to use	Defines the variable name you use for a parameter value in the script logic.
Description	Defines the text displayed on the Values tab in the Knowledge Script Properties dialog box for the variable.
Data type	Defines the data type for the value associated with this variable: • String • Integer • Double

Item	Description
Delim	Defines the delimiter for parameters that accept multiple values. If there will not be multiple values, and whitespace is a valid part of the parameter, set this value to comma ","
User Interface control type	Defines the user interface control to display for the parameter.
Min	Defines the minimum valid value for a parameter. This field applies for Integer and Double variables. It is not application for string type variables.
Max	Defines the maximum valid value for a parameter. This field applies for Integer and Double variables. It is not application for string type variables.
Unit	Defines the unit associated with the value for a parameter. For example, you can specify that values represent a percentage, MB, or severity level. This field applies for Integer and Double variables. It is not application for string type variables.
String size	Defines the length of a valid string.
String range	Defines the range of valid values for a string.
Default value	Defines the default value for a variable displayed in the Knowledge Script Properties dialog.
No quotation required	For scripts written in Perl, select this option if the script uses an associative array.

Action Tab, Script Properties dialog box

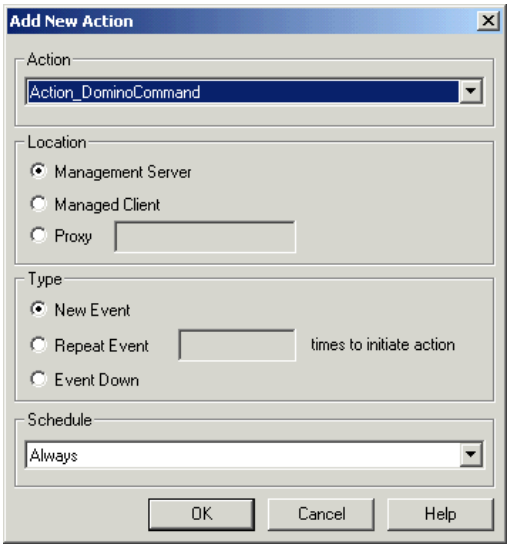
Use the **Action** tab in the **Script Properties** dialog box (choose **View > Properties > Action**) to add or modify actions associated with events raised by the Knowledge Script.



Item	Description
Action List	List of actions initiated by events raised by the script.
New	Click to add a new action.
Modify	Select an action in the Action List, and click to modify the properties.
Delete	Select an action in the Action List, and click to delete.

Add New/Modify Action dialog box

Use the **New/Modify** button in the **Action** tab in the **Script Properties** dialog box (choose **View > Properties > Action > New** or **Modify**) to define the properties of a new or existing action.

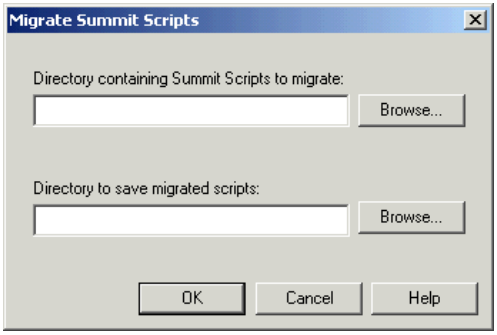


Item	Description
Action	Select an action from the list.
Location	Select the computer from which the action is initiated: • Management server • Managed client • Proxy (another computer running the AppManager agent)

Item	Description
Type	Select the type of event that initiates the action: • New Event. The action is initiated when a new event is raised. • Repeated Event. The action is initiated when a duplicate event is raised a specified number of times. Specify that number in the field for this selection. • Event Down. The action is initiated when the event condition no longer exists (for example, when the transfer of bits per seconds is back above the minimum threshold).
Schedule	Select a schedule for the action. The schedules listed here correspond to the action schedule types defined in the AppManager repository preferences.

