

Using the Player, Script Development Workbench, and Analyze

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QALoad Online Help

Welcome to QALoad

With QALoad, you can simulate the load generated by thousands of users without the expense of actual end users or their equipment. QALoad enables you to quickly develop test scripts, control the conditions for the test, create the virtual users that simulate the load, initiate and monitor the test, and report the results.

The following components of QALoad control different aspects of the load testing process:

Script Development Workbench

Develop your scripts. Capture sessions and convert the transactions into C++ or Java-based script. For more information, see [Overview of the Script Development Workbench](#).

Conductor

Control session activity. Initiate and monitor the test. For more information, see [Overview of the QALoad Conductor](#).

Player

Simulate user activity based on commands given from the Conductor. For more information, see [Overview of the QALoad Player](#).

Analyze

View summary report data and create other statistical reports from the test. For more information, see [Overview of QALoad Analyze](#).

Before you begin using QALoad, you should familiarize yourself with load testing concepts. For more information, see [The Load Testing Process](#).

Getting Started

The Load Testing Process

You begin the testing process by determining the types of application transactions you want to emulate. You then develop these transactions into QALoad scripts by creating the same types of requests that your applications invoke on the server. Each transaction becomes its own script. The QALoad Script Development Workbench lets you easily create full-function scripts.

When you plan your test, you need to decide which transactions to run, the number of simulated clients that will run each transaction script, and the frequency at which each script will run. When you run the test on a workstation with the QALoad Player component, you can specify transaction rates as well as fixed and random delays to better emulate real-system activity. QALoad considers these factors a test scenario and stores them in a session ID file.

While a test is running, the test operator can dynamically view overall run times as well as individual transaction performance. QALoad's Conductor component collects this data for analysis at the conclusion of the test.

After executing the test, summary reports show the response times that the emulated clients experienced during the test. Individual and global checkpoints let you view and identify specific areas of system performance. You can export all test output data to spreadsheet and statistical packages for further analysis or use QALoad's Analyze component to create presentation-quality reports and graphs.

As shown in the following image, a typical load test setup consists of a QALoad Conductor, one or more QALoad Players, and the system under test.

QALoad Conductor

QALoad's Conductor controls all testing activity such as setting up the session description files, initiating and monitoring the test, and reporting and analyzing test results.

QALoad Player

A QALoad Player creates virtual users that simulate multiple clients sending middleware calls to a server under test. In a typical test setup, one or more QALoad Player workstations run under any Windows 32-bit platform (Windows XP or 2000) or UNIX. For large tests (thousands of simulated clients), you can connect multiple Players to QALoad's Conductor. The Conductor and Players communicate using TCP/IP.

The hardware and software capabilities of the Player machine are the only factors that limit the capacity of an individual QALoad Player. The maximum number of virtual users per Player machine is dependent on the system under test, the characteristics of the script, and the test scenario. You can specify how many threaded- and process-based virtual users to assign on a machine in the Machines window of the Options dialog box in the Conductor. The Conductor calculates how many virtual users will be active per 64 MB of RAM, based on the values you provide in these fields. For more information, see [Machines Dialog Box](#).

System Under Test

The servers you test are typically production systems or a duplicate of a production system that is set up at a test facility. If you perform any kind of system selection or performance stress test, the system under test must use the same hardware and software (including current versions) as the production environment. Compuware has found that even subtle changes have profound effects on performance.

Developing Scripts

Use the QALoad Script Development Workbench to develop test scripts. It contains facilities for capturing sessions, converting captured sessions into scripts, and modifying and compiling scripts. Once you compile your script, use QALoad's Conductor and Player components to test your system.

Record Facility: QALoad's Record facility, which you can access through the QALoad Script Development Workbench, records the transactions that your terminal, browser, or client makes. It stores these transactions in a capture file.

Convert Facility: QALoad's Convert facility, which you can access through the QALoad Script Development Workbench, converts capture files into scripts. It generates a one-to-one correspondence of transactions from the original session to your QALoad script.

Visual Navigator: Visual Navigator for WWW is QALoad's easy-to-use visual interface to QALoad's powerful script development tools. Visual Navigator for WWW renders your recorded C++ -based transaction in a tri-paned, browser-like environment similar to popular visually-oriented development tools, with icons representing all the elements of your script.

Validating Scripts

Before you conduct an actual load test, you should individually validate the script(s) you plan to use by running a simple load test. If the script runs to the end without any errors and runs multiple times without errors, it is valid to use in a load test.

If the script aborts on an error, debug the script and run it through a simple test again. You can validate scripts from the QALoad Script Development Workbench, the QALoad Player, or the QALoad Conductor:

[Validating a Script in the Script Development Workbench](#)

[Validating a Script in the Player](#)

[Validating a Script in the Conductor](#)

How to Use the Online Help

QALoad's online help includes a Table of Contents (TOC), an index, and a search input field. When you click on a topic title in the TOC, the topic appears in the right-hand pane of the online help. Topics included in the Table of Contents are synchronized with the TOC. This means that when you click a topic link in the right-hand pane, the topic title is highlighted in the TOC in the left-hand pane.

Use the Index tab to search for a specific reference by typing a keyword in the index entry field. Use the Search tab to search for associated topics. Type a keyword in the search entry field. All topics that contain the keyword are listed.

When you are working in QALoad, click the Help button on an individual dialog box or press F1 to view a description of each field in the dialog box. For these topics and others that do not appear in the Table of Contents, the synchronization function with the TOC is disabled.

Compuware Customer Support

At Compuware, we strive to make our products and documentation the best in the industry. Feedback from our customers helps us maintain our quality standards. If you need support services, please obtain the following information before calling Compuware's 24-hour product support hotline:

- ! The release (version), and build number of your QALoad installation. This information is displayed when you select the About command from any QALoad component's Help menu.
- ! Installation information, including installed components, whether it is installed in the default directories, and so on.
- ! Environment information, such as the operating system and release on which the product is installed, memory, hardware/network specifications, and the names and releases of other applications that were running.
- ! The location of the problem in the QALoad software, and the actions taken before the problem occurred.
- ! The exact QALoad error message, if any.
- ! The exact application, licensing, or operating system error messages, if any.
- ! Your Compuware client, office, or site number, if available.

Contact Information

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Detroit, MI 48226-5099

(800) 538-7822

World Wide Web Information

To access Compuware Corporation's site on the World Wide Web, point your browser at <http://www.compuware.com>. The Compuware site provides a variety of product and support information.

FrontLine Support Web Site

You can access online technical support for Compuware products using our FrontLine support Web site. FrontLine provides fast access to critical information about your QACenter product. You can read or download documentation, frequently asked questions, and product fixes, or email your questions or comments. To access FrontLine, you must first register and obtain a password. To register, point your browser at <http://frontline.compuware.com>.

ZipFile Wizard

You can use the [ZipFile Wizard](#) to transmit smaller files to QALoad Technical Support. This simplifies the task of collecting the files needed to assist you in resolving your problem.

Overview of the ZipFile Wizard

The ZipFile Wizard simplifies the task of collecting the files needed by the Technical Support team to analyze and resolve a problem that you might be having with QALoad. It facilitates navigation through QALoad's installation so you can easily select the required files without actually knowing where they reside. Once selected, the files are collected and compressed into a ZIP file that optionally can be transmitted to the QALoad Technical Support team.

Accessibility Features

Compuware is committed to compliance with Section 508 standards for accessibility in software products. Section 508 standards were enacted by Congress in 1998 as an amendment to the Rehabilitation Act. The standards require federal agencies to increase the accessibility of their electronic information to people with disabilities. Software that is fully compliant with Section 508 standards provides information access to people with disabilities that is comparable to the information access available to people without disabilities. Software that is compliant with exceptions, such as QALoad, provides support for most, but not all, criteria of compliance.

This topic describes the level of accessibility currently available in QALoad, including the product documentation.

Accessibility of QALoad Components

All components of QALoad — Script Development Workbench, Conductor, Player, and Analyze — support the basic criteria of accessibility for software applications. For most categories of compliance, there are exceptions in which assistive technologies do not work in all situations or the alternate methods of information retrieval or product function are not always available. However, the following basic accessibility features are available in QALoad:

- ! Product functions are executable from the keyboard
- ! The application does not disrupt or disable activated features of other products that are identified as accessibility features
- ! The product provides an on-screen indication of the current focus and the focus can be tracked by assistive technologies
- ! The identity, operation, and state of elements of the user interface are available to assistive technologies
- ! Textual information is provided through the operating system functions for displaying text
- ! The application does not override user-selected contrast and color selections
- ! Color-coding is not used as the only means of conveying information
- ! Electronic forms allow people using assistive technology to access the information, field elements, and functionality required for completion and submission of the form

Accessibility of QALoad Documentation

Generally, the QALoad documentation is accessible and can be read by screen readers. Alternate formats of the documentation are not currently available.

Online Help

QALoad's online help system is HTML-based and can be read by screen readers. All graphics in the online help have text descriptions. Topics in the online help can be printed.

Release Notes

The QALoad Release Notes is an HTML document that can be read by screen readers and printed.

Installation Guide

The QALoad Installation and Configuration Guide is an accessible PDF-based book that provides text descriptions for images in addition to the ability to be read by some screen readers and the Read Aloud feature of Adobe Acrobat. To take advantage of the accessibility features in the Installation Guide, you must have Adobe Acrobat Reader 6.0 or later. This book can be printed.

Assistive Technology Tools that Enhance the Accessibility of QALoad

There are many third-party assistive technology tools that you can use to access the QALoad user interface and product documentation by alternate means. These products perform a variety of functions, such as enlarging the user interface and reading text on the interface or in the documentation. Many features are available in Windows, such as:

- ! Windows Narrator
- ! Windows accessibility wizard (includes features such as SoundSentry, ShowSounds, StickyKeys, and MouseKeys)
- ! Windows On-Screen Keyboard
- ! Microsoft Magnifier

Refer to the Windows documentation to learn more about using these features. Most other tools fall into one of the following two categories:

- ! **Screen readers:** Software programs that present graphics and text as speech. A screen reader is used to verbalize, or "speak," everything on the screen including names and descriptions of control buttons, menus, text, and punctuation. (Example: JAWS for Windows by Freedom Scientific, Inc.)
- ! **Screen enlargers (or screen magnifiers):** Software that works like a magnifying glass on other applications. They enlarge a portion of the screen as the user moves the focus — increasing legibility for some users. Some screen enlargers allow you to zoom in and out on a particular area of the screen. (Example: ZoomText Magnifier by AI Squared)

Product Shortcut Keys

The following tables list the defined shortcut keys for each component of QALoad. You can use these key combinations to open dialog boxes, start or stop processes, or interact in other ways with QALoad without using a mouse.

Script Development Workbench

Shortcut Key Combination	Action
CTRL+N	Open the New dialog box, from which you can create new scripts or datapools.
CTRL+O	Open the Open dialog box, from which you can open various product files.
CTRL+S	Save the active document.
CTRL+P	Print the active document
CTRL+Z	Undo the last action.
CTRL+Y	Redo the last action.

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CTRL+X	Cut.
CTRL+C	Copy.
CTRL+V	Paste.
CTRL+F	Find.
CTRL+H	Replace.
CTRL+G	Open the Go to Line dialog box, from which you can go to a specific line number in the active script.
CTRL+F2	Toggle bookmark on/off.
F2	Move to next bookmark.
SHIFT+F2	Move to previous bookmark.
CTRL+SHIFT+F2	Clear all bookmarks.
CTRL+ALT+C	Start a recording.
CTRL+ALT+T	Stop a recording.
CTRL+ALT+R	Restart a recording.
CTRL+ALT+U	Resume a recording.
F7	Compile the active script.
CTRL+F5	Validate the active script.
CTRL+T	Open the FTP Transfer dialog box, from which you can send a file via FTP.
F1	Open the QALoad online help.
ALT+F4	Close the Script Development Workbench.

Conductor

Shortcut Key Combination	Description
F1	Open the QALoad online help.
CTRL+X	Cut.
CTRL+C	Copy.
CTRL+P	Paste.
ALT+F4	Close the Conductor.

Analyze

Shortcut Key Combination	Description
CTRL+O	Open a timing file.
CTRL+P	Print the active document.
CTRL+C	Copy Summary and Data selections.
CTRL+A	Select all items.
CTRL+U	Unselect all items.
F1	Open QALoad online help.
ALT+F6	Move to the next tab in the Data window.
ALT+F4	Close Analyze.

Player

Shortcut Key Combination	Description
CTRL+N	Clear any current messages from the Player's main window.
CTRL+S	Save a text file of the messages reported by a QALoad Player during a test.
CTRL+P	Print Player output.
CTRL+Z	Undo the last action.
CTRL+X	Cut.
CTRL+C	Copy.
CTRL+V	Paste.
F1	Open QALoad online help.
ALT+F4	Close the Player.

To request a Voluntary Product Accessibility Template (VPAT) or for more information regarding accessibility of QALoad or any other Compuware product, see <http://www.compuware.com/accessibility/>

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Native Character Chinese, Japanese, and Korean Support

By default, QALoad translates Chinese, Japanese, and Korean (CJK) characters if you are using the QALoad Workbench on the same CJK language operating system as the operating system on which the Web application is being captured. There are no options to enable, but you may wish to ensure that the Represent CJK as Octal Characters option check box is not selected.

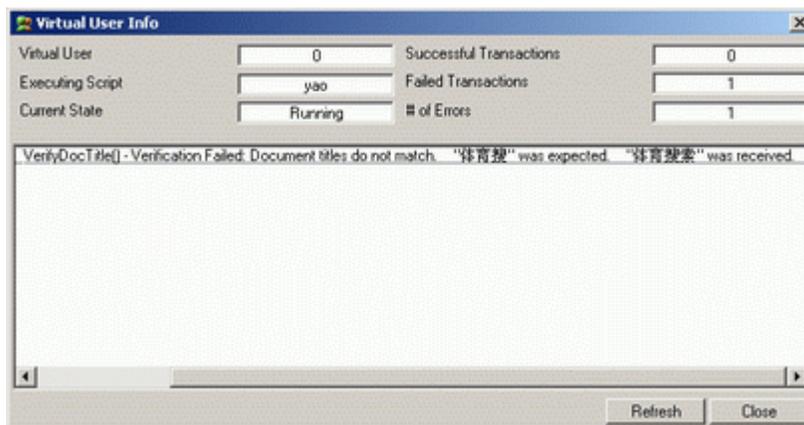
QALoad uses the encoding option when converting a capture file containing more than one set of Chinese, Japanese, or Korean (CJK) language characters. The encoding option also is used when converting the script on a CJK language operating system different than the one on which the application was captured.

To verify or to override, this option is located on the Configuration Options dialog box in the QALoad Workbench. Select Options>Convert. The Configuration Options dialog box appears. Choose WWW>Convert Options> General. Select the Represent CJK as Octal Characters check box to override QALoad's Native Character Support and enable Encoded Support. To take advantage of QALoad's Native Character support, ensure that the check box is not selected.

If you capture a script from a Web application that contains CJK characters, QALoad converts the captured transaction into a test script.

QALoad uses the native characters in the document title to create, for example, DO_VerifyDocTitle() and BeginCheckpoint() functions meaningful to the native character set. The same character conversion logic is applied to DO_SetValue() and all DO_Get<xxx> functions such as DO_GetAnchorHREF().

When using native characters within QALoad test scripts, the resulting timing files display checkpoints in their native language. If you use native characters in any other system function that produces an error message, you also see the native characters displayed in QALoad Conductor's error message display as shown below. This applies to function calls like DO_VerifyDocTitle and any DO_Get<xxx> functions that fail during test execution.



When using encoded characters in QALoad test scripts, the resulting timing files do not display checkpoints in their native language.

Chinese, Japanese, and Korean Support in QALoad

QALoad supports load testing of Chinese, Japanese, and Korean (CJK) Web applications that use Double Byte Character Sets (DBCS). DBCS is a character set that uses two bytes (16 bits) rather than one byte (8 bits) to represent a single character. Some languages, such as Chinese, Japanese, and Korean, have writing schemes with many different characters and character sets that cannot be represented with single-byte characters such as ASCII and EBCDIC.

QALoad supports the following:

- ! Simplified Chinese - People's Republic of China (PRC), Singapore
- ! Traditional Chinese - Taiwan, Hong Kong, Macau
- ! Japanese
- ! Korean

Notes:

CJK support only applies to the WWW middleware. Currently, QALoad only supports the CJK Double Byte Character Sets; Web applications that host Bi-Directional (BiDi) characters (which includes Arabic and Hebrew languages) are not currently supported.

UTF-8-encoded characters are treated as an additional character set used on CJK platforms. They are supported when represented on their native operating system. For example, Japanese characters are displayed properly on a Japanese operating system.

QALoad provides two methods of support for CJK: native character and encoding. Depending on your testing requirements and environment, it may be necessary to use both mechanisms to support the load testing of a Web site that contains CJK characters.

- ! **Native Character:** converts the CJK characters to their original characters in Chinese, Japanese, or Korean. Native character support is only possible when using a native operating system (OS) such as load testing a Japanese Web application from a Japanese version of Microsoft Windows. QALoad supports one CJK language's characters in a script at a time, plus ASCII/English. Native character support is used within test scripts, error messages (generated through system commands that use native characters) and timing files, making script editing easier and timing file analysis quicker.
- ! **Encoding:** encodes all CJK characters into a sequence of printable characters regardless of the language and exact character set in use. Encoding support is used when load testing multiple language sites from the same OS, or when load testing a CJK site from that of another CJK platform. For example, testing a site with Japanese characters from a Korean or English/ASCII OS. The encoding option is used when native character support cannot be used or when script portability between different CJK language OS is required.

Script Development Workbench

Overview of the Script Development Workbench

The QALoad Script Development Workbench is the QALoad component used to develop load test scripts. It contains the facilities you need for recording transactions such as function calls or request/response interactions placed by your Windows application. The recorded transaction, called a capture file, contains raw data that must be converted to an editable test script based on C++ or Java, depending upon which middleware environment is under test.

After converting the recorded transaction to a script, you can use the Script Development Workbench's script editor and other functionality to make any necessary modifications to your script. For example, maybe you had to sign on to a Web server with a user name and password as part of your recorded transaction. At test time, when multiple virtual users are running your test script, you might want each user to have a different user name/password combination. You can use the Script Development Workbench to create a re-usable pool of user name/password combinations, saved as a datapool file, and edit your script to extract values from that file at test time. QALoad provides scripting commands for situations like that, and provides a Function Wizard and online language reference, both available right from the editor, to help you locate and insert the right commands.

When you are satisfied with your test script, you can compile it directly from the Script Development Workbench. And, finally, add it to a load test in the QALoad Conductor.

In short, to produce a usable test script you:

1. **Record** a transaction into a capture file (.cap).
2. **Convert** the capture file to an editable script.
3. **Edit** the script.
4. **Compile** the script.

ODBC Memory Error Crash

Whenever a user-started capture is initiated, QALoad appears to begin capturing, but as soon as the program to capture against it is started, a memory exception is encountered.

The following error is not encountered immediately. It may not occur until you attempt to click on something or perform some sort of activity on your machine.

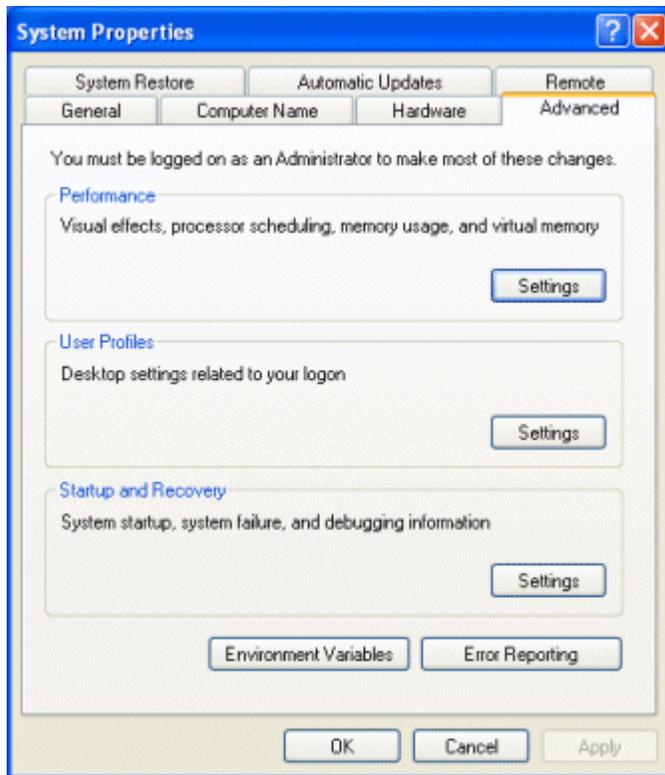
```
Application popup: explorer.exe - Application Error : The instruction at
"0x1001ee30" referenced memory at "0x1001ee30". The memory could not be
"written".
```

To fix the ODBC memory error crash:

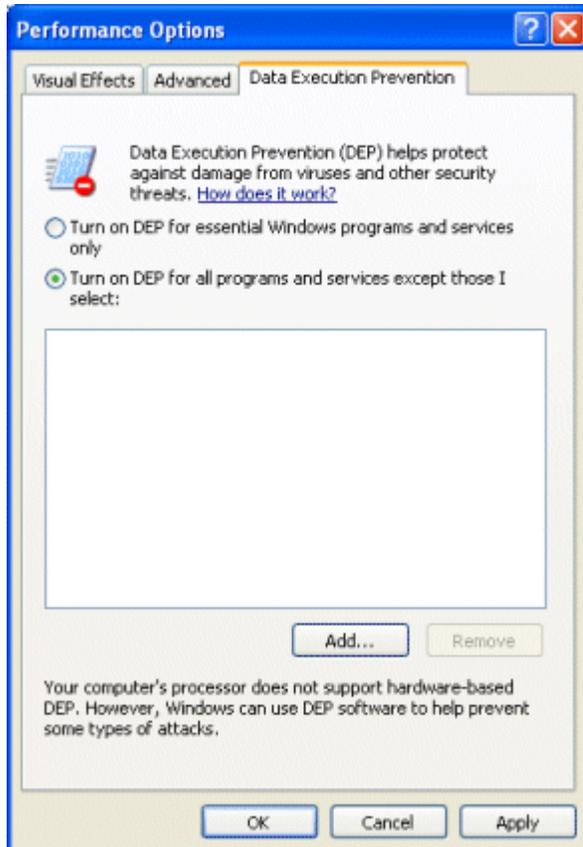
If you are running Windows XP Pro SP2, perform the following steps:

1. Right-click on **My Computer** and select **Properties**. The System Properties dialog box appears. (If your My Computer is not available, access **Control Panel>System**.)
2. Select the **Advanced** tab, then click **Settings** in the Performance group box.

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3. On the Performance Options dialog box, select the **Data Execution Prevention** tab. Make sure that **Turn on DEP for all programs...** is selected.



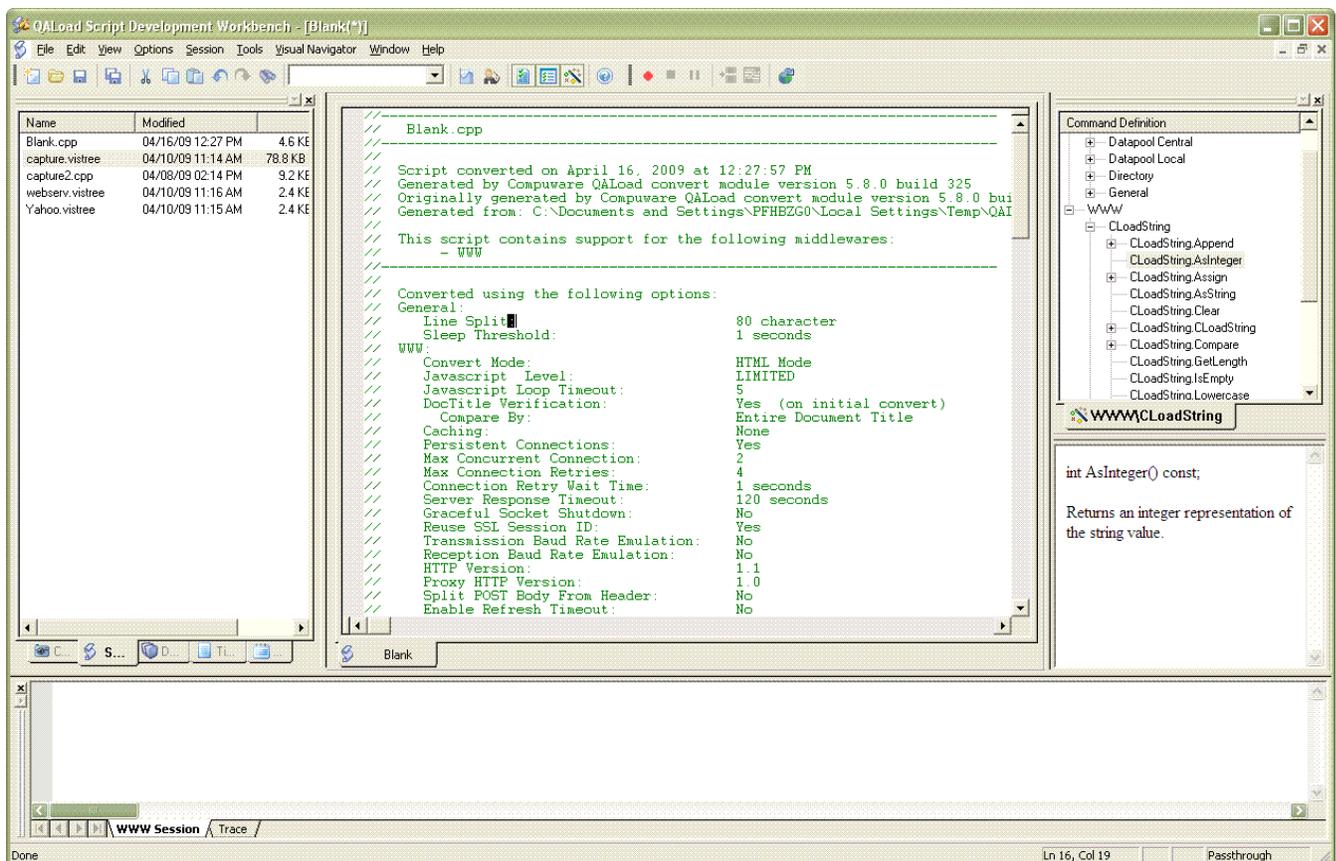
4. Click **Add**, then navigate to select the following applications:

- a. <systemroot>\explorer.exe
 - b. <systemroot>\system32\rundll32.exe
5. Click **OK** for any warnings that appear.
 6. Click **OK** on the Performance Options dialog box to save your changes and close the dialog box.

The Script Development Workbench Main Window

The QALoad Script Development Workbench main window is divided into dynamic panes that you can hide or show as needed by selecting commands from the View menu.

1 Hint: Click on a pane in the following graphic for a description of that pane. Use your scroll bars to see the rest of the graphic.



Menus and Toolbar Buttons

The QALoad Script Development Workbench menus and buttons change depending on whether you have an EasyScript Session open.

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Menus and Toolbars without an Open EasyScript Session

The following menus and toolbars are available when an EasyScript Session is not open.

- File
- View
- Options
- Session
- Tools
- Help
- Toolbar Buttons

Menus and Toolbars with an Open EasyScript Session

The following menus and toolbars are available when an EasyScript Session is open.

- File
- Edit
- View
- Options
- Session
- Tools
- Window
- Help
- Toolbar Buttons
- Recording Toolbar

Setting Conversion Options

Before you begin recording, you can set options to automatically customize your script during conversion. Compuware recommends you set conversion options before recording, then use the option to automatically convert your capture files to scripts.

1. Access the Script Development Workbench.
2. From the **Session** menu, select the appropriate middleware or start a Universal session.
3. Select **Options>Convert** to open the appropriate Convert Options dialog box.
4. Choose **General>Convert Options** from the options tree and set any applicable options. This tree-view contains common options that apply to all the middleware environments QALoad supports.
5. Click the middleware-specific convert options in the Session Options tree, and set any appropriate middleware-specific options.

Notes:

- For the Citrix Web Interface environment, you must select options in both the Citrix Convert Options and the WWW Convert Options in the tree view.
- For WWW, refer to [Using the WWW Convert Options](#).

6. When you are finished, click **OK** to save the current settings.

 Hint: Press F1 from any middleware options tab for a description of available options.

Opening a Middleware Session

To access the Script Development Workbench and open a middleware session:

1. Click **Start>Programs>Compuware>QALoad\Script Development Workbench**.
2. Choose the middleware name from the **Session** menu or by click the appropriate button on the toolbar. The **Default Session Prompt** opens.

 **Note:** If this middleware type should be the default every time you open the Script Development Workbench, select the check box **Make this my default session**. If you do not want to be prompted to set a default middleware, clear the **Enable default session checking** check box. You can also turn default session checking on or off from the [Configure Script Development Workbench dialog box](#) at any time.

3. Click **OK**.

The Default Session Prompt Did Not Open?

If the **Default Session Prompt** fails to open when you start a middleware session, then default session checking was previously disabled. Do the following to enable default session checking:

1. From the **Options** menu, choose **Workbench**. The **Configure QALoad Script Development Workbench** dialog box opens.
2. On the **Workbench Configuration** tab, select the **Enable default Session checking** check box.

The next time you open a QALoad Script Development Workbench middleware session, you are prompted to make it your default session.

Accessing the QALoad Script Development Workbench

To access the Script Development Workbench:

1. From the Windows taskbar, click the **Start** button.
2. Choose **Programs>Compuware>QALoad>Script Development Workbench**.

Configuring the Script Development Workbench

The first time you use the QALoad Script Development Workbench, you should set options to determine a working directory QALoad can use for temporary files, compiler settings, and other general options related to the behavior of the QALoad Script Development Workbench.

To configure the Script Development Workbench:

1. [Access the Script Development Workbench](#).

Using the Player, Script Development Workbench, and Analyze

2. From the **Session** menu, choose the session you want to start.
3. From the **Options** menu, choose **Workbench**.
4. Set any appropriate options. For a description of the available options, press **F1** from the Configure Script Development Workbench dialog box.

 **Note:** Compuware recommends that you always select **Automatically Convert Capture on the Record Options page** and **Automatically Compile Scripts on the Convert Options page**.

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

Importing ApplicationVantage Trace Files

Convert ApplicationVantage trace files to QALoad WWW or Winsock capture files for use in WWW visual scripts or Winsock scripts. This allows you to use ApplicationVantage-captured network traffic as WWW and Winsock sessions in QALoad to run multiple virtual user load tests.

To import ApplicationVantage trace files:

1. Open the QALoad Script Development Workbench.
2. Choose **Tools>Import>ApplicationVantage Trace**. The [Import ApplicationVantage Trace](#) dialog box appears.
3. Type file location or browse to the ApplicationVantage trace file.
4. Select WWW or Winsock to capture file type.
5. Click **Import**. QALoad converts the ApplicationVantage trace file to the selected capture file type. Results display in the Results field. At this time, the .cap files are generated but are not converted to scripts.
6. Manually [Convert](#) the imported capture files into scripts.

Script Packaging for ClientVantage

ClientVantage users must verify that versions of scripts and Player software located on each agent machine are compatible. When disparities exist, for example, when production systems are upgraded, the test scripts used to monitor the end-user experience also must be updated.

QALoad's Package Script function enables you to select a QALoad script, verify that it is up-to-date, and then package it in a zip file that you can transfer to Player machines in any location. The Package Script utility automatically determines and includes all associated files, such as datapools and binary files, that are required to run the script. The zip file contains the script, its auxiliary files, and a manifest file that lists the packaged files and the middleware the script uses.

 **Note:** You must compile scripts before placing them in the zip file.

Packaging a Script

Use this procedure to select a QALoad script and package it and all its associated files into a zip file. For example, you can transfer the zip file to a Player machine for use by ClientVantage.

To select a script:

1. Open a session in the Script Development Workbench.

2. Select a script in the Workspace pane and click **File>Package Script**. The Package Scripts dialog box appears with the script you selected displayed in the **Script File** field.

 **Note:** You can open the Package Scripts dialog box before choosing a script, then click Browse to open the **Select Script File to Package** dialog box and select the script.

To package the script:

1. In the Package Scripts dialog box, click **Package**. The **Select Package Directory and Name** dialog box appears.
2. Click the down arrow in the **Save in** field to select the directory where you want to save the zip file. The default directory provided is `Program Files\Compuware\QALoad`.
3. In the **File name** field, type a name for the zip file. The default name provided is the name of the script.
4. Click **Save**. The zip file is created and saved in the directory you selected. The Package Scripts dialog box displays.

 **Note:** You can only package compiled scripts. If you try to use the Package Scripts utility on an uncompiled script, an error message appears. You must exit the Package Scripts dialog box, compile the script, and start the script packaging process again.

5. Select another script to package, or click **Close**.

To unpackage the script:

To unpackage the script, access the Vantage Console in ClientVantage where you can publish the script. For more information on how to use the Vantage Console, refer to the online help in ClientVantage.

Using EasyScript Sessions

Using the Universal Session

The Universal session allows you to record calls from multiple middleware applications within a single Script Development Workbench session. You might use the Universal session in cases where your application accesses an additional application that uses a different protocol.

For example, your browser might download and open a Java applet which then communicates with a Winsock server. If you recorded that activity using a simple WWW session, the Script Development Workbench would only record the HTTP requests that downloaded and opened the Java applet. Recording that transaction with the Universal session ensures that you record the HTTP requests from the browser as well as the Winsock-based communication between the Java applet and the Winsock server — all within a single script.

You start and record from a Universal session exactly like a single middleware session with one difference — after starting a Universal session you must select which middleware applications to record.

Citrix

Overview

Use QALoad's Citrix middleware to load test systems that run Citrix MetaFrame or Citrix MetaFrame XP.

Using the Player, Script Development Workbench, and Analyze

What is Citrix?

Citrix middleware is a communication layer that provides remote access to Windows systems. The remote system appears in a window on the local system.

Connecting to the remote system

Once connected to a machine that is running the MetaFrame server, log into the remote system and run applications. Alternatively, specify an application in addition to a user name and password, which provides access only to the specified application and minimizes user input that is necessary to access the application under test. Test the environment using the Window Citrix Client to start a Citrix session.

Testing in load-balanced environments

If testing an environment that includes a server farm, use Citrix ICA files to support this type of configuration. Specify the ICA file on the [Citrix Record Options](#) dialog box. ICA files are also necessary for encryption. ICA files are generated on the MetaFrame server and can be obtained from your MetaFrame administrator. For more information about using ICA files, see [Using ICA files](#).

When ICA files are not provided by an application, specify connection information using the Published Applications or the Single Server options in the Citrix Record Options dialog box. These options also enable you to specify lists of published applications and servers to invoke when you log on to the Citrix client session.

Testing using the Citrix Web Interface

When you initiate Citrix-published applications using a web browser, you can capture and playback scripts in QALoad using the [Citrix Web Interface](#). The Citrix Web Interface starts a Universal session with the Citrix and WWW middlewares selected. The WWW middleware intercepts the ICA file created by the web server. It passes data to and from the Citrix Server during the capture process, enabling you to test the performance of applications that are available through internet connections.

[Wait Points in Citrix Scripts](#)

When mouse move consolidation is enabled via the Combine Mouse Input option on the Convert Options dialog box, not all events that were captured appear during replay. As a result, the placement of wait points for window moves and window resizing is important. When a window is moved on the desktop, a window move event is created for each mouse move. However, during replay of a consolidated script, only one mouse move is made (to the final destination), and subsequently only one window move event occurs. Because of this consolidation of consecutive mouse and window moves, the [CtxWaitForWindowMove](#) command in your script should target the final window move in the series. This issue also applies to the [CtxWaitForWindowResize](#) command and the resizing of windows on the desktop.

If a window's title changes while the window is being created (such as a browser window's title bar changing once the default Web page begins to load), the [CtxWaitForWindowCreate](#) command may time out. If this occurs, remove the wait point or insert a [CtxWaitForScreenUpdate](#) command to preserve the wait in the script.

[Recording Citrix Scripts for Restricted Desktops](#)

When recording a Citrix script on a restricted desktop, you must take extra steps to ensure proper playback. Dynamic windows may be created and destroyed with no user interaction at both logon and logoff. To prevent unexpected results during playback, do not click on any of these dynamic windows. For example, the script might attempt to click on a destroyed window or a window that has not been created yet. The appearance of dynamic windows often depends on the speed of the server or the load on the farm during playback.

Performance issues with SAP or Citrix scripts

If you experience performance issues with SAP or Citrix scripts, increase your system paging file size to a fixed size of at least four times the amount of RAM on the machine.

About the Citrix Web Interface

Capture and playback scripts for Citrix applications accessed through a web browser using the Citrix Web Interface. This starts a Universal session for both the Citrix and WWW middlewares, which enables the WWW middleware to pass information to and from the Citrix server.

When selecting a published application through a web browser, the request is sent to the web server. The web server creates an ICA file for the requested application and returns it to the web browser. When the web browser finds an associated application to handle the ICA file, the Citrix client starts the published application requested. The ICA file used during the capture process is saved in `QALoad\Middlewares\Temp`.

 **Note:** Only the first ICA file received by the web browser is recorded.

The converted script contains both Citrix and WWW functions. A new variable, `char* strICAFileName[N]`, is declared at the top of the script. All allocated memory is released at the end of the script.

Accessing a Citrix Session

Use one of the following methods to begin recording a Citrix session.

To access a Citrix Client session:

! From the **Session** menu, click **Citrix>Windows Client**.

OR

! On the toolbar, select the down arrow next to the Citrix button on the toolbar, then select **Windows Client**.

To access the Citrix Web Interface when selecting a Citrix session:

! From the **Session** menu, click **Citrix>Web Interface**.

OR

! On the toolbar, click the down arrow next to the Citrix button, then select **Web Interface**.

The Universal session starts with both the Citrix and WWW middlewares selected. In the Citrix tab, **Web Interface** is selected in the **Type** field.

To access the Citrix Web Interface from a Universal session:

1. On the toolbar, click **Session>Universal** or click the **Universal** button on the toolbar.
2. Click **Options>Record**. The Universal Record Options dialog box appears.
3. In the Middleware Selection pane, select **WWW**, then select **Citrix**. The Universal Record dialog box displays both a **WWW** tab and a **Citrix** tab. In the **Citrix** tab, **Web Interface** is selected in the **Type** field.

Recording a Citrix Session

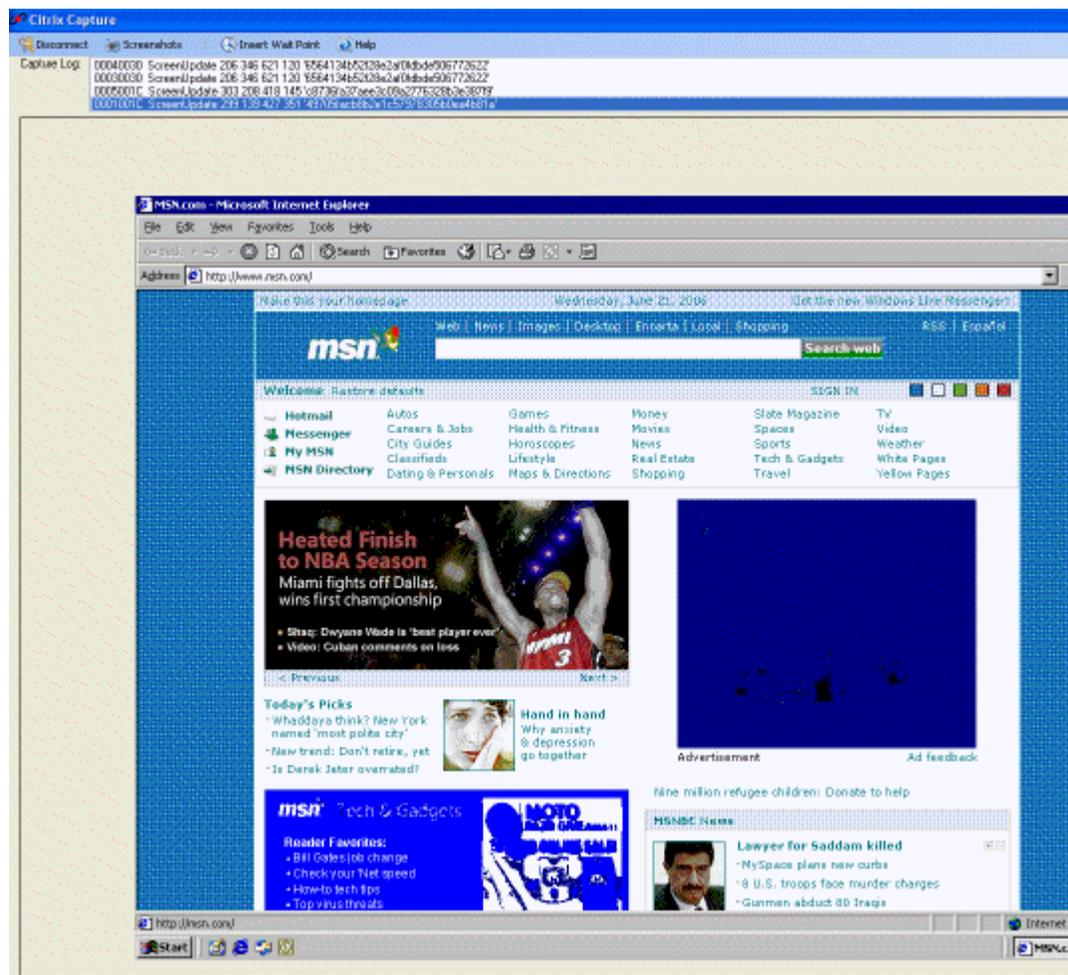
To begin recording a Citrix session, select the down arrow next to the Citrix button on the toolbar, then do one of the following procedures below.

1 Tips: It is recommended not to use the Caps Lock key during Citrix session capture and replay. During capture, either use the Shift key or modify the script to use uppercase characters. During replay, the Caps Lock key may interfere with replayed keystrokes. Similarly, the Windows Logo key is not supported. Do not use the Windows Logo key to start applications while recording a Citrix script.

To begin recording a Citrix Client session:

1. Select **Windows Client** to activate a new Citrix session.
2. From the toolbar, select **Options>Record**, and select the appropriate **options**.
3. Click **Record** on the **Session** toolbar.

The Citrix capture application appears, as shown in the following image. Click the three sections of the image to learn more about the fields and the information that is displayed in each area.



To begin recording using the Citrix Web Interface:

1. Select **Web Interface** to activate Universal session for the Citrix Web Interface.
2. Click **Record** on the **Session** toolbar. The **Universal Record Options** dialog box displays.
3. Select the appropriate [options](#), then click **Start Record**.

Setting Citrix Convert Options

To set conversion options for Citrix Client session:

1. Choose **Options>Convert** in the Script Development Workbench toolbar. The **Session Options** dialog box appears.
2. Select the appropriate [options](#), then click **OK**.

To set conversion options for Citrix Web Interface session:

1. Choose **Options>Convert** in the Script Development Workbench toolbar. The **Session Options** dialog box appears with both Citrix and WWW selected.
2. Click the **Session Options** tab.
3. Under **Convert Options**, click **Citrix Convert Options**.
4. Select the appropriate [options](#), then click **OK**.

Note: During the conversion process for both Client and Web Interface sessions, calls to the `CtxSetWindowTitle` method are sometimes placed at an incorrect line in the script. Determine the correct line by inspecting the capture file and moving the call to that position in the script.

The `CtxSetWindowTitle` method is added by QALoad during conversion and should otherwise not be modified or manually added to a script.

Inserting Screenshots in the Citrix Script

During the Citrix session, you can take a screenshot of the contents of the connection window. This inserts a wait point in the script for the screenshot you select and saves the image as a bitmap. You can select:

- ! Insert Wait for Full Screenshot - Inserts a wait point based on a full screenshot of the current display.
- ! Insert Wait for Partial Screenshot - Inserts a wait point based on a partial screenshot of the current display.
- ! Save Current Screenshot - Saves a screenshot of the current display to a bitmap file.