Migrate Summit Scripts dialog box

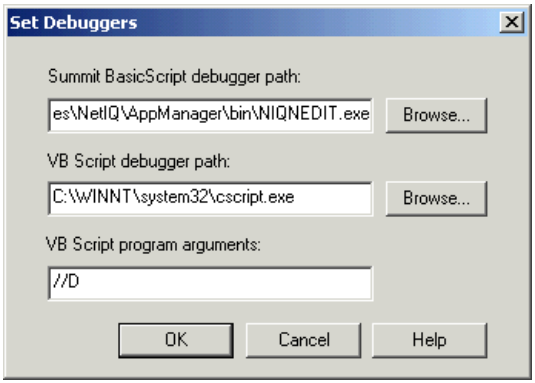
Use the **Migrate Summit Scripts** dialog box (choose **View > Tools > Migrate**) to set the directory paths for migrating Summit BasicScript Knowledge Scripts to the `.qml` format.



Item	Description
Directory containing Summit scripts to migrate	Path to the Summit BasicScript (`.ebs`) files you want to migrate.
Directory to save migrated scripts	Path to where you want the migrated script (`.qml`) saved.

Set Debuggers dialog box

Use the **Set Debuggers** dialog box (choose **View > Tools > Set Debuggers**) to specify the path to the debugger you want to use.



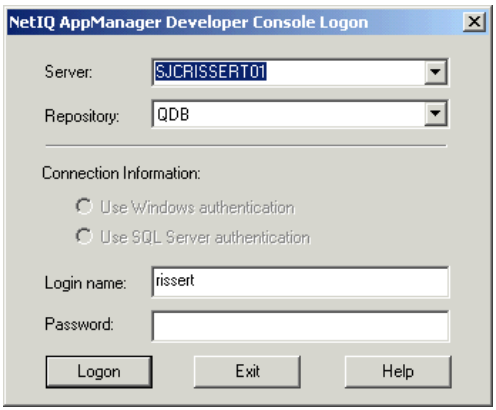
If you have used the default installations, the paths to the debuggers will be:

Scripting Language	Debugger	Default Path to Debugger
Summit BasicScript	NetIQ Knowledge Script Editor	`C:\Program Files\NetIQ\AppManager\bin\niqnedit.exe`
VBScript	Microsoft Script Host	`C:\WINNT\system32\cscript.exe` **NOTE:** To use this Script Host in debug mode, it must be launched with either the //D or /X parameter.

The Microsoft Windows Script Host requires a command line argument, either `//D` or `//X`, to run in debug mode. You must enter one of these arguments in the third field of the **Set Debuggers** dialog box. If you use the //D parameter, the debugger will only kick in if an error occurs. Using the //X parameter starts the debugger and puts a breakpoint on the first executable line of script code.

Script Check-in dialog box

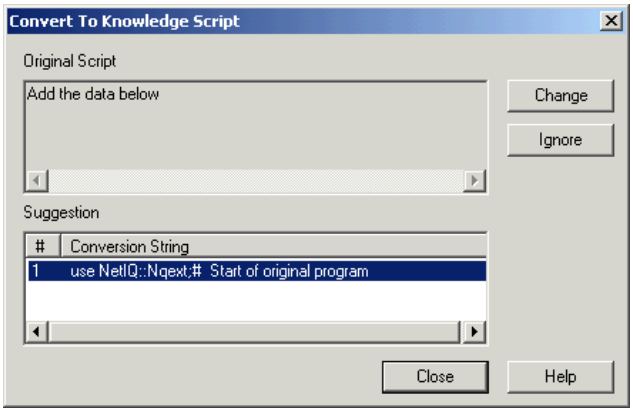
Use the **Developer Console Logon** dialog box (choose **Tools > Check in Knowledge Script**) to log on to the AppManager repository.



For	Do this
Name	Type the user name of the SQL Server login account used to access the AppManager repository.
Password	Type the password for the SQL Server login account.
Server	Type the name of the SQL server that manages the AppManager repository. When specifying a computer name, you can enter the Windows NT computer name or the IP address. For example, to specify a named instance on SQL Server 2000, you can enter `10.1.10.43\INST1`.
Repository	Type the name of the AppManager repository you want.

Convert To Knowledge Script dialog box

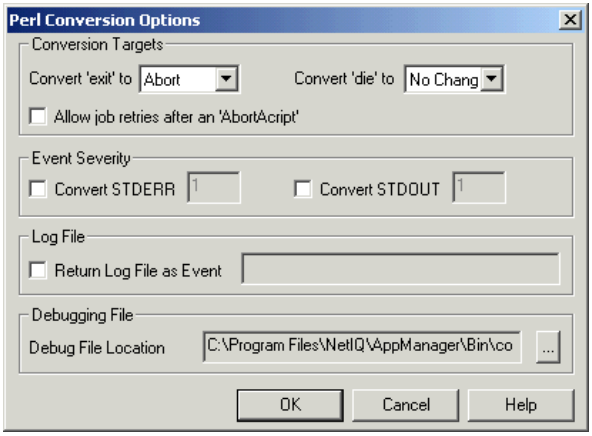
This tool (choose **Tools > Convert Perl script to KS**) steps through a Perl script searching for lines of code that need to be converted to use AppManager-compatible constructs.



Item	Description
Original Script field	Existing code.
Suggestion field	Suggested additions where appropriate code does not exist, or suggested substitutions for existing code. Select a line of suggested code and click **Change** to make the substitution. Click **Ignore** to skip the change and move to the next line in the original script. Double-click a suggested line to open a dialog box that displays the line in its entirety.

Perl Conversion Options

Use the **Perl Conversion Options** dialog box (choose **Tools > Perl Conversion Options**) to take an existing Perl script and automatically generate AppManager-specific callback functions that enable the script to send events and data to the AppManager repository.



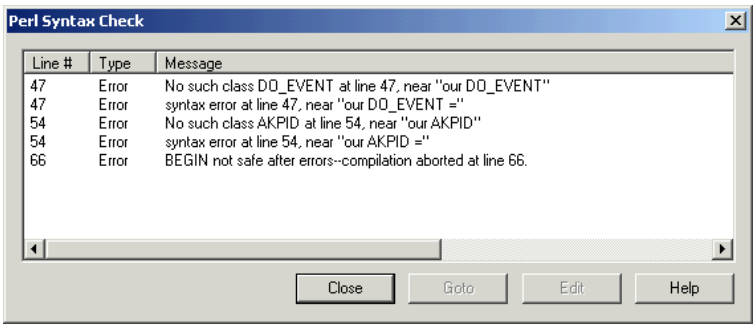
This option	Makes this conversion
Convert ‘die’ to	Perl scripts use `die` to exit on an unrecoverable error. `die` quits the program and prints the line number to `STDERR`. The **`No Change`** option uses the default `die` behavior, and nothing is returned to the AppManager repository. The **`Abort`** option converts `die` to `AbortScript`, which terminates the script and stops it in an error state. The **`Event`** option converts `die` to `CreateEvent`, which raises an event before the script terminates.

This option	Makes this conversion
Convert ‘exit’ to	The Perl command `exit` quits the program with a return value. Since `exit` is not allowed in a Knowledge Script because it quits the agent program, the default behavior is to convert `exit` to `die`. The **`Abort`** option converts `exit` to `die` when the return value is zero, but makes an additional call to `AbortScript` when the return value is not zero (programs typically return a non-zero value to indicate an error). The **`Event`** option converts `exit` to `die` when the return value is zero, but makes an additional call to `CreateEvent` when the return value is non-zero (programs typically return a non-zero value to indicate an error). The **`Data`** option converts `exit` to `CreateData`, with data values equal to `exit`’s return value, regardless of whether the value is zero, and then uses `die` to quit the script.
Allow job retries after an ‘AbortScript’	The default behavior for `AbortScript` is to error out and stop the job. This option indicates that AppManager should periodically try to restart the job.
Convert STDERR	By default, `STDERR` from the script is not returned to the Operator Console. This option allows `STDERR` to be returned as an event by redirecting `print` to a temporary file whose contents are returned to the AppManager repository as an event at the end of execution. Use any positive value for this option. The value for this option takes precedence over the value for the All Events option. If this option is not selected, `STDERR` is not returned as an event.