 **Note:** Images are saved to `\ QALoad \Middlewares\Citrix\Captures\screenshot`.

To insert a full screenshot into the Citrix script:

1. In the Citrix Capture dialog box, click **Screenshots>Insert Wait for Full Screenshot**. The Screen Capture Preview screen displays the image.
2. Click **Finish** to confirm the screenshot. The Specify Screenshot Name dialog box displays with a list of all previously saved screenshots.
3. In the **Name** field, type a descriptive name for the image.
4. Click **OK**. The image is saved as a bitmap and a wait point for the screenshot is inserted into the script.

To insert a partial screenshot into the Citrix script:

1. In the Citrix Capture dialog box, click **Screenshots>Insert Wait for Partial Screenshot**. The selected screen displays with the message "Select a rectangular region of the screenshot you want to insert."
2. Hold down the left mouse button and drag the cursor across the screen to select the region to save. The Screen Capture Preview screen appears with the image you selected.
3. Click **Finish**. The Specify Screenshot Name dialog box appears with a list of all previously saved screenshots.
4. In the Name field, type a descriptive name for the image.
5. Click **OK**. The image is saved as a bitmap and a wait point for the screenshot is inserted into the script.

To save the current screen:

1. In the Citrix Capture dialog box, click **Screenshots>Save Current Screenshot**. The Screen Capture Preview screen displays.
2. Click **Finish**. The Specify Screenshot Name dialog box displays with a list of all previously saved screenshots.
3. In the Name field, type a descriptive name for the image.
4. Click **OK**. The image is saved as a bitmap.

Using ICA files

ICA files, which are generated on the MetaFrame server, contain configuration options for Citrix. You can specify an ICA file on the [Citrix Record Options](#) dialog box.

ICA files are specified in the script with the `CtxSetICAFile` command. If an ICA file is specified, the call is generated with an unqualified file name. For example:

```
CtxSetICAFile("customapp.ica");
```

 **Note:** The file name is not fully-qualified because the file may not exist in the same location among the remote Player machines.

To validate the script on the same machine on which it was captured, copy the ICA file to the `QALoad\BinaryFiles` directory.

To use the ICA file on remote Player machines, the ICA file should be specified as an Attached File in the [External Data](#) page of the Script Properties dialog box. This also displays in the External Data area of the [Script Properties dialog box](#) in the Conductor.

Citrix Command Reference

QALoad provides descriptions and examples of the various commands available for a Citrix script. For details, refer to the Language Reference Help section for [Citrix](#).

Desktop Screen Resolution When Recording Citrix Scripts

To ensure that the entire Citrix interface is visible during recording, set the Resolution field in the Citrix recording options to a lower value than that of the desktop. Also, the screen resolution must be the same as the screen resolution specified in the Citrix ICA file.

Citrix Script Samples

Citrix Script Samples

You can address specific situations or resolve certain problems by modifying converted Citrix scripts.

 **Tips:** Uppercase characters are not captured when the CAPS Lock key is on. Manually modify the script to use uppercase characters or hold down the SHIFT key during recording. Similarly, the Windows Logo key is not supported. Do not use the Windows Logo key to start applications while recording a Citrix script.

The scripts listed below include a description of the problem, the procedure for implementing the modification, and samples of a modified script.

[Handling Citrix Server Farms](#)

[Handling Dynamic Window Titles](#)

[Handling Intermittent Windows](#)

[Handling Unexpected Events](#)

[Moving Citrix Connect and Disconnect Outside the Transaction Loop](#)

[Scripting Mouse Actions](#)

[Using the CtxWaitForScreenUpdate Command](#)

[Flushing Past Events from the Internal Queue](#)

Citrix Server Farms

Handling Citrix Server Farms

Citrix servers can be grouped in farms. When load testing, you may want to connect to a Citrix server farm rather than to a specific server. Load testing requirements may include connecting to a Citrix server farm, where the load balancing feature supports dynamic redirection to a given server at connection time. This load tests the server farm and Citrix load balancing rather than a single server, which can provide a more realistic load test.

To record a script that connects to a farm, you must use an ICA file to connect. However, when a capture takes place, a specific server (in the farm) must have a connection. Specify the correct ICA file to connect to the server farm as well as a specific server within that server farm.

To verify that your script is connecting to a server farm and not a specific server, assign the server name to one blank space when validating the script. In order to record a script that connects to a farm, you must use an ICA file specified in the Citrix Record Options dialog. Since the ICA file should contain all the necessary connection information, the server field should be left blank when recording.

When converted, the CitrixServer variable has a blank space:

```
.
.
.
/* Declare Variables */
const char *CitrixServer = " ";
const char *CitrixUsername = "citrix";
const char *CitrixPassword = "~encr~657E06726F697206";
const char *CitrixDomain = "qacitrix2";
const int CitrixOutputMode = OUTPUT_MODE_NORMAL;

.
.
.
SET_ABORT_FUNCTION(abort_function);
DEFINE_TRANS_TYPE("Orders.cpp");
CitrixInit(4);
```

Using the Player, Script Development Workbench, and Analyze

```
/* Citrix replay settings */
CtxSetConnectTimeout(90);
CtxSetDisconnectTimeout(90);
CtxSetWindowTimeout(30);
CtxSetPingTimeout(20);
CtxSetWaitPointTimeout(30);
CtxSetWindowVerification(TRUE);
CtxSetDomainLoginInfo(CitrixUsername, CitrixPassword, Citrix-Domain);
CtxSetICAFile("PRD_desktop.ica");
CtxSetEnableCounters(TRUE);
CtxSetWindowRetries(5, 5000);
CtxSetEnableWildcardMatching(TRUE);

SYNCHRONIZE();
```

The Citrix client ignores this value and uses the ICA file to dynamically retrieve the server name at playback time.

Conclusion

When you use these techniques to set up a Citrix server farm test script, you allow for dynamic server redirection at playback as part of testing a load balanced Citrix server farm.

Sample Script for Handling Citrix Server Farms

The following sample shows a snippet of a Citrix script that sets up a server farm test script.

Sample Script

```
/* Converted using the following options:
 * General:
 *   Line Split           : 80 characters
 *   Sleep Seconds       : 1
 *   Auto Checkpoints    : No
 * Citrix
 *   General Options     :
 *   Replay Output Mode  : Normal
 *   Enable Counters     : No
 *   Timeout Value Options :
 *   Connect Timeout (s) : 60
 *   Disconnect Timeout (s) : 60
 *   Window Creation Timeout (s) : 30
 *   Ping Timeout (s) : 20
 *   Wait Point Timeout (s) : 30
 *   Input Options       :
 *   Combine Keyboard Input : Yes
 *   Combine Mouse Input  : Yes
 *   Window Options      :
 *   Window Verification  : Yes
 *   Window Max Retries   : 5
 *   Window Wait Retries (ms) : 5000
 *   Enable Wildcard Title Match : Yes
 */

#define CITRIX_CLIENT_VERSION "8.100.29670"
#define CITRIX_ICO_VERSION    "2.4"
#define SCRIPT_VER 0x00000505UL

#include <stdio.h>
#include "smacro.h"

#include "do_citrix.h"
```

```

/* set function to call on abort*/
void abort_function(PLAYER_INFO *s_info);

#ifdef NULL
#define NULL 0
#endif

extern "C" int rrobot_script(PLAYER_INFO *s_info)
{
    /* Declare Variables */

    //////////////////////////////////////
    /// Convert sets the Citrix server name to a single blank
    /// space. This is only necessary to verify that the script actually is connecting to a
    /// server farm.
    //////////////////////////////////////
    const char *CitrixServer      = " ";

    const char *CitrixUsername    = "test";
    const char *CitrixPassword    = "~encr~657E06726F697206";
    const char *CitrixDomain      = "test";
    const int   CitrixOutputMode  = OUTPUT_MODE_NORMAL;

    /* Citrix Window Information Objects */
    CtxWI *CWI_1 = new CtxWI(0x1001c, "Warning !!", 107, 43, 427, 351);
    CtxWI *CWI_2 = new CtxWI(0x5001c, "Please wait...", 111, 112, 418, 145);
    CtxWI *CWI_3 = new CtxWI(0x40030, "Citrix License Warning Notice", 125, 198, 397, 127);
    CtxWI *CWI_4 = new CtxWI(0x4002e, "UsrLogon.Cmd", 0, 456, 161, 25);
    CtxWI *CWI_5 = new CtxWI(0x1003a, "", -2, 452, 645, 31);
    CtxWI *CWI_6 = new CtxWI(0x10066, "ICA Seamless Host Agent", 0, 0, 391, 224);
    CtxWI *CWI_7 = new CtxWI(0x10052, "Program Manager", 0, 0, 641, 481);
    CtxWI *CWI_8 = new CtxWI(0x1008c, "", 115, 0, 405, 457);
    CtxWI *CWI_9 = new CtxWI(0x2006c, "Calculator", 66, 66, 261, 253);

    SET_ABORT_FUNCTION(abort_function);

    DEFINE_TRANS_TYPE("capCtxServerFarm.cpp");

    CitrixInit(1);

    /* Citrix replay settings */
    CtxSetConnectTimeout(60);
    CtxSetDisconnectTimeout(60);
    CtxSetWindowTimeout(30);
    CtxSetPingTimeout(20);
    CtxSetWaitPointTimeout(30);
    CtxSetWindowVerification(TRUE);
    CtxSetDomainLoginInfo(CitrixUsername, CitrixPassword, CitrixDomain);
    CtxSetICAFile("PRD desktop.ica");
    CtxSetEnableCounters(FALSE);
    CtxSetWindowRetries(5, 5000);
    CtxSetEnableWildcardMatching(TRUE);

    SYNCHRONIZE();

    ...rest of script...
}

```

Dynamic Window Titles

Dynamic Window Titles

Some applications create windows whose titles vary depending on the state of the window. For example, Microsoft Word creates a title based on the default document name at the time of the window creation. Other window titles may contain the user's name, or the day or time. When a window name in the record session varies from the name in a validation or playback session, the script fails with a window title mismatch error.

Using the Player, Script Development Workbench, and Analyze

When this error occurs during validation or playback, you must modify the script to recognize the base pattern of the window title name rather than an exact window title.

Modifying the Script to Handle Dynamic Window Titles

Window titles can vary based on the state of the application. For example, Microsoft Word windows may appear with the name of a default document title as part of the window name. Other window titles may contain the user's name, or the day or time. When a window name in the record session varies from the name in a validation or playback session, the script fails with a window title mismatch error.

When this error occurs during validation or playback, you must modify the script to recognize the base pattern of the window title name rather than an exact window title. You can do this during conversion by adding [CtxWaitForWindowCreate](#) calls to the script for each named window creation event.

When you modify a script for these occurrences, you must:

- ! Modify the recording process
- ! Perform an initial validation
- ! Identify a Match Pattern
- ! Modify the script
- ! Revalidate the script

 Note: You may need to [configure](#) the workbench and player for validation.

To modify the recording process:

1. Record the Citrix session with the proper options selected.
2. Click **Options>Convert**, then click the Citrix tab.
3. Ensure that the **Enable Wildcard Title Match** check box is selected.
4. Click **OK** to convert the recording.

To perform an initial validation after script record and conversion:

1. Click **Session>Validate Script**.
2. When the validation session generates the window title mismatch error, compare the actual window title name to the expected window title name.

 Note: Repeated validations should generate a list of one or more window titles that differ from the expected title.

To perform a Match Pattern identification:

Identify a match pattern that compares all actual window titles to original window titles using the list of window titles from validations.

 Note: This regular-expression style match pattern uses the normal character set. Asterisks (*) denote 0 to n wildcard characters. Question marks denote one wildcard character.

To modify the script:

Make the script changes when you identify a workable match pattern for the dynamic window.

1. In the script, ensure that the `CtxSetEnableWildcardMatching` command exists before the `SYNCHRONIZE` command.
2. Ensure that the `CtxSetEnableWildcardMatching` parameter value is set to `TRUE`.

 **Note:** This statement is inserted when you set the `Enable Wildcard Title Match` option in `Options>Convert` before converting the recording.

3. Insert a `CtxSetWindowMatchTitle` command before the `CtxWaitForWindowCreate` call for each window creation wait event for the dynamic window. The parameters include the Citrix window identifier and the identified match pattern for the dynamic window.

To revalidate the script:

1. Click **Session>Validate Script**.
2. If the `CtxWaitForWindowCreate` wait event call fails, identify the actual window title returned.
3. Perform the match pattern identification step and re-create a valid wildcard string to match all expected window values.

Conclusion

Following these techniques, you can modify window creation events to recognize dynamic window titles. The sample scripts illustrate how to determine a base pattern for the window title by sequential validations of the script and how to make relevant changes to the script. The first example uses a [substring match](#) to recognize the dynamic window title. The second example uses a [wildcard match](#) to accomplish this.

Script Samples - Using a Substring Match

Script Samples: Example One - Using a Substring Match

In this example, the Microsoft Word application generates a dynamic title. The dynamic name is a concatenation of the default document that Word creates at application startup with the name of the application.

Original Window Title (Record)	"Microsoft Word"
Actual Window Title (Validation)	"document1 - Microsoft Word"
Actual Window Title (Validation)	"document 2 - Microsoft Word"

The script is altered to reflect the fact that the string "Microsoft Word" is always part of the window title. The asterisk (*) wildcard is substituted for the default document name.

"Match Pattern" from window titles	"* - Microsoft Word"
------------------------------------	----------------------

Sample: Original Citrix Script

This is an example of an original Citrix script converted from capture. In this example, the Microsoft Word application generates a dynamic title. The dynamic name is a concatenation of the default document that Word creates at application startup with the name of the application. Points of interest in the script are highlighted in bold.

Sample Script

Using the Player, Script Development Workbench, and Analyze

```
/*
 * dynamicwindow.cpp
 *
 * Script Converted on April 18, 2005 at 12:13:47 PM
 * Generated by Compuware QALoad convert module version 5.5.0 build 256
 *
 * This script contains support for the following middlewares:
 *   - Citrix
 */
/* Converted using the following options:
 * General:
 *   Line Split                : 80 characters
 *   Sleep Seconds             : 1
 *   Auto Checkpoints          : No
 * Citrix
 *   General Options           :
 *   Replay Output Mode        : Normal
 *   Enable Counters            : No
 *   Timeout Value Options     :
 *   Connect Timeout (s)       : 60
 *   Disconnect Timeout (s)    : 60
 *   Window Creation Timeout (s) : 30
 *   Ping Timeout (s)          : 20
 *   Wait Point Timeout (s)    : 30
 *   Input Options              :
 *   Combine Keyboard Input     : Yes
 *   Combine Mouse Input        : Yes
 *   Window Options             :
 *   Window Verification        : Yes
 *   Window Max Retries         : 5
 *   Window Wait Retries (ms)  : 5000
 *   Enable Wildcard Title Match : Yes
 */

#define CITRIX_CLIENT_VERSION "7.100.21825"
#define CITRIX_ICO_VERSION   "2.3"
#define SCRIPT_VER 0x00000505UL

#include <stdio.h>
#include "smacro.h"

#include "do_citrix.h"

/* set function to call on abort*/
void abort_function(PLAYER_INFO *s_info);

#ifndef NULL
#define NULL 0
#endif

extern "C" int rrobot_script(PLAYER_INFO *s_info)
{
    /* Declare Variables */
    const char *CitrixServer      = "qaccitrix";
    const char *CitrixPassword    = "";
    const int   CitrixOutputMode  = OUTPUT_MODE_NORMAL;

    /* Citrix Window Information Objects */
    CtxWI *CWI_1 = new CtxWI(0x1001c, "Warning !!", 107, 43, 427, 351);
    CtxWI *CWI_2 = new CtxWI(0x2001c, "Log On to Windows", 111, 65, 418, 285);
    CtxWI *CWI_3 = new CtxWI(0x5001c, "Please wait...", 111, 112, 418, 145);
    CtxWI *CWI_4 = new CtxWI(0x30030, "Citrix License Warning Notice", 125, 198, 397, 127);
    CtxWI *CWI_5 = new CtxWI(0x40030, "Citrix License Warning Notice", 125, 198, 397, 127);
    CtxWI *CWI_6 = new CtxWI(0x4002e, "UsrLogon.Cmd", 0, 456, 161, 25);
    CtxWI *CWI_7 = new CtxWI(0x1003a, "", -2, 452, 645, 31);
}
```

```

CtxWI *CWI_8 = new CtxWI(0x10066, "ICA Seamless Host Agent", 0, 0, 391, 224);
CtxWI *CWI_9 = new CtxWI(0x10052, "Program Manager", 0, 0, 641, 481);
CtxWI *CWI_10 = new CtxWI(0x1008c, "", 115, 0, 405, 457);
CtxWI *CWI_11 = new CtxWI(0x20068, "", 112, 116, 416, 248);
// Note the initial window title of "Microsoft Word" is set here in the script...
CtxWI *CWI_12 = new CtxWI(0x2006e, "Microsoft Word", -4, -4, 649, 461);
CtxWI *CWI_13 = new CtxWI(0x7001c, "Please wait...", 111, 112, 418, 145);

SET_ABORT_FUNCTION(abort_function);

DEFINE_TRANS_TYPE("dynamicwindow.cpp");

CitrixInit(1);

/* Citrix replay settings */
CtxSetConnectTimeout(60);
CtxSetDisconnectTimeout(60);
CtxSetWindowTimeout(30);
CtxSetPingTimeout(20);
CtxSetWaitPointTimeout(30);
CtxSetWindowVerification(TRUE);
CtxSetEnableCounters(FALSE);
CtxSetWindowRetries(5, 5000);
CtxSetEnableWildcardMatching(TRUE);

SYNCHRONIZE();

BEGIN_TRANSACTION();

DO_SetTransactionStart();

CtxConnect(CitrixServer, CitrixOutputMode);

CtxPoint(164, 61); //1113840775.516

// Window CWI_1 ("Warning !!") created 1113840775.516
CtxWaitForWindowCreate(CWI_1, 1969);

DO_MSLEEP(2046);
CtxPoint(332, 359); //1113840777.629

DO_MSLEEP(63);
CtxClick(CWI_1, 94, L_BUTTON, NONE); //1113840777.723

// Window CWI_2 ("Log On to Windows") created 1113840777.817
CtxWaitForWindowCreate(CWI_2, 93);

DO_MSLEEP(16);
// Window CWI_1 ("Warning !!") destroyed 1113840777.833

CtxType(CWI_2, "citrix"); //1113840786.615

DO_MSLEEP(8547);
CtxTypeVK(CWI_2, VK_TAB, NONE); //1113840786.678

DO_MSLEEP(281);
CtxType(CWI_2, "citrix"); //1113840788.650

DO_MSLEEP(1672);
CtxTypeVK(CWI_2, VK_TAB, NONE); //1113840788.713

DO_MSLEEP(359);
CtxType(CWI_2, "q"); //1113840789.683

DO_MSLEEP(438);

```

Using the Player, Script Development Workbench, and Analyze

```
DO_MSLEEP(1078);
CtxPoint(231, 325); //1113840790.309

DO_MSLEEP(78);
CtxMouseDown(CWI_2, L_BUTTON, NONE, 231, 325); // 1113840790.309

CtxMouseUp(CWI_2, L_BUTTON, NONE, 232, 325); //1113840790.388

CtxPoint(232, 325); //1113840790.544

// Window CWI_3 ("Please wait...") created 1113840790.544

CtxWaitForWindowCreate(CWI_3, 204);

// Window CWI_2 ("Log On to Windows") destroyed 1113840790.544

// Window CWI_4 ("Citrix License Warning Notice") created 1113840790.591

CtxWaitForWindowCreate(CWI_4, 46);

DO_MSLEEP(16);
// Window CWI_3 ("Please wait...") destroyed 1113840790.607

// Window CWI_5 ("Citrix License Warning Notice") created 1113840790.654

CtxWaitForWindowCreate(CWI_5, 47);

DO_MSLEEP(16);
// Window CWI_4 ("Citrix License Warning Notice") destroyed 1113840790.669

// Window CWI_6 ("UsrLogon.Cmd") created 1113840790.716

CtxWaitForWindowCreate(CWI_6, 46);

DO_MSLEEP(16);
// Window CWI_6 ("UsrLogon.Cmd") destroyed 1113840790.732

// Window CWI_7 ("") created 1113840790.967

DO_MSLEEP(234);
// Window CWI_8 ("ICA Seamless Host Agent") created 1113840791.014

CtxWaitForWindowCreate(CWI_8, 47);

// Window CWI_9 ("Program Manager") created 1113840791.030

CtxWaitForWindowCreate(CWI_9, 16);

CtxPoint(347, 249); //1113840793.080

// Window CWI_10 ("") created 1113840793.080

DO_MSLEEP(16);

DO_MSLEEP(1203);
CtxPoint(571, 256); //1113840796.133

DO_MSLEEP(1844);
// Window CWI_10 ("") destroyed 1113840796.133

DO_MSLEEP(1828);
CtxPoint(446, 208); //1113840798.309

DO_MSLEEP(344);
CtxClick(CWI_5, 78, L_BUTTON, NONE); //1113840798.387

DO_MSLEEP(437);
CtxPoint(311, 303); //1113840798.935
```

```
DO_MSLEEP(110);
CtxClick(CWI_5, 109, L_BUTTON, NONE); //1113840799.045

DO_MSLEEP(94);
// Window CWI_5 ("Citrix License Warning Notice") destroyed 1113840799.138

DO_MSLEEP(390);
CtxPoint(275, 1); //1113840799.718

DO_MSLEEP(188);
CtxClick(CWI_8, 62, L_BUTTON, NONE); //1113840799.780

DO_MSLEEP(703);
CtxPoint(200, 187); //1113840800.579

DO_MSLEEP(94);
CtxClick(CWI_8, 78, L_BUTTON, NONE); //1113840800.657

DO_MSLEEP(110);
CtxPoint(209, 192); //1113840800.766

// Window CWI_8 ("ICA Seamless Host Agent") destroyed 1113840800.766

DO_MSLEEP(5328);
CtxPoint(115, 175); //1113840806.245

DO_MSLEEP(140);
CtxDoubleClick(CWI_9); // 1113840806.621

CtxMouseUp(CWI_7, L_BUTTON, NONE, 114, 174); //1113840806.512

DO_MSLEEP(16);
CtxPoint(114, 174); //1113840806.621

DO_MSLEEP(359);
CtxPoint(284, 205); //1113840807.028

// Window CWI_11 ("") created 1113840807.028

DO_MSLEEP(16);
CtxPoint(309, 208); //1113840807.326

// Window CWI_12 ("Microsoft Word") created 1113840807.326

///  
///  
///  
CtxWaitForWindowCreate(CWI_12, 266);

DO_MSLEEP(46);
CWI_12->setTitle("Document1 - Microsoft Word"); //1113840807.388

DO_MSLEEP(16);
// Window CWI_11 ("") destroyed 1113840807.388

DO_MSLEEP(4188);
CtxPoint(626, 8); //1113840811.693

DO_MSLEEP(109);
CtxClick(CWI_12, 94, L_BUTTON, NONE); //1113840811.787

DO_MSLEEP(218);
CtxPoint(623, 40); //1113840812.006

// Window CWI_12 ("Document1 - Microsoft Word") destroyed 1113840812.006

DO_MSLEEP(2204);
CtxPoint(385, 1); //1113840815.262
```

Using the Player, Script Development Workbench, and Analyze

```
DO_MSLEEP(1046);
// Window CWI_9 ("Program Manager") destroyed 1113840815.262

// Window CWI_7 ("") destroyed 1113840815.262

// Window CWI_13 ("Please wait...") created 1113840815.513

CtxWaitForWindowCreate(CWI_13, 0);

DO_SetTransactionCleanup();

CtxDisconnect();

END_TRANSACTION();

delete CWI_1; // "Warning !!"
delete CWI_2; // "Log On to Windows"
delete CWI_3; // "Please wait..."
delete CWI_4; // "Citrix License Warning Notice"
delete CWI_5; // "Citrix License Warning Notice"
delete CWI_6; // "UsrLogon.Cmd"
delete CWI_7; // ""
delete CWI_8; // "ICA Seamless Host Agent"
delete CWI_9; // "Program Manager"
delete CWI_10; // ""
delete CWI_11; // ""
delete CWI_12; // "Microsoft Word"
delete CWI_13; // "Please wait..."

CitrixUninit();

EXIT();
return(0);
}
void abort_function(PPLAYER_INFO *s_info)
{
    RR_printf("Virtual User ABORTED.");

    CitrixUninit();

    EXIT();
}
```

Sample One: Modified Citrix Script

In this example, the Microsoft Word application generates dynamic title that is a concatenation of the default document that Word creates at application startup with the name of the application. This script is altered to reflect the fact that the string "Microsoft Word" is always part of the window title. The asterisk (*) wildcard is substituted for the default document name. Changes to the original script are highlighted in bold>.

Sample Script

```
/*
 * dynamicwindow.cpp
 *
 * Script Converted on April 18, 2005 at 12:13:47 PM
 * Generated by Compuware QALoad convert module version 5.5.0 build 256
 *
 * This script contains support for the following middlewares:
 *     - Citrix
 */
/* Converted using the following options:
 * General:
 * Line Split                : 80 characters
 * Sleep Seconds              : 1
```

```

* Auto Checkpoints           : No
* Citrix
* General Options           :
*   Replay Output Mode      : Normal
*   Enable Counters         : No
*   Timeout Value Options   :
*     Connect Timeout (s)   : 60
*     Disconnect Timeout (s) : 60
*     Window Creation Timeout (s) : 30
*     Ping Timeout (s)      : 20
*     Wait Point Timeout (s) : 30
*   Input Options           :
*     Combine Keyboard Input : Yes
*     Combine Mouse Input    : Yes
*   Window Options         :
*     Window Verification    : Yes
*     Window Max Retries     : 5
*     Window Wait Retries (ms) : 5000
*     Enable Wildcard Title Match : Yes
*/

#define CITRIX_CLIENT_VERSION "7.100.21825"
#define CITRIX_ICO_VERSION   "2.3"
#define SCRIPT_VER 0x00000505UL

#include <stdio.h>
#include "smacro.h"

#include "do_citrix.h"

/* set function to call on abort*/
void abort_function(PLAYER_INFO *s_info);

#ifndef NULL
#define NULL 0
#endif

extern "C" int rrobot_script(PLAYER_INFO *s_info)
{
    /* Declare Variables */
    const char *CitrixServer      = "qaccitrix";
    const char *CitrixPassword    = "";
    const int   CitrixOutputMode  = OUTPUT_MODE_NORMAL;

    /* Citrix Window Information Objects */
    CtxWI *CWI_1 = new CtxWI(0x1001c, "Warning !!", 107, 43, 427, 351);
    CtxWI *CWI_2 = new CtxWI(0x2001c, "Log On to Windows", 111, 65, 418, 285);
    CtxWI *CWI_3 = new CtxWI(0x5001c, "Please wait...", 111, 112, 418, 145);
    CtxWI *CWI_4 = new CtxWI(0x30030, "Citrix License Warning Notice", 125, 198, 397, 127);
    CtxWI *CWI_5 = new CtxWI(0x40030, "Citrix License Warning Notice", 125, 198, 397, 127);
    CtxWI *CWI_6 = new CtxWI(0x4002e, "UsrLogon.Cmd", 0, 456, 161, 25);
    CtxWI *CWI_7 = new CtxWI(0x1003a, "", -2, 452, 645, 31);
    CtxWI *CWI_8 = new CtxWI(0x10066, "ICA Seamless Host Agent", 0, 0, 391, 224);
    CtxWI *CWI_9 = new CtxWI(0x10052, "Program Manager", 0, 0, 641, 481);
    CtxWI *CWI_10 = new CtxWI(0x1008c, "", 115, 0, 405, 457);
    CtxWI *CWI_11 = new CtxWI(0x20068, "", 112, 116, 416, 248);
    // The initial window title of "Microsoft Word" does not change
    CtxWI *CWI_12 = new CtxWI(0x2006e, "Microsoft Word", -4, -4, 649, 461);
    CtxWI *CWI_13 = new CtxWI(0x7001c, "Please wait...", 111, 112, 418, 145);

    SET_ABORT_FUNCTION(abort_function);

    DEFINE_TRANS_TYPE("dynamicwindow.cpp");

    CitrixInit(1);
}

```

Using the Player, Script Development Workbench, and Analyze

```
/* Citrix replay settings */
CtxSetConnectTimeout(60);
CtxSetDisconnectTimeout(60);
CtxSetWindowTimeout(30);
CtxSetPingTimeout(20);
CtxSetWaitPointTimeout(30);
CtxSetWindowVerification(TRUE);
CtxSetEnableCounters(FALSE);
CtxSetWindowRetries(5, 5000);
CtxSetEnableWildcardMatching(TRUE);

SYNCHRONIZE();

BEGIN_TRANSACTION();

DO_SetTransactionStart();

CtxConnect(CitrixServer, CitrixOutputMode);

CtxPoint(164, 61); //1113840775.516

// Window CWI_1 ("Warning !!") created 1113840775.516

CtxWaitForWindowCreate(CWI_1, 1969);

DO_MSLEEP(2046);
CtxPoint(332, 359); //1113840777.629

DO_MSLEEP(63);
CtxClick(CWI_1, 94, L_BUTTON, NONE); //1113840777.723

// Window CWI_2 ("Log On to Windows") created 1113840777.817

CtxWaitForWindowCreate(CWI_2, 93);

DO_MSLEEP(16);
// Window CWI_1 ("Warning !!") destroyed 1113840777.833

CtxType(CWI_2, "citrix"); //1113840786.615

DO_MSLEEP(8547);
CtxTypeVK(CWI_2, VK_TAB, NONE); //1113840786.678

DO_MSLEEP(281);
CtxType(CWI_2, "citrix"); //1113840788.650

DO_MSLEEP(1672);
CtxTypeVK(CWI_2, VK_TAB, NONE); //1113840788.713

DO_MSLEEP(359);
CtxType(CWI_2, "q"); //1113840789.683

DO_MSLEEP(438);

DO_MSLEEP(1078);
CtxPoint(231, 325); //1113840790.309

DO_MSLEEP(78);
CtxMouseDown(CWI_2, L_BUTTON, NONE, 231, 325); // 1113840790.309

CtxMouseUp(CWI_2, L_BUTTON, NONE, 232, 325); //1113840790.388

CtxPoint(232, 325); //1113840790.544

// Window CWI_3 ("Please wait...") created 1113840790.544

CtxWaitForWindowCreate(CWI_3, 204);
```

```
// Window CWI_2 ("Log On to Windows") destroyed 1113840790.544
// Window CWI_4 ("Citrix License Warning Notice") created 1113840790.591
CtxWaitForWindowCreate(CWI_4, 46);

DO_MSLEEP(16);
// Window CWI_3 ("Please wait...") destroyed 1113840790.607
// Window CWI_5 ("Citrix License Warning Notice") created 1113840790.654
CtxWaitForWindowCreate(CWI_5, 47);

DO_MSLEEP(16);
// Window CWI_4 ("Citrix License Warning Notice") destroyed 1113840790.669
// Window CWI_6 ("UsrLogon.Cmd") created 1113840790.716
CtxWaitForWindowCreate(CWI_6, 46);

DO_MSLEEP(16);
// Window CWI_6 ("UsrLogon.Cmd") destroyed 1113840790.732
// Window CWI_7 ("") created 1113840790.967

DO_MSLEEP(234);
// Window CWI_8 ("ICA Seamless Host Agent") created 1113840791.014
CtxWaitForWindowCreate(CWI_8, 47);

// Window CWI_9 ("Program Manager") created 1113840791.030
CtxWaitForWindowCreate(CWI_9, 16);

CtxPoint(347, 249); //1113840793.080
// Window CWI_10 ("") created 1113840793.080

DO_MSLEEP(16);

DO_MSLEEP(1203);
CtxPoint(571, 256); //1113840796.133

DO_MSLEEP(1844);
// Window CWI_10 ("") destroyed 1113840796.133

DO_MSLEEP(1828);
CtxPoint(446, 208); //1113840798.309

DO_MSLEEP(344);
CtxClick(CWI_5, 78, L_BUTTON, NONE); //1113840798.387

DO_MSLEEP(437);
CtxPoint(311, 303); //1113840798.935

DO_MSLEEP(110);
CtxClick(CWI_5, 109, L_BUTTON, NONE); //1113840799.045

DO_MSLEEP(94);
// Window CWI_5 ("Citrix License Warning Notice") destroyed 1113840799.138

DO_MSLEEP(390);
CtxPoint(275, 1); //1113840799.718

DO_MSLEEP(188);
CtxClick(CWI_8, 62, L_BUTTON, NONE); //1113840799.780

DO_MSLEEP(703);
```

Using the Player, Script Development Workbench, and Analyze

```
CtxPoint(200, 187); //1113840800.579

DO_MSLEEP(94);
CtxClick(CWI_8, 78, L_BUTTON, NONE); //1113840800.657

DO_MSLEEP(110);
CtxPoint(209, 192); //1113840800.766

// Window CWI_8 ("ICA Seamless Host Agent") destroyed 1113840800.766

DO_MSLEEP(5328);
CtxPoint(115, 175); //1113840806.245

DO_MSLEEP(140);
CtxDoubleClick(CWI_9); // 1113840806.621

CtxMouseUp(CWI_7, L_BUTTON, NONE, 114, 174); //1113840806.512

DO_MSLEEP(16);
CtxPoint(114, 174); //1113840806.621

DO_MSLEEP(359);
CtxPoint(284, 205); //1113840807.028

// Window CWI_11 ("") created 1113840807.028

DO_MSLEEP(16);
CtxPoint(309, 208); //1113840807.326

// Window CWI_12 ("Microsoft Word") created 1113840807.326

////////////////////////////////////
// The CtxSetWindowMatchTitle command is inserted before the
// CtxWaitForWindowCreate call. Note that the window identifier is the
// same for both calls, and the "match pattern" for the command is from
// Example One in the Match Pattern Identification section above.
////////////////////////////////////

    CtxSetWindowMatchTitle(CWI_12, "*Microsoft Word" );

// The window create wait event call does not change.
CtxWaitForWindowCreate(CWI_12, 266);

DO_MSLEEP(46);
CWI_12->setTitle("Document1 - Microsoft Word"); //1113840807.388

DO_MSLEEP(16);
// Window CWI_11 ("") destroyed 1113840807.388

DO_MSLEEP(4188);
CtxPoint(626, 8); //1113840811.693

DO_MSLEEP(109);
CtxClick(CWI_12, 94, L_BUTTON, NONE); //1113840811.787

DO_MSLEEP(218);
CtxPoint(623, 40); //1113840812.006

// Window CWI_12 ("Document1 - Microsoft Word") destroyed 1113840812.006

DO_MSLEEP(2204);
CtxPoint(385, 1); //1113840815.262

DO_MSLEEP(1046);
// Window CWI_9 ("Program Manager") destroyed 1113840815.262

// Window CWI_7 ("") destroyed 1113840815.262
```

```
// Window CWI_13 ("Please wait...") created 1113840815.513

CtxWaitForWindowCreate(CWI_13, 0);

DO_SetTransactionCleanup();

CtxDisconnect();

END_TRANSACTION();

delete CWI_1; // "Warning !!"
delete CWI_2; // "Log On to Windows"
delete CWI_3; // "Please wait..."
delete CWI_4; // "Citrix License Warning Notice"
delete CWI_5; // "Citrix License Warning Notice"
delete CWI_6; // "UsrLogon.Cmd"
delete CWI_7; // ""
delete CWI_8; // "ICA Seamless Host Agent"
delete CWI_9; // "Program Manager"
delete CWI_10; // ""
delete CWI_11; // ""
delete CWI_12; // "Microsoft Word"
delete CWI_13; // "Please wait..."

CitrixUninit();

EXIT();
return(0);
}
void abort_function(PPLAYER_INFO *s_info)
{
    RR_printf("Virtual User ABORTED.");

    CitrixUninit();

    EXIT();
}

```

Script Samples - Using a Wildcard Match

Script Samples: Example Two - Using a Wildcard Match

In this example, the Sample Application generates a dynamic title. The dynamic name is the name of the application followed by the time the script is created.

Original Window Title (Record)	"Sample Application – 09:01:23 AM"
Actual Window Title (Validation)	"Sample Application – 11:00:04 AM"
Actual Window Title (Validation)	"Sample Application – 12:20:52 PM"

The question mark (?) wildcard is substituted for a given time.

"Match Pattern" from window titles	"Sample Application – ??:?:?:? ?M"
------------------------------------	------------------------------------

Sample Two: Original Citrix Script

The following sample is an original Citrix script converted from capture. In this example, the Sample Application generates a dynamic title. The dynamic name is the name of the application followed by the time the script is created. Points of interest in the script are highlighted in bold.

Using the Player, Script Development Workbench, and Analyze

Sample Script

```
/*
 * dynamicwindow2.cpp
 *
 * Script Converted on April 18, 2005 at 12:13:47 PM
 * Generated by Compuware QALoad convert module version 5.5.0 build 256
 *
 * This script contains support for the following middlewares:
 *   - Citrix
 */
/* Converted using the following options:
 * General:
 *   Line Split           : 80 characters
 *   Sleep Seconds       : 1
 *   Auto Checkpoints    : No
 * Citrix
 *   General Options     :
 *   Replay Output Mode  : Normal
 *   Enable Counters     : No
 *   Timeout Value Options :
 *   Connect Timeout (s) : 60
 *   Disconnect Timeout (s) : 60
 *   Window Creation Timeout (s) : 30
 *   Ping Timeout (s) : 20
 *   Wait Point Timeout (s) : 30
 * Input Options
 *   Combine Keyboard Input : Yes
 *   Combine Mouse Input   : Yes
 * Window Options
 *   Window Verification   : Yes
 *   Window Max Retries    : 5
 *   Window Wait Retries (ms) : 5000
 *   Enable Wildcard Title Match : Yes
 */

#define CITRIX_CLIENT_VERSION "7.100.21825"
#define CITRIX_ICO_VERSION    "2.3"
#define SCRIPT_VER 0x00000505UL

#include <stdio.h>
#include "smacro.h"

#include "do_citrix.h"

/* set function to call on abort*/
void abort_function(PLAYER_INFO *s_info);

#ifdef NULL
#define NULL 0
#endif

extern "C" int rrobot_script(PLAYER_INFO *s_info)
{
    /* Declare Variables */
    const char *CitrixServer      = "qaccitrix";
    const char *CitrixPassword    = "";
    const int   CitrixOutputMode  = OUTPUT_MODE_NORMAL;

    /* Citrix Window Information Objects */
    CtxWI *CWI_1 = new CtxWI(0x1001c, "Warning !!", 107, 43, 427, 351);
    CtxWI *CWI_2 = new CtxWI(0x2001c, "Log On to Windows", 111, 65, 418, 285);
    CtxWI *CWI_3 = new CtxWI(0x5001c, "Please wait...", 111, 112, 418, 145);
    CtxWI *CWI_4 = new CtxWI(0x30030, "Citrix License Warning Notice", 125, 198, 397, 127);
    CtxWI *CWI_5 = new CtxWI(0x40030, "Citrix License Warning Notice", 125, 198, 397, 127);
    CtxWI *CWI_6 = new CtxWI(0x4002e, "UsrLogon.Cmd", 0, 456, 161, 25);
}
```

```

CtxWI *CWI_7 = new CtxWI(0x1003a, "", -2, 452, 645, 31);
CtxWI *CWI_8 = new CtxWI(0x10066, "ICA Seamless Host Agent", 0, 0, 391, 224);
CtxWI *CWI_9 = new CtxWI(0x10052, "Program Manager", 0, 0, 641, 481);
CtxWI *CWI_10 = new CtxWI(0x1008c, "", 115, 0, 405, 457);
CtxWI *CWI_11 = new CtxWI(0x20068, "", 112, 116, 416, 248);
// Note the initial window title of "Sample Application 09:01:23 AM" is set here...
CtxWI *CWI_12 = new CtxWI(0x2006e, "Sample Application 09:01:23 AM ", -4, -4, 649, 461);
CtxWI *CWI_13 = new CtxWI(0x7001c, "Please wait...", 111, 112, 418, 145);

SET_ABORT_FUNCTION(abort_function);

DEFINE_TRANS_TYPE("dynamicwindow.cpp");

CitrixInit(1);

/* Citrix replay settings */
CtxSetConnectTimeout(60);
CtxSetDisconnectTimeout(60);
CtxSetWindowTimeout(30);
CtxSetPingTimeout(20);
CtxSetWaitPointTimeout(30);
CtxSetWindowVerification(TRUE);
CtxSetEnableCounters(FALSE);
CtxSetWindowRetries(5, 5000);
CtxSetEnableWildcardMatching(TRUE);

SYNCHRONIZE();

BEGIN_TRANSACTION();

DO_SetTransactionStart();

CtxConnect(CitrixServer, CitrixOutputMode);

CtxPoint(164, 61); //1113840775.516

// Window CWI_1 ("Warning !!") created 1113840775.516

CtxWaitForWindowCreate(CWI_1, 1969);

DO_MSLEEP(2046);
CtxPoint(332, 359); //1113840777.629

DO_MSLEEP(63);
CtxClick(CWI_1, 94, L_BUTTON, NONE); //1113840777.723

// Window CWI_2 ("Log On to Windows") created 1113840777.817

CtxWaitForWindowCreate(CWI_2, 93);

DO_MSLEEP(16);
// Window CWI_1 ("Warning !!") destroyed 1113840777.833

CtxType(CWI_2, "citrix"); //1113840786.615

DO_MSLEEP(8547);
CtxTypeVK(CWI_2, VK_TAB, NONE); //1113840786.678

DO_MSLEEP(281);
CtxType(CWI_2, "citrix"); //1113840788.650

DO_MSLEEP(1672);
CtxTypeVK(CWI_2, VK_TAB, NONE); //1113840788.713

DO_MSLEEP(359);

```

Using the Player, Script Development Workbench, and Analyze

```
CtxType(CWI_2, "q"); //1113840789.683

DO_MSLEEP(438);

DO_MSLEEP(1078);
CtxPoint(231, 325); //1113840790.309

DO_MSLEEP(78);
CtxMouseDown(CWI_2, L_BUTTON, NONE, 231, 325); // 1113840790.309

CtxMouseUp(CWI_2, L_BUTTON, NONE, 232, 325); //1113840790.388

CtxPoint(232, 325); //1113840790.544

// Window CWI_3 ("Please wait...") created 1113840790.544

CtxWaitForWindowCreate(CWI_3, 204);

// Window CWI_2 ("Log On to Windows") destroyed 1113840790.544

// Window CWI_4 ("Citrix License Warning Notice") created 1113840790.591

CtxWaitForWindowCreate(CWI_4, 46);

DO_MSLEEP(16);
// Window CWI_3 ("Please wait...") destroyed 1113840790.607

// Window CWI_5 ("Citrix License Warning Notice") created 1113840790.654

CtxWaitForWindowCreate(CWI_5, 47);

DO_MSLEEP(16);
// Window CWI_4 ("Citrix License Warning Notice") destroyed 1113840790.669

// Window CWI_6 ("UsrLogon.Cmd") created 1113840790.716

CtxWaitForWindowCreate(CWI_6, 46);

DO_MSLEEP(16);
// Window CWI_6 ("UsrLogon.Cmd") destroyed 1113840790.732

// Window CWI_7 ("") created 1113840790.967

DO_MSLEEP(234);
// Window CWI_8 ("ICA Seamless Host Agent") created 1113840791.014

CtxWaitForWindowCreate(CWI_8, 47);

// Window CWI_9 ("Program Manager") created 1113840791.030

CtxWaitForWindowCreate(CWI_9, 16);

CtxPoint(347, 249); //1113840793.080

// Window CWI_10 ("") created 1113840793.080

DO_MSLEEP(16);

DO_MSLEEP(1203);
CtxPoint(571, 256); //1113840796.133

DO_MSLEEP(1844);
// Window CWI_10 ("") destroyed 1113840796.133

DO_MSLEEP(1828);
```

```

CtxPoint(446, 208); //1113840798.309

DO_MSLEEP(344);
CtxClick(CWI_5, 78, L_BUTTON, NONE); //1113840798.387

DO_MSLEEP(437);
CtxPoint(311, 303); //1113840798.935

DO_MSLEEP(110);
CtxClick(CWI_5, 109, L_BUTTON, NONE); //1113840799.045

DO_MSLEEP(94);
// Window CWI_5 ("Citrix License Warning Notice") destroyed 1113840799.138

DO_MSLEEP(390);
CtxPoint(275, 1); //1113840799.718

DO_MSLEEP(188);
CtxClick(CWI_8, 62, L_BUTTON, NONE); //1113840799.780

DO_MSLEEP(703);
CtxPoint(200, 187); //1113840800.579

DO_MSLEEP(94);
CtxClick(CWI_8, 78, L_BUTTON, NONE); //1113840800.657

DO_MSLEEP(110);
CtxPoint(209, 192); //1113840800.766

// Window CWI_8 ("ICA Seamless Host Agent") destroyed 1113840800.766

DO_MSLEEP(5328);
CtxPoint(115, 175); //1113840806.245

DO_MSLEEP(140);
CtxDoubleClick(CWI_9); // 1113840806.621

CtxMouseUp(CWI_7, L_BUTTON, NONE, 114, 174); //1113840806.512

DO_MSLEEP(16);
CtxPoint(114, 174); //1113840806.621

DO_MSLEEP(359);

CtxPoint(284, 205); //1113840807.028

// Window CWI_11 ("") created 1113840807.028

DO_MSLEEP(16);
CtxPoint(309, 208); //1113840807.326

// Window CWI_12 ("Microsoft Word") created 1113840807.326

/// The window create wait event. If the window title at replay
/// is any different that "Sample Application 09:01:23 AM", this wait event
/// will FAIL.
CtxWaitForWindowCreate(CWI_12, 266);

DO_MSLEEP(46);
CWI_12->setTitle("Document1 - Microsoft Word"); //1113840807.388

DO_MSLEEP(16);
// Window CWI_11 ("") destroyed 1113840807.388

DO_MSLEEP(4188);

```

Using the Player, Script Development Workbench, and Analyze

```
CtxPoint(626, 8); //1113840811.693

DO_MSLEEP(109);
CtxClick(CWI_12, 94, L_BUTTON, NONE); //1113840811.787

DO_MSLEEP(218);
CtxPoint(623, 40); //1113840812.006

// Window CWI_12 ("Document1 - Microsoft Word") destroyed 1113840812.006

DO_MSLEEP(2204);
CtxPoint(385, 1); //1113840815.262

DO_MSLEEP(1046);
// Window CWI_9 ("Program Manager") destroyed 1113840815.262

// Window CWI_7 ("") destroyed 1113840815.262

// Window CWI_13 ("Please wait...") created 1113840815.513

CtxWaitForWindowCreate(CWI_13, 0);

DO_SetTransactionCleanup();

CtxDisconnect();

END_TRANSACTION();

delete CWI_1; // "Warning !!"
delete CWI_2; // "Log On to Windows"
delete CWI_3; // "Please wait..."
delete CWI_4; // "Citrix License Warning Notice"
delete CWI_5; // "Citrix License Warning Notice"
delete CWI_6; // "UsrLogon.Cmd"
delete CWI_7; // ""
delete CWI_8; // "ICA Seamless Host Agent"
delete CWI_9; // "Program Manager"
delete CWI_10; // ""
delete CWI_11; // ""
delete CWI_12; // "Microsoft Word"
delete CWI_13; // "Please wait..."

CitrixUninit();

EXIT();
return(0);
}
void abort_function(PLAYER_INFO *s_info)
{
    RR_printf("Virtual User ABORTED.");

    CitrixUninit();

    EXIT();
}
```

Sample Two: Modified Citrix Script

The following is an example of a Citrix script modified to handle a dynamic window title. In this example, the Sample Application generates a dynamic title. The dynamic name is the name of the application followed by the time the script is created. The question mark (?) wildcard is substituted for a given time. Changes to the original script are highlighted in bold>.