This option	Makes this conversion
Convert STDOUT	By default, `STDOUT` from the script is not returned to the Operator Console. This option allows `STDOUT` to be returned as an event by redirecting `print` to a temporary file whose contents are returned to the AppManager repository as an event at the end of execution. Use any positive value for this option. The value for this option takes precedence over the value for the All Events option. If this option is not selected, `STDOUT` is not returned as an event.
Return Log File as Event	If the Perl script writes data to a log file, this option returns the contents of that file as an event. Use any name for the file.
Debug File Location	This file contains the original script plus the line numbers where problems might occur in the conversion. Alongside each line number are possible versions of the line: • The original line • The converted line • Alternative conversions of the line The conversion tool reads each of the possible line versions and gives the user the option to select one of them or to make the changes manually.

Perl Syntax Check

Use the **Perl Syntax Check** (choose **Tools > Perl Syntax Check**) dialog box to check the syntax of a Perl script.



To	Do this
Dismiss the dialog box	Click **Close**.
Highlight the line of code containing the error	Select the error message from the list, and click **Go to**. The corresponding line of code is highlighted in the Developer's Console. The script code is displayed in the Perl Script (Read-only) view.
Edit the code to fix the error	Select the error message from the list, and click **Edit**. The dialog box is dismissed, the corresponding line of code is highlighted in the Developer's Console, and the script is displayed in the Edit view. You can then make the necessary changes to your code. To continue with the syntax check, click **Tools > Perl Syntax Check**.

Appendix B

Perl Development

Due to the AppManager agent architecture on UNIX (a multi-threaded application which hosts multiple Perl engines on several threads), one should not use certain Perl language constructs. Nor should one use certain system functions within C/C++ based managed objects. Here is a list of these restrictions. Workarounds are provided in some cases.

In the AppManager UNIX agent architecture, each Perl job is executed by a Posix thread within the UNIX agent. Perl Knowledge Scripts and managed objects should *not* perform any operations that are not multi-thread safe. In the V1 UNIX agent, each Perl job is executed by one separate Perl engine and there is no limitation on concurrent Perl engines. In the V1.1 UNIX agent, each Perl job is still executed by one separate Perl engine—however, for this agent there is a limitation of concurrent Perl engines that is configurable via the `nqmcfg.xml` file or the `nqmagt` command line option. The V2 UNIX agent uses a pool of Perl engines where one Perl engine may execute more than one Perl jobs.

The Perl engine bundled with all of the AppManager UNIX agents is version 5.6.1.

Compiling your Perl modules

You must compile your Perl module or C/C++ based managed object with the exact same Perl engine that is bundled with the UNIX agent (located in `/code/perl/5.6.1`). You will need to compile separate objects for Solaris, Linux, HPUX, and AIX.

Warning If you do not use the same perl engine (e.g., you compiled

your Perl module with single threaded Perl engine and then use it under UNIX agent which has multi-threaded Perl engine), at runtime you may observe "reallocation error" or "unsolved symbol …" in the `nqmlog` file.

The correct multi-threaded Perl engines (5.6.1) are available as:

- `perl-solaris.tar.Z`
- `perl-linux.tar.Z`
- `perl-hpux.tar.Z`
- `Lperl-aix.tar.Z`

The Perl engine must be installed under:

```
.../opt/netiq/UnixAgent/lib/.....
```

You should compile your code with the exact same compiler/linker options that were used to compile the Perl engine. The easiest way to achieve this is to use the Perl way to compile your Perl module, i.e., use the correct Perl to generate a `Makefile` based on `Makefile.PL`. This means the compilation of your perl module should use the same compiler and compilation/linking options as the Perl engine. Refer to:

- `http://www.perldoc.com/perl5.8.0/pod/perlxstut.html`
- `http://www.perldoc.com/perl5.8.0/lib/ExtUtils/MakeMaker.html`

Perl best practices

1. Do not call `fork()`, `exec()`, `system()`.

   Any `fork`, `exec`, or `system` operation from a thread within a multi-threaded application can cause application deadlock.

   Workaround: Use the `ExecCmd` callback function. `ExecCmd` is programmed to serialize concurrent `fork`, `exec`, and `system` calls and therefore avoid deadlock. Also see the note about I/O redirection in issue #11.

2. Do not use back quotes to call a command (`` `CMD` ``).

   The same reason as #1.