Sample Script

```

/*
 * dynamicwindow2.cpp
 *
 * Script Converted on April 18, 2005 at 12:13:47 PM
 * Generated by Compuware QALoad convert module version 5.5.0 build 256
 *
 * This script contains support for the following middlewares:
 *   - Citrix
 */
/* Converted using the following options:
 * General:
 * Line Split                : 80 characters
 * Sleep Seconds             : 1
 * Auto Checkpoints          : No
 * Citrix
 * General Options           :
 *   Replay Output Mode      : Normal
 *   Enable Counters         : No
 * Timeout Value Options    :
 *   Connect Timeout (s)    : 60
 *   Disconnect Timeout (s) : 60
 *   Window Creation Timeout (s) : 30
 *   Ping Timeout (s)       : 20
 *   Wait Point Timeout (s)  : 30
 * Input Options             :
 *   Combine Keyboard Input   : Yes
 *   Combine Mouse Input     : Yes
 * Window Options           :
 *   Window Verification     : Yes
 *   Window Max Retries      : 5
 *   Window Wait Retries (ms) : 5000
 *   Enable Wildcard Title Match : Yes
 */

#define CITRIX_CLIENT_VERSION "7.100.21825"
#define CITRIX_ICO_VERSION    "2.3"
#define SCRIPT_VER 0x00000505UL

#include <stdio.h>
#include "smacro.h"

#include "do_citrix.h"

/* set function to call on abort*/
void abort_function(PLAYER_INFO *s_info);

#ifndef NULL
#define NULL 0
#endif

extern "C" int rrobot_script(PLAYER_INFO *s_info)
{
    /* Declare Variables */
    const char *CitrixServer      = "qaccitrix";
    const char *CitrixPassword    = "";
    const int   CitrixOutputMode  = OUTPUT_MODE_NORMAL;

    /* Citrix Window Information Objects */
    CtxWI *CWI_1 = new CtxWI(0x1001c, "Warning !!", 107, 43, 427, 351);
    CtxWI *CWI_2 = new CtxWI(0x2001c, "Log On to Windows", 111, 65, 418, 285);
    CtxWI *CWI_3 = new CtxWI(0x5001c, "Please wait...", 111, 112, 418, 145);
    CtxWI *CWI_4 = new CtxWI(0x30030, "Citrix License Warning Notice", 125, 198, 397, 127);
    CtxWI *CWI_5 = new CtxWI(0x40030, "Citrix License Warning Notice", 125, 198, 397, 127);
    CtxWI *CWI_6 = new CtxWI(0x4002e, "UsrLogon.Cmd", 0, 456, 161, 25);
    CtxWI *CWI_7 = new CtxWI(0x1003a, "", -2, 452, 645, 31);

```

Using the Player, Script Development Workbench, and Analyze

```
CtxWI *CWI_8 = new CtxWI(0x10066, "ICA Seamless Host Agent", 0, 0, 391, 224);
CtxWI *CWI_9 = new CtxWI(0x10052, "Program Manager", 0, 0, 641, 481);
CtxWI *CWI_10 = new CtxWI(0x1008c, "", 115, 0, 405, 457);
CtxWI *CWI_11 = new CtxWI(0x20068, "", 112, 116, 416, 248);
// The initial window title of "Sample Application 09:01:23 AM" does not change
CtxWI *CWI_12 = new CtxWI(0x2006e, "Sample Application 09:01:23 AM", -4, -4, 649, 461);
CtxWI *CWI_13 = new CtxWI(0x7001c, "Please wait...", 111, 112, 418, 145);

SET_ABORT_FUNCTION(abort_function);

DEFINE_TRANS_TYPE("dynamicwindow.cpp");

CitrixInit(1);

/* Citrix replay settings */
CtxSetConnectTimeout(60);
CtxSetDisconnectTimeout(60);
CtxSetWindowTimeout(30);
CtxSetPingTimeout(20);
CtxSetWaitPointTimeout(30);
CtxSetWindowVerification(TRUE);
CtxSetEnableCounters(FALSE);
CtxSetWindowRetries(5, 5000);
CtxSetEnableWildcardMatching(TRUE);

SYNCHRONIZE();

BEGIN_TRANSACTION();

DO_SetTransactionStart();

CtxConnect(CitrixServer, CitrixOutputMode);

CtxPoint(164, 61); //1113840775.516

// Window CWI_1 ("Warning !!") created 1113840775.516

CtxWaitForWindowCreate(CWI_1, 1969);

DO_MSLEEP(2046);
CtxPoint(332, 359); //1113840777.629

DO_MSLEEP(63);
CtxClick(CWI_1, 94, L_BUTTON, NONE); //1113840777.723

// Window CWI_2 ("Log On to Windows") created 1113840777.817

CtxWaitForWindowCreate(CWI_2, 93);

DO_MSLEEP(16);
// Window CWI_1 ("Warning !!") destroyed 1113840777.833

CtxType(CWI_2, "citrix"); //1113840786.615

DO_MSLEEP(8547);
CtxTypeVK(CWI_2, VK_TAB, NONE); //1113840786.678

DO_MSLEEP(281);
CtxType(CWI_2, "citrix"); //1113840788.650

DO_MSLEEP(1672);
CtxTypeVK(CWI_2, VK_TAB, NONE); //1113840788.713

DO_MSLEEP(359);
CtxType(CWI_2, "q"); //1113840789.683
```

```
DO_MSLEEP(438);

DO_MSLEEP(1078);
CtxPoint(231, 325); //1113840790.309

DO_MSLEEP(78);
CtxMouseDown(CWI_2, L_BUTTON, NONE, 231, 325); // 1113840790.309

CtxMouseUp(CWI_2, L_BUTTON, NONE, 232, 325); //1113840790.388

CtxPoint(232, 325); //1113840790.544

// Window CWI_3 ("Please wait...") created 1113840790.544

CtxWaitForWindowCreate(CWI_3, 204);

// Window CWI_2 ("Log On to Windows") destroyed 1113840790.544

// Window CWI_4 ("Citrix License Warning Notice") created 1113840790.591

CtxWaitForWindowCreate(CWI_4, 46);

DO_MSLEEP(16);
// Window CWI_3 ("Please wait...") destroyed 1113840790.607

// Window CWI_5 ("Citrix License Warning Notice") created 1113840790.654

CtxWaitForWindowCreate(CWI_5, 47);

DO_MSLEEP(16);
// Window CWI_4 ("Citrix License Warning Notice") destroyed 1113840790.669

// Window CWI_6 ("UsrLogon.Cmd") created 1113840790.716

CtxWaitForWindowCreate(CWI_6, 46);

DO_MSLEEP(16);
// Window CWI_6 ("UsrLogon.Cmd") destroyed 1113840790.732

// Window CWI_7 ("") created 1113840790.967

DO_MSLEEP(234);
// Window CWI_8 ("ICA Seamless Host Agent") created 1113840791.014

CtxWaitForWindowCreate(CWI_8, 47);

// Window CWI_9 ("Program Manager") created 1113840791.030

CtxWaitForWindowCreate(CWI_9, 16);

CtxPoint(347, 249); //1113840793.080

// Window CWI_10 ("") created 1113840793.080

DO_MSLEEP(16);

DO_MSLEEP(1203);
CtxPoint(571, 256); //1113840796.133

DO_MSLEEP(1844);
// Window CWI_10 ("") destroyed 1113840796.133

DO_MSLEEP(1828);
CtxPoint(446, 208); //1113840798.309
```

Using the Player, Script Development Workbench, and Analyze

```
DO_MSLEEP(344);
CtxClick(CWI_5, 78, L_BUTTON, NONE); //1113840798.387

DO_MSLEEP(437);
CtxPoint(311, 303); //1113840798.935

DO_MSLEEP(110);
CtxClick(CWI_5, 109, L_BUTTON, NONE); //1113840799.045

DO_MSLEEP(94);
// Window CWI_5 ("Citrix License Warning Notice") destroyed 1113840799.138

DO_MSLEEP(390);
CtxPoint(275, 1); //1113840799.718

DO_MSLEEP(188);
CtxClick(CWI_8, 62, L_BUTTON, NONE); //1113840799.780

DO_MSLEEP(703);
CtxPoint(200, 187); //1113840800.579

DO_MSLEEP(94);
CtxClick(CWI_8, 78, L_BUTTON, NONE); //1113840800.657

DO_MSLEEP(110);
CtxPoint(209, 192); //1113840800.766

// Window CWI_8 ("ICA Seamless Host Agent") destroyed 1113840800.766

DO_MSLEEP(5328);
CtxPoint(115, 175); //1113840806.245

DO_MSLEEP(140);
CtxDoubleClick(CWI_9); // 1113840806.621

CtxMouseUp(CWI_7, L_BUTTON, NONE, 114, 174); //1113840806.512

DO_MSLEEP(16);
CtxPoint(114, 174); //1113840806.621

DO_MSLEEP(359);

CtxPoint(284, 205); //1113840807.028

// Window CWI_11 ("") created 1113840807.028

DO_MSLEEP(16);
CtxPoint(309, 208); //1113840807.326

// Window CWI_12 ("Microsoft Word") created 1113840807.326

////////////////////////////////////
/// The CtxSetWindowMatchTitle command is inserted before the
/// CtxWaitForWindowCreate call. Note that the window identifier is the
/// same for both calls, and the "match pattern" for the command is from
/// Example Two in the Match Pattern Identification section above.
////////////////////////////////////

    CtxSetWindowMatchTitle(CWI_12, "Sample Application ??:??:?? ?M" );

/// The window create wait event call does not change.
CtxWaitForWindowCreate(CWI_12, 266);

DO_MSLEEP(46);
```

```

CWI_12->setTitle("Document1 - Microsoft Word"); //1113840807.388

DO_MSLEEP(16);
// Window CWI_11 ("") destroyed 1113840807.388

DO_MSLEEP(4188);
CtxPoint(626, 8); //1113840811.693

DO_MSLEEP(109);
CtxClick(CWI_12, 94, L_BUTTON, NONE); //1113840811.787

DO_MSLEEP(218);
CtxPoint(623, 40); //1113840812.006

// Window CWI_12 ("Document1 - Microsoft Word") destroyed 1113840812.006

DO_MSLEEP(2204);
CtxPoint(385, 1); //1113840815.262

DO_MSLEEP(1046);
// Window CWI_9 ("Program Manager") destroyed 1113840815.262

// Window CWI_7 ("") destroyed 1113840815.262

// Window CWI_13 ("Please wait...") created 1113840815.513

CtxWaitForWindowCreate(CWI_13, 0);

DO_SetTransactionCleanup();

CtxDisconnect();

END_TRANSACTION();
delete CWI_1; // "Warning !!"
delete CWI_2; // "Log On to Windows"
delete CWI_3; // "Please wait..."
delete CWI_4; // "Citrix License Warning Notice"
delete CWI_5; // "Citrix License Warning Notice"
delete CWI_6; // "UsrLogon.Cmd"
delete CWI_7; // ""
delete CWI_8; // "ICA Seamless Host Agent"
delete CWI_9; // "Program Manager"
delete CWI_10; // ""
delete CWI_11; // ""
delete CWI_12; // "Microsoft Word"
delete CWI_13; // "Please wait..."

CitrixUninit();

EXIT();
return(0);
}
void abort_function(PLAYER_INFO *s_info)
{
    RR_printf("Virtual User ABORTED.");

    CitrixUninit();

    EXIT();
}

```

Intermittent Windows

Intermittent Windows

Windows that do not appear when a script is recorded can appear intermittently during replay. One example commonly encountered with Citrix is the ICA Seamless Host Agent window. If an unexpected window appears at validation or playback, you must modify the script to handle the window event.

To simplify the scripting process, record a temporary session and convert it to a script. This should be a session where the unexpected window appears so that the user must interact, for example, with a mouse click or keyboard entry, to dismiss the intermittent window. Note the location in the playback script where the presence of the intermittent window prevented the script from continuing. This is where code is added to the script.

When this error occurs during validation or playback, you must modify the script to recognize the base pattern of the window title name rather than an exact window title.

An intermittent window, if it appears, requires user action or the script may fail.

Modifying the Script for Intermittent Windows

Windows that don't appear when a script is recorded can appear intermittently during replay. One example commonly encountered with Citrix is the ICA Seamless Host Agent window. If an unexpected window appears at validation or playback, you must modify the script to handle the window event.

To simplify the scripting process, record a temporary session and convert it to a script. This should be a session where the unexpected window appears so that the user must interact, for example, with a mouse click or keyboard entry, to dismiss the intermittent window. Note the location in the playback script where the presence of the intermittent window prevented the script from continuing. This is where code is added to the script.

Do the following if a validation or playback session indicates an unexpected window appeared that requires user interaction:

- ! Record a temporary script where the unexpected window event appears.
- ! Convert the original session to a script.
- ! Modify the original script with a section of the temporary script.

To record a temporary script:

Simplify the scripting effort required by doing the following:

1. Record a temporary session of the transaction. This should include the appearance of the intermittent window and the subsequent user interaction that dismisses the window.
2. Add a comment when the window appears and before the window is dismissed.
3. Give the successful record session a temporary name.
4. Click Options>Convert, and click OK to convert the session to a script.

To modify the original script:

Extract a small section of the temporary script code and insert it into the original script.

1. Identify the location in the original script where the unexpected window appeared. You can do this by noting the last window that was successfully created before validation failure.

 **Tip:** Note the location with a code-style comment. This is the location where you paste in code from the temporary script.

2. Identify the code in the temporary script that creates the Citrix window object. This code is in the section labeled `/* Citrix Window Information Objects */` and can be identified by the name parameter.
3. Cut and paste this line into the corresponding section in the original script.
4. Modify the line pasted into the original script, giving the statement a unique Citrix window identifier.

 **Note:** This identifier, `CWI_n`, must be a unique value in the original script or the script will not compile.

5. Find the line in the temporary script that deletes the Citrix window object. This code is after the `END_TRANSACTION` call.
6. Copy this line to the same location in the original script and modify it with the unique Citrix window identifier from Step 4.
7. Add a special version of the `CtxSetWindowMatchTitle` command in the original script in the location where the original script failed because of the intermittent window.

This is where the window must be recognized and dismissed, if it exists. The first parameter is the Citrix window object identifier from Step 2. The second parameter is an asterisk enclosed in double quotes ("`*`"). This parameter ensures that commands like `CtxClick` work with any matched window, even if the intermittent window does not exist.

9. Identify the code that dismisses this window in the temporary script by scrolling to the comment you inserted during capture, and backtracking until you find the correct `CtxWaitForWindowCreate` statement. Usually this code consists of either a set of `CtxPoint` and `CtxClick` or one or more keyboard entry calls after the window create event.

 **Caution:** Do not include the `CtxWaitForWindowCreate` statement.

10. Copy the code from the temporary script and paste it after the `CtxSetWindowMatchTitle` call added in Step 5. Ensure that the Citrix window object parameter for these calls is the Citrix window object identifier from Step 2.

Conclusion

Following these techniques, you can modify a session to handle the appearance of intermittent windows that require user action to dismiss. The sample scripts illustrate this process.

Sample: Original Citrix Script for Intermittent Windows

The following is an example of an original Citrix script converted from capture. Points of interest in the script are highlighted in bold>.

Sample Script

```
/*
 * intermittent_original.cpp
 *
 * Script Converted on April 18, 2005 at 03:23:41 PM
 * Generated by Compuware QALoad convert module version 5.5.0 build 256
 *
 * This script contains support for the following middlewares:
 *   - Citrix
 */
/* Converted using the following options:
 * General:
 * Line Split           : 80 characters
 * Sleep Seconds        : 1
```

Using the Player, Script Development Workbench, and Analyze

```
* Auto Checkpoints           : No
* Citrix
* General Options            :
*   Replay Output Mode       : Normal
*   Enable Counters          : No
*   Timeout Value Options    :
*     Connect Timeout (s)    : 60
*     Disconnect Timeout (s) : 60
*     Window Creation Timeout (s) : 30
*     Ping Timeout (s)       : 20
*     Wait Point Timeout (s) : 30
* Input Options              :
*   Combine Keyboard Input   : Yes
*   Combine Mouse Input      : Yes
* Window Options            :
*   Window Verification      : Yes
*   Window Max Retries       : 5
*   Window Wait Retries (ms) : 5000
*   Enable Wildcard Title Match : Yes
*/

#define CITRIX_CLIENT_VERSION "7.100.21825"
#define CITRIX_ICO_VERSION   "2.3"
#define SCRIPT_VER 0x00000505UL

#include <stdio.h>
#include "smacro.h"

#include "do_citrix.h"

/* set function to call on abort*/
void abort_function(PLAYER_INFO *s_info);

#ifndef NULL
#define NULL 0
#endif

extern "C" int rrobot_script(PLAYER_INFO *s_info)
{
    /* Declare Variables */
    const char *CitrixServer      = "qaccitrix";
    const char *CitrixPassword    = "";
    const int   CitrixOutputMode  = OUTPUT_MODE_NORMAL;

    /* Citrix Window Information Objects */
    CtxWI *CWI_1 = new CtxWI(0x1001c, "Warning !!", 107, 43, 427, 351);
    CtxWI *CWI_2 = new CtxWI(0x2001c, "Log On to Windows", 111, 65, 418, 285);
    CtxWI *CWI_3 = new CtxWI(0x5001c, "Please wait...", 111, 112, 418, 145);
    CtxWI *CWI_4 = new CtxWI(0x30030, "Citrix License Warning Notice", 125, 198, 397, 127);
    CtxWI *CWI_5 = new CtxWI(0x40030, "Citrix License Warning Notice", 125, 198, 397, 127);
    CtxWI *CWI_6 = new CtxWI(0x4002e, "UsrLogon.Cmd", 0, 456, 161, 25);
    CtxWI *CWI_7 = new CtxWI(0x1003a, "", -2, 452, 645, 31);
    CtxWI *CWI_8 = new CtxWI(0x10052, "Program Manager", 0, 0, 641, 481);
    CtxWI *CWI_9 = new CtxWI(0x100b8, "", 115, 0, 405, 457);
    CtxWI *CWI_10 = new CtxWI(0x7001c, "Please wait...", 111, 112, 418, 145);
    ///  
A line will be copied and modified here to create the new Citrix window object

    SET_ABORT_FUNCTION(abort_function);

    DEFINE_TRANS_TYPE("intermittent_original.cpp");

    CitrixInit(1);

    /* Citrix replay settings */
    CtxSetConnectTimeout(60);
    CtxSetDisconnectTimeout(60);
}
```

```
CtxSetWindowTimeout(30);
CtxSetPingTimeout(20);
CtxSetWaitPointTimeout(30);
CtxSetWindowVerification(TRUE);
CtxSetEnableCounters(FALSE);
CtxSetWindowRetries(5, 5000);
CtxSetEnableWildcardMatching(TRUE);

SYNCHRONIZE();

BEGIN_TRANSACTION();

DO_SetTransactionStart();

CtxConnect(CitrixServer, CitrixOutputMode);

// Window CWI_1 ("Warning !!") created 1113852175.329

CtxWaitForWindowCreate(CWI_1, 2047);

DO_MSLEEP(1203);
CtxPoint(162, 161); //1113852176.561

DO_MSLEEP(31);
CtxClick(CWI_1, 79, L_BUTTON, NONE); //1113852176.639

DO_MSLEEP(718);
CtxPoint(323, 362); //1113852177.451

DO_MSLEEP(94);
CtxClick(CWI_1, 63, L_BUTTON, NONE); //1113852177.513

// Window CWI_2 ("Log On to Windows") created 1113852177.638

CtxWaitForWindowCreate(CWI_2, 125);

// Window CWI_1 ("Warning !!") destroyed 1113852177.638

CtxType(CWI_2, "citr"); //1113852180.291

DO_MSLEEP(2625);
CtxType(CWI_2, "ix"); //1113852180.790

DO_MSLEEP(343);
CtxPoint(324, 362); //1113852180.790

CtxTypeVK(CWI_2, VK_TAB, NONE); //1113852180.868

DO_MSLEEP(266);
CtxType(CWI_2, "citrix"); //1113852182.194

DO_MSLEEP(1078);
CtxTypeVK(CWI_2, VK_TAB, NONE); //1113852182.225

DO_MSLEEP(281);
CtxType(CWI_2, "q"); //1113852183.692

DO_MSLEEP(1078);

DO_MSLEEP(844);
CtxPoint(263, 324); //1113852184.176

DO_MSLEEP(31);
CtxClick(CWI_2, 79, L_BUTTON, NONE); //1113852184.254
```



```

DO_MSLEEP(328);
// Window CWI_9 ("") destroyed 1113852189.934

DO_MSLEEP(19766);
CtxPoint(337, 157); //1113852210.000

DO_MSLEEP(328);
// Window CWI_9 ("Program Manager") destroyed 1113852210.000

// Window CWI_7 ("") destroyed 1113852210.016

// Window CWI_10 ("Please wait...") created 1113852210.266

CtxWaitForWindowCreate(CWI_10, 0);

DO_SetTransactionCleanup();

CtxDisconnect();

END_TRANSACTION();

delete CWI_1; // "Warning !!"
delete CWI_2; // "Log On to Windows"
delete CWI_3; // "Please wait..."
delete CWI_4; // "Citrix License Warning Notice"
delete CWI_5; // "Citrix License Warning Notice"
delete CWI_6; // "UsrLogon.Cmd"
delete CWI_7; // ""
delete CWI_8; // "Program Manager"
delete CWI_9; // ""
delete CWI_10; // "Please wait..."
///  

CitrixUninit();

EXIT();
return(0);
}
void abort_function(PLAYER_INFO *s_info)
{
    RR_printf("Virtual User ABORTED.");

    CitrixUninit();

    EXIT();
}

```

Sample: Modified Citrix Script to Handle Intermittent Window

The following is an example of a modified Citrix script to handle an intermittent window. Changes to Original script are highlighted in bold.

Sample Script

```

/*
 * intermittent_original.cpp
 *
 * Script Converted on April 18, 2005 at 03:23:41 PM
 * Generated by Compuware QALoad convert module version 5.5.0 build 256
 *
 * This script contains support for the following middlewares:
 *     - Citrix
 */
/* Converted using the following options:

```

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```
* General:
* Line Split           : 80 characters
* Sleep Seconds       : 1
* Auto Checkpoints    : No
* Citrix
* General Options     :
*   Replay Output Mode : Normal
*   Enable Counters    : No
*   Timeout Value Options :
*     Connect Timeout (s) : 60
*     Disconnect Timeout (s) : 60
*     Window Creation Timeout (s) : 30
*     Ping Timeout (s) : 20
*     Wait Point Timeout (s) : 30
* Input Options       :
*   Combine Keyboard Input : Yes
*   Combine Mouse Input   : Yes
* Window Options      :
*   Window Verification   : Yes
*   Window Max Retries    : 5
*   Window Wait Retries (ms) : 5000
*   Enable Wildcard Title Match : Yes
*/

#define CITRIX_CLIENT_VERSION "7.100.21825"
#define CITRIX_ICO_VERSION    "2.3"
#define SCRIPT_VER 0x00000505UL

#include <stdio.h>
#include "smacro.h"

#include "do_citrix.h"

/* set function to call on abort*/
void abort_function(PLAYER_INFO *s_info);

#ifdef NULL
#define NULL 0
#endif

extern "C" int rrobot_script(PLAYER_INFO *s_info)
{
    /* Declare Variables */
    const char *CitrixServer      = "qaccitrix";
    const char *CitrixPassword    = "";
    const int   CitrixOutputMode  = OUTPUT_MODE_NORMAL;

    /* Citrix Window Information Objects */
    CtxWI *CWI_1 = new CtxWI(0x1001c, "Warning !!", 107, 43, 427, 351);
    CtxWI *CWI_2 = new CtxWI(0x2001c, "Log On to Windows", 111, 65, 418, 285);
    CtxWI *CWI_3 = new CtxWI(0x5001c, "Please wait...", 111, 112, 418, 145);
    CtxWI *CWI_4 = new CtxWI(0x30030, "Citrix License Warning Notice", 125, 198, 397, 127);
    CtxWI *CWI_5 = new CtxWI(0x40030, "Citrix License Warning Notice", 125, 198, 397, 127);
    CtxWI *CWI_6 = new CtxWI(0x4002e, "UsrLogon.Cmd", 0, 456, 161, 25);
    CtxWI *CWI_7 = new CtxWI(0x1003a, "", -2, 452, 645, 31);
    CtxWI *CWI_8 = new CtxWI(0x10052, "Program Manager", 0, 0, 641, 481);
    CtxWI *CWI_9 = new CtxWI(0x100b8, "", 115, 0, 405, 457);
    CtxWI *CWI_10 = new CtxWI(0x7001c, "Please wait...", 111, 112, 418, 145);
    /// This line was added from the temporary script and modified so the Citrix window variable is unique for the original script.
    CtxWI *CWI_99 = new CtxWI(0x10066, "ICA Seamless Host Agent", 0, 0, 391, 224);

    SET_ABORT_FUNCTION(abort_function);

    DEFINE_TRANS_TYPE("intermittent_original.cpp");
}
```

```

CitrixInit(1);

/* Citrix replay settings */
CtxSetConnectTimeout(60);
CtxSetDisconnectTimeout(60);
CtxSetWindowTimeout(30);
CtxSetPingTimeout(20);
CtxSetWaitPointTimeout(30);
CtxSetWindowVerification(TRUE);
CtxSetEnableCounters(FALSE);
CtxSetWindowRetries(5, 5000);
CtxSetEnableWildcardMatching(TRUE);

SYNCHRONIZE();

BEGIN_TRANSACTION();

DO_SetTransactionStart();

CtxConnect(CitrixServer, CitrixOutputMode);

// Window CWI_1 ("Warning !!") created 1113852175.329

CtxWaitForWindowCreate(CWI_1, 2047);

DO_MSLEEP(1203);
CtxPoint(162, 161); //1113852176.561

DO_MSLEEP(31);
CtxClick(CWI_1, 79, L_BUTTON, NONE); //1113852176.639

DO_MSLEEP(718);
CtxPoint(323, 362); //1113852177.451

DO_MSLEEP(94);
CtxClick(CWI_1, 63, L_BUTTON, NONE); //1113852177.513

// Window CWI_2 ("Log On to Windows") created 1113852177.638

CtxWaitForWindowCreate(CWI_2, 125);

// Window CWI_1 ("Warning !!") destroyed 1113852177.638

CtxType(CWI_2, "citr"); //1113852180.291

DO_MSLEEP(2625);
CtxType(CWI_2, "ix"); //1113852180.790

DO_MSLEEP(343);
CtxPoint(324, 362); //1113852180.790

CtxTypeVK(CWI_2, VK_TAB, NONE); //1113852180.868

DO_MSLEEP(266);
CtxType(CWI_2, "citrix"); //1113852182.194

DO_MSLEEP(1078);
CtxTypeVK(CWI_2, VK_TAB, NONE); //1113852182.225

DO_MSLEEP(281);
CtxType(CWI_2, "q"); //1113852183.692

DO_MSLEEP(1078);

DO_MSLEEP(844);

```

Using the Player, Script Development Workbench, and Analyze

```
CtxPoint(263, 324); //1113852184.176

DO_MSLEEP(31);
CtxClick(CWI_2, 79, L_BUTTON, NONE); //1113852184.254

DO_MSLEEP(109);
// Window CWI_2 ("Log On to Windows") destroyed 1113852184.363

// Window CWI_3 ("Please wait...") created 1113852184.394

CtxWaitForWindowCreate(CWI_3, 16);

// Window CWI_4 ("Citrix License Warning Notice") created 1113852184.457

CtxWaitForWindowCreate(CWI_4, 78);

// Window CWI_3 ("Please wait...") destroyed 1113852184.472

// Window CWI_5 ("Citrix License Warning Notice") created 1113852184.566

CtxWaitForWindowCreate(CWI_5, 109);

// Window CWI_6 ("UsrLogon.Cmd") created 1113852184.566

CtxWaitForWindowCreate(CWI_6, 0);

// Window CWI_4 ("Citrix License Warning Notice") destroyed 1113852184.566

DO_MSLEEP(31);
// Window CWI_6 ("UsrLogon.Cmd") destroyed 1113852184.597

// Window CWI_7 ("") created 1113852184.878

DO_MSLEEP(282);

// Window CWI_9 ("Program Manager") created 1113852184.941

CtxWaitForWindowCreate(CWI_8, 0);

CtxPoint(195, 192); //1113852186.891

// Window CWI_10 ("") created 1113852186.891

DO_MSLEEP(516);
CtxPoint(316, 271); //1113852187.406

CtxMouseDown(CWI_5, L_BUTTON, NONE, 316, 271); // 1113852187.406

CtxMouseUp(CWI_5, L_BUTTON, NONE, 317, 278); //1113852187.515

DO_MSLEEP(219);
CtxPoint(317, 287); //1113852187.671

DO_MSLEEP(46);
CtxClick(CWI_5, 63, L_BUTTON, NONE); //1113852187.734

DO_MSLEEP(62);
// Window CWI_5 ("Citrix License Warning Notice") destroyed 1113852187.796

/// This is the location where the code to set the intermittent
/// window match name is added.

    CtxSetWindowMatchTitle( CWI_99, "*" );

/// The location where the code to dismiss the code was copied from
```

```

/// the temporary script. The parameter for the CtxClick command
/// was corrected with the Citrix window object variable.

DO_MSLEEP(14000);
CtxPoint(178, 194); //1113851799.788

DO_MSLEEP(47);
CtxClick(CWI_8, 63, L_BUTTON, NONE); //1113851799.866

DO_MSLEEP(829);
CtxPoint(555, 200); //1113852188.639

DO_MSLEEP(15);
CtxClick(CWI_9, 94, L_BUTTON, NONE); //1113852188.732

DO_MSLEEP(875);
CtxPoint(555, 199); //1113852189.934

DO_MSLEEP(328);
// Window CWI_10 ("") destroyed 1113852189.934

DO_MSLEEP(19766);
CtxPoint(337, 157); //1113852210.000

DO_MSLEEP(328);
// Window CWI_9 ("Program Manager") destroyed 1113852210.000

// Window CWI_7 ("") destroyed 1113852210.016

// Window CWI_11 ("Please wait...") created 1113852210.266

CtxWaitForWindowCreate(CWI_10, 0);

DO_SetTransactionCleanup();

CtxDisconnect();

END_TRANSACTION();

delete CWI_1; // "Warning !!"
delete CWI_2; // "Log On to Windows"
delete CWI_3; // "Please wait..."
delete CWI_4; // "Citrix License Warning Notice"
delete CWI_5; // "Citrix License Warning Notice"
delete CWI_6; // "UsrLogon.Cmd"
delete CWI_7; // ""
delete CWI_8; // "ICA Seamless Host Agent"
delete CWI_9; // "Program Manager"
delete CWI_10; // ""
delete CWI_11; // "Please wait..."
/// The code copied and modified to delete the Citrix window object.
delete CWI_99;

CitrixUninit();

EXIT();
return(0);
}
void abort_function(PLAYER_INFO *s_info)
{
RR_printf("Virtual User ABORTED.");

CitrixUninit();

EXIT();

```

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```
}
```

Sample: Temporary Citrix Script with Window Creation and Dismissal

The following is an example of a temporary Citrix script with window creation and dismissal. Code to be identified and copied from the temporary script is highlighted in bold.

Sample Script

```
/*
 * intermittent_temporary.cpp
 *
 * Script Converted on April 18, 2005 at 03:16:57 PM
 * Generated by Compuware QALoad convert module version 5.5.0 build 256
 *
 * This script contains support for the following middlewares:
 *   - Citrix
 */
/* Converted using the following options:
 * General:
 * Line Split                : 80 characters
 * Sleep Seconds             : 1
 * Auto Checkpoints          : No
 * Citrix
 * General Options           :
 * Replay Output Mode        : Normal
 * Enable Counters           : No
 * Timeout Value Options    :
 *   Connect Timeout (s)    : 60
 *   Disconnect Timeout (s) : 60
 *   Window Creation Timeout (s) : 30
 *   Ping Timeout (s)       : 20
 *   Wait Point Timeout (s) : 30
 * Input Options             :
 * Combine Keyboard Input    : Yes
 * Combine Mouse Input       : Yes
 * Window Options           :
 * Window Verification       : Yes
 * Window Max Retries        : 5
 * Window Wait Retries (ms) : 5000
 * Enable Wildcard Title Match : Yes
 */

#define CITRIX_CLIENT_VERSION "7.100.21825"
#define CITRIX_ICO_VERSION    "2.3"
#define SCRIPT_VER 0x00000505UL

#include <stdio.h>
#include "smacro.h"

#include "do_citrix.h"

/* set function to call on abort*/
void abort_function(PLAYER_INFO *s_info);

#ifdef NULL
#define NULL 0
#endif

extern "C" int rrobot_script(PLAYER_INFO *s_info)
{
    /* Declare Variables */
    const char *CitrixServer      = "qaccitrix";
    const char *CitrixPassword    = "";
    const int   CitrixOutputMode  = OUTPUT_MODE_NORMAL;

```

```

/* Citrix Window Information Objects */
CtxWI *CWI_1 = new CtxWI(0x1001c, "Warning !!", 107, 43, 427, 351);
CtxWI *CWI_2 = new CtxWI(0x2001c, "Log On to Windows", 111, 65, 418, 285);
CtxWI *CWI_3 = new CtxWI(0x5001c, "Please wait...", 111, 112, 418, 145);
CtxWI *CWI_4 = new CtxWI(0x30030, "Citrix License Warning Notice", 125, 198, 397, 127);
CtxWI *CWI_5 = new CtxWI(0x40030, "Citrix License Warning Notice", 125, 198, 397, 127);
CtxWI *CWI_6 = new CtxWI(0x4002e, "UsrLogon.Cmd", 0, 456, 161, 25);
CtxWI *CWI_7 = new CtxWI(0x1003a, "", -2, 452, 645, 31);
/// The code line to copy to the original script.
CtxWI *CWI_8 = new CtxWI(0x10066, "ICA Seamless Host Agent", 0, 0, 391, 224);
CtxWI *CWI_9 = new CtxWI(0x10052, "Program Manager", 0, 0, 641, 481);
CtxWI *CWI_10 = new CtxWI(0x10084, "", 115, 0, 405, 457);

SET_ABORT_FUNCTION(abort_function);

DEFINE_TRANS_TYPE("intermittent_temporary.cpp");

CitrixInit(1);

/* Citrix replay settings */
CtxSetConnectTimeout(60);
CtxSetDisconnectTimeout(60);
CtxSetWindowTimeout(30);
CtxSetPingTimeout(20);
CtxSetWaitPointTimeout(30);
CtxSetWindowVerification(TRUE);
CtxSetEnableCounters(FALSE);
CtxSetWindowRetries(5, 5000);
CtxSetEnableWildcardMatching(TRUE);

SYNCHRONIZE();

BEGIN_TRANSACTION();

DO_SetTransactionStart();

CtxConnect(CitrixServer, CitrixOutputMode);

CtxPoint(120, 159); //1113851768.564

// Window CWI_1 ("Warning !!") created 1113851768.564

CtxWaitForWindowCreate(CWI_1, 2063);

DO_MSLEEP(766);
CtxPoint(313, 361); //1113851769.344

DO_MSLEEP(31);
CtxClick(CWI_1, 62, L_BUTTON, NONE); //1113851769.407

// Window CWI_2 ("Log On to Windows") created 1113851769.454

CtxWaitForWindowCreate(CWI_2, 47);

// Window CWI_1 ("Warning !!") destroyed 1113851769.454

CtxType(CWI_2, "citrix"); //1113851774.556

DO_MSLEEP(4891);
CtxTypeVK(CWI_2, VK_TAB, NONE); //1113851774.618

DO_MSLEEP(281);
CtxType(CWI_2, "citrix"); //1113851776.460

```

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```
DO_MSLEEP(1594);
CtxTypeVK(CWI_2, VK_TAB, NONE); //1113851776.522

DO_MSLEEP(312);
CtxType(CWI_2, "q"); //1113851779.627

DO_MSLEEP(2469);

DO_MSLEEP(953);
CtxPoint(231, 322); //1113851780.017

DO_MSLEEP(78);
CtxMouseDown(CWI_2, L_BUTTON, NONE, 231, 322); // 1113851780.017

CtxMouseUp(CWI_2, L_BUTTON, NONE, 231, 321); //1113851780.080

DO_MSLEEP(16);
CtxPoint(231, 321); //1113851780.127

DO_MSLEEP(94);
// Window CWI_2 ("Log On to Windows") destroyed 1113851780.127

// Window CWI_3 ("Please wait...") created 1113851780.236

CtxWaitForWindowCreate(CWI_3, 109);

// Window CWI_4 ("Citrix License Warning Notice") created 1113851780.298

CtxWaitForWindowCreate(CWI_4, 63);

// Window CWI_3 ("Please wait...") destroyed 1113851780.298

// Window CWI_5 ("Citrix License Warning Notice") created 1113851780.314

CtxWaitForWindowCreate(CWI_5, 15);

// Window CWI_6 ("UsrLogon.Cmd") created 1113851780.330

CtxWaitForWindowCreate(CWI_6, 16);

// Window CWI_4 ("Citrix License Warning Notice") destroyed 1113851780.330

DO_MSLEEP(78);
// Window CWI_6 ("UsrLogon.Cmd") destroyed 1113851780.408

// Window CWI_7 ("") created 1113851780.766

DO_MSLEEP(344);
// Window CWI_8 ("ICA Seamless Host Agent") created 1113851780.766

CtxWaitForWindowCreate(CWI_8, 15);

// Window CWI_9 ("Program Manager") created 1113851780.766

CtxWaitForWindowCreate(CWI_9, 0);

DO_MSLEEP(891);
CtxPoint(333, 300); //1113851781.718

DO_MSLEEP(62);
CtxClick(CWI_5, 141, L_BUTTON, NONE); //1113851781.859

DO_MSLEEP(156);
CtxPoint(261, 250); //1113851782.186
```

```

DO_MSLEEP(172);
// Window CWI_5 ("Citrix License Warning Notice") destroyed 1113851782.186

CtxPoint(303, 251); //1113851782.811

// Window CWI_10 ("") created 1113851782.811

DO_MSLEEP(625);

DO_MSLEEP(2078);
CtxPoint(518, 254); //1113851785.760

DO_MSLEEP(875);
// Window CWI_10 ("") destroyed 1113851785.760
/// The following code dismisses the "ICA Seamless Host Agent".
/// Copy the bold section below to the original script.
/// The DO_MSLEEP comments can also be copied.

DO_MSLEEP(14000);
CtxPoint(178, 194); //1113851799.788

DO_MSLEEP(47);
CtxClick(CWI_8, 63, L_BUTTON, NONE); //1113851799.866

/// End of code section to copy.

DO_MSLEEP(125);
CtxPoint(183, 197); //1113851799.975

// Window CWI_8 ("ICA Seamless Host Agent") destroyed 1113851799.975

DO_MSLEEP(1250);
CtxPoint(609, 12); //1113851804.469

DO_MSLEEP(3250);
// Window CWI_9 ("Program Manager") destroyed 1113851804.469

// Window CWI_7 ("") destroyed 1113851804.469

DO_SetTransactionCleanup();

CtxDisconnect();

END_TRANSACTION();

delete CWI_1; // "Warning !!"
delete CWI_2; // "Log On to Windows"
delete CWI_3; // "Please wait..."
delete CWI_4; // "Citrix License Warning Notice"
delete CWI_5; // "Citrix License Warning Notice"
delete CWI_6; // "UsrLogon.Cmd"
delete CWI_7; // ""
/// Copy this code to the original script to delete the Citrix window object.
delete CWI_8; // "ICA Seamless Host Agent"
delete CWI_9; // "Program Manager"
delete CWI_10; // ""

CitrixUninit();

EXIT();
return(0);
}
void abort_function(PLAYER_INFO *s_info)
{
RR_printf("Virtual User ABORTED.");

```

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```
CitrixUninit();  
  
EXIT();  
}
```

Unexpected Events

Unexpected Events in Citrix

The `CtxWindowEventExists` and `CtxScreenEventExists` commands can be used to handle unexpected window and screen events in Citrix scripts. When there is a possibility of unexpected dialogs appearing or unexpected screen events occurring, you must modify the script to respond to the changes and continue the load test.