Workaround: Use the `ExecCmd` callback function, which is programmed to serialize concurrent calls to avoid deadlock. Also see #11.

3 Do not call `chdir()` and `chroot()`

There is only one current directory per application. Changing the current directory of an application from one thread may cause problems for other threads within the same application. Also see issue #17.

Workaround: Either of the following two will do.

1. Instead of `ExecCmd("cmd")`, use `ExecCmd("cd $dir ; cmd")`. That is, replace

```
chdir $dir;
.....
ExecCmd("cmd");
```

with

```
ExecCmd("cd $dir ; cmd")
```

The entire command execution within `ExecCmd` is to change to the directory specified by `$dir` and then execute `cmd`. It is also OK to start background processes by using this method. For example, `ExecCmd("cd $dir ; cmd &")`.

2. Use the `ExecCmd` callback function to invoke an external program (shell script, for example) that performs the `cd` operation.

4 Do not set up any signal handling routines, including `alarm()`, in Perl.

The UNIX agent is based on Java, which already catches quite a few signals. In addition, the UNIX agent itself also catches a few signals. Any operation to modify any signal handling routines can cause UNIX agent deadlock.

5 Redirect `stdout` or `stderr` to the `Nqext::CreateEvent` callback function, or to `/dev/null`, or to an individual file.

Any `stdout` or `stderr` will be lost because the UNIX agent runs as a daemon process. One should also replace `print` or `printf` with other functions.

6 Avoid calling `sleep()`.

Invoking `sleep()` ties the current job to a Perl engine that could otherwise execute other jobs (in the case of pool of Perl engine).

Workaround: Avoid **sleep()** if possible. If you must use it, specify a short period for **sleep()** (e.g., less than 5 seconds). If one expects to sleep for a long time, remember the state of the job/Knowledge Script and re-check the status in the next job iteration.

You can also wrap the sleep logic into an external script and have `Exec` callback execute the script asynchronously.

7 The `END` block in Knowledge Scripts or in Perl modules for V2 (or greater) UNIX will *not* be executed

Having `BEGIN` or `INIT` in either Knowledge Scripts or Perl modules is OK. Also note that you can have initialization code defined in the boot section within XS based code.

Workaround: None.

8 Take advantage of Perl features, as much as possible. for example:

- hash variables

  To avoid memory leaks, before the end of each KS iteration, one must deallocate each hash variable, i.e.,

  %hash_var = ();
  or
  undef %hash_var;

- Regular expression, pattern matching (instead of invoking grep command via ExecCmd)

- Perl built-in constructs for file operations, input/output operations, directory reading operations, system interactions, networking, IPC, information from system files, etc.
- Various Perl modules

9 Use the `ExecCmd()` callback function sparingly.

Minimize calls to this callback because it is serialized. All current running Perl jobs within the UNIX agent have to be suspended during the process of `ExecCmd`. Instead of calling `ExecCmd`, you should consider using Perl language constructs to perform operations wherever possible.

10 Do not open a pipe with the Perl construct `open()`

The Perl construct open(F, "CMD |") opens a pipe to command CMD and read the stdout from CMD. For the same reason that one should not use fork(), exec(), or system(), one should not create processes via the construct open().

Workaround: Replace the following code

```
open(F, CMD |);
...
close(F);
```

with

```
$f = Nqext::ExecCmd(CMD, 1);
open(F, $f);
close F;
unlink F;
```

Redirect `stdout` and `stderr` if you start a background process with the `ExecCmd()` callback function.

If `stdout` and `stderr` are not redirected, the `ExecCmd()` callback function will hang forever.

Workaround: You should always redirect `stdout` and `stderr` of

any background process to `/dev/null` (if `stdout` and `stderr` are not needed) or to files (if they are needed). For example, do either of the following:

```
# start script.sh in background
ExecCmd(script.sh > /dev/null 2> /dev/null &);
```

or

```
ExecCmd(wrap_script.sh);   # start wrap_script.sh
```

where `wrap_script.sh` contains

```
#! /bin/sh
...
script.sh > /dev/null 2> /dev/null &
# wrap_script.sh continues even if script.sh
# has not terminated.
```

You can also redirect to a temporary file.