For example, if a script opens a Microsoft Word document that resides on a network, and that document is already open by another network user, an unexpected dialog box appears that prompts the user to choose between continuing to open the document in read-only mode or to cancel it. To prevent script failure, modifications can be made in the script to handle the dialog boxes that appear in this situation.

Generally, to handle unexpected events, you record two scripts. The first script contains a recording of the expected events. The second script should include the unexpected events. Using the `CtxWindowEventExists` and `CtxScreenEventExists` functions, create a conditional block of code that handles the dialogs that may appear.

Modifying the Script to Handle Unexpected Events

Unexpected Citrix events that were not recorded in the original script can occur during a playback session. These can include [Intermittent Windows](#) or application windows that may appear based on the user's session state. For example, the calculator application may already be present when the Citrix user logs on a session, or the user may need to invoke the application.

When there is the possibility of unexpected events occurring, you must modify the script to respond to the changes and continue the load test. Use the `CtxWindowEventExists` function to create a conditional block of code that handles the unexpected dialogs.

When you modify a script to handle unexpected events, you must:

- ! Perform an initial validation of the script.
- ! Record a temporary script to capture the unexpected event.
- ! Modify the original script to include and handle the unexpected event.
- ! Re-validate the script.

 **Note:** You may need to [configure](#) the workbench and player for validation.

To perform an initial validation:

1. Click **Session>Validate** to validate the script. This is when an unexpected event can cause sporadic failure during validation or playback.
2. Identify the sporadic event visually so that you can recognize it in a later record session.

To record a temporary script:

1. Click **Options>Record** to record a second script that recreates the unexpected event. Successive sessions should be recorded until the unexpected event occurs.

2. Insert comments at two points:

- ! Where the event is first recognized.
- ! Where the event is acted on and the Citrix session state and any window states have returned to the state before the event occurred.

 **Note:** You may need to position the mouse over a window or control, such as a button, before inserting the second comment. (See [Scripting Mouse Events](#).)

3. Give this capture a name to denote this session's temporary status.
4. Click **Options>Convert**, then click **OK** to convert the session to a script.

To modify the original script with code from the temporary script:

Follow these steps to insert script code from the temporary script that handles the unexpected event.

1. Insert a code comment in the original script where the unexpected event occurred.
2. Copy the code between the two comments in the temporary script and paste it into the original script at the location of the unexpected event you identified.

 **Note:** Comments ensure that the pasted code is clearly marked in the script.

3. Identify any Citrix window objects that exist in API calls in the pasted code snippet. For each object, do one of the following:
 - ! If the window object is wholly contained, both created and destroyed, in the pasted code snippet:
 - a. Identify the Citrix window creation and deletion lines of code in the temporary script.
 - b. Copy these lines to the original script. This is the creation line in the `/* Citrix Window Information Objects */` section and the deletion line after the `END_TRANSACTION` call.
 - c. Give the Citrix window object variable a unique variable name.
 - d. Change all variable references to the Citrix window in the pasted code snippet API calls to the new variable name.
 - ! If the window object referenced in a pasted API call is an action on an existing window object in the original script, modify all API calls in the pasted calls to refer to the variable name of the Citrix window object in the original script.
4. Before the code snippet, add a conditional check to see if the unexpected window event has occurred. Use the `CtxWindowEventExists` API call in an `IF` conditional, where if the result is `TRUE`, a block of code is executed. Then add a `BeginBlock` on the next line. `BeginBlock` is logically identical to the C begin brace `{`.
5. After the code snippet, add an `EndBlock`. `EndBlock` is logically identical to the C end brace `}`.

 **Note:** If there is code in the original script that should not be executed if the condition is `TRUE`, put this code in an `Else` block within the `BeginBlock` and `EndBlock` calls.

To re-validate the script:

1. Click **Session>Compile** to compile the script after making scripting changes.
2. Click **Session>Validate Script** to validate the script. Make sure that validation succeeds when the unexpected event occurs and when the event does not occur.

Conclusion

Following these techniques, you can modify scripts to handle unexpected events that occur during playback. Scripting around unexpected events allows you to perform load testing for complex user scenarios. The following sample scripts illustrate this process:

Sample: Original Citrix Scripts for Unexpected Events

The following sample shows two examples of an unexpected Citrix event. In the first example, the calculator application must be started in the original script. The second example has a session where the calculator application is already present when the user logs on. Points of interest in the script are highlighted in bold.

Example 1: Original Record Script with No Calculator Application Present at Logon

```
/*
 * CalculatorCreateNew.cpp
 *
 * Script Converted on May 17, 2004 at 12:33:36 PM
 * Generated by Compuware QALoad convert module version 5.2.0 build 33
 *
 * This script contains support for the following middlewares:
 *   - Citrix
 */
/* Converted using the following options:
 * General:
 * Line Split           : 80 characters
 * Sleep Seconds       : 1
 * Auto Checkpoints    : No
 * Citrix
 * General Options     :
 * Window Verification : Yes
 * Session Timeouts    : Yes
 * Connect Timeout (s) : 60
 * Disconnect Timeout (s) : 60
 * Window Creation Timeout (s) : 30
 * Ping Timeout (s)    : 20
 * Wait Point Timeout (s) : 30
 * Include Wait Points : Yes
 * Enable Counters     : No
 * Include Unnamed Windows : Yes
 * Output Mode         : Normal
 * Input Options       :
 * Combine Keyboard Input : Yes
 * Combine Mouse Input  : Yes
 */
#define CITRIX_CLIENT_VERSION "7.100.21825"
#define CITRIX_ICO_VERSION    "2.3"
#define SCRIPT_VER 0x00000205UL
#include <stdio.h>
#include "smacro.h"
#include "do_citrix.h"
/* set function to call on abort*/
void abort_function(PLAYER_INFO *s_info);
#ifdef NULL
#define NULL 0
#endif
extern "C" int rrobot_script(PLAYER_INFO *s_info)
{
    /* Declare Variables */
    const char *CitrixServer      = "qaccitrix2";
    const int   CitrixOutputMode  = OUTPUT_MODE_NORMAL;

    /* Citrix Window Information Objects */
    CtxWI *CWI_1 = new CtxWI(0x1001a, "Warning !!", 107, 43, 427, 351);
    CtxWI *CWI_2 = new CtxWI(0x2001a, "Log On to Windows", 111, 65, 418, 285);
    CtxWI *CWI_3 = new CtxWI(0x3002e, "Please wait...", 111, 112, 418, 145);
}
```

```

CtxWI *CWI_4 = new CtxWI(0x40030, "UsrLogon.Cmd", 0, 456, 161, 25);
CtxWI *CWI_5 = new CtxWI(0x3002c, "", 0, 0, 641, 481);
CtxWI *CWI_6 = new CtxWI(0x20026, "", -2, 452, 645, 31);
CtxWI *CWI_7 = new CtxWI(0x10052, "ICA Seamless Host Agent", 0, 0, 391, 224);
CtxWI *CWI_8 = new CtxWI(0x10048, "Program Manager", 0, 0, 641, 481);
CtxWI *CWI_9 = new CtxWI(0x10084, "", 115, 0, 405, 457);
CtxWI *CWI_10 = new CtxWI(0x20058, "Calculator", 44, 44, 261, 255);
CtxWI *CWI_11 = new CtxWI(0x5002e, "Please wait...", 111, 112, 418, 145);

SET_ABORT_FUNCTION(abort_function);
DEFINE_TRANS_TYPE("CalculatorCreateNew.cpp");
CitrixInit(1);
/* Citrix replay settings */
CtxSetConnectTimeout(60);
CtxSetDisconnectTimeout(60);
CtxSetWindowTimeout(30);
CtxSetPingTimeout(20);
CtxSetWaitPointTimeout(30);
CtxSetWindowVerification(TRUE);
CtxSetEnableCounters(FALSE);
CtxSetWindowRetries(5, 5000);
CtxSetEnableWildcardMatching(TRUE);

SYNCHRONIZE();
BEGIN_TRANSACTION();
CtxConnect(CitrixServer, CitrixOutputMode);

DO_MSLEEP(1172);
CtxPoint(172, 214);

DO_MSLEEP(250);
// Window CWI_1 ("Warning !!") created 1084811574.696

CtxWaitForWindowCreate(CWI_1);

DO_MSLEEP(906);
CtxPoint(308, 359);

DO_MSLEEP(156);
CtxClick(CWI_1, 78, L_BUTTON, NONE);

DO_MSLEEP(63);
// Window CWI_2 ("Log On to Windows") created 1084811575.899

CtxWaitForWindowCreate(CWI_2);

// Window CWI_1 ("Warning !!") destroyed 1084811575.899

Type(CWI_2, "citrix");

DO_MSLEEP(2547);
CtxTypeVK(CWI_2, VK_TAB, NONE);

DO_MSLEEP(328);
Type(CWI_2, "citrix");

DO_MSLEEP(3015);
CtxTypeVK(CWI_2, VK_TAB, NONE);

DO_MSLEEP(282);
Type(CWI_2, "q");

DO_MSLEEP(703);

DO_MSLEEP(1343);

```

Using the Player, Script Development Workbench, and Analyze

```
CtxPoint(247, 322);

DO_MSLEEP(110);
CtxClick(CWI_2, 62, L_BUTTON, NONE);

DO_MSLEEP(391);
// Window CWI_2 ("Log On to Windows") destroyed 1084811584.685

DO_MSLEEP(16);
// Window CWI_3 ("Please wait...") created 1084811584.701

CtxWaitForWindowCreate(CWI_3);

DO_MSLEEP(156);
// Window CWI_3 ("Please wait...") destroyed 1084811584.857

DO_MSLEEP(156);
// Window CWI_4 ("UsrLogon.Cmd") created 1084811585.013

CtxWaitForWindowCreate(CWI_4);

DO_MSLEEP(63);
CtxPoint(259, 322);

// Window CWI_4 ("UsrLogon.Cmd") destroyed 1084811585.076

DO_MSLEEP(187);
CtxPoint(449, 462);

DO_MSLEEP(63);
// Window CWI_5 ("") created 1084811585.326

DO_MSLEEP(93);
// Window CWI_5 ("") destroyed 1084811585.420

DO_MSLEEP(16);
// Window CWI_6 ("") created 1084811585.436

DO_MSLEEP(219);
// Window CWI_7 ("ICA Seamless Host Agent") created 1084811585.654

CtxWaitForWindowCreate(CWI_7);

DO_MSLEEP(15);
// Window CWI_8 ("Program Manager") created 1084811585.670

CtxWaitForWindowCreate(CWI_8);

DO_MSLEEP(641);
CtxPoint(135, 347);

DO_MSLEEP(3359);
// Window CWI_9 ("") created 1084811589.672

DO_MSLEEP(3032);
CtxPoint(192, 216);

// Window CWI_9 ("") destroyed 1084811592.705

DO_MSLEEP(921);
CtxPoint(190, 199);

DO_MSLEEP(63);
CtxClick(CWI_6, 78, L_BUTTON, NONE);
```

```

DO_MSLEEP(16);
// Window CWI_7 ("ICA Seamless Host Agent") destroyed 1084811593.784

/// These methods are, by placement in the script prior to the creation
/// of the calculator window, deduced to be the actions that result in the
/// creation of the Calculator application window. Paying attention to actions
/// performed while recording makes this task easier.
DO_MSLEEP(3843);
CtxPoint(112, 98);

DO_MSLEEP(282);
CtxDoubleClick(CWI_8);

DO_MSLEEP(110);

DO_MSLEEP(140);
// Window CWI_10 ("Calculator") created 1084811598.255

/// Scripting Step 1:
/// The calculator window is created at this point
/// Working backward, we deduce that the CtxPoint and
/// CtxDoubleClick API calls created this window.
CtxWaitForWindowCreate(CWI_10);

DO_MSLEEP(2672);
CtxPoint(295, 48);

DO_MSLEEP(672);
CtxClick(CWI_10, 94, L_BUTTON, NONE);

// Window CWI_10 ("Calculator") destroyed 1084811601.694

DO_MSLEEP(1125);
CtxPoint(256, 95);

DO_MSLEEP(281);
// Window CWI_8 ("Program Manager") destroyed 1084811603.101

// Window CWI_6 ("") destroyed 1084811603.101

// Window CWI_11 ("Please wait...") created 1084811603.601

CtxWaitForWindowCreate(CWI_11);

CtxDisconnect();

END_TRANSACTION();
delete CWI_1; // "Warning !!"
delete CWI_2; // "Log On to Windows"
delete CWI_3; // "Please wait..."
delete CWI_4; // "UsrLogon.Cmd"
delete CWI_5; // ""
delete CWI_6; // ""
delete CWI_7; // "ICA Seamless Host Agent"
delete CWI_8; // "Program Manager"
delete CWI_9; // ""
delete CWI_10; // "Calculator"
delete CWI_11; // "Please wait..."

CitrixUninit();

REPORT(SUCCESS);
EXIT();
return(0);
}

```

Using the Player, Script Development Workbench, and Analyze

```
void abort_function(PPLAYER_INFO *s_info)
{
    RR_printf("Virtual User ABORTED.");

    CitrixUninit();

    EXIT();
}
```

Example 2: Original Record Script with Calculator Application Present at Logon

Points of interest in the script are highlighted in bold.

```
/*
 * CalculatorUseExisting.cpp
 *
 * Script Converted on May 17, 2004 at 12:35:29 PM
 * Generated by Compuware QALoad convert module version 5.2.0 build 33
 *
 * This script contains support for the following middlewares:
 *   - Citrix
 */
/* Converted using the following options:
 * General:
 * Line Split                : 80 characters
 * Sleep Seconds             : 1
 * Auto Checkpoints         : No
 * Citrix
 * General Options          :
 * Window Verification      : Yes
 * Session Timeouts        : Yes
 *   Connect Timeout (s)   : 60
 *   Disconnect Timeout (s) : 60
 *   Window Creation Timeout (s) : 30
 *   Ping Timeout (s)      : 20
 *   Wait Point Timeout (s) : 30
 * Include Wait Points      : Yes
 * Enable Counters          : No
 * Include Unnamed Windows : Yes
 * Output Mode              : Normal
 * Input Options            :
 *   Combine Keyboard Input : Yes
 *   Combine Mouse Input    : Yes
 */
#define CITRIX_CLIENT_VERSION "7.100.21825"
#define CITRIX_ICO_VERSION    "2.3"
#define SCRIPT_VER 0x00000205UL
#include <stdio.h>
#include "smacro.h"
#include "do_citrix.h"
/* set function to call on abort*/
void abort_function(PPLAYER_INFO *s_info);
#ifdef NULL
#define NULL 0
#endif
extern "C" int rrobot_script(PPLAYER_INFO *s_info)
{
    /* Declare Variables */
    const char *CitrixServer      = "qaccitrix2";
    const int   CitrixOutputMode = OUTPUT_MODE_NORMAL;

    /* Citrix Window Information Objects */
    CtxWI *CWI_1 = new CtxWI(0x1001c, "Warning !!", 107, 43, 427, 351);
    CtxWI *CWI_2 = new CtxWI(0x2001c, "Log On to Windows", 111, 65, 418, 285);
    CtxWI *CWI_3 = new CtxWI(0x20026, "", -2, 740, 1029, 31);
    CtxWI *CWI_4 = new CtxWI(0x10136, "Calculator", 154, 154, 261, 253);
}
```

```

CtxWI *CWI_5 = new CtxWI(0x10048, "Program Manager", 0, 0, 1025, 769);
CtxWI *CWI_6 = new CtxWI(0x2017c, "ICA Seamless Host Agent", 0, 0, 391, 224);
CtxWI *CWI_7 = new CtxWI(0x5002e, "Please wait...", 303, 208, 418, 145);

SET_ABORT_FUNCTION(abort_function);
DEFINE_TRANS_TYPE("CalculatorUseExisting.cpp");
CitrixInit(1);
/* Citrix replay settings */
CtxSetConnectTimeout(60);
CtxSetDisconnectTimeout(60);
CtxSetWindowTimeout(30);
CtxSetPingTimeout(20);
CtxSetWaitPointTimeout(30);
CtxSetWindowVerification(TRUE);
CtxSetEnableCounters(FALSE);
CtxSetWindowRetries(5, 5000);
CtxSetEnableWildcardMatching(TRUE);

SYNCHRONIZE();
BEGIN_TRANSACTION();
CtxConnect(CitrixServer, CitrixOutputMode);

DO_MSLEEP(625);
CtxPoint(130, 78);

DO_MSLEEP(797);
// Window CWI_1 ("Warning !!") created 1084811688.065

CtxWaitForWindowCreate(CWI_1);

DO_MSLEEP(1813);
CtxPoint(309, 365);

DO_MSLEEP(203);
CtxClick(CWI_1, 140, L_BUTTON, NONE);

DO_MSLEEP(63);
// Window CWI_2 ("Log On to Windows") created 1084811690.285

CtxWaitForWindowCreate(CWI_2);

DO_MSLEEP(15);
// Window CWI_1 ("Warning !!") destroyed 1084811690.300

CtxType(CWI_2, "citrix");

DO_MSLEEP(2375);
CtxPoint(309, 364);

CtxTypeVK(CWI_2, VK_TAB, NONE);

DO_MSLEEP(813);
CtxType(CWI_2, "citrix");

DO_MSLEEP(1844);
CtxTypeVK(CWI_2, VK_TAB, NONE);

DO_MSLEEP(328);
CtxType(CWI_2, "q");

DO_MSLEEP(672);

DO_MSLEEP(1281);
CtxPoint(241, 317);

```

Using the Player, Script Development Workbench, and Analyze

```
DO_MSLEEP(125);
CtxClick(CWI_2, 141, L_BUTTON, NONE);

DO_MSLEEP(406);
// Window CWI_2 ("Log On to Windows") destroyed 1084811698.289

DO_MSLEEP(828);
CtxPoint(514, 358);

DO_MSLEEP(125);
// Window CWI_3 ("") created 1084811699.258

DO_MSLEEP(16);
// Window CWI_4 ("Calculator") created 1084811699.258

/// The following comment inserted during record indicates that the
/// calculator window has appeared in the script.
/// Since it happens before any events after the Logon window
/// was destroyed, we know that in this session, we will not have to
/// start the calculator application - it is already present!
/*
    The calculator has been created at this point in the modified script!
*/
/// Scripting Step 2:
/// The code in bold is cut and pasted into the original script
CtxWaitForWindowCreate(CWI_4);

// Window CWI_5 ("Program Manager") created 1084811699.258

CtxWaitForWindowCreate(CWI_5);

DO_MSLEEP(640);
// Window CWI_6 ("ICA Seamless Host Agent") created 1084811699.899

CtxWaitForWindowCreate(CWI_6);

DO_MSLEEP(1672);
CtxPoint(200, 195);

DO_MSLEEP(234);
CtxClick(CWI_6, 141, L_BUTTON, NONE);

DO_MSLEEP(16);
// Window CWI_6 ("ICA Seamless Host Agent") destroyed 1084811701.962

DO_MSLEEP(672);
CtxPoint(200, 205);

DO_MSLEEP(125);
CtxClick(CWI_3, 109, L_BUTTON, NONE);

DO_MSLEEP(719);
CtxPoint(275, 316);

DO_MSLEEP(31);
CtxMouseDown(CWI_4, L_BUTTON, NONE, 275, 316);

CtxMouseUp(CWI_4, L_BUTTON, NONE, 274, 316);

DO_MSLEEP(812);
CtxPoint(349, 376);

DO_MSLEEP(172);
CtxClick(CWI_4, 110, L_BUTTON, NONE);
```

```

DO_MSLEEP(1297);
CtxPoint(259, 313);

DO_MSLEEP(46);
CtxClick(CWI_4, 79, L_BUTTON, NONE);

DO_MSLEEP(843);
CtxPoint(387, 374);

CtxMouseDown(CWI_4, L_BUTTON, NONE, 387, 374);

CtxMouseUp(CWI_4, L_BUTTON, NONE, 387, 375);

DO_MSLEEP(3782);
CtxPoint(397, 160);

DO_MSLEEP(1140);
CtxClick(CWI_4, 125, L_BUTTON, NONE);

DO_MSLEEP(16);
// Window CWI_4 ("Calculator") destroyed 1084811712.045
/// Scripting Step 2:
/// This is the end of the code snippet that will be cut and pasted into the
/// original script.
/// The following comment inserted during record indicates that the
/// calculator window has been destroyed.
/// Since it happens before any events after the Logon window
/// was destroyed, we know that in this session, we will not have to
/// start the calculator application - it is already present!
/*
The calculator has been destroyed at this point in the modified script!
*/
DO_MSLEEP(1469);
CtxPoint(235, 85);

DO_MSLEEP(343);
// Window CWI_5 ("Program Manager") destroyed 1084811713.858

// Window CWI_3 ("") destroyed 1084811713.858

// Window CWI_7 ("Please wait...") created 1084811714.359

CtxWaitForWindowCreate(CWI_7);

CtxDisconnect();

END_TRANSACTION();
delete CWI_1; // "Warning !!"
delete CWI_2; // "Log On to Windows"
delete CWI_3; // ""
delete CWI_4; // "Calculator"
delete CWI_5; // "Program Manager"
delete CWI_6; // "ICA Seamless Host Agent"
delete CWI_7; // "Please wait..."

CitrixUninit();

REPORT(SUCCESS);
EXIT();
return(0);
}
void abort_function(PLAYER_INFO *s_info)
{
RR_printf("Virtual User ABORTED.");
}

```

Using the Player, Script Development Workbench, and Analyze

```
CitrixUninit();

EXIT();
}
```

Sample: Modified Citrix Script for Handling Unexpected Events

The following sample shows a Citrix script that is modified to address whether the calculator application is present is present at logon. Changes to Original script are highlighted in bold.

Sample Script

```
/*
 * CalculatorUseExisting.cpp
 *
 * Script Converted on May 17, 2004 at 12:35:29 PM
 * Generated by Compuware QALoad convert module version 5.2.0 build 33
 *
 * This script contains support for the following middlewares:
 *   - Citrix
 */
/* Converted using the following options:
 * General:
 * Line Split                : 80 characters
 * Sleep Seconds             : 1
 * Auto Checkpoints          : No
 * Citrix
 * General Options           :
 * Window Verification       : Yes
 * Session Timeouts         : Yes
 *   Connect Timeout (s)    : 60
 *   Disconnect Timeout (s) : 60
 *   Window Creation Timeout (s) : 30
 *   Ping Timeout (s)       : 20
 *   Wait Point Timeout (s)  : 30
 * Include Wait Points       : Yes
 * Enable Counters           : No
 * Include Unnamed Windows  : Yes
 * Output Mode               : Normal
 * Input Options             :
 *   Combine Keyboard Input  : Yes
 *   Combine Mouse Input    : Yes
 */
#define CITRIX_CLIENT_VERSION "7.100.21825"
#define CITRIX_ICO_VERSION    "2.3"
#define SCRIPT_VER 0x00000205UL
#include <stdio.h>
#include "smacro.h"
#include "do_citrix.h"
/* set function to call on abort*/
void abort_function(PLAYER_INFO *s_info);
#ifndef NULL
#define NULL 0
#endif
extern "C" int rrobot_script(PLAYER_INFO *s_info)
{
    /* Declare Variables */
    const char *CitrixServer      = "qaccitrix2";
    const int   CitrixOutputMode  = OUTPUT_MODE_NORMAL;

    /* Citrix Window Information Objects */
    CtxWI *CWI_1 = new CtxWI(0x1001c, "Warning !!", 107, 43, 427, 351);
    CtxWI *CWI_2 = new CtxWI(0x2001c, "Log On to Windows", 111, 65, 418, 285);
    CtxWI *CWI_3 = new CtxWI(0x20026, "", -2, 740, 1029, 31);
    CtxWI *CWI_4 = new CtxWI(0x10136, "Calculator", 154, 154, 261, 253);
}
```

```

CtxWI *CWI_5 = new CtxWI(0x10048, "Program Manager", 0, 0, 1025, 769);
CtxWI *CWI_6 = new CtxWI(0x2017c, "ICA Seamless Host Agent", 0, 0, 391, 224);
CtxWI *CWI_7 = new CtxWI(0x5002e, "Please wait...", 303, 208, 418, 145);

SET_ABORT_FUNCTION(abort_function);
DEFINE_TRANS_TYPE("CalculatorUseExisting.cpp");
CitrixInit(1);
/* Citrix replay settings */
CtxSetConnectTimeout(60);
CtxSetDisconnectTimeout(60);
CtxSetWindowTimeout(30);
CtxSetPingTimeout(20);
CtxSetWaitPointTimeout(30);
CtxSetWindowVerification(TRUE);
CtxSetEnableCounters(FALSE);
CtxSetWindowRetries(5, 5000);
CtxSetEnableWildcardMatching(TRUE);

SYNCHRONIZE();
BEGIN_TRANSACTION();
CtxConnect(CitrixServer, CitrixOutputMode);

DO_MSLEEP(625);
CtxPoint(130, 78);

DO_MSLEEP(797);
// Window CWI_1 ("Warning !!") created 1084811688.065

CtxWaitForWindowCreate(CWI_1);

DO_MSLEEP(1813);
CtxPoint(309, 365);

DO_MSLEEP(203);
CtxClick(CWI_1, 140, L_BUTTON, NONE);

DO_MSLEEP(63);
// Window CWI_2 ("Log On to Windows") created 1084811690.285

CtxWaitForWindowCreate(CWI_2);

DO_MSLEEP(15);
// Window CWI_1 ("Warning !!") destroyed 1084811690.300

CtxType(CWI_2, "citrix");

DO_MSLEEP(2375);
CtxPoint(309, 364);

CtxTypeVK(CWI_2, VK_TAB, NONE);

DO_MSLEEP(813);
CtxType(CWI_2, "citrix");

DO_MSLEEP(1844);
CtxTypeVK(CWI_2, VK_TAB, NONE);

DO_MSLEEP(328);
CtxType(CWI_2, "q");

DO_MSLEEP(672);

DO_MSLEEP(1281);
CtxPoint(241, 317);

```

Using the Player, Script Development Workbench, and Analyze

```
DO_MSLEEP(125);
CtxClick(CWI_2, 141, L_BUTTON, NONE);

DO_MSLEEP(406);
// Window CWI_2 ("Log On to Windows") destroyed 1084811698.289

DO_MSLEEP(828);
CtxPoint(514, 358);

DO_MSLEEP(125);
// Window CWI_3 ("") created 1084811699.258

DO_MSLEEP(16);
// Window CWI_4 ("Calculator") created 1084811699.258

/// Here is where we can determine that either the Calculator application
/// exists in this session or it needs to be created.

/// Scripting Step
    if(CtxWindowEventExists("WindowCreate", 4000, "Calculator", ""))

/// If the window exists, the block below will be
/// executed.

    BeginBlock();

/// Scripting Step 2:
/// The following code was cut and pasted from the second script.

/// Scripting Step 3:
/// All Citrix window object name references have been reconciled with the
/// correct Citrix window object definition.

    CtxWaitForWindowCreate(CWI_4);

    // Window CWI_5 ("Program Manager") created 1084811699.258

    CtxWaitForWindowCreate(CWI_5);

    DO_MSLEEP(640);
    // Window CWI_6 ("ICA Seamless Host Agent") created 1084811699.899

    CtxWaitForWindowCreate(CWI_6);

    DO_MSLEEP(1672);
    CtxPoint(200, 195);

    DO_MSLEEP(234);
    CtxClick(CWI_6, 141, L_BUTTON, NONE);

    DO_MSLEEP(16);
    // Window CWI_6 ("ICA Seamless Host Agent") destroyed 1084811701.962

    DO_MSLEEP(672);
    CtxPoint(200, 205);

    DO_MSLEEP(125);
    CtxClick(CWI_3, 109, L_BUTTON, NONE);

    DO_MSLEEP(719);
    CtxPoint(275, 316);

    DO_MSLEEP(31);
    CtxMouseDown(CWI_4, L_BUTTON, NONE, 275, 316);
```

```

    CtxMouseUp(CWI_4, L_BUTTON, NONE, 274, 316);

    DO_MSLEEP(812);
    CtxPoint(349, 376);

    DO_MSLEEP(172);
    CtxClick(CWI_4, 110, L_BUTTON, NONE);

    DO_MSLEEP(1297);
    CtxPoint(259, 313);

    DO_MSLEEP(46);
    CtxClick(CWI_4, 79, L_BUTTON, NONE);

    DO_MSLEEP(843);
    CtxPoint(387, 374);

    CtxMouseDown(CWI_4, L_BUTTON, NONE, 387, 374);

    CtxMouseUp(CWI_4, L_BUTTON, NONE, 387, 375);

    DO_MSLEEP(3782);
    CtxPoint(397, 160);

    DO_MSLEEP(1140);
    CtxClick(CWI_4, 125, L_BUTTON, NONE);

/// Scripting Step 5:
/// Here is the end of the code snippet, so an EndBlock goes here.

    EndBlock()

/// Scripting Step 6:
/// The original behavior has been put into the else
/// section of the if conditional between BeginBlock
/// and EndBlock commands.

    else
    BeginBlock();

        DO_MSLEEP(1672);
        CtxPoint(200, 195);

        DO_MSLEEP(234);
        CtxClick(CWI_6, 141, L_BUTTON, NONE);

        DO_MSLEEP(3843);
        CtxPoint(112, 98);

        DO_MSLEEP(282);
        CtxDoubleClick(CWI_5);

        CtxWaitForWindowCreate(CWI_4);

        DO_MSLEEP(2672);
        CtxPoint(295, 48);

        DO_MSLEEP(672);
        CtxClick(CWI_4, 94, L_BUTTON, NONE);

    EndBlock();

    DO_MSLEEP(16);
    // Window CWI_4 ("Calculator") destroyed 1084811712.045

    DO_MSLEEP(1469);

```

Using the Player, Script Development Workbench, and Analyze

```
CtxPoint(235, 85);

DO_MSLEEP(343);
// Window CWI_5 ("Program Manager") destroyed 1084811713.858

// Window CWI_3 ("") destroyed 1084811713.858

// Window CWI_7 ("Please wait...") created 1084811714.359

//CtxWaitForWindowCreate(CWI_7);

CtxDisconnect();

END_TRANSACTION();

delete CWI_1; // "Warning !!"
delete CWI_2; // "Log On to Windows"
delete CWI_3; // ""
delete CWI_4; // "Calculator"
delete CWI_5; // "Program Manager"
delete CWI_6; // "ICA Seamless Host Agent"
delete CWI_7; // "Please wait..."

CitrixUninit();

REPORT(SUCCESS);
EXIT();
return(0);
}
void abort_function(PLAYER_INFO *s_info)
{
    RR_printf("Virtual User ABORTED.");

    CitrixUninit();

    EXIT();
}
```

Moving Connect and Disconnect Actions

Modifying the Script to Move Connect and Disconnect Outside the Transaction Loop

Load testing for Citrix may require you to create extended logon sessions, in which the user remains connected to the Citrix server between transactions. When this is necessary, you can move the connect and disconnect actions outside the transaction loop so that the script does not logon and off with each iteration through the loop.

To modify the script, you must:

- ! Modify the recording process to prepare for moving the connect and disconnect actions.
- ! Modify the script.

To modify the recording process:

Prepare for moving the connect and disconnect actions outside the transaction loop by performing the following steps during recording:

1. Insert a comment, such as "Logged in to Citrix" , after the Citrix logon but before any windows are opened or any applications are started.
2. Ensure that all application windows are closed before disconnecting from the Citrix session.

3. Insert a comment, such as “Ready to log off Citrix”, before the Citrix logoff sequence is initiated. You must place the second comment after all applications have been closed but before the user logs off.

To modify the script:

1. Comment out the BEGIN_TRANSACTION and END_TRANSACTION calls.
2. Add new BEGIN_TRANSACTION and END_TRANSACTION calls where the comments were placed in Step 1 and Step 3 in the recording process described above.
3. Comment out the DO_SetTransactionStart and DO_SetTransactionCleanup calls.

 **Note:** Commenting out the calls instead of deleting them allows you to determine the original location of these commands for debugging purposes.

Conclusion

When you use these techniques, you can script a set of actions so that the script does not log on and log off with each iteration through the loop.

 **Caution:** You must take care when you perform this action. In the event of a failure, you must log off before using a transaction restart.

The following sample scripts illustrate this process:

Sample: Original Citrix Script for Modifying the Transaction Loop

The following sample is an original Citrix script converted from capture. Points of interest in the script are shown in bold>.

Sample Script

```

/*
 * capCtxMoveLoop.cpp
 *
 * Script Converted on February 28, 2005 at 08:30:06 AM
 * Generated by Compuware QALoad convert module version 5.5.0 build 231
 *
 * This script contains support for the following middlewares:
 *   - Citrix
 */
/* Converted using the following options:
 * General:
 * Line Split                : 80 characters
 * Sleep Seconds             : 1
 * Auto Checkpoints          : No
 * Citrix
 * General Options           :
 *   Replay Output Mode      : Normal
 *   Enable Counters         : No
 *   Timeout Value Options   :
 *     Connect Timeout (s)   : 60
 *     Disconnect Timeout (s): 60
 *     Window Creation Timeout (s) : 30
 *     Ping Timeout (s)      : 20
 *     Wait Point Timeout (s) : 30
 * Input Options             :

```

Using the Player, Script Development Workbench, and Analyze

```
*   Combine Keyboard Input           : Yes
*   Combine Mouse Input              : Yes
*   Window Options                    :
*   Window Verification               : Yes
*   Window Max Retries                : 5
*   Window Wait Retries (ms)         : 5000
*   Enable Wildcard Title Match       : Yes
*/
#define CITRIX_CLIENT_VERSION "8.100.29670"
#define CITRIX_ICO_VERSION      "2.4"
#define SCRIPT_VER 0x00000505UL
#include <stdio.h>
#include "smacro.h"
#include "do_citrix.h"
/* set function to call on abort*/
void abort_function(PLAYER_INFO *s_info);
#ifndef NULL
#define NULL 0
#endif
extern "C" int rrobot_script(PLAYER_INFO *s_info)
{
    /* Declare Variables */
    const char *CitrixServer      = "QACCitrix";
    const char *CitrixUsername     = "Citrix";
    const char *CitrixPassword    = "~encr~657E06726F697206";
    const char *CitrixDomain      = "QACCitrix";
    const int   CitrixOutputMode  = OUTPUT_MODE_NORMAL;

    /* Citrix Window Information Objects */
    CtxWI *CWI_1 = new CtxWI(0x1001c, "Warning !!", 107, 43, 427, 351);
    CtxWI *CWI_2 = new CtxWI(0x5001c, "Please wait...", 111, 112, 418, 145);
    CtxWI *CWI_3 = new CtxWI(0x40030, "Citrix License Warning Notice", 125, 198, 397, 127);
    CtxWI *CWI_4 = new CtxWI(0x4002e, "UsrLogon.Cmd", 0, 456, 161, 25);
    CtxWI *CWI_5 = new CtxWI(0x1003a, "", -2, 452, 645, 31);
    CtxWI *CWI_6 = new CtxWI(0x10066, "ICA Seamless Host Agent", 0, 0, 391, 224);
    CtxWI *CWI_7 = new CtxWI(0x10052, "Program Manager", 0, 0, 641, 481);
    CtxWI *CWI_8 = new CtxWI(0x1008c, "", 115, 0, 405, 457);
    CtxWI *CWI_9 = new CtxWI(0x2006c, "Calculator", 66, 66, 261, 253);

    SET_ABORT_FUNCTION(abort_function);
    DEFINE_TRANS_TYPE("capCtxMoveLoop.cpp");
    CitrixInit(1);
    /* Citrix replay settings */
    CtxSetConnectTimeout(60);
    CtxSetDisconnectTimeout(60);
    CtxSetWindowTimeout(30);
    CtxSetPingTimeout(20);
    CtxSetWaitPointTimeout(30);
    CtxSetWindowVerification(TRUE);
    CtxSetDomainLoginInfo(CitrixUsername, CitrixPassword, CitrixDomain);
    CtxSetEnableCounters(FALSE);
    CtxSetWindowRetries(5, 5000);
    CtxSetEnableWildcardMatching(TRUE);

    SYNCHRONIZE();
    BEGIN_TRANSACTION();
    DO_SetTransactionStart();

    CtxConnect(CitrixServer, CitrixOutputMode);

    // Window CWI_1 ("Warning !!") created 1109597295.502

    CtxWaitForWindowCreate(CWI_1, 2156);

    DO_MSLEEP(922);
}
```

```
CtxPoint(333, 233); //1109597296.611

DO_MSLEEP(188);
CtxMouseDown(CWI_1, L_BUTTON, NONE, 333, 233); // 1109597296.611

CtxMouseUp(CWI_1, L_BUTTON, NONE, 332, 233); //1109597296.861

DO_MSLEEP(1250);
CtxPoint(319, 360); //1109597297.938

DO_MSLEEP(78);
CtxMouseDown(CWI_1, L_BUTTON, NONE, 319, 360); // 1109597297.938

CtxMouseUp(CWI_1, L_BUTTON, NONE, 320, 360); //1109597298.235

DO_MSLEEP(78);
CtxPoint(320, 360); //1109597298.282

DO_MSLEEP(265);
// Window CWI_1 ("Warning !!") destroyed 1109597298.282

CtxPoint(321, 358); //1109597298.469

// Window CWI_2 ("Please wait...") created 1109597298.469

CtxWaitForWindowCreate(CWI_2, 31);

DO_MSLEEP(47);
CtxPoint(324, 353); //1109597298.500

// Window CWI_2 ("Please wait...") destroyed 1109597298.500

CtxPoint(321, 325); //1109597298.578

// Window CWI_3 ("Citrix License Warning Notice") created 1109597298.578

CtxWaitForWindowCreate(CWI_3, 15);

// Window CWI_4 ("UsrLogon.Cmd") created 1109597298.578

CtxWaitForWindowCreate(CWI_4, 0);

DO_MSLEEP(16);
// Window CWI_4 ("UsrLogon.Cmd") destroyed 1109597298.594

CtxPoint(307, 268); //1109597298.766

// Window CWI_5 ("") created 1109597298.766

DO_MSLEEP(63);
// Window CWI_6 ("ICA Seamless Host Agent") created 1109597298.828

CtxWaitForWindowCreate(CWI_6, 62);

// Window CWI_7 ("Program Manager") created 1109597298.828

CtxWaitForWindowCreate(CWI_7, 0);

// Window CWI_8 ("") created 1109597301.123

DO_MSLEEP(2297);

DO_MSLEEP(2797);
// Window CWI_8 ("") destroyed 1109597303.918
```

Using the Player, Script Development Workbench, and Analyze

```
DO_MSLEEP(5438);
CtxPoint(289, 212); //1109597309.524

DO_MSLEEP(171);
CtxClick(CWI_3, 266, L_BUTTON, NONE); //1109597309.789

DO_MSLEEP(1109);
CtxPoint(329, 295); //1109597310.944

DO_MSLEEP(47);
CtxClick(CWI_3, 250, L_BUTTON, NONE); //1109597311.194

DO_MSLEEP(63);
// Window CWI_3 ("Citrix License Warning Notice") destroyed 1109597311.257

DO_MSLEEP(984);
CtxPoint(261, 132); //1109597312.475

DO_MSLEEP(235);
CtxClick(CWI_6, 312, L_BUTTON, NONE); //1109597312.787

DO_MSLEEP(563);
CtxPoint(208, 194); //1109597313.708

DO_MSLEEP(359);
CtxClick(CWI_6, 281, L_BUTTON, NONE); //1109597313.989

DO_MSLEEP(78);
// Window CWI_6 ("ICA Seamless Host Agent") destroyed 1109597314.067

/*
After Logon
*/
DO_MSLEEP(29578);
CtxPoint(101, 96); //1109597343.983

DO_MSLEEP(360);
CtxDoubleClick(CWI_7); // 1109597344.186

CtxMouseUp(CWI_5, L_BUTTON, NONE, 100, 96); //1109597344.093

DO_MSLEEP(47);
CtxPoint(100, 96); //1109597344.186

DO_MSLEEP(156);

// Window CWI_9 ("Calculator") created 1109597344.327

CtxWaitForWindowCreate(CWI_9, 141);

DO_MSLEEP(921);
CtxPoint(181, 195); //1109597345.420

DO_MSLEEP(172);
CtxMouseDown(CWI_9, L_BUTTON, NONE, 181, 195); // 1109597345.420

CtxMouseUp(CWI_9, L_BUTTON, NONE, 181, 196); //1109597345.529

DO_MSLEEP(438);
CtxPoint(210, 196); //1109597345.857

CtxMouseDown(CWI_9, L_BUTTON, NONE, 210, 196); // 1109597345.857

CtxMouseUp(CWI_9, L_BUTTON, NONE, 211, 197); //1109597346.013
```

```

DO_MSLEEP(562);
CtxPoint(252, 230); //1109597346.950

DO_MSLEEP(532);
CtxClick(CWI_9, 140, L_BUTTON, NONE); //1109597347.091

DO_MSLEEP(531);
CtxPoint(171, 222); //1109597347.653

DO_MSLEEP(32);
CtxMouseDown(CWI_9, L_BUTTON, NONE, 171, 222); // 1109597347.653

CtxMouseUp(CWI_9, L_BUTTON, NONE, 172, 222); //1109597347.746

DO_MSLEEP(547);
CtxPoint(231, 231); //1109597348.215

DO_MSLEEP(15);
CtxMouseDown(CWI_9, L_BUTTON, NONE, 231, 231); // 1109597348.215

CtxMouseUp(CWI_9, L_BUTTON, NONE, 230, 231); //1109597348.340

DO_MSLEEP(953);
CtxPoint(303, 293); //1109597349.370

DO_MSLEEP(188);
CtxMouseDown(CWI_9, L_BUTTON, NONE, 303, 293); // 1109597349.370

CtxMouseUp(CWI_9, L_BUTTON, NONE, 302, 293); //1109597349.480

DO_MSLEEP(1859);
CtxPoint(314, 79); //1109597351.494

DO_MSLEEP(281);
CtxClick(CWI_9, 157, L_BUTTON, NONE); //1109597351.650

DO_MSLEEP(62);
// Window CWI_9 ("Calculator") destroyed 1109597351.712

/*
Before Logoff
*/
DO_MSLEEP(33781);
CtxPoint(384, 13); //1109597396.040

DO_MSLEEP(10579);
// Window CWI_7 ("Program Manager") destroyed 1109597396.040
// Window CWI_5 ("") destroyed 1109597396.040

DO_SetTransactionCleanup();
CtxDisconnect();

END_TRANSACTION();
delete CWI_1; // "Warning !!"
delete CWI_2; // "Please wait..."
delete CWI_3; // "Citrix License Warning Notice"
delete CWI_4; // "UsrLogon.Cmd"
delete CWI_5; // ""
delete CWI_6; // "ICA Seamless Host Agent"
delete CWI_7; // "Program Manager"
delete CWI_8; // ""
delete CWI_9; // "Calculator"

CitrixUninit();

```

Using the Player, Script Development Workbench, and Analyze

```
    EXIT();
    return(0);
}
void abort_function(PPLAYER_INFO *s_info)
{
    RR_printf("Virtual User ABORTED.");

    CitrixUninit();

    EXIT();
}
```

Sample: Modified Citrix Script for Modifying the Transaction Loop

The following sample is a modified Citrix script that moves the transaction loop. Changes to the original script are shown in bold.