Note If you redirect `stdout` and `stderr` to `/dev/null`, then `ExecCmd` will not be able to return `stdout` or `stderr` from the command.

11 Unless you are within an `eval`, do not escape any Perl scripts run by the AppManager UNIX agent. This includes both Knowledge Scripts and the managed objects in Perl modules. That is, do not use the `die`, `exit`, or `croak` commands. They will (sometimes, but not always) exit the entire UNIX agent.

Workaround: Use `AbortScript`.

12 You can overwrite any section of `Makefile` generated from `Makefile.PL`

Most of time the `Makefile` generated from the Perl `Makefile.PL` has everything you need. But sometimes it does not, especially for AIX.

Workaround: Use the Perl module `ExtUtils::MakeMaker` to overwrite *any* section within the `Makefile`. For example, you can

overwrite the *postamble* section of the `Makefile` with the following from within `Makefile.PL`:

```
sub MY::postamble {
'
 $(MYEXTLIB): sdbm/Makefile
 cd sdbm && $(MAKE) all
 ';
}
```

See http://www.perldoc.com/perl5.6.1/lib/ExtUtils/MakeMaker.html#Overriding-MakeMaker-Methods for details. See `AIX DB2 Makefile.PL` as an example.

13 The `ExecCmd` callback function does not provide exit code from the command just executed.

Workaround: Replace

```
ExecCmd(cmd);
```

with

```
ExecCmd(cmd ;
echo $?);
```

14 If you are using C/C++ to develop your managed objects, be aware that any operation should be thread-safe. Use an appropriate mutex mechanism (e.g., `pthread_mutex_lock`, `pthread_mutex_unlock`) to protect the critical section.

15 Never hard-code an output file name. If you do, and then two such jobs (using the same output file name) run concurrently, you will have problem. You could use callback `GetTempFileName` to get a unique file name, or make the file name be a function of something unique, such as `jobid`.

16 {A super set of #3} Unless you know what you are doing, do not call functions that can affect process-scope state, such as

- setpgrp() -- sets the process group for a specific PID
- setpriority() -- sets the current priority for a process
- umask() -- sets the umask for the process
- chdir() -- changes cthe urrent working directory for the process. See #3 for work around.
- chroot() -- changes the root directory for the process.

17 {super set of #6} Avoid issuing any *long* blocking calls, such as reading from a socket, etc. This again would tie the current job to a Perl engine that could otherwise execute other jobs in the case of pool of Perl engine.

Workaround: If the KS can perform other useful computations while the long API is in execution,

- Use an asynchronous version of the API, if available, instead of using the sync version.
- Create a separate process (ExecCmd) to perform the blocking operation

18 On AIX, use the `slibclean` command to clean up any modules (including any dynamically loaded modules, `.so`) cached in the kernel before starting the UNIX agent with an updated Perl module. In C, `unload()` is the API for this purpose. See http://publib.boulder.ibm.com/doc_link/en_US/a_doc_lib/cmds/aixcmds5/slibclean.htm

and

http://publib.boulder.ibm.com/doc_link/en_US/a_doc_lib/aixprggd/kernextc/kernex_binding.htm#A23C0f1a0

for details.

19 Avoid calling C/C++ functions that are thread-unsafe. Depending on the platform, thread-safe functions usually have the name

appended with _r. Check the manual pages for details. The following are a few important ones for Solaris:

Thread-unsafe functions	Thread-safe functions
`localtime ()`	`localtime_r()`
`gmtime()`	`gmtime_r()`
`get{gr,host,net,proto,serv,pw}*()`	`get{gr,host,net,proto,serv,pw}*_r()`
`readdir()`	`readdir_r()`
`rand()`	`rand_r()`
`srand()`	`N/A`

20 Do not call perl built-in functions that are not thread-safe. In Perl 5.6.1 on Solaris, the following are not thread safe (list is not all-inclusive):

`localtime()`, `gmtime()`, `get{gr,host,net,proto,serv,pw}*()`, `readdir()`.

Note Perl functions `rand` and `srand` invoke `rand48(3C)` and `srand48(3C)`, which are thread-safe.

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