Sample Script

```
/* Converted using the following options:
 * General:
 *   Line Split                : 80 characters
 *   Sleep Seconds             : 1
 *   Auto Checkpoints          : No
 * Citrix
 *   General Options           :
 *   Replay Output Mode        : Normal
 *   Enable Counters           : No
 *   Timeout Value Options     :
 *   Connect Timeout (s)       : 60
 *   Disconnect Timeout (s)    : 60
 *   Window Creation Timeout (s) : 30
 *   Ping Timeout (s)          : 20
 *   Wait Point Timeout (s)    : 30
 *   Input Options              :
 *   Combine Keyboard Input     : Yes
 *   Combine Mouse Input        : Yes
 *   Window Options             :
 *   Window Verification        : Yes
 *   Window Max Retries         : 5
 *   Window Wait Retries (ms)   : 5000
 *   Enable Wildcard Title Match : Yes
 */
#define CITRIX_CLIENT_VERSION "8.100.29670"
#define CITRIX_ICO_VERSION    "2.4"
#define SCRIPT_VER 0x00000505UL
#include <stdio.h>
#include "smacro.h"
#include "do_citrix.h"
/* set function to call on abort*/
void abort_function(PPLAYER_INFO *s_info);
#ifdef NULL
#define NULL 0
#endif
extern "C" int rrobot_script(PPLAYER_INFO *s_info)
{
    /* Declare Variables */
    const char *CitrixServer      = "QACCitrix";
    const char *CitrixUsername    = "Citrix";
    const char *CitrixPassword    = "~encr~657E06726F697206";
    const char *CitrixDomain      = "QACCitrix";
    const int   CitrixOutputMode  = OUTPUT_MODE_NORMAL;

    /* Citrix Window Information Objects */
    CtxWI *CWI_1 = new CtxWI(0x1001c, "Warning !!", 107, 43, 427, 351);
```

```

CtxWI *CWI_2 = new CtxWI(0x5001c, "Please wait...", 111, 112, 418, 145);
CtxWI *CWI_3 = new CtxWI(0x40030, "Citrix License Warning Notice", 125, 198, 397, 127);
CtxWI *CWI_4 = new CtxWI(0x4002e, "UsrLogon.Cmd", 0, 456, 161, 25);
CtxWI *CWI_5 = new CtxWI(0x1003a, "", -2, 452, 645, 31);
CtxWI *CWI_6 = new CtxWI(0x10066, "ICA Seamless Host Agent", 0, 0, 391, 224);
CtxWI *CWI_7 = new CtxWI(0x10052, "Program Manager", 0, 0, 641, 481);
CtxWI *CWI_8 = new CtxWI(0x1008c, "", 115, 0, 405, 457);
CtxWI *CWI_9 = new CtxWI(0x2006c, "Calculator", 66, 66, 261, 253);

SET_ABORT_FUNCTION(abort_function);

DEFINE_TRANS_TYPE("capCtxMoveLoop.cpp");

CitrixInit(1);

/* Citrix replay settings */
CtxSetConnectTimeout(60);
CtxSetDisconnectTimeout(60);
CtxSetWindowTimeout(30);
CtxSetPingTimeout(20);
CtxSetWaitPointTimeout(30);
CtxSetWindowVerification(TRUE);
CtxSetDomainLoginInfo(CitrixUsername, CitrixPassword, CitrixDomain);
CtxSetEnableCounters(FALSE);
CtxSetWindowRetries(5, 5000);
CtxSetEnableWildcardMatching(TRUE);

SYNCHRONIZE();
////////////////////////////////////
// Remove the BEGIN_TRANSACTION();
// and place it after the logon comment
// in the script
////////////////////////////////////
// BEGIN_TRANSACTION();

////////////////////////////////////
// Remove the DO_SetTransactionStart();
// Restart transaction cannot be used if the
// Transaction Loop has been moved
////////////////////////////////////
// DO_SetTransactionStart();

CtxConnect(CitrixServer, CitrixOutputMode);

// Window CWI_1 ("Warning !!") created 1109597295.502

CtxWaitForWindowCreate(CWI_1, 2156);

DO_MSLEEP(922);
CtxPoint(333, 233); //1109597296.611

DO_MSLEEP(188);
CtxMouseDown(CWI_1, L_BUTTON, NONE, 333, 233); // 1109597296.611

CtxMouseUp(CWI_1, L_BUTTON, NONE, 332, 233); //1109597296.861

DO_MSLEEP(1250);
CtxPoint(319, 360); //1109597297.938

DO_MSLEEP(78);
CtxMouseDown(CWI_1, L_BUTTON, NONE, 319, 360); // 1109597297.938

CtxMouseUp(CWI_1, L_BUTTON, NONE, 320, 360); //1109597298.235

```

Using the Player, Script Development Workbench, and Analyze

```
DO_MSLEEP(78);
CtxPoint(320, 360); //1109597298.282

DO_MSLEEP(265);
// Window CWI_1 ("Warning !!") destroyed 1109597298.282

CtxPoint(321, 358); //1109597298.469

// Window CWI_2 ("Please wait...") created 1109597298.469

CtxWaitForWindowCreate(CWI_2, 31);

DO_MSLEEP(47);
CtxPoint(324, 353); //1109597298.500

// Window CWI_2 ("Please wait...") destroyed 1109597298.500

CtxPoint(321, 325); //1109597298.578

// Window CWI_3 ("Citrix License Warning Notice") created 1109597298.578

CtxWaitForWindowCreate(CWI_3, 15);

// Window CWI_4 ("UsrLogon.Cmd") created 1109597298.578

CtxWaitForWindowCreate(CWI_4, 0);

DO_MSLEEP(16);
// Window CWI_4 ("UsrLogon.Cmd") destroyed 1109597298.594

CtxPoint(307, 268); //1109597298.766

// Window CWI_5 ("") created 1109597298.766

DO_MSLEEP(63);
// Window CWI_6 ("ICA Seamless Host Agent") created 1109597298.828

CtxWaitForWindowCreate(CWI_6, 62);

// Window CWI_7 ("Program Manager") created 1109597298.828

CtxWaitForWindowCreate(CWI_7, 0);

// Window CWI_8 ("") created 1109597301.123

DO_MSLEEP(2297);

DO_MSLEEP(2797);
// Window CWI_8 ("") destroyed 1109597303.918

DO_MSLEEP(5438);
CtxPoint(289, 212); //1109597309.524

DO_MSLEEP(171);
CtxClick(CWI_3, 266, L_BUTTON, NONE); //1109597309.789

DO_MSLEEP(1109);
CtxPoint(329, 295); //1109597310.944

DO_MSLEEP(47);
CtxClick(CWI_3, 250, L_BUTTON, NONE); //1109597311.194

DO_MSLEEP(63);
// Window CWI_3 ("Citrix License Warning Notice") destroyed 1109597311.257
```

```

DO_MSLEEP(984);
CtxPoint(261, 132); //1109597312.475

DO_MSLEEP(235);
CtxClick(CWI_6, 312, L_BUTTON, NONE); //1109597312.787

DO_MSLEEP(563);
CtxPoint(208, 194); //1109597313.708

DO_MSLEEP(359);
CtxClick(CWI_6, 281, L_BUTTON, NONE); //1109597313.989

DO_MSLEEP(78);
// Window CWI_6 ("ICA Seamless Host Agent") destroyed 1109597314.067

/*
After Logon
*/
////////////////////////////////////
// Move Begin Transaction Loop to after
// the Logon comment created during capture
// process You may want to reduce the sleep
// time introduced into the process by adding
// the comment
////////////////////////////////////
BEGIN_TRANSACTION();

DO_MSLEEP(2578);
CtxPoint(101, 96); //1109597343.983

DO_MSLEEP(360);
CtxDoubleClick(CWI_7); // 1109597344.186

CtxMouseUp(CWI_5, L_BUTTON, NONE, 100, 96); //1109597344.093

DO_MSLEEP(47);
CtxPoint(100, 96); //1109597344.186

DO_MSLEEP(156);

// Window CWI_9 ("Calculator") created 1109597344.327

CtxWaitForWindowCreate(CWI_9, 141);

DO_MSLEEP(921);
CtxPoint(181, 195); //1109597345.420

DO_MSLEEP(172);
CtxMouseDown(CWI_9, L_BUTTON, NONE, 181, 195); // 1109597345.420

CtxMouseUp(CWI_9, L_BUTTON, NONE, 181, 196); //1109597345.529

DO_MSLEEP(438);
CtxPoint(210, 196); //1109597345.857

CtxMouseDown(CWI_9, L_BUTTON, NONE, 210, 196); // 1109597345.857

CtxMouseUp(CWI_9, L_BUTTON, NONE, 211, 197); //1109597346.013

DO_MSLEEP(562);
CtxPoint(252, 230); //1109597346.950

DO_MSLEEP(532);
CtxClick(CWI_9, 140, L_BUTTON, NONE); //1109597347.091

```

Using the Player, Script Development Workbench, and Analyze

```
DO_MSLEEP(531);
CtxPoint(171, 222); //1109597347.653

DO_MSLEEP(32);
CtxMouseDown(CWI_9, L_BUTTON, NONE, 171, 222); // 1109597347.653

CtxMouseUp(CWI_9, L_BUTTON, NONE, 172, 222); //1109597347.746

DO_MSLEEP(547);
CtxPoint(231, 231); //1109597348.215

DO_MSLEEP(15);
CtxMouseDown(CWI_9, L_BUTTON, NONE, 231, 231); // 1109597348.215

CtxMouseUp(CWI_9, L_BUTTON, NONE, 230, 231); //1109597348.340

DO_MSLEEP(953);
CtxPoint(303, 293); //1109597349.370

DO_MSLEEP(188);
CtxMouseDown(CWI_9, L_BUTTON, NONE, 303, 293); // 1109597349.370

CtxMouseUp(CWI_9, L_BUTTON, NONE, 302, 293); //1109597349.480

DO_MSLEEP(1859);
CtxPoint(314, 79); //1109597351.494

DO_MSLEEP(281);
CtxClick(CWI_9, 157, L_BUTTON, NONE); //1109597351.650

DO_MSLEEP(62);
// Window CWI_9 ("Calculator") destroyed 1109597351.712

/*
Before Logoff
*/
////////////////////////////////////
// Move End Transaction Loop to before
// the Logoff comment created during capture
// process You may want to reduce the sleep
// time introduced into the process by adding
// the comment
////////////////////////////////////
END_TRANSACTION();

DO_MSLEEP(3781);
CtxPoint(384, 13); //1109597396.040

DO_MSLEEP(1079);
// Window CWI_7 ("Program Manager") destroyed 1109597396.040

// Window CWI_5 ("") destroyed 1109597396.040
////////////////////////////////////
// Remove the DO_SetTransactionCleanup();
// Restart transaction cannot be used if the
// Transaction Loop has been moved
////////////////////////////////////

// DO_SetTransactionCleanup();

CtxDisconnect();

////////////////////////////////////
// Remove the END_TRANSACTION();
```

```

// and place it before the logoff comment
// in the script
////////////////////////////////////

// END_TRANSACTION();
delete CWI_1; // "Warning !!"
delete CWI_2; // "Please wait..."
delete CWI_3; // "Citrix License Warning Notice"
delete CWI_4; // "UsrLogon.Cmd"
delete CWI_5; // ""
delete CWI_6; // "ICA Seamless Host Agent"
delete CWI_7; // "Program Manager"
delete CWI_8; // ""
delete CWI_9; // "Calculator"

CitrixUninit();

EXIT();
return(0);
}
void abort_function(PPLAYER_INFO *s_info)
{
    RR_printf("Virtual User ABORTED.");

    CitrixUninit();

    EXIT();
}

```

Scripting Mouse Actions

Modifying the Script for Controlling Mouse Actions

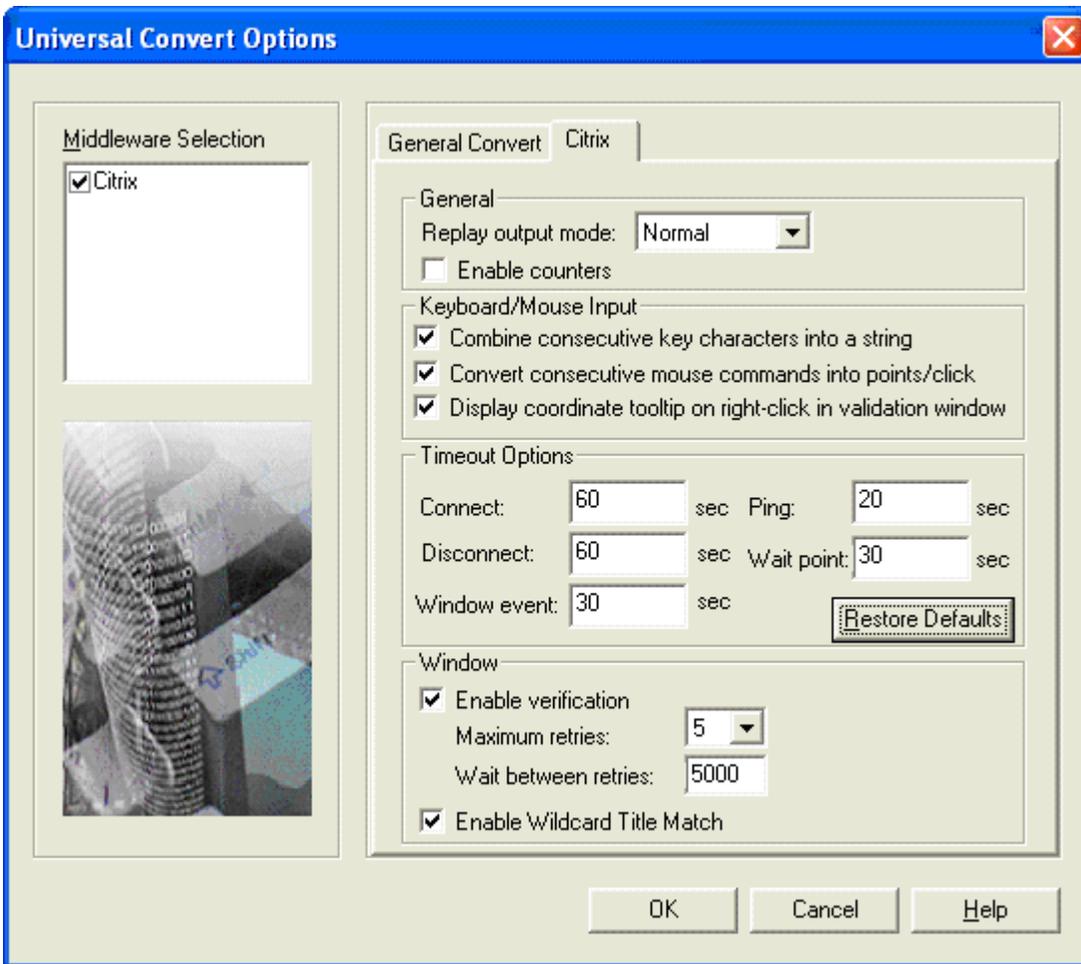
Changes to screen resolution or server settings can cause the appearance, size, and location coordinates of a window to differ from the expected behavior in the recorded script. By setting Display coordinate tooltip on right-click option in validation window in the Convert Options dialog box, you can right-click the mouse at the desired location to extract screen coordinate values that correspond to buttons and other controls in real time during validation .

To modify a script to retrieve coordinate values, you must:

- ! Validate the settings.
- ! Modify the script.

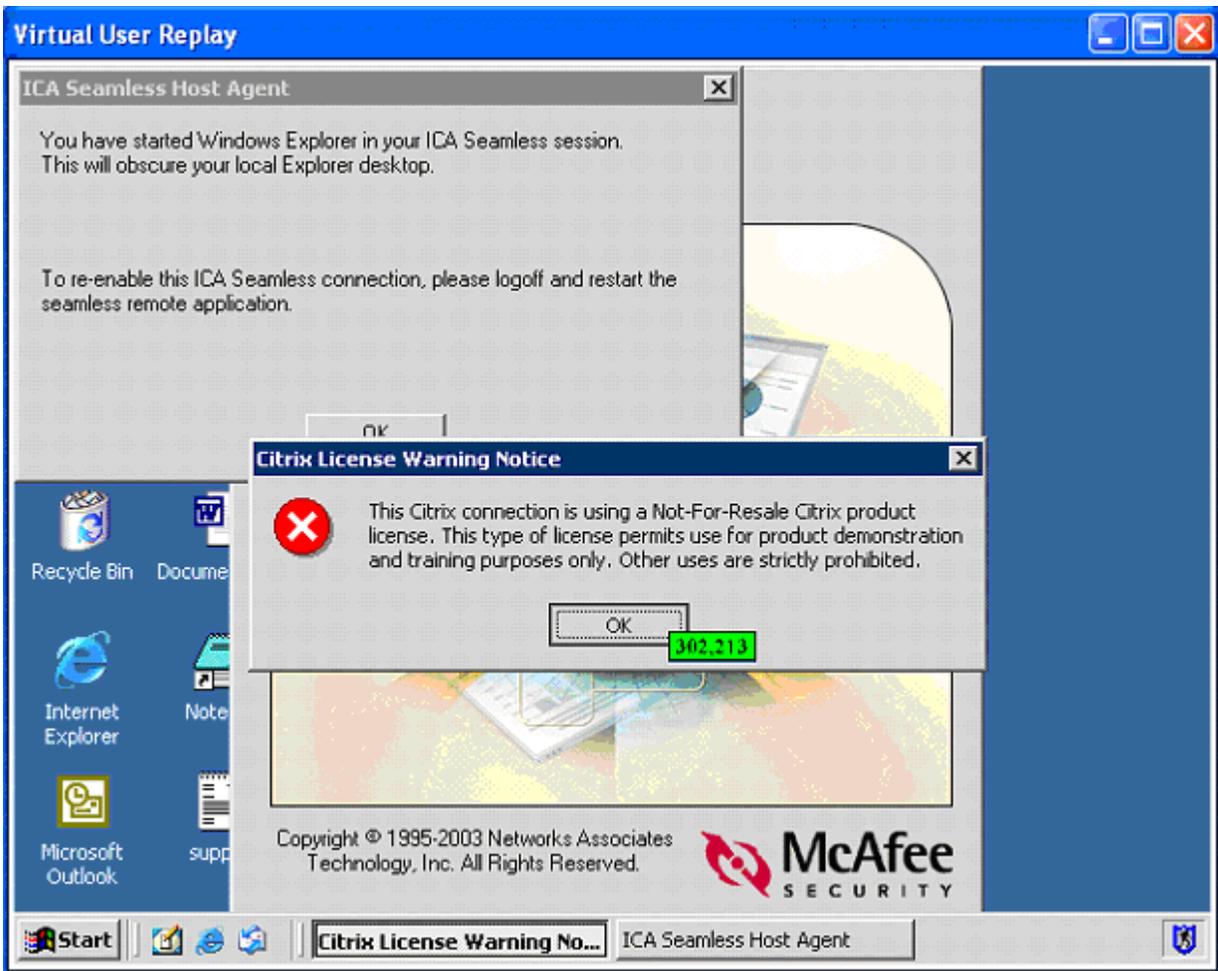
To validate the settings:

1. Click Options>Convert, and click the Citrix tab.
2. Ensure that the Display coordinate tooltip on right-click option in validation window checkbox is selected.
3. Set Replay output mode to Normal.
4. Click OK to convert the script.



During validation, a right mouse-click results in a tooltip display of the screen coordinate values. You can use these values in a manually added `CtxPoint` call to ensure that the mouse is moved to these coordinates before any subsequent mouse click actions.

i Tip: Make a note of these coordinate values, since this tooltip is not logged.



To modify the script:

Once you determine the correct mouse coordinates from validation, modify the script.

1. Add or modify the CtxPoint command.
2. Insert the new values into the script.

Conclusion

Following these techniques, you can retrieve screen coordinates at validation and insert them into a script. This corrects mouse behavior as a result of changes to the server settings or the user session environment. The sample scripts, showing **added CtxPoint** and **CtxMouseClicked**, and **modified CtxPoint**, illustrate these techniques.

Sample: Script Snippet with Added CtxPoint and CtxClick

The following sample shows a script extract with CtxPoint and CtxClick commands added. Comments and added script lines are highlighted in bold.

Sample Script Snippet

```

...beginning of script...
    DO_MSLEEP(687);

/// This CtxPoint is for an intermittent window

```

Using the Player, Script Development Workbench, and Analyze

```
/// that appeared. A button is required to dismiss
/// this window. Right-clicking on the button during
/// validation gave the coordinates in a tooltip.

    CtxPoint(268, 60);

/// A DO_MSLEEP will pause execution for a second.
    DO_MSLEEP(1000);
/// This CtxSetWindowMatchTitle is for the intermittent window name.

    CtxSetWindowMatchTitle( CWI_9, "*" );

/// This CtxClick command is added to dismiss the window.
    CtxClick(CWI_9, 78, L_BUTTON, NONE);

...end of script...
```

Sample: Script Snippet with Modified CtxPoint

The following sample shows a script extract with a modified CtxPoint command. Comments and added script lines are highlighted in bold.

Sample Script

```
...beginning of script...

    DO_MSLEEP(1844);
    // Window CWI_10 ("" ) destroyed 1113840796.133

    DO_MSLEEP(1828);

/// Modifying a CtxPoint is easy once you have the
/// target coordinates and have identified the
/// CtxClick statement that was failing. Just
/// insert the X and Y coordinates as the parameters.

    CtxPoint(200, 200); //1113840798.309

    DO_MSLEEP(344);
    CtxClick(CWI_5, 78, L_BUTTON, NONE); //1113840798.387

...end of script...
```

CtxWaitForScreenUpdate Command

CtxWaitForScreenUpdate

Waits for the specified screen update to occur at the specified coordinates.

Syntax

```
void CtxWaitForScreenUpdate(long x, long y, long w, long h, long nmWait);
```

Return Value

Parameters

Parameter	Description
x	X coordinate
y	Y coordinate
w	Width of the screen update
h	Height of the screen update
nmWait	Timeout offset, in milliseconds. Amount to increase or decrease the wait time specified by CtxSetWaitPointTimeout.

Example

```
CtxWaitForScreenUpdate(154, 154, 253, 261, 500);
```

Modifying the Script with the CtxWaitForScreenUpdate Command

Windows in a Citrix session can take varying amounts of time to complete screen updates. This can result in keyboard and mouse events not synchronizing with the appropriate window.

For example, the Windows Start menu is an unnamed window. The amount of time it takes to appear depends on system resource usage. Adding a [CtxWaitForScreenUpdate](#) command before the keyboard entry or mouse click can ensure that the window has enough time to display before any subsequent mouse clicks or keyboard entries take place. You can add the command while recording a script or after a script has been recorded.

 **Note:** When recording a session with windows that load slowly, pay attention to the ScreenUpdate messages that scroll in the message panel.

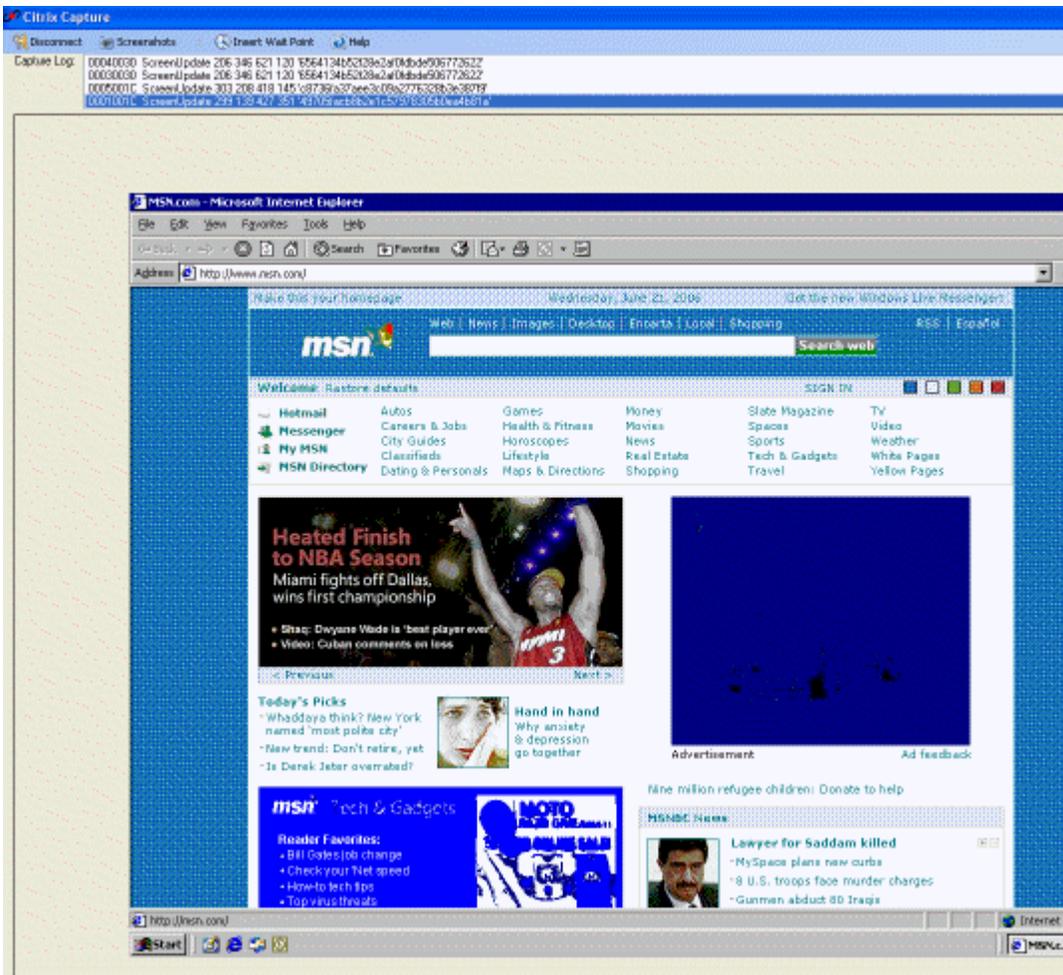
Once the window has completed loading, add CtxWaitForScreenUpdate.

To add CtxWaitForScreenUpdate while recording a session:

1. Click Insert WaitPoint. An expanded list of log entries appears.
2. Select the last ScreenUpdate message in the log entry to highlight the line.
3. Click OK to insert a statement in the record session. The statement is converted to a CtxWaitForScreenUpdate command in the script, which waits for the screen update before proceeding.

 **Note:** Anytime a window loads slowly or has the potential to load slowly during a Citrix record session, such as when traffic is heavy, consider using this technique before performing any keyboard or mouse activity on that window.

Using the Player, Script Development Workbench, and Analyze



To add CtxWaitForScreenUpdate to an existing script:

Manually enter the CtxWaitForScreenUpdate before the keyboard or mouse event that is firing prematurely.

Note: To prevent playback problems in which a mouse click does not synchronize with its intended window, insert the command in the script after the action that causes the window to appear. You also can use [CtxScreenEventExists](#) to clear past events from the internal queue and ensure that the script waits for a specific screen update event.

The parameters for the CtxWaitForScreenUpdate command correspond to the X and Y coordinates, and the width and height of the window. Determine the parameters from the Citrix window object declaration parameters.

Conclusion

Following these techniques, you can prevent problems with premature mouse clicks and keyboard entry statements during replay. The following sample scripts illustrate this process:

Sample: Using the Command After Recording

The following sample shows a script with WaitPoint inserted after recording is completed. Script changes are highlighted in bold.

Sample Script

```

/*
 * ctwaitforscreenupdate.cpp
 *
 * Script Converted on April 19, 2005 at 02:44:44 PM
 * Generated by Compuware QALoad convert module version 5.5.0 build 256
 *
 * This script contains support for the following middlewares:
 *   - Citrix
 */
/* Converted using the following options:
 * General:
 *   Line Split                : 80 characters
 *   Sleep Seconds             : 1
 *   Auto Checkpoints          : No
 * Citrix
 *   General Options           :
 *   Replay Output Mode        : Normal
 *   Enable Counters           : No
 *   Timeout Value Options     :
 *   Connect Timeout (s)       : 60
 *   Disconnect Timeout (s)    : 60
 *   Window Creation Timeout (s) : 30
 *   Ping Timeout (s)          : 20
 *   Wait Point Timeout (s)    : 30
 *   Input Options             :
 *   Combine Keyboard Input     : Yes
 *   Combine Mouse Input       : Yes
 *   Window Options            :
 *   Window Verification        : Yes
 *   Window Max Retries        : 5
 *   Window Wait Retries (ms)  : 5000
 *   Enable Wildcard Title Match : Yes
 */
#define CITRIX_CLIENT_VERSION "7.100.21825"
#define CITRIX_ICO_VERSION    "2.3"
#define SCRIPT_VER 0x00000505UL

#include <stdio.h>
#include "smacro.h"

#include "do_citrix.h"

/* set function to call on abort*/
void abort_function(PLAYER_INFO *s_info);

#ifdef NULL
#define NULL 0
#endif

extern "C" int rrobot_script(PLAYER_INFO *s_info)
{
    /* Declare Variables */
    const char *CitrixServer      = "qaccitrix";
    const char *CitrixPassword    = "";
    const int   CitrixOutputMode  = OUTPUT_MODE_NORMAL;

    /* Citrix Window Information Objects */
    CtxWI *CWI_1 = new CtxWI(0x1001c, "Warning !!", 107, 43, 427, 351);
    CtxWI *CWI_2 = new CtxWI(0x2001c, "Log On to Windows", 111, 65, 418, 285);
    CtxWI *CWI_3 = new CtxWI(0x5001c, "Please wait...", 111, 112, 418, 145);
    CtxWI *CWI_4 = new CtxWI(0x40030, "Citrix License Warning Notice", 125, 198, 397, 127);
    CtxWI *CWI_5 = new CtxWI(0x4002e, "UsrLogon.Cmd", 0, 456, 161, 25);
    CtxWI *CWI_6 = new CtxWI(0x1003a, "", -2, 452, 645, 31);
    CtxWI *CWI_7 = new CtxWI(0x10066, "ICA Seamless Host Agent", 0, 0, 391, 224);

```

Using the Player, Script Development Workbench, and Analyze

```
CtxWI *CWI_8 = new CtxWI(0x10052, "Program Manager", 0, 0, 641, 481);
CtxWI *CWI_9 = new CtxWI(0x10088, "", 115, 0, 405, 457);
CtxWI *CWI_10 = new CtxWI(0x10134, "", 112, 116, 416, 248);
CtxWI *CWI_11 = new CtxWI(0x1012e, "Microsoft Word", 0, 0, 649, 461);
CtxWI *CWI_12 = new CtxWI(0x10176, "Microsoft Word", 162, 193, 322, 109);
CtxWI *CWI_13 = new CtxWI(0x7001c, "Please wait...", 111, 112, 418, 145);

SET_ABORT_FUNCTION(abort_function);

DEFINE_TRANS_TYPE("ctxwaitforscreenupdate.cpp");

CitrixInit(1);

/* Citrix replay settings */
CtxSetConnectTimeout(60);
CtxSetDisconnectTimeout(60);
CtxSetWindowTimeout(30);
CtxSetPingTimeout(20);
CtxSetWaitPointTimeout(30);
CtxSetWindowVerification(TRUE);
CtxSetEnableCounters(FALSE);
CtxSetWindowRetries(5, 5000);
CtxSetEnableWildcardMatching(TRUE);

SYNCHRONIZE();

BEGIN_TRANSACTION();

DO_SetTransactionStart();

CtxConnect(CitrixServer, CitrixOutputMode);

CtxPoint(202, 89); //1113936216.354

// Window CWI_1 ("Warning !!") created 1113936216.354
CtxWaitForWindowCreate(CWI_1, 1953);

DO_MSLEEP(1859);
CtxPoint(320, 372); //1113936218.260

DO_MSLEEP(47);
CtxClick(CWI_1, 78, L_BUTTON, NONE); //1113936218.338

// Window CWI_2 ("Log On to Windows") created 1113936218.479
CtxWaitForWindowCreate(CWI_2, 141);

// Window CWI_1 ("Warning !!") destroyed 1113936218.479
CtxType(CWI_2, "citrix"); //1113936220.995

DO_MSLEEP(2312);
CtxTypeVK(CWI_2, VK_TAB, NONE); //1113936221.073

DO_MSLEEP(281);
CtxType(CWI_2, "citrix"); //1113936223.104

DO_MSLEEP(1782);
CtxTypeVK(CWI_2, VK_TAB, NONE); //1113936223.151

DO_MSLEEP(297);
CtxType(CWI_2, "q"); //1113936224.354

DO_MSLEEP(718);
```

```
DO_MSLEEP(1407);
CtxPoint(243, 326); //1113936225.291

DO_MSLEEP(15);
CtxClick(CWI_2, 63, L_BUTTON, NONE); //1113936225.354

DO_MSLEEP(78);
// Window CWI_2 ("Log On to Windows") destroyed 1113936225.432

// Window CWI_3 ("Please wait...") created 1113936225.510

CtxWaitForWindowCreate(CWI_3, 78);

DO_MSLEEP(78);
// Window CWI_3 ("Please wait...") destroyed 1113936225.588

// Window CWI_4 ("Citrix License Warning Notice") created 1113936225.651

CtxWaitForWindowCreate(CWI_4, 63);

// Window CWI_5 ("UsrLogon.Cmd") created 1113936225.666

CtxWaitForWindowCreate(CWI_5, 15);

DO_MSLEEP(16);
// Window CWI_5 ("UsrLogon.Cmd") destroyed 1113936225.682

// Window CWI_6 ("") created 1113936225.916

DO_MSLEEP(234);
// Window CWI_7 ("ICA Seamless Host Agent") created 1113936225.963

CtxWaitForWindowCreate(CWI_7, 47);

// Window CWI_8 ("Program Manager") created 1113936225.979

CtxWaitForWindowCreate(CWI_8, 16);

DO_MSLEEP(953);
CtxPoint(332, 299); //1113936226.963

DO_MSLEEP(31);
CtxClick(CWI_7, 78, L_BUTTON, NONE); //1113936227.041

DO_MSLEEP(63);
// Window CWI_4 ("Citrix License Warning Notice") destroyed 1113936227.104

DO_MSLEEP(328);
CtxPoint(198, 203); //1113936227.588

DO_MSLEEP(156);
CtxClick(CWI_7, 63, L_BUTTON, NONE); //1113936227.651

DO_MSLEEP(78);
CtxPoint(208, 216); //1113936227.744

DO_MSLEEP(15);
// Window CWI_7 ("ICA Seamless Host Agent") destroyed 1113936227.744

CtxPoint(266, 237); //1113936228.260

// Window CWI_9 ("") created 1113936228.260

DO_MSLEEP(453);
```

Using the Player, Script Development Workbench, and Analyze

```
DO_MSLEEP(3031);
// Window CWI_9 ("") destroyed 1113936231.291

DO_MSLEEP(8531);
CtxPoint(115, 170); //1113936240.182

DO_MSLEEP(360);
CtxDoubleClick(CWI_8); // 1113936240.338

DO_MSLEEP(78);

// Window CWI_10 ("") created 1113936240.463

DO_MSLEEP(125);
CtxPoint(243, 205); //1113936240.619

// Window CWI_11 ("Microsoft Word") created 1113936240.619

CtxWaitForWindowCreate(CWI_11, 156);

// Window CWI_10 ("") destroyed 1113936240.619

DO_MSLEEP(32);
CtxPoint(250, 208); //1113936240.666

DO_MSLEEP(15);
CWI_11->setTitle("Document1 - Microsoft Word"); //1113936240.869

CtxPoint(296, 0); //1113936245.916

/// This command was added to the script manually. The size parameters
/// are from the Citrix window creation object, and the last parameter
/// indicates that the wait time for completion of this screen
/// update is set to 5 seconds. Note that this statement is
/// placed before any mouse moves for that window.

CtxWaitForScreenUpdate(0, 0, 649, 481, 5000);

DO_MSLEEP(2094);
CtxPoint(56, 201); //1113936248.260

DO_MSLEEP(250);
CtxClick(CWI_11, 47, L_BUTTON, NONE); //1113936248.307

CtxType(CWI_11, "N"); //1113936249.760

DO_MSLEEP(1453);
CtxPoint(68, 213); //1113936249.760

CtxType(CWI_11, "ow I"); //1113936251.041

DO_MSLEEP(1281);
CtxType(CWI_11, " can type text!"); //1113936255.119

DO_MSLEEP(4078);

DO_MSLEEP(2766);

DO_MSLEEP(2094);
CtxPoint(635, 5); //1113936260.010

DO_MSLEEP(31);
CtxClick(CWI_11, 78, L_BUTTON, NONE); //1113936260.088
```

```

CtxPoint(634, 12); //1113936260.213

// Window CWI_12 ("Microsoft Word") created 1113936260.213

CtxWaitForWindowCreate(CWI_12, 16);

DO_MSLEEP(875);
CtxPoint(325, 275); //1113936261.088

CtxClick(CWI_12, 63, L_BUTTON, NONE); //1113936261.151

DO_MSLEEP(62);
// Window CWI_12 ("Microsoft Word") destroyed 1113936261.213

DO_MSLEEP(16);
// Window CWI_11 ("Document1 - Microsoft Word") destroyed 1113936261.229

DO_MSLEEP(1375);
CtxPoint(385, 165); //1113936262.963

DO_MSLEEP(359);
// Window CWI_8 ("Program Manager") destroyed 1113936262.963

// Window CWI_6 ("") destroyed 1113936262.979

// Window CWI_13 ("Please wait...") created 1113936263.244

CtxWaitForWindowCreate(CWI_13, 0);

DO_SetTransactionCleanup();

CtxDisconnect();

END_TRANSACTION();

delete CWI_1; // "Warning !!"
delete CWI_2; // "Log On to Windows"
delete CWI_3; // "Please wait..."
delete CWI_4; // "Citrix License Warning Notice"
delete CWI_5; // "UsrLogon.Cmd"
delete CWI_6; // ""
delete CWI_7; // "ICA Seamless Host Agent"
delete CWI_8; // "Program Manager"
delete CWI_9; // ""
delete CWI_10; // ""
delete CWI_11; // "Microsoft Word"
delete CWI_12; // "Microsoft Word"
delete CWI_13; // "Please wait..."

CitrixUninit();

EXIT();
return(0);
}
void abort_function(PLAYER_INFO *s_info)
{
    RR_printf("Virtual User ABORTED.");

    CitrixUninit();

    EXIT();
}

```

Using the Player, Script Development Workbench, and Analyze

Sample: Using the Command While Recording

The following sample shows a script with the WaitPoint command inserted at record time. Points of interest in the script are highlighted in bold.

Sample Script

```
/*
 * ctxwaitforscreenupdate.cpp
 *
 * Script Converted on April 19, 2005 at 02:44:44 PM
 * Generated by Compuware QALoad convert module version 5.5.0 build 256
 *
 * This script contains support for the following middlewares:
 *   - Citrix
 */
/* Converted using the following options:
 * General:
 * Line Split                : 80 characters
 * Sleep Seconds             : 1
 * Auto Checkpoints         : No
 * Citrix
 * General Options          :
 *   Replay Output Mode     : Normal
 *   Enable Counters        : No
 *   Timeout Value Options  :
 *     Timeout (s)          : 60
 *     Disconnect Timeout (s) : 60
 *     Window Creation Timeout (s) : 30
 *     Ping Timeout (s)     : 20
 *     Wait Point Timeout (s) : 30
 * Input Options            :
 *   Combine Keyboard Input : Yes
 *   Combine Mouse Input   : Yes
 * Window Options          :
 *   Window Verification    : Yes
 *   Window Max Retries    : 5
 *   Window Wait Retries (ms) : 5000
 *   Enable Wildcard Title Match : Yes
 */

#define CITRIX_CLIENT_VERSION "7.100.21825"
#define CITRIX_ICO_VERSION   "2.3"
#define SCRIPT_VER 0x00000505UL

#include <stdio.h>
#include "smacro.h"

#include "do_citrix.h"

/* set function to call on abort*/
void abort_function(PLAYER_INFO *s_info);

#ifdef NULL
#define NULL 0
#endif

extern "C" int rrobot_script(PLAYER_INFO *s_info)
{
    /* Declare Variables */
    const char *CitrixServer      = "qaccitrix";
    const char *CitrixPassword    = "";
    const int   CitrixOutputMode  = OUTPUT_MODE_NORMAL;

    /* Citrix Window Information Objects */
    CtxWI *CWI_1 = new CtxWI(0x1001c, "Warning !!", 107, 43, 427, 351);
```

```

CtxWI *CWI_2 = new CtxWI(0x2001c, "Log On to Windows", 111, 65, 418, 285);
CtxWI *CWI_3 = new CtxWI(0x5001c, "Please wait...", 111, 112, 418, 145);
CtxWI *CWI_4 = new CtxWI(0x40030, "Citrix License Warning Notice", 125, 198, 397, 127);
CtxWI *CWI_5 = new CtxWI(0x4002e, "UsrLogon.Cmd", 0, 456, 161, 25);
CtxWI *CWI_6 = new CtxWI(0x1003a, "", -2, 452, 645, 31);
CtxWI *CWI_7 = new CtxWI(0x10066, "ICA Seamless Host Agent", 0, 0, 391, 224);
CtxWI *CWI_8 = new CtxWI(0x10052, "Program Manager", 0, 0, 641, 481);
CtxWI *CWI_9 = new CtxWI(0x10088, "", 115, 0, 405, 457);
CtxWI *CWI_10 = new CtxWI(0x10134, "", 112, 116, 416, 248);
CtxWI *CWI_11 = new CtxWI(0x1012e, "Microsoft Word", -4, -4, 649, 461);
CtxWI *CWI_12 = new CtxWI(0x10176, "Microsoft Word", 162, 193, 322, 109);
CtxWI *CWI_13 = new CtxWI(0x7001c, "Please wait...", 111, 112, 418, 145);

SET_ABORT_FUNCTION(abort_function);

DEFINE_TRANS_TYPE("ctxwaitforscreenupdate.cpp");

CitrixInit(1);

/* Citrix replay settings */
CtxSetConnectTimeout(60);
CtxSetDisconnectTimeout(60);
CtxSetWindowTimeout(30);
CtxSetPingTimeout(20);
CtxSetWaitPointTimeout(30);
CtxSetWindowVerification(TRUE);
CtxSetEnableCounters(FALSE);
CtxSetWindowRetries(5, 5000);
CtxSetEnableWildcardMatching(TRUE);

SYNCHRONIZE();

BEGIN_TRANSACTION();

DO_SetTransactionStart();

CtxConnect(CitrixServer, CitrixOutputMode);

CtxPoint(202, 89); //1113936216.354

// Window CWI_1 ("Warning !!") created 1113936216.354

CtxWaitForWindowCreate(CWI_1, 1953);

DO_MSLEEP(1859);
CtxPoint(320, 372); //1113936218.260

DO_MSLEEP(47);
CtxClick(CWI_1, 78, L_BUTTON, NONE); //1113936218.338

// Window CWI_2 ("Log On to Windows") created 1113936218.479

CtxWaitForWindowCreate(CWI_2, 141);

// Window CWI_1 ("Warning !!") destroyed 1113936218.479

CtxType(CWI_2, "citrix"); //1113936220.995

DO_MSLEEP(2312);
CtxTypeVK(CWI_2, VK_TAB, NONE); //1113936221.073

DO_MSLEEP(281);
CtxType(CWI_2, "citrix"); //1113936223.104

DO_MSLEEP(1782);

```

Using the Player, Script Development Workbench, and Analyze

```
CtxTypeVK(CWI_2, VK_TAB, NONE); //1113936223.151

DO_MSLEEP(297);
CtxType(CWI_2, "q"); //1113936224.354

DO_MSLEEP(718);

DO_MSLEEP(1407);
CtxPoint(243, 326); //1113936225.291

DO_MSLEEP(15);
CtxClick(CWI_2, 63, L_BUTTON, NONE); //1113936225.354

DO_MSLEEP(78);
// Window CWI_2 ("Log On to Windows") destroyed 1113936225.432

// Window CWI_3 ("Please wait...") created 1113936225.510

CtxWaitForWindowCreate(CWI_3, 78);

DO_MSLEEP(78);
// Window CWI_3 ("Please wait...") destroyed 1113936225.588

// Window CWI_4 ("Citrix License Warning Notice") created

CtxWaitForWindowCreate(CWI_4, 63);

// Window CWI_5 ("UsrLogon.Cmd") created 1113936225.666

CtxWaitForWindowCreate(CWI_5, 15);

DO_MSLEEP(16);
// Window CWI_5 ("UsrLogon.Cmd") destroyed 1113936225.682

// Window CWI_6 ("") created 1113936225.916

DO_MSLEEP(234);
// Window CWI_7 ("ICA Seamless Host Agent") created 1113936225.963

CtxWaitForWindowCreate(CWI_7, 47);

// Window CWI_8 ("Program Manager") created 1113936225.979

CtxWaitForWindowCreate(CWI_8, 16);

DO_MSLEEP(953);
CtxPoint(332, 299); //1113936226.963

DO_MSLEEP(31);
CtxClick(CWI_7, 78, L_BUTTON, NONE); //1113936227.041

DO_MSLEEP(63);
// Window CWI_4 ("Citrix License Warning Notice") destroyed 1113936227.104

DO_MSLEEP(328);
CtxPoint(198, 203); //1113936227.588

DO_MSLEEP(156);
CtxClick(CWI_7, 63, L_BUTTON, NONE); //1113936227.651

DO_MSLEEP(78);
CtxPoint(208, 216); //1113936227.744

DO_MSLEEP(15);
// Window CWI_7 ("ICA Seamless Host Agent") destroyed 1113936227.744
```

```

CtxPoint(266, 237); //1113936228.260

// Window CWI_9 ("") created 1113936228.260

DO_MSLEEP(453);

DO_MSLEEP(3031);
// Window CWI_9 ("") destroyed 1113936231.291

DO_MSLEEP(8531);
CtxPoint(115, 170); //1113936240.182

DO_MSLEEP(360);
CtxDoubleClick(CWI_8); // 1113936240.338

DO_MSLEEP(78);

// Window CWI_10 ("") created 1113936240.463

DO_MSLEEP(125);
CtxPoint(243, 205); //1113936240.619

// Window CWI_11 ("Microsoft Word") created 1113936240.619

CtxWaitForWindowCreate(CWI_11, 156);

// Window CWI_10 ("") destroyed 1113936240.619

DO_MSLEEP(32);
CtxPoint(250, 208); //1113936240.666

DO_MSLEEP(15);
CWI_11->setTitle("Document1 - Microsoft Word"); //1113936240.869

CtxPoint(296, 0); //1113936245.916

/// This command was added to the script by clicking on the
/// ScreenUpdate message in the message panel, highlighting it,
/// then clicking on the WaitPoint button

CtxWaitForScreenUpdate(0, 0, 481, 641, 1406);

DO_MSLEEP(2094);
CtxPoint(56, 201); //1113936248.260

DO_MSLEEP(250);
CtxClick(CWI_11, 47, L_BUTTON, NONE); //1113936248.307

CtxType(CWI_11, "N"); //1113936249.760

DO_MSLEEP(1453);
CtxPoint(68, 213); //1113936249.760

CtxType(CWI_11, "ow I"); //1113936251.041

DO_MSLEEP(1281);
CtxType(CWI_11, " can type text!"); //1113936255.119

DO_MSLEEP(4078);

DO_MSLEEP(2766);

DO_MSLEEP(2094);
CtxPoint(635, 5); //1113936260.010

```

Using the Player, Script Development Workbench, and Analyze

```
DO_MSLEEP(31);
CtxClick(CWI_11, 78, L_BUTTON, NONE); //1113936260.088

CtxPoint(634, 12); //1113936260.213

// Window CWI_12 ("Microsoft Word") created 1113936260.213

CtxWaitForWindowCreate(CWI_12, 16);

DO_MSLEEP(875);
CtxPoint(325, 275); //1113936261.088

CtxClick(CWI_12, 63, L_BUTTON, NONE); //1113936261.151

DO_MSLEEP(62);
// Window CWI_12 ("Microsoft Word") destroyed 1113936261.213

DO_MSLEEP(16);
// Window CWI_11 ("Document1 - Microsoft Word") destroyed 1113936261.229

DO_MSLEEP(1375);
CtxPoint(385, 165); //1113936262.963

DO_MSLEEP(359);
// Window CWI_8 ("Program Manager") destroyed 1113936262.963

// Window CWI_6 ("") destroyed 1113936262.979

// Window CWI_13 ("Please wait...") created 1113936263.244

CtxWaitForWindowCreate(CWI_13, 0);

DO_SetTransactionCleanup();

CtxDisconnect();

END_TRANSACTION();

delete CWI_1; // "Warning !!"
delete CWI_2; // "Log On to Windows"
delete CWI_3; // "Please wait..."
delete CWI_4; // "Citrix License Warning Notice"
delete CWI_5; // "UsrLogon.Cmd"
delete CWI_6; // ""
delete CWI_7; // "ICA Seamless Host Agent"
delete CWI_8; // "Program Manager"
delete CWI_9; // ""
delete CWI_10; // ""
delete CWI_11; // "Microsoft Word"
delete CWI_12; // "Microsoft Word"
delete CWI_13; // "Please wait..."

CitrixUninit();

EXIT();
return(0);
}
void abort_function(PLAYER_INFO *s_info)
{
    RR_printf("Virtual User ABORTED.");

    CitrixUninit();
    EXIT();
}
}
```

Clearing Events from the Internal Queue

Clearing Events from the Internal Queue

In response to mouse and keyboard input, the Citrix server sends screen update events of the updated screen image to the Citrix client application. You can synchronize these screen update events with the text or graphic updates in the application by using [CtxWaitForScreenUpdate](#) to insert waitpoints in the Citrix script.

When numerous matching screen update events occur, such as the flashing edit cursor, they stay in the internal queue indefinitely. This can cause the [CtxWaitForScreenUpdate](#) function to complete prematurely by matching events with previously stored screen updates. You can clear the internal queue by using the [CtxScreenEventExists](#) function in a simple loop. This flushes all past screen update events from the internal queue, so a following [CtxWaitForScreenUpdate](#) can successfully wait for the next occurrence of the desired screen update event.

Modifying the Script to Clear Events

Synchronize keyboard and mouse events with the appropriate application events in a Citrix script, using [CtxWaitForScreenUpdate](#) to identify specific screen events and [CtxScreenEventExists](#) to flush all past screen update events from the internal queue. This enables a following [CtxWaitForScreenUpdate](#) to successfully wait for the next occurrence of the desired screen update event.

To modify an existing Citrix script that contains one or more [CtxWaitForScreenUpdate](#) commands:

1. Open the script in QALoad Script Development Workbench.
2. If not already active, select **View>Function Wizard**.
3. Copy the existing **CtxWaitForScreenUpdate** command from the script, and paste it immediately above the existing command.
4. In the **Command Definition** pane, click the plus (+) or double-click the **Citrix** heading. The list of Citrix commands appears.
5. Click and drag the **CtxScreenEventExists** command from the **Command Definition** pane to the line above the first **CtxWaitForScreenUpdate** command. The [CtxScreenEventExists](#) function prototype appears and the suggested parameter **EVT_STR_CTXSCREENUPDATE** displays in a separate dialog box.
6. Double-click **EVT_STR_CTXSCREENUPDATE**. The parameter is inserted in the command.
7. After the **EVT_STR_CTXSCREENUPDATE** parameter, type:
`, 0, " ")`
8. Inside the quotation marks, type the four numeric values from the **CtxWaitForScreenUpdate** command. Separate the values by spaces instead of commas, for example:

```
"66 66 457 336"
```

9. Enclose the statement with the command:

```
while ( )
```

In this example, the script now appears as:

```
while (CtxScreenEventExists(EVT_STR_CTXSCREENUPDATE, 0, "43 39 569 401"))
    CtxWaitForScreenUpdate(43, 39, 569, 401, 0);
    CtxWaitForScreenUpdate(43, 39, 569, 401, 3917);
```

 **Note:** The timeout value for both the [CtxScreenEventExists](#) and [CtxWaitForScreenUpdate](#) commands is set to zero, since no actual waiting occurs in either command.

Using the Player, Script Development Workbench, and Analyze

Conclusion

Use this technique to prevent problems with extra screen update events causing premature matching when using a `CtxWaitForScreenUpdate` command during script replay. The following sample scripts illustrate this process.

Sample: Original Citrix Script using `CtxWaitForScreenUpdate`

The following sample shows a script with the `CtxWaitForScreenUpdate` inserted during the script capture. The relevant portion of the script is highlighted in bold.

Sample Script

```
/*
 * CtxScreenEventExistsScript.cpp
 *
 * Script Converted on March 22, 2006 at 04:34:21 PM
 * Generated by Compuware QALoad convert module version 5.5.0 build 478
 * Generated From: C:\Program
Files\Compuware\QALoad\Middlewares\Citrix\Captures\CtxScreenEventExistsScript.cap
 *
 * This script contains support for the following middlewares:
 *     - Citrix
 */
/* Converted using the following options:
 * General:
 * Line Split                : 80 characters
 * Sleep Seconds             : 1
 * Auto Checkpoints          : No
 * Citrix
 * General Options           :
 * Replay Output Mode        : Normal
 * Enable Counters           : No
 * Timeout Value Options     :
 *   Connect Timeout (s)     : 60
 *   Disconnect Timeout (s)  : 60
 *   Window Creation Timeout (s) : 30
 *   Ping Timeout (s)        : 20
 *   Wait Point Timeout (s)  : 30
 * Input Options             :
 * Combine Keyboard Input    : Yes
 * Combine Mouse Input       : Yes
 * Window Options            :
```

```

*   Window Verification           : Yes
*   Window Max Retries           : 5
*   Window Wait Retries (ms)     : 5000
*   Enable Wildcard Title Match   : Yes
*/

#define CITRIX_CLIENT_VERSION "9.150.39151"
#define CITRIX_ICO_VERSION    "2.5"
#define SCRIPT_VER 0x00000505UL
#include <stdio.h>
#include "smacro.h"
#include "do_citrix.h"

/* set function to call on abort*/
void abort_function(PLAYER_INFO *s_info);

#ifndef NULL
#define NULL 0
#endif

extern "C" int rrobot_script(PLAYER_INFO *s_info)
{
/* Declare Variables */
const char *CitrixServer      = "qaccitrix";
const char *CitrixPassword    = "";
const int   CitrixOutputMode  = OUTPUT_MODE_NORMAL;

/* Citrix Window Information Objects */
CtxWI *CWI_1 = new CtxWI(0x1001c, "Warning !!", 107, 43, 427, 351);
CtxWI *CWI_2 = new CtxWI(0x2001c, "Log On to Windows", 111, 65, 418, 285);
CtxWI *CWI_3 = new CtxWI(0x5001c, "Please wait...", 111, 112, 418, 145);
CtxWI *CWI_4 = new CtxWI(0x30030, "Citrix License Warning Notice", 125, 198, 397,
127);
CtxWI *CWI_5 = new CtxWI(0x40030, "Citrix License Warning Notice", 125, 198, 397,
127);
CtxWI *CWI_6 = new CtxWI(0x4002e, "UsrLogon.Cmd", 0, 456, 161, 25);
CtxWI *CWI_7 = new CtxWI(0x1003a, "", -2, 452, 645, 31);
CtxWI *CWI_8 = new CtxWI(0x10066, "ICA Seamless Host Agent", 0, 0, 391, 224);
CtxWI *CWI_9 = new CtxWI(0x10052, "Program Manager", 0, 0, 641, 481);
CtxWI *CWI_10 = new CtxWI(0x10054, "", 2, 49, 205, 408);
CtxWI *CWI_11 = new CtxWI(0x20068, "Run", 5, 269, 348, 180);
CtxWI *CWI_12 = new CtxWI(0x10116, "", 65, 369, 254, 30);

```

Using the Player, Script Development Workbench, and Analyze

```
CtxWI *CWI_13 = new CtxWI(0x20114, "Untitled - Notepad", 43, 39, 569, 401);
CtxWI *CWI_14 = new CtxWI(0x30068, "", 47, 80, 151, 144);
CtxWI *CWI_15 = new CtxWI(0x40068, "Open", 47, 81, 564, 348);
CtxWI *CWI_16 = new CtxWI(0x10130, "", 249, 386, 226, 30);
CtxWI *CWI_17 = new CtxWI(0x7001c, "Please wait...", 111, 112, 418, 145);

SET_ABORT_FUNCTION(abort_function);
DEFINE_TRANS_TYPE("NotepadSampleForDoc.cpp");

CitrixInit(1);

/* Citrix replay settings */
CtxSetConnectTimeout(60);
CtxSetDisconnectTimeout(60);
CtxSetWindowTimeout(30);
CtxSetPingTimeout(20);
CtxSetWaitPointTimeout(30);
CtxSetWindowVerification(TRUE);
CtxSetEnableCounters(FALSE);
CtxSetWindowRetries(5, 5000);
CtxSetEnableWildcardMatching(TRUE);
CtxSetGracefulDisconnect(TRUE);

SYNCHRONIZE();
BEGIN_TRANSACTION();
DO_SetTransactionStart();
CtxConnect(CitrixServer, CitrixOutputMode);
CtxPoint(341, 298); //1143063207.863
// Window CWI_1 ("Warning !!") created 1143063207.863
CtxWaitForWindowCreate(CWI_1, 843);

DO_MSLEEP(1094);
CtxPoint(320, 366); //1143063209.160

DO_MSLEEP(203);
CtxClick(CWI_1, 157, L_BUTTON, NONE); //1143063209.316

// Window CWI_1 ("Warning !!") destroyed 1143063209.395
```

```
CtxPoint(320, 365); //1143063209.473

// Window CWI_9 ("Program Manager") created 1143063210.348

CtxWaitForWindowCreate(CWI_9, 0);

DO_MSLEEP(1437);
CtxPoint(32, 469); //1143063214.676

DO_MSLEEP(94);
CtxClick(CWI_7, 0, L_BUTTON, NONE); //1143063214.816

// Window CWI_10 ("") created 1143063214.816

DO_MSLEEP(125);

DO_MSLEEP(1391);
CtxPoint(52, 369); //1143063216.332

DO_MSLEEP(140);
CtxClick(CWI_7, 125, L_BUTTON, NONE); //1143063216.457

// Window CWI_11 ("Run") created 1143063216.488

CtxWaitForWindowCreate(CWI_11, 31);

DO_MSLEEP(16);
// Window CWI_10 ("") destroyed 1143063216.504

CtxType(CWI_11, "notepad"); //1143063218.051

DO_MSLEEP(1312);

DO_MSLEEP(63);
// Window CWI_12 ("") destroyed 1143063219.426
```

Using the Player, Script Development Workbench, and Analyze

```
DO_MSLEEP(16);
CtxTypeVK(CWI_11, VK_RETURN, NONE); //1143063219.582

DO_MSLEEP(140);
// Window CWI_13 ("Untitled - Notepad") created 1143063219.582

CtxWaitForWindowCreate(CWI_13, 0);

// Window CWI_11 ("Run") destroyed 1143063219.582

DO_MSLEEP(31);

DO_MSLEEP(3563);
CtxPoint(55, 71); //1143063223.316

DO_MSLEEP(141);
CtxClick(CWI_13, 16, L_BUTTON, NONE); //1143063223.441

// Window CWI_14 ("") created 1143063223.426

DO_MSLEEP(109);

DO_MSLEEP(1156);
CtxPoint(74, 111); //1143063224.832

DO_MSLEEP(234);
CtxClick(CWI_13, 72, L_BUTTON, NONE); // 1143063224.832

DO_MSLEEP(110);
CtxPoint(74, 112); //1143063225.004

DO_MSLEEP(62);
// Window CWI_14 ("") destroyed 1143063225.004

// Window CWI_15 ("Open") created 1143063225.176

CtxWaitForWindowCreate(CWI_15, 172);
```

```
CtxType(CWI_15, "bigfile.txt"); //1143063229.410

DO_MSLEEP(4000);
CtxPoint(151, 149); //1143063229.410

// Window CWI_16 (") created 1143063229.410

DO_MSLEEP(78);
// Window CWI_16 (") destroyed 1143063232.379

DO_MSLEEP(63);
CtxTypeVK(CWI_15, VK_RETURN, NONE); //1143063234.441

DO_MSLEEP(1906);

DO_MSLEEP(15);
// Window CWI_15 ("Open") destroyed 1143063234.363

DO_MSLEEP(79);

DO_MSLEEP(1218);
CtxPoint(157, 1); //1143063235.926

DO_MSLEEP(266);

CWI_13->setTitle("bigfile.txt - Notepad"); //1143063243.035

DO_MSLEEP(5453);
CtxPoint(594, 48); //1143063244.441

///
/// This waitpoint was inserted during the Citrix session capture:
///
CtxWaitForScreenUpdate(43, 39, 569, 401, 2406);
```

Using the Player, Script Development Workbench, and Analyze

```
DO_MSLEEP(657);
CtxClick(CWI_13, 171, L_BUTTON, NONE); //1143063244.613

DO_MSLEEP(94);
// Window CWI_13 ("bigfile.txt - Notepad") destroyed 1143063244.707

DO_MSLEEP(594);
CtxPoint(567, 6); //1143063247.582

DO_MSLEEP(2281);
// Window CWI_9 ("Program Manager") destroyed 1143063247.582

// Window CWI_7 ("") destroyed 1143063247.645

// Window CWI_17 ("Please wait...") created 1143063247.926

CtxWaitForWindowCreate(CWI_17, 0);

DO_SetTransactionCleanup();

CtxDisconnect();

END_TRANSACTION();
delete CWI_1; // "Warning !!"
delete CWI_2; // "Log On to Windows"
delete CWI_3; // "Please wait..."
delete CWI_4; // "Citrix License Warning Notice"
delete CWI_5; // "Citrix License Warning Notice"
delete CWI_6; // "UsrLogon.Cmd"
delete CWI_7; // ""
delete CWI_8; // "ICA Seamless Host Agent"
delete CWI_9; // "Program Manager"
delete CWI_10; // ""
delete CWI_11; // "Run"
delete CWI_12; // ""
delete CWI_13; // "Untitled - Notepad"
delete CWI_14; // ""
```

```

delete CWI_15; // "Open"
delete CWI_16; // ""
delete CWI_17; // "Please wait..."

CitrixUninit();

EXIT();
return(0);
}

void abort_function(PLAYER_INFO *s_info)
{
RR__printf("Virtual User ABORTED.");

CitrixUninit();

EXIT();
}

```

Sample: Modified Citrix Script Clearing Events

The following sample shows the script modified to use the `CtxScreenEventExists` command to flush past screen update events from the internal queue. Script changes are highlighted in bold.

Sample Script

```

/*
 * CtxScreenEventExistsScript.cpp
 *
 * Script Converted on March 22, 2006 at 04:34:21 PM
 * Generated by Compuware QALoad convert module version 5.5.0 build 478
 * Generated From: C:\Program
Files\Compuware\QALoad\Middlewares\Citrix\Captures\CtxScreenEventExistsScript.cap
 *
 * This script contains support for the following middlewares:
 *     - Citrix
 */
/* Converted using the following options:
 * General:

```

Using the Player, Script Development Workbench, and Analyze

```
* Line Split                : 80 characters
* Sleep Seconds             : 1
* Auto Checkpoints         : No
* Citrix
* General Options          :
* Replay Output Mode       : Normal
* Enable Counters          : No
* Timeout Value Options    :
*   Connect Timeout (s)    : 60
*   Disconnect Timeout (s) : 60
*   Window Creation Timeout (s) : 30
*   Ping Timeout (s)       : 20
*   Wait Point Timeout (s) : 30
* Input Options            :
*   Combine Keyboard Input : Yes
*   Combine Mouse Input    : Yes
* Window Options           :
*   Window Verification    : Yes
*   Window Max Retries     : 5
*   Window Wait Retries (ms) : 5000
*   Enable Wildcard Title Match : Yes
*/

#define CITRIX_CLIENT_VERSION "9.150.39151"
#define CITRIX_ICO_VERSION    "2.5"
#define SCRIPT_VER 0x00000505UL

#include <stdio.h>
#include "smacro.h"
#include "do_citrix.h"

/* set function to call on abort*/
void abort_function(PLAYER_INFO *s_info);

#ifndef NULL
#define NULL 0
#endif

extern "C" int rrobot_script(PLAYER_INFO *s_info)
{
/* Declare Variables */
const char *CitrixServer      = "qaccitrix";
```

```

const char *CitrixPassword      = "";
const int   CitrixOutputMode    = OUTPUT_MODE_NORMAL;

/* Citrix Window Information Objects */
CtxWI *CWI_1 = new CtxWI(0x1001c, "Warning !!", 107, 43, 427, 351);
CtxWI *CWI_2 = new CtxWI(0x2001c, "Log On to Windows", 111, 65, 418, 285);
CtxWI *CWI_3 = new CtxWI(0x5001c, "Please wait...", 111, 112, 418, 145);
CtxWI *CWI_4 = new CtxWI(0x30030, "Citrix License Warning Notice", 125, 198, 397,
127);
CtxWI *CWI_5 = new CtxWI(0x40030, "Citrix License Warning Notice", 125, 198, 397,
127);
CtxWI *CWI_6 = new CtxWI(0x4002e, "UsrLogon.Cmd", 0, 456, 161, 25);
CtxWI *CWI_7 = new CtxWI(0x1003a, "", -2, 452, 645, 31);
CtxWI *CWI_8 = new CtxWI(0x10066, "ICA Seamless Host Agent", 0, 0, 391, 224);
CtxWI *CWI_9 = new CtxWI(0x10052, "Program Manager", 0, 0, 641, 481);
CtxWI *CWI_10 = new CtxWI(0x10054, "", 2, 49, 205, 408);
CtxWI *CWI_11 = new CtxWI(0x20068, "Run", 5, 269, 348, 180);
CtxWI *CWI_12 = new CtxWI(0x10116, "", 65, 369, 254, 30);
CtxWI *CWI_13 = new CtxWI(0x20114, "Untitled - Notepad", 43, 39, 569, 401);
CtxWI *CWI_14 = new CtxWI(0x30068, "", 47, 80, 151, 144);
CtxWI *CWI_15 = new CtxWI(0x40068, "Open", 47, 81, 564, 348);
CtxWI *CWI_16 = new CtxWI(0x10130, "", 249, 386, 226, 30);
CtxWI *CWI_17 = new CtxWI(0x7001c, "Please wait...", 111, 112, 418, 145);

SET_ABORT_FUNCTION(abort_function);

DEFINE_TRANS_TYPE("NotepadSampleForDoc.cpp");

CitrixInit(1);

/* Citrix replay settings */
CtxSetConnectTimeout(60);
CtxSetDisconnectTimeout(60);
CtxSetWindowTimeout(30);
CtxSetPingTimeout(20);
CtxSetWaitPointTimeout(30);
CtxSetWindowVerification(TRUE);
CtxSetEnableCounters(FALSE);
CtxSetWindowRetries(5, 5000);
CtxSetEnableWildcardMatching(TRUE);
CtxSetGracefulDisconnect(TRUE);

```

Using the Player, Script Development Workbench, and Analyze

```
SYNCHRONIZE();
BEGIN_TRANSACTION();
DO_SetTransactionStart();

CtxConnect(CitrixServer, CitrixOutputMode);

CtxPoint(341, 298); //1143063207.863

// Window CWI_1 ("Warning !!") created 1143063207.863

CtxWaitForWindowCreate(CWI_1, 843);

DO_MSLEEP(1094);
CtxPoint(320, 366); //1143063209.160

DO_MSLEEP(203);
CtxClick(CWI_1, 157, L_BUTTON, NONE); //1143063209.316

// Window CWI_1 ("Warning !!") destroyed 1143063209.395

CtxPoint(320, 365); //1143063209.473

// Window CWI_9 ("Program Manager") created 1143063210.348

CtxWaitForWindowCreate(CWI_9, 0);

DO_MSLEEP(1437);
CtxPoint(32, 469); //1143063214.676

DO_MSLEEP(94);
CtxClick(CWI_7, 0, L_BUTTON, NONE); //1143063214.816

// Window CWI_10 ("") created 1143063214.816
```

```
DO_MSLEEP(125);

DO_MSLEEP(1391);
CtxPoint(52, 369); //1143063216.332

DO_MSLEEP(140);
CtxClick(CWI_7, 125, L_BUTTON, NONE); //1143063216.457

// Window CWI_11 ("Run") created 1143063216.488

CtxWaitForWindowCreate(CWI_11, 31);

DO_MSLEEP(16);
// Window CWI_10 ("") destroyed 1143063216.504

CtxType(CWI_11, "notepad"); //1143063218.051

DO_MSLEEP(1312);

DO_MSLEEP(63);
// Window CWI_12 ("") destroyed 1143063219.426

DO_MSLEEP(16);
CtxTypeVK(CWI_11, VK_RETURN, NONE); //1143063219.582

DO_MSLEEP(140);
// Window CWI_13 ("Untitled - Notepad") created 1143063219.582

CtxWaitForWindowCreate(CWI_13, 0);

// Window CWI_11 ("Run") destroyed 1143063219.582

DO_MSLEEP(31);

DO_MSLEEP(3563);
CtxPoint(55, 71); //1143063223.316
```

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```
DO_MSLEEP(141);
CtxClick(CWI_13, 16, L_BUTTON, NONE); //1143063223.441

// Window CWI_14 ("" ) created 1143063223.426

DO_MSLEEP(109);

DO_MSLEEP(1156);
CtxPoint(74, 111); //1143063224.832

DO_MSLEEP(234);
CtxClick(CWI_13, 72, L_BUTTON, NONE); // 1143063224.832

DO_MSLEEP(110);
CtxPoint(74, 112); //1143063225.004

DO_MSLEEP(62);
// Window CWI_14 ("" ) destroyed 1143063225.004

// Window CWI_15 ("Open" ) created 1143063225.176

CtxWaitForWindowCreate(CWI_15, 172);

CtxType(CWI_15, "bigfile.txt"); //1143063229.410

DO_MSLEEP(4000);
CtxPoint(151, 149); //1143063229.410

// Window CWI_16 ("" ) created 1143063229.410

DO_MSLEEP(78);
// Window CWI_16 ("" ) destroyed 1143063232.379

DO_MSLEEP(63);
CtxTypeVK(CWI_15, VK_RETURN, NONE); //1143063234.441
```

```
DO_MSLEEP(1906);

DO_MSLEEP(15);
// Window CWI_15 ("Open") destroyed 1143063234.363

DO_MSLEEP(79);

DO_MSLEEP(1218);
CtxPoint(157, 1); //1143063235.926

DO_MSLEEP(266);

CWI_13->setTitle("bigfile.txt - Notepad"); //1143063243.035

DO_MSLEEP(5453);
CtxPoint(594, 48); //1143063244.441
/// Flush all past screen update events for specified screen region (window) from  
the queue:
while (CtxScreenEventExists(EVT_STR_CTXSCREENUPDATE, 0, "43 39 569 401"))
    CtxWaitForScreenUpdate(43, 39, 569, 401, 0);
///
/// This waitpoint was inserted during the Citrix session capture.
/// Wait 2.5 seconds for new update to the specified screen region/window:
///
CtxWaitForScreenUpdate(43, 39, 569, 401, 2500);

DO_MSLEEP(657);
CtxClick(CWI_13, 171, L_BUTTON, NONE); //1143063244.613

DO_MSLEEP(94);
// Window CWI_13 ("bigfile.txt - Notepad") destroyed 1143063244.707

DO_MSLEEP(594);
CtxPoint(567, 6); //1143063247.582
```

Using the Player, Script Development Workbench, and Analyze

```
DO_MSLEEP(2281);
// Window CWI_9 ("Program Manager") destroyed 1143063247.582

// Window CWI_7 ("") destroyed 1143063247.645

// Window CWI_17 ("Please wait...") created 1143063247.926

CtxWaitForWindowCreate(CWI_17, 0);

DO_SetTransactionCleanup();

CtxDisconnect();

END_TRANSACTION();
delete CWI_1; // "Warning !!"
delete CWI_2; // "Log On to Windows"
delete CWI_3; // "Please wait..."
delete CWI_4; // "Citrix License Warning Notice"
delete CWI_5; // "Citrix License Warning Notice"
delete CWI_6; // "UsrLogon.Cmd"
delete CWI_7; // ""
delete CWI_8; // "ICA Seamless Host Agent"
delete CWI_9; // "Program Manager"
delete CWI_10; // ""
delete CWI_11; // "Run"
delete CWI_12; // ""
delete CWI_13; // "Untitled - Notepad"
delete CWI_14; // ""
delete CWI_15; // "Open"
delete CWI_16; // ""
delete CWI_17; // "Please wait..."

CitrixUninit();

EXIT();
return(0);
}
```

```

void abort_function(PLAYER_INFO *s_info)
{
RR__printf("Virtual User ABORTED.");

CitrixUninit();

EXIT();
}

```

.NET

Overview of the QALoad .NET Session

QALoad provides performance testing in .NET environments not supported by a capture facility. It creates a template C# script, or stub script, that you can edit manually in a Microsoft Visual Studio session.

 **Note:** You must install Microsoft Visual Studio 2005, Microsoft .NET Framework v2.0 Service Pack 1, and the QALoad Add-In in order to use the QALoad .NET session.

Use the QALoad functions provided in the .NET session to create and edit the C# script from the script template. All standard QALoad functionality is supported in the .NET session, including datapools and checkpoints, VU-specific data, such as VU number, Transaction number, and pacing values.

Once you insert custom code into the stub script, you compile it, debug it, and validate it using the QALoad menu options provided in the .NET session. You also can use the compiler options and debugging capabilities available in Visual Studio.

When the source file is created, a solution file and a project file also are created. The source file, solution file, and project file are stored together in their own subdirectory in QALoad\Middlewares\DOTNET\Scripts.

 **Note:** You can have only one solution file open at a time. If a solution is loaded, you must save any changes and close the file before you create and load a new script.

Execute compiled scripts using the QALoad Conductor. When you create a new Conductor session and select the DOTNET middleware type in the Test Configuration Wizard, your .NET scripts display for selection.

Starting a .NET Session

Use the following procedure to open a .NET session.

To start a .NET session:

From the workbench, click **Session>.NET**. This starts a Microsoft Visual Studio session with the Manage QALoad Scripts dialog box displayed. From this dialog box you can:

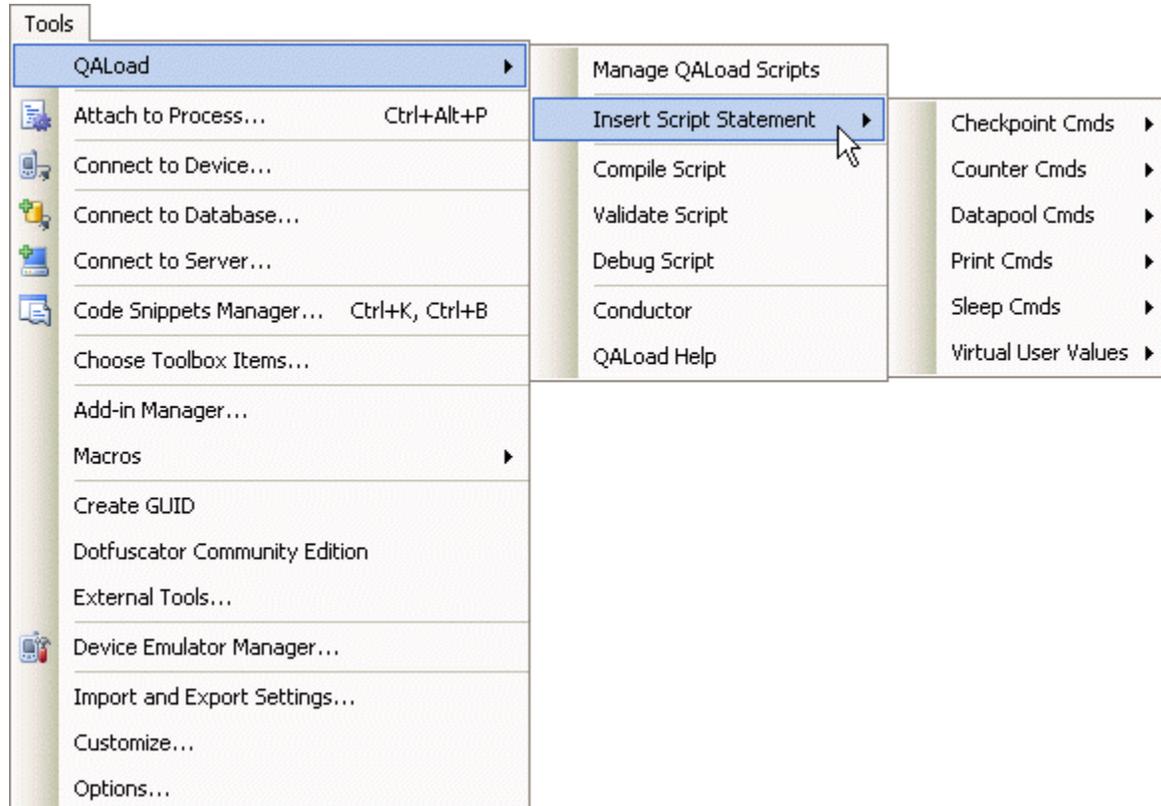
- ! **Create** a new script
- ! **Edit** a script
- ! **Delete** a script.

 **Notes:**

- ! You must install Microsoft Visual Studio 2005, Microsoft .NET Framework v2.0 Service Pack 1, and the QALoad Add-In before using the .NET session.
- ! In Microsoft Visual Studio, you can have only one solution file open at a time. If a solution is loaded, you are asked to save any changes and close the file before the new script is created and loaded.

QALoad .NET Menu

The following QALoad menu options are available from Tools>QALoad when a QALoad .NET Session is open in Microsoft Visual Studio.



Manage QALoad Scripts: Use this option to create a new C# script, edit an existing script, or delete a script. Scripts are stored in `\QALoad\Middlewares\DOTNET\Scripts`.

Insert Script Statement: Displays the commands that you can insert into your script. Commands are grouped in logical categories. Refer to [.NET](#) in the Language Reference Commands folder in the QALoad online help for information on the individual commands available for .NET sessions.

Compile Script: Available when a QALoad script is open. The QALoad script is C# based and therefore must be compiled before it can be used. Scripts are compiled using the current build configuration (Release or Debug mode). If you make changes to an existing script, you must re-compile it before you can successfully use it in a test. Compiled scripts are stored in `\QALoad\Scripts`.

Validate Script: Available when a QALoad script is open. This option compiles the script using Release mode. When the compilation completes successfully, the Validate session begins with one Virtual User (VU) for one transaction.

Debug Script: Available when a QALoad script is open. This option compiles the script in Debug mode so that you can place breakpoints in your script. When the compilation completes successfully, the validate session begins with one VU for one transaction.

Conductor: Opens the Conductor to set up and start a test.

QALoad Help: Opens the main QALoad online help for .NET sessions.

Managing QALoad .NET Scripts

Once you open a .NET session in Visual Studio, you can access, create, and update QALoad scripts using the Manage QALoad Scripts dialog box.

To access the Manage QALoad dialog box in Visual Studio:

With a .NET session open in Visual Studio, click Tools>QALoad>Manage QALoad Scripts. The Manage QALoad Scripts dialog box appears.

From this dialog box you can:

[Create a script](#)

[Edit an existing script](#)

[Delete a script](#)

Compiling, Validating, and Debugging a QALoad .NET Script

A QALoad .NET script is a real C#-based script, and therefore needs to be compiled before it can be used.

Once compiled, you can debug and validate the script. If you make changes to an existing script, you must re-compile it before you can successfully use it in a test. Use the QALoad menu in Visual Studio to:

[Compile a QALoad .NET Script](#)

[Debug a QALoad .NET Script](#)

[Validate a QALoad .NET Script](#)

.NET Command Reference

The QALoad Language Reference provides command reference information for general and middleware-specific functions. Refer to [.NET](#) in the Language Reference Commands folder in the QALoad online help for information on the individual functions available in .NET sessions.

Java

Overview—About Java

QALoad does not support recording of Java scripts. Instead, Java scripts are created from script templates that you use to create a stub script that you can then edit manually. Templates are saved in the `QALoad\Middlewares\Java\Templates` directory. QALoad supplies four default templates. QALoad uses a token name to represent the classpath — when you create a new Java script, QALoad simply replaces the token `<classnamehere>` with the class/script name you assign. You can also install additional templates using the `<classnamehere>` token if you wish.

Following is an example of a Java template with the classname token (in bold):

Using the Player, Script Development Workbench, and Analyze

```
import com.compuware.qacenter.qaload.EasyScript.*;
public class <classnamehere> implements EasyScript
{
    /** optional - Class method runs once for each script when class is loaded */
    public static void setup QALoad Test () throws Exception
    {
    }
}
```

Use the Script Development Workbench to create a new EasyScript for Java script from the provided stub scripts.

Accessing JavaDoc

QALoad provides JavaDoc for your reference. To access it from the Script Development Workbench menu, choose Help>EasyScript for Java: JavaDoc from a Java session.

Creating a Java Script

To create a Java script for QALoad :

1. With a Java session open, choose **File>New** from the menu.
 2. In the File area, click on the **Middleware** tree item.
 3. In the Filename field, type a name for your new Java script. Note that Java file names do have special requirements, and QALoad enforces those requirements. For example, Java file names cannot contain spaces. If you try to include a space in your file name, QALoad gives you an error prompt.
 4. Click **OK**. The Create Java Script dialog box opens.
 5. Under the Script field is a selection box listing all the templates available in your `\QALoad\Middlewares\Java\Templates` directory. QALoad provides four default templates. If you click on a template name, a sample is shown in the right pane. The four templates are:
 - ! long format — Provides all required and optional methods.
 - ! new class — Creates a class associated with the script.
 - ! old format — Shows modifications needed to run legacy scripts.
 - ! short format — Provides only the minimum required methods.
- Select the template that best suits your needs and click OK. QALoad creates a stub script by the name you designated and opens it in the Workbook pane for editing.
6. Edit your script as necessary. You can use QALoad's [Java Script Options dialog box](#) to edit some script attributes.

Note: The main call in the script is used for debugging proposes and is not executed in the Conductor.

Setting Classpaths in QALoad Player for EasyScript for Java

When loading a class by name in the QALoad Player during runtime, do not use a class name on the Enterprise Java Bean (EJB) InitialContext call. Instead, use a class instance or add a line of code before the JNDI lookup call. Refer to the following examples:

Using a class instance

Replace the InitialContext properties and JNDI names in the following example with the values that are appropriate for your application.

Before:

```
java.util.Hashtable ht = new java.util.Hashtable();
ht.put(javax.naming.Context.INITIAL_CONTEXT_FACTORY,
"org.jnp.interfaces.NamingContextFactory");
ht.put(javax.naming.Context.PROVIDER_URL, "fh12623:1099");
javax.naming.InitialContext ic = new javax.naming.InitialContext(ht);
Object ref = ic.lookup("AddressMSvc");
```

After:

```
org.jnp.interfaces.NamingContextFactory nf = new
org.jnp.interfaces.NamingContextFactory();
java.util.Hashtable ht = new java.util.Hashtable();
ht.put(javax.naming.Context.PROVIDER_URL, "fh12623:1099");
javax.naming.Context ic = nf.getInitialContext(ht);
Object ref = ic.lookup("AddressMSvc");
```

Adding a line of code before the JNDI lookup call

Add the following line before the JNDI lookup call:

```
Thread.currentThread().setContextClassLoader(getClass().getClassLoader());
```

If it is a static method, use the following sample, replacing CLASSNAME with the class name of the code.

```
Thread.currentThread().setContextClassLoader(CLASSNAME.class.getClassLoader());
```

Executing a Java Applet

Java applets are handled by the following process:

1. The browser makes a request to a Web server for an HTML document that contains embedded Java applets.
2. The browser downloads the Java applets, in the order in which they appear on the Web page, and immediately executes them.

Example Web Page

The following Web page contains two sections that reference Java applets. Notice the parameters that follow the applet. The browser passes these parameters when invoking an applet.

```
<HTML>
<HEAD>
<TITLE>Java Example</TITLE></HEAD>
<BODY>

<center><h2>Java Applet Example</h2><hr>

<applet code="LScrollText.class" width="500" height="20" >
<PARAM NAME="MESSAGE" VALUE="Scrolling Text created by Java Applet... >>Click here to
Download<< Use it FREE">
<PARAM NAME="FONTHEIGHT" VALUE="14">
<PARAM NAME="SPEED" VALUE="2">
<PARAM NAME="PIXELS" VALUE="1">
<PARAM NAME="FONTCOLOR" VALUE="0000FF">
<PARAM NAME="BACKCOLOR" VALUE="FFFF00">
<PARAM NAME="TARGET" VALUE="lscrolltext.zip">
</applet>

<br><br><br>
```

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A scrolling message, with custom colors, font size, speed, and target URL.
The source (.ZIP) file can be downloaded by clicking the associated area in text window.

```
<br><br><br><hr>
<APPLET CODE="imagefader.class" WIDTH=80 HEIGHT=107>
<PARAM name="demicron" value="www.demicron.se">
<PARAM name="reg" value="A00012">
<PARAM name="maxitems" value="3">
<PARAM name="width" value="80">
<PARAM name="height" value="107">
<PARAM name="bitmap0" value="anibal.jpg">
<PARAM name="bitmap1" value="jak.jpg">
<PARAM name="bitmap2" value="jan.jpg">
<PARAM name="url0" value=" ">
<PARAM name="url1" value=" ">
<PARAM name="url2" value=" ">
<PARAM name="step" value="0.05">
<PARAM name="delay" value="20">
<PARAM name="sleeptime" value="2000">
</APPLET>
<br><br><br>
```

This applet is a very popular image fader that displays a series of images, and allows URLs to be associated with each image.

<hr>

```
</center>
</BODY></HTML>
```

Example script

QALoad does not evaluate Java applets. They appear as main requests. The example script features the following elements:

- ! A DO_Http call to retrieve the main page.
- ! A DO_Http call to retrieve the scrolling text class.
- ! A DO_Http call to retrieve the image fader class Java applet.

How It Works: QALoad interacts with the Web server without execution of the Java applet program within the virtual browser. The browser accepts the pages that contain Java applets, but does not execute the applet as part of the load test. The Java applets are not evaluated by QALoad and appear as main requests in the script.

```
DO_InitHttp(s_info);
...
...
BEGIN_TRANSACTION();
...
...
DO_Http("GET http://www.host.com/java.htm HTTP/1.0\r\n\r\n");
DO_VerifyDocTitle("Java Example", TITLE);

/* Request: 2 */
DO_Http("GET http://www.host.com/LScrollText.class HTTP/1.0\r\n\r\n");

/* Request: 3 */
DO_Http("GET http://www.host.com/imagefader.class HTTP/1.0\r\n\r\n");
DO_Http("GET http://www.host.com/jak.jpg HTTP/1.0\r\n\r\n");

...
...
END_TRANSACTION();
```

Oracle Forms Server

Verifying Oracle Forms Server Window Creation

The `ofsWindowCreated` command does two things. First, it ensures that for the `ofsSendRecv()` command preceding it, the server includes in the response that a `FormWindow` object with the title specified is created. The script returns `FALSE` if the object is not created. Second, the original (captured) control ID is associated with the object representing the control in OFSreplay's internal list of controls, which is in addition to the (runtime) control ID that is tracked.

This allows better tracking of `FormWindow` GUI controls that exist at runtime by being able to match up both the control name and the original control ID.

The `ofsWindowCreated` command only handles objects of type `FormWindow`.

Using the ofsWindowCreated Script Command

The following example shows an example from a modified OFS script:

```
ofsSendRecv(1); //ClientSeqNo=1|MsgCount=1|1137439721.484
  if (!ofsWindowCreated(11, "WINDOW_LARGE_GRAPH"))
  {
    // Only fail if this window was not created
    RR__FailedMsg(s_info, "WINDOW_LARGE_GRAPH was not created!");
  }
ofsWindowCreated(15, "WINDOW_START_APP");
ofsWindowCreated(20, "WINDOW_CONTROLSTEST");
ofsWindowCreated(24, "WINDOW_GRAPHICSTEST");
ofsWindowCreated(28, "WINDOW_DATABASETEST");
```

Understanding the C++ Script

Oracle Forms Server scripts are produced for all Oracle E-Business Suite and Oracle Applications recordings. The C++ script executes OFS-related statements by passing the statements in the script DLL to the OFS Java engine that performs the client activities and the client communication with the server. Because the C++ script statements are directly tied to corresponding methods in the OFS Java engine, modifications to the script statements are limited to changing the property parameter values through variablization.

An OFSC++ script contains three main sections: [Connection](#), [Application Body](#), and [Disconnect](#). The QALoad transaction loop includes all three sections by default. The transaction loop can be moved using the guidelines described in [Moving the OFS transaction loop](#). An internal auto checkpoint is created during connection statements and transmission statements.

The C++ script statements are a condensed version of the Java-style script statements. The C++ script statements show the GUI controls in the OFS application and the control properties, which are either control attributes or activities. For example:

```
ofsClickButton( "BUTTON", 52, OFS_ENDMSG, 325 );
```

In this example, the user clicks (property 325) a button (control ID 52). `OFS_ENDMSG` is a flag that indicates that the GUI activity ends the current OFS Message.

QALoad also allows OFS and WWW statements from a Universal session to be scripted in the C++ script, providing the ability to play back WWW and OFS statements. QALoad automatically extracts ICX tickets and any necessary cookies from the WWW middleware traffic and passes them to the OFS middleware.

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Setting Oracle Forms Convert Options

Use the following procedures to set Oracle Forms convert options and advanced convert options. Use the advanced convert options to customize the post-capture steps taken before converting the capture file to a script, or to manually perform post-capture processing of a proxycap (hexadecimal encoded) file. This produces a new cap file, postcapweb file, longcap file, and sortedcap. This process overwrites these files when they already exist.

To set conversion options for Oracle Forms in a single session:

1. Choose **Options>Convert** in the Script Development Workbench toolbar. The **Session Options** dialog box appears.
2. Select the appropriate **options**, then click **OK**.

To set conversion options for Oracle Forms in a Universal session:

1. Choose **Options>Convert** in the Script Development Workbench toolbar. The **Session Options** dialog box appears with both Oracle Forms Server and WWW selected.
2. Click the **Session Options** tab.
3. Under **Convert Options** in the tree view, click **Oracle Forms Convert Options**.
4. Select the appropriate **options**, then click **OK**.

To set Advanced convert options:

1. Choose **Options>Convert** in the Script Development Workbench toolbar to open the **Session Options** dialog box.
2. In the **Convert Options** tree view, click **Advanced Convert Options**.
3. Select the appropriate **options**, then click **OK**.

Recording Oracle Forms Server Sessions

You can record an Oracle Forms session in a single session, or in a Universal session for Oracle E-Business Suite 11i (EBS-11i) and Oracle E-Business Suite 12 (EBS-12). Select the down arrow next to the Oracle Forms Server Session button on the toolbar, then follow one of the procedures below.

To begin recording an OFS single session:

1. Select **Oracle Forms** to activate a new OFS single session.
2. From the toolbar, select **Options>Record**, and select the appropriate **options**.
3. Click **Record** on the **Session** toolbar.

To begin recording OFS in a Universal session:

1. Select **E-Business Suite 11i** or **E-Business Suite 12** to activate Universal session for Oracle Forms and WWW middlewares.
2. Click **Record** on the **Session** toolbar. The **Session Options** dialog box displays with the **Middleware** tab on top. Both WWW and Oracle Forms Server are selected.
3. Click the **Session Options** tab.

4. In the tree view under Record Options, select **Oracle Forms Record Options**. The Oracle Forms Record Options pane displays on the right. The session you initiated, either E-Business Suite 11i or E-Business Suite 12, automatically displays in the **Forms Environment** field.
5. Select the appropriate [options](#), then click **OK** to begin recording.

 **Note:** When you record EBS-12 using Internet Explorer 6, changing the Accessibility option on the EBS-12 login page from the default (None) requires modifications to your script in order for it to run properly. Refer to [Changing Accessibility Options in Oracle EB-12](#) for more information.

Oracle Forms Recording Modes

QALoad supports recording Oracle E-Business Suite (EBS) 12 and 11i, and Oracle Applications using Forms 10g, 9i, and patched 6i (versions 6.0.8.14 and up). These applications may be recorded in HTTP mode (also called Servlet mode), SSL mode (also called HTTPS or Secure Servlet mode), and socket mode. These recording types are described briefly below.

Recording Servlet Mode

Oracle Forms Applications use HTTP to send Forms data across the network. To record in Servlet mode, select Servlet in the Connection Mode list in the Record Options dialog box before you start recording your application.

 **Note:** When using server-side recording, you must perform steps to configure the server. See [Using server-side recording](#) for more information. Server-side recording is not available for EBS-12 or EBS-11i.

Recording SSL Mode

To record an OFS application in Secure Servlet (SSL) mode, select Secure Servlet in the Connection Mode list in the Record Options dialog box. For non-EBS-12 applications, you must specify a certDB file by entering the Jinitiator certDB file that the application uses. The certDB file verifies the SSL Certificate Authority on the client side prior to the Forms connection. This field is not required for EBS-12.

 **Note:** SSL mode is not available with server-side recording.

Recording Socket Mode

For Socket Mode recording, QALoad must start your application for you through your browser. Before recording, enter the URL of the Forms applet page in the URL field, and the Forms Server port in the Port field. If you leave the Port field blank, or enter an incorrect port number, your recording will only result in an empty capture file. You may leave the URL field blank, but will be prompted for the Forms applet page on the initial browser page. From the applet page, click the link to your Forms application. QALoad will take over recording at this point.

Checkpoints in Oracle Forms Server scripts

EasyScript for Oracle Forms Server supports QALoad's automatic middleware checkpoint timings in both HTTP and socket modes. Default checkpoints (Begin/End Checkpoint pairs) are not supported.

Automatic checkpoints are enabled from the Conductor on [Timing Options](#) page of the Script Properties dialog box and are enabled on a script-by-script basis.

At playback, automatic checkpoints are executed during the ofsSendRecv statement.

Debug data

When the Debug Data option is enabled on the Configure Script Development Workbench dialog box for validation, or the Conductor's Debug Trace option is enabled for playback, executed script statements will be displayed. For example:

Using the Player, Script Development Workbench, and Analyze

```
VU 0 : Line:90, ofsSetWindowSize( "FORMWINDOW" ,6, ofs_ENDMSG, 137, 750, 600 )
VU 0 : Line:91, ofsActivateWindow( "WINDOW_START_APP" ,11, ofs_ENDMSG, 247 )
VU 0 : Line:92, ofsShowWindow( "WINDOW_START_APP" ,11, ofs_ENDMSG, 173 )
VU 0 : Line:93, ofsFocus( "BUTTON" ,51, ofs_ENDMSG, 174 )
VU 0 : Line:94, ofsSetWindowSize( "FORMWINDOW" ,6, ofs_ENDMSG, 137, 750, 600 )
VU 0 : Line:95, ofsSendRecv( 1 ) //ClientSeqNo=2|MsgCount=6
```

Oracle Forms Server method reference

QALoad provides descriptions and examples of the various methods and functions available for an Oracle Forms Server script. For details, refer to the Language Reference Help section for [Oracle Forms Server](#).

Using the certDB File for OFS Replay

In some Oracle Application Server and Oracle E-Business Suite 11i environments, the certificates needed for the SSL handshake with the server are not in the default wallet used during replay. This causes the SSL handshake to fail.

You can use the certDB file used by Jinitiator for OFS replay. To do this for Script Validation, place the certdb.txt file in the BinaryFiles directory.

To use the certDB file for OFS replay in Conductor:

1. In the Conductor's Visual Designer, select the script icon for the appropriate script to display the Script Properties panel on the right-hand of the window.
2. In the External Data area, click the **browse [...]** button in the **Attached Files** field. The Attached Files page of the Script Properties dialog box appears.
3. Click **Add**. The Choose a File to Attach dialog box displays.
4. From the BinaryFiles folder, select **certdb.txt**, then click **Open**.
5. Click **OK**.

Connection Statements

The connection script lines in the C++ script vary depending on the type of Forms connection mode that is active. You choose the Forms connection mode on the [Oracle Forms Record Options](#) dialog box. Forms connection modes include server-side recording, HTTP, HTTPS, or socket.

Server-side recording is limited to applications that use Forms 9i (applications running in Oracle 9iAS Release 2 and above). HTTP connection mode is available for applications using Forms 9i and for applications using the patched Forms 6i version configured with the HTTP servlet. HTTPS connection mode is strictly for SSL-enabled applications that use Forms 9i. Socket connection mode is for applications that use Forms 6i and lower versions, such as Oracle 11i.

Server-side recording connections

Server-side recording mode contains only one connection statement. The function that is used – [ofsSetServletMode](#) – contains the listener servlet value that you entered on the Oracle Forms Server Recording Options dialog box. The first parameter defines the HTTP or HTTPS configuration of the application environment. The second parameter defines the name of the Forms Listener Servlet used by the application. To connect, QALoad internally invokes Oracle's dispatch calls using the two parameters. Oracle's proprietary classes provide the implementation for the HTTP or HTTPS connection. For example:

```
ofsSetServletMode(OFS_HTTP, "http://ntsap45b:7779/forms90/190servlet" );
```

HTTP connections

HTTP connection mode contains multiple connection statements. To connect, QALoad internally performs Java calls to accomplish the following tasks:

- ! Define HTTP header properties
- ! Connect to the Forms Servlet (an HTTP-GET request)
- ! Set the parameters of the Forms Listener Servlet
- ! Connect to the Forms Listener Servlet (an HTTP-GET request)
- ! Set additional HTTP header property for the Listener Servlet
- ! Connect to the Forms Listener Servlet (an HTTP-POST request). The last connection statement also initiates the required Forms "handshake" and determines the Forms encryption used by the application environment.

For example:

```
ofsHTTPSetHdrProperty("User-Agent", "Java1.3.1.9" );
ofsHTTPSetHdrProperty("Host", "ntsap45b:7779" );
ofsHTTPSetHdrProperty("Accept", "text/html, image/gif, image/jpeg, *; q=.2, */*; q=.2"
);
ofsHTTPSetHdrProperty("Connection", "Keep-alive" );
ofsHTTPConnectToFormsServlet(
"http://ntsap45b:7779/forms90/f90servlet?ifcmd=startsession" );
ofsHTTPSetListenerServletParms( "?ifcmd=getinfo&ifhost=C104444D01&ifip= "192.168.234.1"
);
ofsHTTPConnectToListenerServlet( "http://ntsap45b:7779/forms90/190servlet" );
ofsHTTPSetHdrProperty("Content-type", "application/x-www-form-urlencoded" );
ofsHTTPInitialFormsConnect();
```

HTTPS connections

HTTPS connection mode uses the same connection statements as HTTP mode.

Socket connections

Socket mode contains only one connection statement. The function that is used – [ofsConnectToSocket](#) – contains the port number and the URL you entered on the [Oracle Forms Record Options](#) dialog box to start OFScapture. The port value is the port on which the Forms Server directly listens for Forms traffic. To connect, QALoad uses Java calls to open a Java socket using the parameters, initiate the required Forms "handshake", and determine the Forms encryption used by the application environment. For example:

```
ofsConnectToSocket("10.10.0.167", 9002 );
```

Application Statements

The application statements in the C++ script consist of property statements and transmission statements. Property statements describe the attributes and activities of GUI controls in the application. Transmission statements send the GUI controls and their properties as Forms Message data to the server. There is only one transmission statement: [ofsSendRecv](#). QALoad creates an internal auto checkpoint when this statement

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is executed. In the following example, the first two (property) statements set the location and size of a FormWindow GUI control. The ofsSendRecv statement sends the GUI control properties to the server.

```
ofsSetWindowLocation( "FORMWINDOW", 6, ofs_ENDMSG, 135, 0, 0); //Property
ofsSetWindowSize( "FORMWINDOW", 6, ofs_ENDMSG, 137, 650, 500); //Property
ofsSendRecv(1 ); //Transmission
```

Parameters of a property statement:

The parameters of a property statement are arranged in the following sequence:

1. **Captured control name.** If the name is not available, this value is the class name to which the control belongs.
2. **Captured control ID.**
3. **Action type.** This flag indicates if the property is to be added to the current Forms Message or if the property ends the current Forms Message. During playback, each control is treated as a Forms Message. When the current Message ends, QALoad translates the control and its properties to binary format. The valid values are:
 - **ofs_ADD** – add the property to the current Message.
 - **ofs_ENDMSG** – add the property to the current Message and end the Message.
 - **ofs_STARTSUBMSG** – add the property of the succeeding nested Message to the current Message.
4. **Property ID.** The Forms version-specific ID of the property.
5. **Property value.** Captured value of the property (optional)
6. **Property value.** Captured value of the property (optional)

For example:

```
ofsSetWindowSize( "FORMWINDOW", 6, ofs_ENDMSG, 137, 650, 500);
```

In this example, control ID 6, which belongs to GUI class FORMWINDOW, is resized (PROPERTY 137) to have coordinates 650 and 500. This marks the end of the current Message.

Forms environment statements:

The initial set of statements in the Forms script describes the Forms application environment. In this set, the "version" and the "cmdline" properties are the most important. The version property shows the Forms Builder version used by the application. The version indicates the capabilities of the application. For example, some versions cannot support HTTP connections. The cmdline property shows the Forms configuration parameters passed to the server by the Forms applet. The parameter "record=names" indicates that the application enables GUI control names to be captured. Control names are preferred in multi-threaded playback. The "ICX" parameter indicates that the application uses a Personal Home Page.

In the sample script below, the Forms builder version is 90290 (the version used in Oracle 9iAS Release 2, unpatched). The cmdline property shows "record=forms" which defaults "record=names". The cmdline property does not have the "ICX" ticket parameter.

```
ofsSetInitialVersion( "RUNFORM", 1, ofs_ADD, 268, "90290" );
ofsSetScreenResolution( "RUNFORM", 1, ofs_ADD, 263, 96, 96);
ofsSetDisplaySize( "RUNFORM", 1, ofs_ADD, 264, 1024, 768);
ofsInitSessionCmdLine("RUNFORM", 1, ofs_ADD, 265,
"server module=test1.fmx userid= sso_userid= debug=no buffer_records=no debug_"
"messages=no array=no query_only=no quiet=yes render=no host=ntsap45b.proditi.com"
"puware.com port= record=forms tracegroup=debug log=run1 term=" );
ofsSetColorDepth( "RUNFORM", 1, ofs_ADD, 266, "256" );
ofsColorAdd( "RUNFORM", 1, ofs_ADD, 284, "0" );
ofsColorAdd( "RUNFORM", 1, ofs_ADD, 284, "8421504" );
ofsSetFontName( "RUNFORM", 1, ofs_ADD, 383, "Dialog" );
ofsSetFontSize( "RUNFORM", 1, ofs_ADD, 377, "900" );
ofsSetFontStyle( "RUNFORM", 1, ofs_ADD, 378, "0" );
ofsSetFontWeight( "RUNFORM", 1, ofs_ADD, 379, "0" );
ofsSetScaleInfo( "RUNFORM", 1, ofs_ADD, 267, 8, 20);
```

```
ofsSetNoRequiredVAlList( "RUNFORM", 1, OFS_ADD, 291 );
ofsSetPropertyString( "RUNFORM", 1, OFS_ENDMSG, 530, "America/New_York" );
ofsSendRecv(1 );
//ClientSeqNo=1|CapTime=1086884188.281|MsgCount=1
```

Sending messages to the server:

The `ofsSendRecv` statement sends the accumulated GUI controls and their properties to the Forms Server as binary data. This statement represents the point at which the client sends a Forms Terminal Message to the server. In Oracle Forms, the client and the server must end each data block with a Terminal Message before any transmission occurs.

Internally, QALoad varies the binary data transmission depending on the connection mode:

- ! For server-side recording mode, QALoad sends the binary data by invoking Oracle's dispatch calls. Oracle's own classes provide the implementation for the HTTP transmission.
- ! For HTTP or HTTPS mode, QALoad wraps the binary data inside an HTTP stream and invokes Java's HTTP calls.
- ! For socket mode, QALoad sends the binary data directly to the Java socket opened at the connection point.

The `ofsSendRecv` statement has one parameter: the response code of the captured Terminal Message. The possible values for this parameter are 1 (add), 2 (update), and 3 (close). Typically, when the response code is 3, the Forms Server reacts by removing the GUI controls associated with the client message from the server cache.

A comment line appears after each `ofsSendRecv` statement that contains script-tracking information. The information on the comment line is also found in the capture file in each `ofsSendRecv` capture line. The comment line shows the relative sequence of each client request, as represented by a Terminal Message, from the start of the application (e.g. `ClientSeqNo=1`). The comment line also shows the timing mark of the captured Terminal Message (e.g. `CapTime=1086884188.281`) and the number of Forms messages contained in the request (e.g. `MsgCount=1`). The number of Messages can be verified by counting the preceding `ENDMSG` and `STARTSUBMSG` flags in the request block. The comment line is useful for debugging playback issues because it readily shows the client request sequence number where the issue is occurring.

Getting the server reply:

During the execution of `ofsSendRecv`, QALoad also obtains the server's reply and translates the binary Forms data into Forms control values and control properties. The values are also written to the playback log file (in capture file format) if script logging is enabled. The following sample is a server reply:

```
VU 0 : M|S|2|0|1
VU 0 : P|S|322|java.lang.Integer|0|151000320
VU 0 : P|S|279|java.lang.Boolean|0|false
VU 0 : P|S|525|java.lang.String|AMERICAN_AMERICA.WE8MSWIN1252
VU 0 : T|S|1|ServerSeqNo=1|MsgCount=76
```

The first line indicates the start of a Forms Message from the server (M|S). The third parameter is an action code (1= add, 2= update, 3= delete, 4= get property value). The fourth parameter is the Class Code of the control (0 = root class). The fifth parameter is the Control ID (1= RunForm).

The second, third and fourth lines are property lines related to the above Forms Message from the server (P|S). The third parameter of each line is the property ID (322). The fourth parameter is the data type of this property (`java.lang.Integer`). The fifth parameter is the data value. If the value is 0, the data value is in a sixth parameter (`false`).

The third line is the terminal message line from the server (T|S). The third parameter is the response code associated with the terminal message (1= add, 2= update, = close). The fourth parameter is the relative sequence of the server reply, as represented by a Terminal Message, from the start of the application (e.g. `ServerSeqNo= 1`). The fifth parameter is the number of Forms messages contained in the reply (e.g. `MsgCount = 1`). The number of Messages may be verified by counting the preceding M|S flags in the reply block. The fourth and fifth parameters are script-tracking information, which can be useful for debugging

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a playback issue. If logging is enabled, the log file shows the tracking information, which can make the comparison between server responses and captured responses easier.

Processing large data and delayed response scenarios:

When HTTP or HTTPS connection mode is used, Forms data is wrapped inside the HTTP reply stream. QALoad checks the HTTP header of the reply before processing the Forms data. The HTTP header sometimes indicates that the client needs to perform additional HTTP POST requests to obtain the complete Forms data. This indication occurs when the content-length of the reply is 64000 (a large data scenario), or the content-type is "text/plain" and the HTTP header contains an "iferror:" string (a delayed response/re-post scenario). QALoad performs the necessary POST requests to obtain the complete reply data, and then translates the accumulated reply data to Forms controls and properties.

Disconnect statements

The disconnect script lines vary depending on the Forms connection mode.

- ! In server-side recording mode, the ofsServerSideDisconnect script statement internally invokes Oracle's dispatch calls to disconnect.
- ! In HTTP mode, the ofsHTTPDisconnect statement internally makes Java calls to disconnect the main URL connection from the servlet.
- ! In socket mode, the ofsSocketDisconnect statement closes the socket on which the Forms Server listens for traffic.

Using Script Logging as a Debugging tool

You can debug a playback issue in a C++ script by enabling replay logging. The option for enabling replay logging is located on the Debug page of the Script Properties dialog box of the Conductor. For more information about enabling log file generation, see [Debugging a script](#).

When logging is enabled, QALoad writes the client requests and server replies to the playback log file in the same format as the capture file. The playback log file is found in the \QALoad\LogFiles directory. When there is an issue during playback, such as the server not responding to a client request, you can compare the capture files and check the differences in the server reply data. Both the capture file and the log file contain tracking information appended to the server's terminal messages. The tracking data contains the relative sequence number of the server reply from the start of the Forms session and the timing mark. The tracking data also shows the number of Forms messages contained in the reply block. The number of messages are based on the number of "M|S" lines prior to the "T|S" lines.

In the following example, the first set of statements shows the logged statements and the second set of statements shows the captured statements. The ServerSeqNo value shows that this is the 8th reply from the server. The MsgCount value of 1 shows that only one Forms Message is included in this reply block.

```
1087419810.000|ofsShowWindow|WINDOW_START_APP|11|OFS_ENDMSG|173|PROPERTY_VISIBLE|java.lang.Boolean|true
1087419810.000|ofsSendRecv|1|ClientSeqNo=8|CapTime=1087419810.000|MsgCount=1
1087419810.000|M|S|2|0|30
1087419810.000|P|S|135|java.awt.Point|0|java.awt.Point[x=0,y=0]
1087419810.000|P|S|137|java.awt.Point|0|java.awt.Point[x=706,y=464]
1087419810.000|P|S|139|java.awt.Point|0|java.awt.Point[x=0,y=0]
1087419810.000T|S|1|ServerSeqNo=8|CapTime=1087419810.000|MsgCount=1
```

```
1087402349.296|ofsShowWindow|WINDOW_START_APP|11|OFS_ENDMSG|173|PROPERTY_VISIBLE|java.lang.Boolean|true
1087402349.296|ofsSendRecv|1|ClientSeqNo=8|CapTime=1087402349.296|MsgCount=1
```

```

1087402349.296|M|S|2|0|30
1087402349.296|P|S|135|java.awt.Point|0|java.awt.Point[x=0,y=0]
1087402349.296|P|S|137|java.awt.Point|0|java.awt.Point[x=706,y=464]
1087402349.296|P|S|139|java.awt.Point|0|java.awt.Point[x=0,y=0]
1087402349.296|T|S|1|ServerSeqNo=8|CapTime=1087402349.296|MsgCount=1

```

Moving the OFS Transaction Loop

To enable movement of the QALoad transaction loop in the C++ script, you must first record a full business transaction and a partial business transaction. The business transaction is the activity that you would like to repeat during QALoad playback. Insert QALoad [capture comments](#) (using the Insert Command button on the [Recording toolbar](#)) at the start and end of a business transaction. These comments will help you find the spots in the script where you would like to reposition the BEGIN_TRANSACTION() and END_TRANSACTION() statements. Then re-start the business transaction.

QALoad's OFS script presents a sequence of Forms GUI objects. The GUI objects contain context dependencies. For example, when a window is opened, the buttons, text fields and edit boxes inside that window are logically dependent on the state of that window. When only one business transaction is captured and the corresponding script's transaction loop is moved, the sequence of the GUI objects is broken during the second iteration of the transaction loop. The broken sequence results in a broken context, which causes the server to respond unpredictably during playback on the second and subsequent iterations of the transaction loop. When the business transaction is restarted during capture, the Forms GUI objects that compose the new transaction are used to anchor into the new transaction loop without breaking the context dependencies of GUI objects.

When modifying the script, use the comment lines as guides in moving the END_TRANSACTION() and BEGIN_TRANSACTION() statements. Ensure that there is a contextual flow from the new position of the END_TRANSACTION() statement to the new position of the BEGIN_TRANSACTION() statement. The set of GUI objects that belong to the ofsSendRecv() statement just before the new END_TRANSACTION() statement must be the same as the set of GUI objects that belong to the ofsSendRecv() statement prior to the new BEGIN_TRANSACTION() statement.

During playback, modify the Conductor setting for [Script Pacing](#) to allow the database to process each new business transaction.

The following example shows a modified OFS transaction loop:

New position of the BEGIN_TRANSACTION statement

```

/*
NewSales
*/

DO_SLEEP(13);
ofsEdit( "ORDER_SOLD_TO_0", 562, OFS_ADD, 131, "B" );
ofsSetSelection( "ORDER_SOLD_TO_0", 562, OFS_ADD, 195, 1, 1);
ofsSetCursorPosition( "ORDER_SOLD_TO_0", 562, OFS_ENDMSG, 193, "1" );
ofsIndexKey( "ORDER_SOLD_TO_0", 562, OFS_ENDMSG, 175, 97, 0);

DO_SLEEP(6);
ofsSendRecv(1); //ClientSeqNo=31|MsgCount=2|1093981339.921
BEGIN_TRANSACTION();

ofsEdit( "ORDER_SOLD_TO_0", 562, OFS_ADD, 131, "Business World" );
ofsSetSelection( "ORDER_SOLD_TO_0", 562, OFS_ADD, 195, 14, 14);
ofsSetCursorPosition( "ORDER_SOLD_TO_0", 562, OFS_ENDMSG, 193, "14" );
ofsRemoveFocus( "ORDER_SOLD_TO_0", 562, OFS_ENDMSG, 174 );
ofsSetSelection( "ORDER_CUSTOMER_NUMBER_0", 564, OFS_ADD, 195, 0, 0);
ofsSetCursorPosition( "ORDER_CUSTOMER_NUMBER_0", 564, OFS_ENDMSG, 193, "0" );
ofsFocus( "ORDER_CUSTOMER_NUMBER_0", 564, OFS_ENDMSG, 174 );

```

Using the Player, Script Development Workbench, and Analyze

```
DO_SLEEP(6);
ofsSendRecv(1); //ClientSeqNo=32|MsgCount=4|1093981347.296
```

New position of the END_TRANSACTION statement

```
/*
EndTrans
*/

DO_SLEEP(39);
ofsSendRecv(1); //ClientSeqNo=61|MsgCount=4|1093981458.031

ofsSetCursorPosition( "ORDER_SOLD_TO_0", 562, OFS_ENDMSG, 193, "14" );
ofsSelectMenuItem( "Sales Orders", 257, OFS_ENDMSG, 477, "MENU_11059" );

DO_SLEEP(26);
ofsSendRecv(1); //ClientSeqNo=62|MsgCount=2|1093981485.265

ofsEdit( "ORDER_SOLD_TO_0", 562, OFS_ADD, 131, "B" );
ofsSetSelection( "ORDER_SOLD_TO_0", 562, OFS_ADD, 195, 1, 1);
ofsSetCursorPosition( "ORDER_SOLD_TO_0", 562, OFS_ENDMSG, 193, "1" );
ofsIndexKey( "ORDER_SOLD_TO_0", 562, OFS_ENDMSG, 175, 97, 0);

DO_SLEEP(3);
ofsSendRecv(1); //ClientSeqNo=63|MsgCount=2|1093981488.437
END_TRANSACTION();

ofsEdit( "ORDER_SOLD_TO_0", 562, OFS_ADD, 131, "Business World" );
ofsSetSelection( "ORDER_SOLD_TO_0", 562, OFS_ADD, 195, 14, 14);
ofsSetCursorPosition( "ORDER_SOLD_TO_0", 562, OFS_ENDMSG, 193, "14" );
ofsIndexKey( "ORDER_SOLD_TO_0", 562, OFS_ENDMSG, 176, 10, 0);

DO_SLEEP(13);
ofsSendRecv(1); //ClientSeqNo=64|MsgCount=2|1093981502.640
```



Tips:

During capture, the OFS configuration parameter "record=names" must be enabled to produce control names that may be included in the converted script. Control names persist throughout the Forms session, unlike control IDs, whose values may change at runtime. Add the "record=names" parameter in the `Formsweb.cfg` file or add this parameter to the startup servlet URL.

Control IDs can create problems when the transaction loop is moved. Some of the control IDs that have been instantiated by the server prior to the new transaction loop lose context during iterations of the new loop. For example, in a second loop iteration, the server assumes that these client controls are new, generates new control IDs, and eventually cannot find the proper context. Then the server stops responding. If control names are used, Forms objects that have been instantiated before the new transaction loop are maintained through all iterations of the loop because the control name persists throughout the application session.

During playback, ensure that the sleep factor is at 100% and that the transaction pacing is set to a large enough value for the server to process the business transaction that is contained in the new loop. These options can be set using the [Script Properties panel](#) of the Conductor's Visual Designer.

OFS Script Samples

Oracle Forms Server Script Samples

You can address specific situations or resolve certain problems by modifying converted Oracle Forms Server (OFS) scripts. The samples shown here include a description of the problem, the procedure for implementing the modification, and samples of a modified script. Script modifications are discussed for:

[Parameterization of Login Credentials](#)

[Changing Accessibility Options in Oracle EBS-12](#)

Modifying the OFS Script to Parameterize Logon Credentials

If your load testing environment for Oracle Forms Server prevents a user from being logged in multiple times concurrently, you may need to [parameterize](#) the logon information. This means creating unique values for the username and password of each virtual user (VU) and transaction.

To script parameters for logon information:

1. Create a datapool that contains user names and passwords for the system you are testing.
2. Modify the script to open the datapool, read the username and password from the datapool, and use the values in the `ofsSetLogonUserName()` and `ofsSetLogonPassWord()` script commands.

Conclusion

The [sample script](#) illustrates the parameterization of logon credentials.

Changing the Accessibility Option in Oracle EBS-12

When recording EBS-12, the login page appears with the default option, None, selected in the Accessibility field. When you capture using Internet Explorer 6 and you select a different Accessibility option (Screen Reader Optimized or Standard Accessibility), a new request is made using JavaScript, to display the login page with the new option selected. You must modify the resulting script in order to successfully login to the environment.

The following procedure shows the necessary modifications when you select the Standard Accessibility option.

To modify the script for alternate Accessibility options:

1. Modify the Accessibility parameter in POST data in the initial request for the login page.

```
//Note: Comment out the GET statement that extracts the value for Accessibility option
"None". Add //a GET statement that extracts the value for the Accessibility
options"Standard Accessibility".
//__Extract_Accessibility = Get(REPLY,
//    STRING,
//    name="\Accessibility\"><option selected "
//        "value=\"",
//    "\");
__Extract_Accessibility = Get(REPLY,
    STRING,
    "Screen Reader Optimized</option>"
    "<option value=\"",
    ">Standard Accessibility");
```

2. Modify the `_FORM_SUBMIT_BUTTON` parameter in the initial request for the login page to use a blank string instead of the extracted parameter.

```
// NOTE: Change the value used for the Form Submit Button parameter to
// an empty string, since that is what happened at capture time.
//Set(NEXT_REQUEST_ONLY,
//    POST_DATA,
//    "_FORM_SUBMIT_BUTTON",
//    __FORM_SUBMIT_BU);
Set(NEXT_REQUEST_ONLY,
    POST_DATA,
    "_FORM_SUBMIT_BUTTON",
    "");
```

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3. Select the new Accessibility option and comment out the GET command for the Accessibility parameter in the second POST request for the login page so that the previously extracted value is used.

```
// NOTE: Comment out the Get for Accessibility. The value extracted
// previously can be used here.
//__Extract_Accessibility = Get(REPLY,
// STRING, // "name=\"Accessibility\"><option selected "
// "value=\"", "\"");
```

The [sample script](#) shows a complete script with the necessary modifications made.

Sample: Parameterization of OFS Logon Credentials

The following is a sample script from an Oracle Forms Server Session that tests Oracle 10g Application Server and uses a central datapool to ensure that username and passwords are unique. The code necessary to parameterize the username and password is in bold.

Sample Script

```
/*
 * sample_parameterization.cpp
 *
 * Script Converted on July 06, 2007 at 11:14:51 AM
 * Generated by Compuware QALoad convert module version 5.6.0 build 95
 * Generated From: C:\Program Files\Compuware\QALoad\Middlewares\Oracle Forms
Server\Captures\sample_parameterization.cap
 *
 * This script contains support for the following middlewares:
 * - Oracle Forms Server
 */
/* Converted using the following options:
 * General:
 * Line Split : 80 characters
 * Sleep Seconds : 1
 * Auto Checkpoints : No
 * Oracle Forms Server
 * Stop for server error messages : Yes
 * Stop if server msg is matched : No
 */
#define SCRIPT_VER 0x00000605UL
#include <stdio.h>
extern "C" {
#include "smacro.h"
#include "do_OFS.h"
}
/* set function to call on abort*/
void abort_function(PLAYER_INFO *s_info);
#ifdef NULL
#define NULL 0
#endif
extern "C" int rrobot_script(PLAYER_INFO *s_info)
{
/* Declare Variables */

//-----
// Pointers to use for username and password values
// returned from VARDATA().
//-----
char *username = NULL;
char *password = NULL;

SET_ABORT_FUNCTION(abort_function);
```

```

DEFINE_TRANS_TYPE("sample_parameterization.cpp");

ofsSetRunOptions(FORMS_OAS, OFS_HTTP, 0, OFS_CHECKMSGS);

SYNCHRONIZE();
BEGIN_TRANSACTION();

//-----
// Request QALoad Conductor to send the next
// datapool record to the script.
//-----

GET_DATA();

ofsHTTPSetHdrProperty("User-Agent", "Java1.3.1.22-internal"
);
ofsHTTPSetHdrProperty("Host", "hostname.com"
);
ofsHTTPSetHdrProperty("Accept", "text/html, image/gif, image/jpeg, *; q=.2, */*; "
"q=.2"
);
ofsHTTPSetHdrProperty("Connection", "Keep-alive"
);
ofsHTTPConnectToFormsServlet("http://hostname.com/forms/frmservlet?acceptLanguage="
"en-us&ifcmd=startsession");

ofsHTTPSetListenerServletParms( "ifcmd=getinfo&ifhost=test32d11&ifip="
"10.10.10.10");

ofsHTTPConnectToListenerServlet("http://hostname.com/forms/lervlet"
);

DO_SLEEP(1);
ofsHTTPSetHdrProperty("Content-type", "application/octet-stream"
);
ofsHTTPInitialFormsConnect();

DO_SLEEP(1);
ofsSetInitialVersion("RUNFORM", 1, OFS_ADD, 268, "1012000");

ofsSetScreenResolution("RUNFORM", 1, OFS_ADD, 263, 96, 96);

ofsSetDisplaySize("RUNFORM", 1, OFS_ADD, 264, 1600, 1200);

ofsInitSessionCmdLine("RUNFORM", 1, OFS_ADD, 265,
"server escapeParams=true module=test1.fmx userid= sso_userid=%20 sso_formsid="
"f"
"ormsApp.hostname.com_E11FD4617E1A11CBFAFA485E1AE302DEE sso"
"_subDN= sso_usrDN= debug=no host= port= buffer_records=no debug_messages=no arr"
"ay=no obr=no query_only=no quiet=yes render=no record= tracegroup= log= term="
);

ofsSetColorDepth("RUNFORM", 1, OFS_ADD, 266, "256");

ofsColorAdd("RUNFORM", 1, OFS_ADD, 284, "0");

ofsColorAdd("RUNFORM", 1, OFS_ADD, 284, "255");

ofsColorAdd("RUNFORM", 1, OFS_ADD, 284, "65535");

ofsColorAdd("RUNFORM", 1, OFS_ADD, 284, "4210752");

ofsColorAdd("RUNFORM", 1, OFS_ADD, 284, "8421504");

```

Using the Player, Script Development Workbench, and Analyze

```
ofsColorAdd("RUNFORM", 1, OFS_ADD, 284, "65280");
ofsColorAdd("RUNFORM", 1, OFS_ADD, 284, "12632256");
ofsColorAdd("RUNFORM", 1, OFS_ADD, 284, "16711935");
ofsColorAdd("RUNFORM", 1, OFS_ADD, 284, "16762880");
ofsColorAdd("RUNFORM", 1, OFS_ADD, 284, "16756655");
ofsColorAdd("RUNFORM", 1, OFS_ADD, 284, "16711680");
ofsColorAdd("RUNFORM", 1, OFS_ADD, 284, "16777215");
ofsColorAdd("RUNFORM", 1, OFS_ADD, 284, "16776960");
ofsSetFontName("RUNFORM", 1, OFS_ADD, 383, "Dialog");
ofsSetFontSize("RUNFORM", 1, OFS_ADD, 377, "900");
ofsSetFontStyle("RUNFORM", 1, OFS_ADD, 378, "0");
ofsSetFontWeight("RUNFORM", 1, OFS_ADD, 379, "0");
ofsSetScaleInfo("RUNFORM", 1, OFS_ADD, 267, 8, 20);
ofsSetNoRequiredVAList("RUNFORM", 1, OFS_ADD, 291);
ofsInitSessionTimeZone("RUNFORM", 1, OFS_ENDMSG, 530, "America/New_York");
ofsSendRecv(1); //ClientSeqNo=1|MsgCount=1|1183734844.209
ofsWindowCreated(15, "WINDOW_START_APP");
ofsWindowCreated(20, "WINDOW_MAIN");

DO_SLEEP(2);
ofsSetWindowLocation("FORMWINDOW", 6, OFS_ENDMSG, 135, 0, 0);
ofsSetWindowSize("FORMWINDOW", 6, OFS_ENDMSG, 137, 750, 600);
ofsSetWindowSize("FORMWINDOW", 6, OFS_ENDMSG, 137, 750, 600);
ofsSendRecv(1); //ClientSeqNo=2|MsgCount=3|1183734846.053
ofsSetWindowSize("FORMWINDOW", 6, OFS_ENDMSG, 137, 750, 600);
ofsSendRecv(1); //ClientSeqNo=3|MsgCount=1|1183734846.084

DO_SLEEP(9);

//-----
// Get values from the datapool. Column 1 contains
// the username and column 2 the password.
//-----
username = VARDATA(1);
password = VARDATA(2);

RR_printf("username=\"%s\"", username);
RR_printf("password=\"%s\"", password);

//-----
// Pass the username and password retrieved from
// the datapool into the OFS script commands that
```

```

// specify the login credentials.
//-----

ofsSetLogonUserName("Logon", 42, OFS_ADD, 433, username);

ofsSetLogonPassWord("Logon", 42, OFS_ADD, 434, password);

// ofsSetLogonUserName("Logon", 42, OFS_ADD, 433, "scott");

// ofsSetLogonPassWord("Logon", 42, OFS_ADD, 434, "tiger");
ofsSetLogonDatabase("Logon", 42, OFS_ENDMSG, 435, "asil0g");

ofsSendRecv(1); //ClientSeqNo=4|MsgCount=1|1183734854.631

ofsActivateWindow("WINDOW_START_APP", 15, OFS_ENDMSG, 247);

ofsFocus("BUTTON", 60, OFS_ENDMSG, 174);

ofsSendRecv(1); //ClientSeqNo=5|MsgCount=2|1183734854.881

ofsSetWindowSize("FORMWINDOW", 6, OFS_ENDMSG, 137, 750, 600);

ofsSendRecv(1); //ClientSeqNo=6|MsgCount=1|1183734854.912

ofsShowWindow("WINDOW_START_APP", 15, OFS_ENDMSG, 173);

ofsSendRecv(1); //ClientSeqNo=7|MsgCount=1|1183734854.943

DO_SLEEP(2);
ofsRemoveFocus("BUTTON", 60, OFS_ENDMSG, 174);

ofsFocus("BUTTON", 61, OFS_ENDMSG, 174);

ofsSendRecv(1); //ClientSeqNo=8|MsgCount=2|1183734856.834

ofsClickButton("BUTTON", 61, OFS_ENDMSG, 325);

ofsSendRecv(1); //ClientSeqNo=9|MsgCount=1|1183734856.928

DO_SLEEP(1);
ofsHTTPDisconnect();

RESTART_TRANSACTION_BOTTOM(); // do not modify this statement

Clear (ALL_COOKIES);
Clear (CACHE);
Clear (CONNECTION);
Clear (REFERER);
Clear (BASIC_AUTH_FLAG);
Clear (PROXY_AUTH_FLAG);

END_TRANSACTION();

EXIT();
return(0);
}
void abort_function(PLAYER_INFO *s_info)
{
RR_printf("Virtual User ABORTED.");
EXIT();
}
}
ofsSetLogonPassWord()

```

Using the Player, Script Development Workbench, and Analyze

SAP

Overview of SAP

Use QALoad's SAP middleware to load test systems that run SAP 6.20, 6.40, and 7.10.

What is SAP?

The SAP GUI front-end is a middleware that allows users to access SAP servers from Windows. The SAP servers run various SAP business applications, such as applications for customer relationship management, human resources, and supply chain management.

Connecting to the SAP Server

Once you have connected to a machine that is running the SAP server, you can log on and interact with the SAP applications.

Performance issues with SAP or Citrix scripts

If you experience performance issues with SAP or Citrix scripts, increase your system paging file size to a fixed size of at least four times the amount of RAM on the machine.

Compiler Errors with SAP Scripts

If you receive a type mismatch error when compiling an SAP script, you must remove the quotation marks around the last parameter of the affected command. For example:

```
error C2664: '<FuncName>' : cannot convert parameter n from 'char [n]' to 'long'
```

This compiler error, which can occur in commands that manipulate column widths, indicates a data type error and can be corrected by removing the quotation marks around the last parameter.

The following example shows the lines in a script that could cause an error, and the corrected version of the same lines:

Script that produces the error:

```
SAPGuiPropIdStr("wnd[0]/shellcont[1]/shell");  
SAPGuiCmd2(GuiCtrlTree, SetColumnWidth, "REPNAME", "218");
```

Corrected script:

```
SAPGuiPropIdStr("wnd[0]/shellcont[1]/shell");  
SAPGuiCmd2(GuiCtrlTree, SetColumnWidth, "REPNAME", 218);
```

Linking Errors During Validation or Compilation of SAP Scripts

When you re-record SAP scripts, you must click Build SAP Libraries on the [SAP Convert Options](#) dialog box. This button generates new libraries based on the version of SAP that is currently installed. If you have upgraded to a newer version of SAP and do not update the libraries, you may experience various linking errors during validation or compilation.

SAP Script Validation Fails

If your SAP script fails during validation it perform any of the following procedures to resolve the problem.

Disable Automatic Proxy Configuration in Internet Explorer

To disable automatic proxy configuration:

You may need to disable automatic proxy configuration in Internet Explorer.

1. In Internet Explorer, click **Tools>Internet Options**.
2. On the **Connections** tab, click **LAN Settings**.
3. Ensure that the **Use automatic configuration script** check box is cleared.

Increase the Script Execution Timeout Value

To increase the timeout value:

If disabling the automatic proxy configuration does not solve the problem, consider increasing the script execution timeout value to 100 seconds or to the length of the capture file (in seconds), whichever is greater.

1. With an SAP session open in the Script Development Workbench, click **Options>Workbench**.
2. On the **Script Validation** tab, type the new value in the **Wait up to** field.
3. Click **OK**.

Do Not Minimize the SAP Window

To maximize the SAP window:

During validation of SAP scripts, do not minimize the SAP window. If the window is minimized, the validation may fail. This problem does not occur if you do the following:

1. In Conductor, select the script icon to display the Script Properties panel on the right-hand side of the Visual Designer window.
2. In the Middleware Options area, click the arrow in the **Hide Citrix/SAP GUI** field, and select **True**.

Configuring an SAP Client for Load Testing

Before you can record an SAP session, you must have an SAP client that is configured to enable QALoad to access the SAP server. Configure the SAP client through the SAP Logon application.

To configure an SAP client for load testing:

1. Start the SAP Logon application. From the taskbar, click **Start>Programs>SAP Front End>SAPlogon**.
2. Click **New...** on the SAP Logon dialog box. The New Entry dialog box appears.



3. Type values in the **Description**, **Application Server**, and **System number** fields.

 **Note:** QALoad uses the value in the Description field to connect to the server.

4. Click **OK**. The new SAP server entry appears in the list in the SAP Logon dialog box.

SAP Recording Options

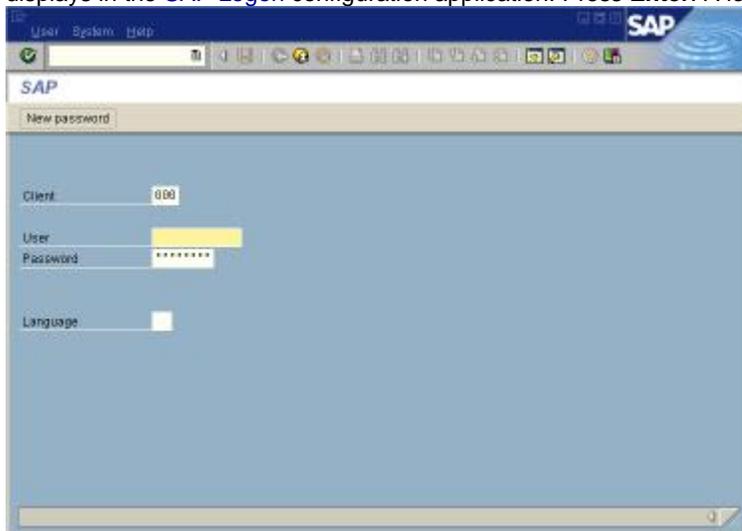
Save Server Description: Select to specify and save the server description (name) to which you want to connect during recording. If this check box is not selected, you are prompted for a server description during the log on process.

Recording an SAP Session

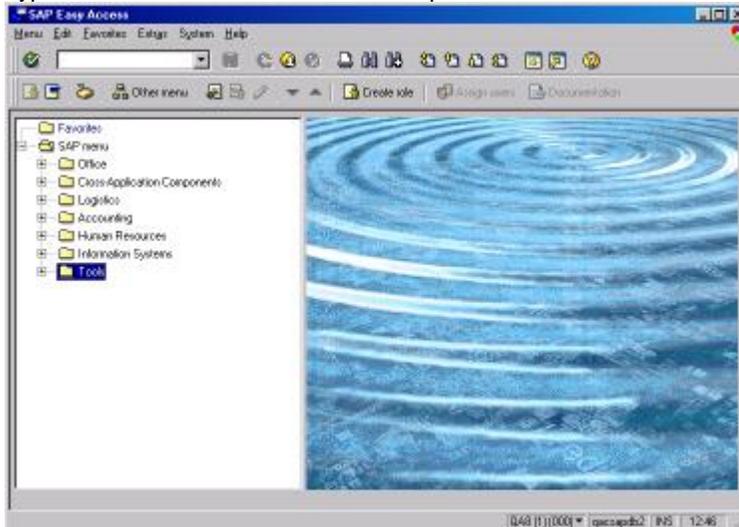
An SAP server connection must be configured before you can connect with QALoad. See [Configuring an SAP Client for Load Testing](#) for more information. Additionally, your SAP administrator must set the `SAPGUI/User_Scripting` security profile parameter to TRUE to successfully record a script. For more information about SAP security settings, refer to the SAP publication titled "Sapgui Scripting Security".

To record an SAP session:

1. If you have not already chosen SAP as the session type, click **SAP Session** to activate a new SAP session.
2. In the Script Development Workbench, click **Record** on the Session toolbar.
3. If you have not selected the [Save Server Description Record option](#), the SAP Server Description dialog box appears. Type the name of the SAP server to which you want to connect. This value is the same as the **Description** field that displays in the [SAP Logon](#) configuration application. Press **Enter**. A logon dialog box appears.



4. Type a user ID in the **User** field and the password in the **Password** field. Press **Enter**. The SAP application starts.



5. In the SAP application, turn off the scripting and notification options. Click **Customizing of local layout** and choose **Options**. The Options dialog box appears. On the Scripting tab, select **Enable Scripting** and clear the two **Notify** check boxes.
6. Begin recording actions in SAP.

SAP Convert Options

Save Password: Select to save the encrypted password. If this check box is not selected, you are prompted for a password during conversion.

VB Script: Select to generate Visual Basic Script for debugging outside QALoad. If this option is not selected, you receive C++ scripts that can be used for playback within QALoad.

Insert SAP control comments: Select one of the following to insert SAP control lists as comments in your script.

- ! **None:** There is no control information shown as a comment in the script.
- ! **Textfields and Statusbars:** Control types GuiTextField or GuiStatusbar will be in the script as comments with information: type, name, and id string.
- ! **All controls:** All controls will be in the script as comments with information: type, name, and id string.

Build SAP Libraries: Click Build to generate the QALoad SAP libraries based on your version of SAP. If you receive [linking errors while validating or compiling](#), you should click this button.

SAP Command Reference

QALoad provides descriptions and examples of the various commands available for an SAP script. For details, refer to [SAP Language Reference Commands](#).

Viewing the SAP Control Log

Assist your scripting by using the SAP capture control log file to view the information that was present at capture. The log file is in XML format.

To open the control log:

1. In the Script Development Workbench Workspace, click the **Captures** tab or the **Scripts** tab, then right-click on an SAP script or capture file.

OR

Open an SAP script or capture file, then right-click on the open file.

2. From the right-click menu, choose **View Control Log**.

[Overview: Handling SAPGuiCheckScreen Errors](#)

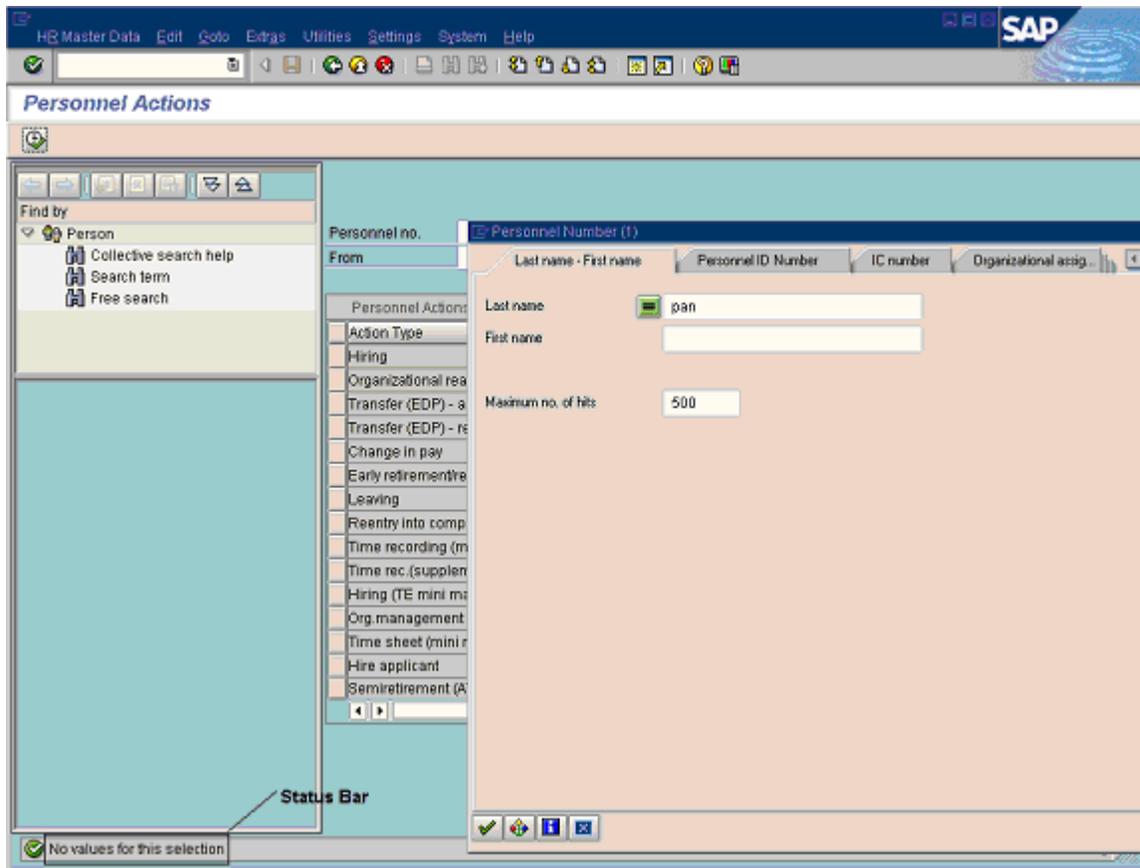
The SAP screen returned from the SAP server during playback can differ from the screen status of the session during record. The [SAPGuiCheckScreen](#) call returns a Boolean value that indicates whether the screen status is expected or unexpected. By checking the status returned from this call, you can build more extensive error handling capability into the script.

Create custom error handling code by placing the [SAPGuiCheckScreen](#) call within an `IF` conditional that checks the return value, then writing custom error handling code for the functions that fail within that conditional block.

The [sample script](#) shows the code for creating error code blocks to use with checking the status of a returned SAP screen.

[Overview: Checking the Status Bar](#)

The SAP status bar displays error and status messages. When running an SAP script, you can check the status bar to determine whether the script is executing properly.



Conclusion

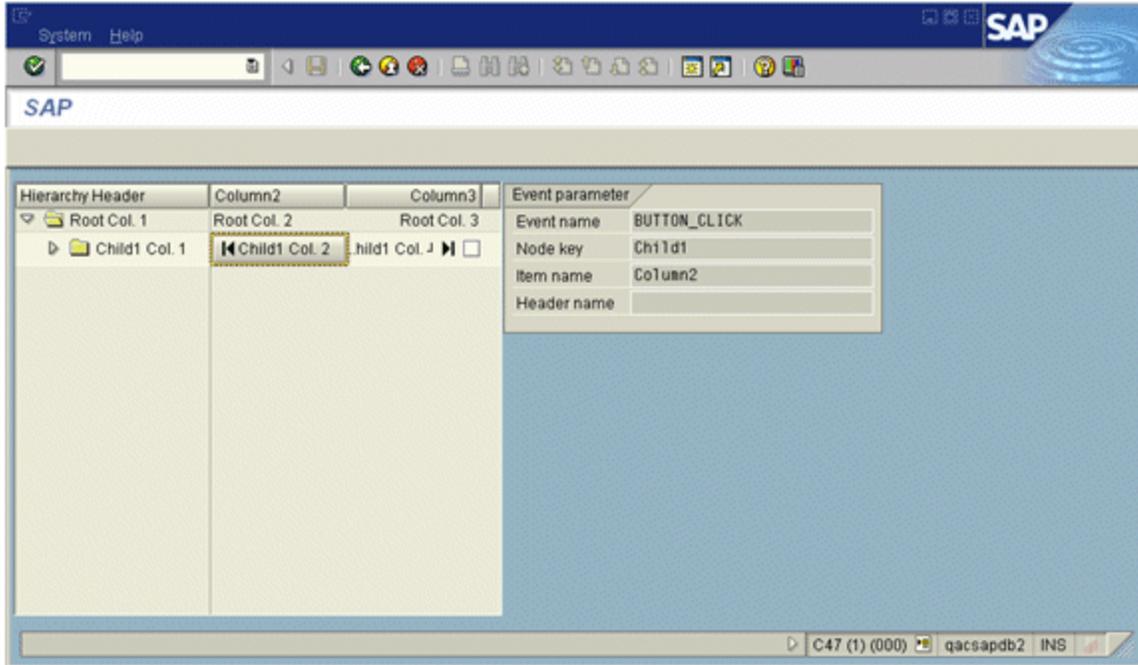
Use the [SAPGuiCheckStatusbar](#) command to test for certain status responses in the SAP environment and take actions based on messages returned from the SAP server. The [sample script](#) illustrates this procedure.

Overview: Extracting a String from a SAP Control

When running an SAP script, you may want to get the control's text.

For example, in the following screen, after Child1 Col. 2 is selected, the right table is filled in with data by the SAP server. You can use the information as needed.

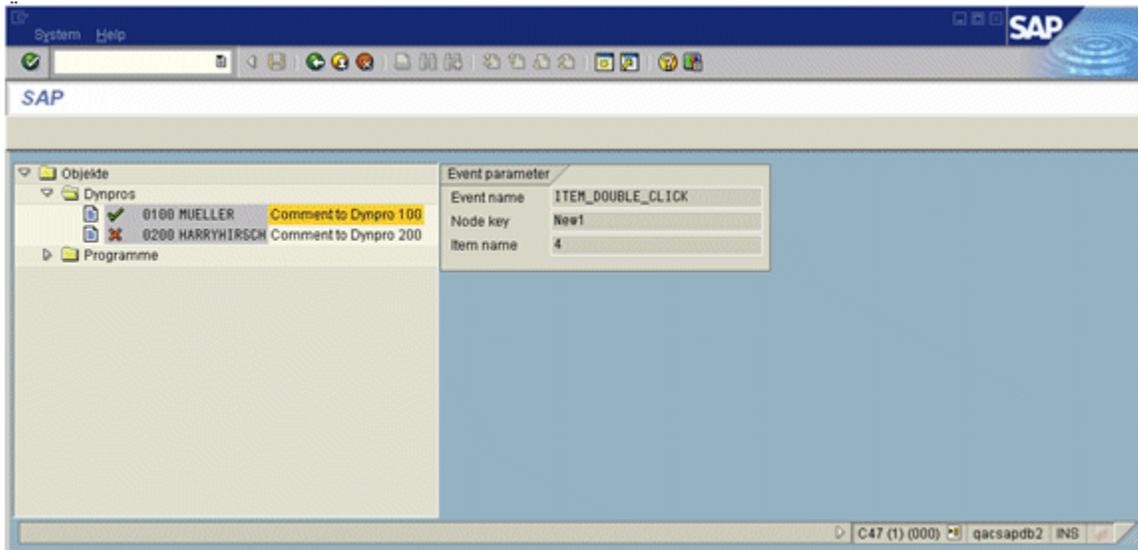
Using the Player, Script Development Workbench, and Analyze



Use the [SAPGuiGetControlText](#) command to extract data from a SAP server returned control. The [sample script](#) illustrates this procedure.

Overview: Extracting a Unique String from a SAP Control

When running an SAP script, you may want to get the unique string from the control's text between two strings.



Use the [SAPGuiGetUniqueString](#) command to extract data from an SAP server returned control that occurs between the left and right input strings. The [sample script](#) illustrates this procedure.

Modifying the Script for Multiple Logons

Load testing requirements for SAP may include allowing for multiple logons in a script session. When you incorporate multiple logon functionality for an SAP script, you must add a code block to the script to see if the multiple logon option is available, and whether the user has selected the radio button that allows concurrent connections from the same user.

To modify a script to handle multiple logons:

1. Find the following line of code in a script you just captured.

 **Tip:** This line of code should be near the top of the script after the logon commands.

```
SAPGuiCheckScreen("S000", "SAPMSYST", "SAP");
```

2. After this line of code, add the following code block. This shows whether the multiple logon option is available and if the user has pressed the Allow Concurrent Connections from the Same User radio button on the SAP logon screen.

```
SAPGuiPropIdStrExists("wnd[1]/usr/radMULTI_LOGON_OPT2");
```

```
DO_SLEEP(20);
```

```
SAPGuiCmd0(GuiRadioButton, Select);
```

```
SAPGuiCmd0(GuiRadioButton, SetFocus);
```

```
SAPGuiPropIdStr("wnd[1]/tbar[0]/btn[0]");
```

```
SAPGuiCmd0(GuiButton, Press);
```

```
SAPGuiCheckScreen("S000", "SAPMSYST", "License Information for Multiple Logon");
```

```
SAPGuiPropIdStrExistsEnd("wnd[1]/usr/radMULTI_LOGON_OPT2");
```

```
SAPGuiPropIdStr("wnd[0]"); // sets focus back to wind[0]
```

This code acts like an If conditional that is not in a control loop. It can be stated as follows:

- ```
! IF the multi-logon screen appears, select radio button option 2. In this code snippet, radio button
! 2 tells the server to allow concurrent connections from the same user.
! THEN check to make certain the script is synced to the "License Information for Multiple Logon"
! section.
! ELSE do nothing and continue with the script.
```

### Conclusion

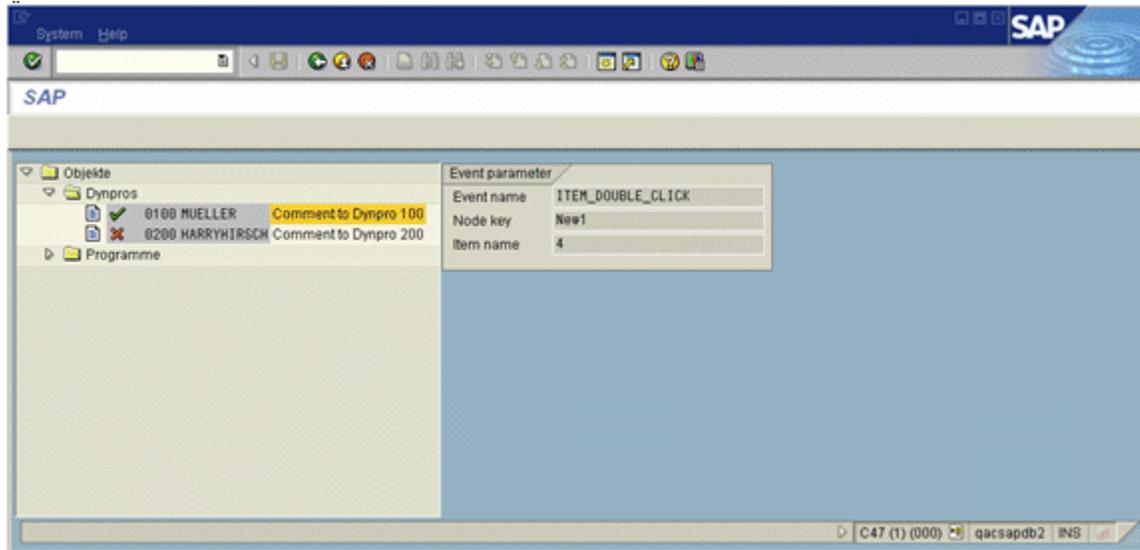
This technique enables support for multiple SAP logon sessions in a script. It asks SAP whether the multi-logon radio button is selected and, if it is, simulates selecting the button during replay. This allows you to run the same script with many virtual users under a single SAP logon ID.

The [sample original script](#) and [sample modified script](#) illustrate this process.

### Overview: Implementing Content Check of a SAP Control

When running an SAP script, you may want to check content of a control's text property.

## Using the Player, Script Development Workbench, and Analyze



### Conclusion

Use the [SAPGuiContentCheck](#) command to compare data from an SAP server returned control with input string based on the comparison options. The [sample script](#) illustrates this procedure.

### Overview: Transaction Restart Commands

If your load testing requirements include supporting transaction restarts, review the following commands and ensure that those required to support transaction restart are present.

 **Note:** These are automatically added during the script conversion process.

### Scripting

Required commands and associated code statements for the SAP script are:

- ! [SAPGuiApplication\(RegisterROT\)](#) - This command sets or resets the SAP runtime object library (ROT). Executing this command ensures the SAP environment is in an initial state at the beginning of the script.
- ! [SAPGuiApplication\(RevokeROT\)](#) - This command clears the SAP runtime object library (ROT). Executing this command ensures the memory SAP environment is de-allocated.
- ! [SAPGui\\_error\\_handler\(s\\_info, buffer\)](#) - When scripting an error code block, be sure to use the [SAPGui\\_error\\_handler](#) command instead of the [RR\\_\\_FailedMsg](#) command if the Transaction Restart option is used.

 **Note:** These functions are required, but additional SAP script commands are also essential to run an SAP script.

### Conclusion

If unexpected playback errors occur when playing back an edited script with Transaction Restart enabled, perform a review of the commands to ensure that those required to support transaction restart are present.

The [sample script](#) shows the commands used in the script.

### Overview: Required SAP Script Commands

Certain commands must be present in an SAP script. These commands are created automatically during the conversion process. Most of the commands are before the [BEGIN\\_TRANSACTION](#) statement. Review this section if you are having unexpected issues after script editing.

 Note: If the SAP script supports transaction restarting, review [Required Commands for Supporting Transaction Restart in SAP](#).

### Required Script Commands

Required commands and associated code statements for the SAP script are:

```
SET_ABORT_FUNCTION(abort function);
DEFINE_TRANS_TYPE("capture.cpp");
HRESULT hr = CoInitialize(0);
if(hr != ERROR_SUCCESS)
 RR_FailedMsg(s_info, "ERROR initializing COM");
SAPGuiSetCheckScreenWildcard('*');
SYNCHRONIZE();
```

 Note: These functions are required, but additional SAP API script commands are also essential to run an SAP script.

### Conclusion

When encountering unexpected compiler errors after script editing, review the script to ensure all required commands are present. This might reveal a problem created by the script edits, especially when moving the transaction loop. You must take care when doing extensive script editing not to accidentally remove critical commands. Recording the transaction again and doing a windiff comparison can also help when unexpected compiler errors occur.

The [sample script](#) shows the statements used in the script.

### Modifying the Script to Retrieve SAP Counter Data

SAP scripts can retrieve customer counter information for each virtual user. By inserting code snippets that use the SAPGui scripting API into the SAP script, you can obtain and save SAP server information.

#### To modify the script to retrieve SAP counter data:

1. Declare and initialize the counter identification (ID) variables using the **int** data type. You should declare a variable for each counter value to be extracted. The `DEFINE_COUNTER` macro initializes the declared counter identifier variable and creates a holder for the value in the timing file.
2. Declare and initialize the variable to hold the actual SAP counter value. You should declare the variable using a datatype that can hold any expected value for the counter. Usually a long is appropriate.
3. Retrieve the counter information from the SAP server using the `SAPGuiSessionInfo` command. The value is placed in the variable you created in Step 2. The first parameter is the SAP property object corresponding to the counter. The second parameter is the variable to hold the value.
4. Save the counter value to the timing file. The `COUNTER_VALUE` macro command extracts the value from the server. The value is extracted to the variable created in Step 2. It is stored in the timing file using the associated ID created in Step 1.

### Conclusion

Following these techniques, you can obtain customer counter information from the SAP server, save it to the virtual user's timing file, and view it in Analyze. The [sample original script](#) and [sample modified script](#) illustrate this modification.

### Adding Custom Counters to Retrieve Server Information

The following example adds custom counters to obtain and save the SAP Server information that is available through the SAP Gui Scripting API. Notice that `SAPGuiSessionInfo` is called before logging off, because the data is not available after logging off.

```
int id1, id2, id3, id4;
long lRoundTrips,lFlushes;
// "Counter Group", "Counter Name", "Counter Units
// (Optional)", Data Type, Counter Type.
id1 = DEFINE_COUNTER("Cumulative Group", "Cumulative RoundTrips", 0, DATA_LONG,
COUNTER_CUMULATIVE);
id2 = DEFINE_COUNTER("Cumulative Group", "Cumulative Flushes", 0, DATA_LONG,
COUNTER_CUMULATIVE);
id3 = DEFINE_COUNTER("Instance Group", "Instance RoundTrips", 0, DATA_LONG,
COUNTER_INSTANCE);
id4 = DEFINE_COUNTER("Instance Group", "Instance Flushes", 0, DATA_LONG, COUNTER_INSTANCE);
SYNCHRONIZE();
BEGIN_TRANSACTION();
try{
 SAPGuiConnect(s_info,"qacsapdb2");
 ...
 SAPGuiSessionInfo(GetRoundTrips,lRoundTrips);
 SAPGuiSessionInfo(GetFlushes,lFlushes);
 SAPGuiPropIdStr("wnd[1]/usr/btnSPOP-OPTION1");
 SAPGuiCmd0(GuiButton,Press);
 SAPGuiCheckScreen("SESSION_MANAGER", "SAPLSP01", "Log Off");

 COUNTER_VALUE(id1,lRoundTrips);
 COUNTER_VALUE(id2,lFlushes);
 COUNTER_VALUE(id3,lRoundTrips);
 COUNTER_VALUE(id4,lFlushes);
} // end try
catch (_com_error e){
 char buffer[1024];
 sprintf(buffer,"SAP: EXCEPTION 0x%x %s for VU(%i)\n",e.Error(), (char *)e.Description(),
S_task_id);
 RR__FailedMsg(s_info,buffer);
} // end catch
END_TRANSACTION();
```

### Error Handling and Reporting

A try/catch block is automatically generated for the commands between the `BEGIN_TRANSACTION` and `END_TRANSACTION` statements. This construct provides error handling and reporting from the script.

```
BEGIN_TRANSACTION();
try{
 SAPGuiConnect(s_info,"qacsapdb2");
 SAPGuiVerCheckStr("6204.119.32");

 //Set SapApplication = CreateObject("Sapgui.ScripingCtrl.1")
 //SapApplication.OpenConnection ("qacsapdb")
 //Set Session = SapApplication.Children(0).Children(0)

 DO_SLEEP(3);
```

```

SAPGuiPropIdStr("wnd[0]");
SAPGuiCmd3(GuiMainWindow, ResizeWorkingPane, 83, 24, false);

DO_SLEEP(6);

SAPGuiPropIdStr("wnd[0]/usr/txtrsyst-bname");
SAPGuiCmd1(GuiTextField, PutText, "qaload1");

SAPGuiPropIdStr("wnd[0]/usr/pwdrsyst-bcode");
SAPGuiCmd1Pwd(GuiPasswordField, PutText, "~encr~1211616261");

SAPGuiCmd0(GuiPasswordField, SetFocus);
SAPGuiCmd1(GuiPasswordField, PutCaretPosition, 3);

SAPGuiPropIdStr("wnd[0]");
SAPGuiCmd1(GuiMainWindow, SendVKey, 0);
SAPGuiCheckScreen("S000", "SAPMSYST", "SAP");

...

DO_SLEEP(10);

SAPGuiPropIdStr("wnd[0]/usr/cntlimage_container/shellcont/shell/shellcont[0]/shell");
SAPGuiCmd1(GuiCtrlTree, ExpandNode, "0000000003");
SAPGuiCmd1(GuiCtrlTree, PutSelectedNode, "0000000004");
SAPGuiCmd1(GuiCtrlTree, PutTopNode, "Favo");
SAPGuiCmd1(GuiCtrlTree, DoubleClickNode, "0000000004");
SAPGuiCheckScreen("SESSION_MANAGER", "SAPLSMTR_NAVIGATION", "SAP Easy Access");
SAPGuiPropIdStr("wnd[1]/usr/btnspop-option1");
SAPGuiCmd0(GuiButton, Press);
SAPGuiCheckScreen("SESSION_MANAGER", "SAPLSP01", "Log Off");
} // end try

catch (_com_error e){
 char buffer[1024];
 sprintf (buffer, " EXCEPTION 0x%x %s for VU(%i)\n", e.Error(),
 (char *)e.Description(), S_task_id);
 RR__FailedMsg(s_info, buffer);
} // end catch

END_TRANSACTION();

```

To include the log on within the transaction loop, move the `SAPGuiConnect` call inside the try block as shown in the following example:

```

SET_ABORT_FUNCTION(abort_function);
DEFINE_TRANS_TYPE("capture.cpp");
RESULT hr = CoInitialize(0);

if(hr != ERROR_SUCCESS)
 RR__FailedMsg(s_info, "ERROR initializing COM");

SAPGuiSetCheckScreenWildcard('*');

SYNCHRONIZE();

BEGIN_TRANSACTION();

try{
 SAPGuiConnect(s_info, "qacsapdb2");
 SAPGuiVerCheckStr("6204.119.32");
 ...
 SAPGuiPropIdStr("wnd[1]/usr/btnspop-option1");
 SAPGuiCmd0(GuiButton, Press);
 SAPGuiCheckScreen("SESSION_MANAGER", "SAPLSP01", "Log Off");
} // end try

catch (_com_error e){

```

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```
char buffer[1024];
sprintf(buffer, " EXCEPTION 0x%x %s for VU(%i)\n",e.Error(),
 (char *)e.Description(), S_task_id);
RR__FailedMsg(s_info,buffer);
} // end catch
END_TRANSACTION();
```

To include the log on outside the transaction loop, move the log off section so that it follows the `END_TRANSACTION` statement. However, ensure that the recording within the transaction loop begins and ends in the same location in the menu system. For example:

```
SET_ABORT_FUNCTION(abort_function);
DEFINE_TRANS_TYPE("capture.cpp");
HRESULT hr = CoInitialize(0);
if(hr != ERROR_SUCCESS)
 RR__FailedMsg(s_info,"ERROR initializing COM");
SAPGuiSetCheckScreenWildcard('*');
SYNCHRONIZE();
SAPGuiConnect(s_info,"qacsapdb2");
SAPGuiPropIdStr("wnd[0]/usr/txtRSYST-BNAME");
SAPGuiCmdl(GuiTextField,PutText,"qaload1");
SAPGuiPropIdStr("wnd[0]/usr/pwdRSYST-BCODE");
SAPGuiCmdlPwd(GuiPasswordField,PutText,"~encr~1211616261");
SAPGuiCmd0(GuiPasswordField,SetFocus);
SAPGuiCmdl(GuiPasswordField,PutCaretPosition,3);
SAPGuiPropIdStr("wnd[0]");
SAPGuiCmdl(GuiMainWindow,SendVKey,0);
SAPGuiCheckScreen("S000","SAPMSYST","SAP");
BEGIN_TRANSACTION();
try{
 SAPGuiVerCheckStr("6204.119.32");
 ...
} // end try
catch (_com_error e){
 char buffer[1024];
 sprintf(buffer, " EXCEPTION 0x%x %s for VU(%i)\n",e.Error(),
 (char *)e.Description(), S_task_id);
 RR__FailedMsg(s_info,buffer);
} // end catch
END_TRANSACTION();
SAPGuiPropIdStr("wnd[1]/usr/btnSPOP-OPTION1");
SAPGuiCmd0(GuiButton,Press);
SAPGuiCheckScreen("SESSION_MANAGER","SAPLSPO1","Log Off");
```

### Object Life Span

Whenever a script is run, all objects on the SAP GUI window are deleted and re-created. These objects, which are created in the SAP environment and can disappear without user interaction, can cause script failure if the script references the objects after they have disappeared.

For more troubleshooting information, refer to SAP's publication titled "SAP GUI Scripting API for the Windows and Java Platforms".

## SAP Script Samples

### Sample: SAP Script with SAPGuiCheckScreen Error Handler

The following shows an SAP script snippet with SAPGuiCheckScreen Error Handler. Points of interest in the script are highlighted in bold.

#### Sample Script Snippet

..beginning of script..

```
SAPGuiPropIdStr("wnd[0]/usr/subSA_0100_1:SAPLEXAMPLE_ENTRY_SCREEN:0200/subSA_200_1:SAPLEXAMP
LE_ENTRY_SCREEN:0800/cntlCC_HTML_INDEX/shellcont/shell");
SAPGuiCmd3(GuiCtrlHTMLViewer, SapEvent, "", "", "sapevent:FLD_SHORT?FLD");

/// In this small example, if any of the following are FALSE
/// OKCode == "BIBS"
/// screen name == "SAPLEXAMPLE_ENTRY_SCREEN"
/// title == "Style Guide: Dropdown list"
/// ..then the block of error code is processed!

 BOOL bRetSts = SAPGuiCheckScreen (
 "BIBS",
 "SAPLEXAMPLE_ENTRY_SCREEN",
 "Style Guide: Dropdown list");

 if (bRetSts != TRUE)
 {
 RR_printf("Style Guide: Dropdown list not found");
 SAPGui_error_handler(s_info, "Error: Style Guide: Dropdown list");
 }

 DO_SLEEP(9);

 SAPGuiCmd3(GuiCtrlHTMLViewer, SapEvent, "", "", "sapevent:PUB_SHORT?PUB");

..end of script..
```

### Sample Script: Checking the SAP Status Bar

The SAPGuiCheckStatusbar command is used in the following script example to test for certain status responses. The code added to check the status bar is shown in bold.

#### Sample Script

```
...
SAPGuiPropIdStr("wnd[0]");//1109615021.466
SAPGuiCmd1(GuiMainWindow, SendVKey, 4);
SAPGuiCheckScreen("PA40", "SAPMP50A", "Personnel Actions"); //1109615021.481

DO_SLEEP(15);

SAPGuiPropIdStr(" "
 "wnd[1]/usr/tabsG_SELONETABSTRIP/tabpTAB001/ssubSUBSCR_PRESEL:SAPLSDH4:0220/sub: "
 "SAPLSDH4:0220/txtG_SELFLD_TAB-LOW[0,24]"); //1109615036.231
SAPGuiCmd1(GuiTextField, PutText, "pan");
SAPGuiCmd1(GuiTextField, PutCaretPosition, 3);
```

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```
SAPGuiPropIdStr("wnd[1]/tbar[0]/btn[0]");//1109615036.246
SAPGuiCmd0(GuiButton,Press);
SAPGuiCheckScreen("PA40","SAPLSDH4","Restrict Value Range");//1109615036.246

// Check to determine if the name we chose is found in db
// If not stop the script should not continue
BOOL bRetSts =
SAPGuiCheckStatusBar("wnd[0]/sbar", "No values for this selection");
if (bRetSts)
{
 RR_printf(" No such last name in Database");
 SAPGui_error_handler(s_info," End Now No such name in Database");
}
...
```

### Sample: Extracting a String from a SAP Control

The following sample script shows the SAP commands required to extract a data string from a returned control in an SAP environment. You can use `SAPGuiGetControlText` to get the content of the Event name textfield. Use convert option `Insert SAP control comments: all controls` to output all controls as comment.

### Sample Script

```
SAPGuiPropIdStr("wnd[0]/usr/cntlTREE_CONTAINER/shellcont/shell"
);//1152817068.134
SAPGuiCmd2(GuiCtrlTree,SelectItem,"Child1","Column2");
SAPGuiCmd2(GuiCtrlTree,EnsureVisibleHorizontalItem,"Child1","Column2");
SAPGuiCmd2(GuiCtrlTree,PressButton,"Child1","Column2");
SAPGuiCheckScreen("DWDM","SAPCOLUMN_TREE_CONTROL_DEMO","SAP");//1152817068.321

// *SAP* GuiMenubar name="mbar" Id="wnd[0]/mbar"
// *SAP* GuiMenu name="System" Id="wnd[0]/mbar/menu[0]"
// *SAP* GuiMenu name="Create Session" Id="wnd[0]/mbar/menu[0]/menu[0]"
// *SAP* GuiMenu name="End Session" Id="wnd[0]/mbar/menu[0]/menu[1]"
// *SAP* GuiMenu name="User Profile" Id="wnd[0]/mbar/menu[0]/menu[2]"
...
// *SAP* GuiLabel name="%#AUTOTEXT004"
Id="wnd[0]/usr/lbl%#AUTOTEXT004"
// *SAP* GuiTextField name="G_EVENT" Id="wnd[0]/usr/txtG_EVENT"
// *SAP* GuiLabel name="%#AUTOTEXT002" Id="wnd[0]/usr/lbl%#AUTOTEXT002"
// *SAP* GuiTextField name="G_NODE_KEY" Id="wnd[0]/usr/txtG_NODE_KEY"
// *SAP* GuiLabel name="%#AUTOTEXT005" Id="wnd[0]/usr/lbl%#AUTOTEXT005"
// *SAP* GuiTextField name="G_ITEM_NAME" Id="wnd[0]/usr/txtG_ITEM_NAME"
// *SAP* GuiLabel name="%#AUTOTEXT006" Id="wnd[0]/usr/lbl%#AUTOTEXT006"
// *SAP* GuiTextField name="G_HEADER_NAME" Id="wnd[0]/usr/txtG_HEADER_NAME"
// *SAP* GuiStatusBar name="sbar" Id="wnd[0]/sbar"
// *SAP* GuiStatusPane name="pane[0]" Id="wnd[0]/sbar/pane[0]"
// *SAP* GuiStatusPane name="pane[1]" Id="wnd[0]/sbar/pane[1]"
// *SAP* GuiStatusPane name="pane[2]" Id="wnd[0]/sbar/pane[2]"
// *SAP* GuiStatusPane name="pane[3]" Id="wnd[0]/sbar/pane[3]"
// *SAP* GuiStatusPane name="pane[4]" Id="wnd[0]/sbar/pane[4]"
// *SAP* GuiStatusPane name="pane[5]" Id="wnd[0]/sbar/pane[5]"
// Check the event name
char * strEvent = SAPGuiGetControlText("wnd[0]/usr/txtG_EVENT", "GuiTextField");
RR_printf(" The Event Name: %s", strEvent);
free(strEvent);
```

### Sample: Extracting a Unique String from a SAP Control

The following sample script shows the SAP commands required to extract a data string from a returned control in an SAP environment. You can use `SAPGuiGetUniqueString` to get the unique string of the Event name text field between `ITEM` and `CLICK`.

Use convert option `Insert SAP control comments: Textfields and Statusbars to output textfield and statusbar as comments in the script.`

### Sample Script

```
SAPGuiPropIdStr("wnd[0]/usr/cntlTREE_CONTAINER/shellcont/shell"
);//1152820409.712
SAPGuiCmd1(GuiCtrlTree,ExpandNode,"Root");
SAPGuiCmd1(GuiCtrlTree,ExpandNode,"Child1");
SAPGuiCmd2(GuiCtrlTree,SelectItem,"New1","4");
SAPGuiCmd2(GuiCtrlTree,EnsureVisibleHorizontalItem,"New1","4");
SAPGuiCmd1(GuiCtrlTree,PutTopNode,"Root");
SAPGuiCmd2(GuiCtrlTree,DoubleClickItem,"New1","4");

SAPGuiCheckScreen("DWDM","SAPTLIST_TREE_CONTROL_DEMO","SAP");//1152820409.915

// *SAP* GuiTextField name="G_EVENT" Id="wnd[0]/usr/txtG_EVENT"
// *SAP* GuiTextField name="G_NODE_KEY" Id="wnd[0]/usr/txtG_NODE_KEY"
// *SAP* GuiTextField name="G_ITEM_NAME" Id="wnd[0]/usr/txtG_ITEM_NAME"
// *SAP* GuiStatusbar name="sbar" Id="wnd[0]/sbar"

DO_SLEEP(5);

// Check the unique string
char* strUniqueString = SAPGuiGetUniqueString("wnd[0]/usr/txtG_EVENT",
"GuiTextField", "ITEM", "CLICK");
RR_printf(" the unique string between ITEM and CLICK is: %s", strUniqueString);
free(strUniqueString);
```

### Sample: Original SAP Script for Multiple Logons

The following sample shows an original script converted from capture. Points of interest in the script are highlighted in bold>.

### Sample Script

```
/*
 * multilogon.cpp
 *
 * Script Converted on July 20, 2004 at 08:43:23 AM
 * Generated by Compuware QALoad convert module version 5.2.0 build 73
 *
 * This script contains support for the following middlewares:
 * - SAP
 */

/* Converted using the following options:
 * General:
 * Line Split : 132 characters
 * Sleep Seconds : 1
 * Constants to Variables : Yes
 * Remove Quotes : No
 * Tabs To Spaces : No
 * Auto Checkpoints : No
 * SAP
 * Version : 6204.119.32
 */
```

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```
#define SCRIPT_VER 0x00000205UL

#include <stdio.h>
#include <windows.h>
#include <atlbase.h>
#include <objbase.h>
#include "do_SAPCCOM.h"
#include <atlwin.h>
#include <atlcom.h>
#include <atlhost.h>
#include "cscript.h"
#include "do_SapGui.h"
#include "mwCommon.h"

extern "C" {
#include "smacro.h"
}

/* set function to call on abort*/
void abort_function(PLAYER_INFO *s_info);

#ifdef NULL
#define NULL 0
#endif

extern "C" int rrobot_script(PLAYER_INFO *s_info)
{
 /* Declare Variables */

 SET_ABORT_FUNCTION(abort_function);

 DEFINE_TRANS_TYPE("capture.cpp");

 HRESULT hr = CoInitialize(0);

 if(hr != ERROR_SUCCESS)
 RR_FailedMsg(s_info,"SAP: ERROR initializing COM");

 SAPGuiSetCheckScreenWildcard('*');

 SYNCHRONIZE();

 BEGIN_TRANSACTION();

 DO_SetTransactionStart();

 try{

 SAPGuiConnect(s_info,"testsap620");

 SAPGuiApplication(RegisterROT);

 SAPGuiVerCheckStr("6204.119.32");

 //Set SapApplication = CreateObject("Sapgui.ScriptingCtrl.1")
 //SapApplication.OpenConnection ("testsap620")
 //Set Session = SapApplication.Children(0).Children(0)

 DO_SLEEP(18);

 SAPGuiPropIdStr("wnd[0]");//1057828784.513
 SAPGuiCmd3(GuiMainWindow,ResizeWorkingPane,92,34,false);

 DO_SLEEP(16);

 SAPGuiPropIdStr("wnd[0]/usr/txtRSYST-BNAME");//1057828800.786
 SAPGuiCmd1(GuiTextField,PutText,"qaload1");
 }
}
```

```

SAPGuiPropIdStr("wnd[0]/usr/pwdRSYST-BCODE");//1057828800.796
SAPGuiCmd1Pwd(GuiPasswordField,PutText,"~encr~0000x_'9d");
SAPGuiCmd0(GuiPasswordField,SetFocus);
SAPGuiCmd1(GuiPasswordField,PutCaretPosition,3);

SAPGuiPropIdStr("wnd[0]");//1057828800.836
SAPGuiCmd1(GuiMainWindow,SendVKey,0);
SAPGuiCheckScreen("S000","SAPMSYST","SAP");//1057828800.856

DO_SLEEP(6);
SAPGuiCmd3(GuiMainWindow,ResizeWorkingPane,92,34,false);

DO_SLEEP(3);

SAPGuiPropIdStr("wnd[0]/tbar[0]/btn[15]");//1057828809.839
SAPGuiCmd0(GuiButton,Press);

/// This is the command to look for. The parameters indicate that this
/// SAP Easy Access session screen.

SAPGuiCheckScreen("SESSION_MANAGER","SAPLSMTR_NAVIGATION","SAP Easy
Access");//1057828809.859

DO_SLEEP(2);

SAPGuiPropIdStr("wnd[1]/usr/btnSPOP-OPTION1");//1057828811.382
SAPGuiCmd0(GuiButton,Press);
SAPGuiCheckScreen("SESSION_MANAGER","SAPLSPO1","Log Off");//1057828811.402

} // end try

catch (_com_error e){
char buffer[1024];
sprintf(buffer,"SAP: EXCEPTION 0x%x %s for VU(%i)\n",e.Error(),(char
*)e.Description(),S_task_id);
SAPGui_error_handler(s_info,buffer);
} // end catch

DO_SetTransactionCleanup();

SAPGuiApplication(RevokeROT);

END_TRANSACTION();

REPORT(SUCCESS);
EXIT();
return(0);
}
void abort_function(PLAYER_INFO *s_info)
{
RR_printf("Virtual User ABORTED.");
EXIT();
}

```

### Sample: Modified SAP Script for Multiple Logons

The following sample shows a SAP script modified to handle multiple logon sessions. Added code snippet and related comments are highlighted in bold.

#### Sample Script

```

/*
* multilogon.cpp
*
* Script Converted on July 20, 2004 at 08:43:23 AM

```

## Using the Player, Script Development Workbench, and Analyze

```
* Generated by Compuware QALoad convert module version 5.2.0 build 73
*
* This script contains support for the following middlewares:
* - SAP
*/
/* Converted using the following options:
* General:
* Line Split : 132 characters
* Sleep Seconds : 1
* Constants to Variables : Yes
* Remove Quotes : No
* Tabs To Spaces : No
* Auto Checkpoints : No
* SAP
* Version : 6204.119.32
*/

#define SCRIPT_VER 0x00000205UL

#include <stdio.h>
#include <windows.h>
#include <atlbase.h>
#include <objbase.h>
#include "do_SAPCCOM.h"
#include <atlwin.h>
#include <atlcom.h>
#include <atlhost.h>
#include "cscript.h"
#include "do_SapGui.h"
#include "mwCommon.h"

extern "C" {
#include "smacro.h"
}

/* set function to call on abort*/
void abort_function(PLAYER_INFO *s_info);

#ifdef NULL
#define NULL 0
#endif

extern "C" int rrobot_script(PLAYER_INFO *s_info)
{
 /* Declare Variables */

 SET_ABORT_FUNCTION(abort_function);

 DEFINE_TRANS_TYPE("multilogon.cpp");

 HRESULT hr = CoInitialize(0);

 if(hr != ERROR_SUCCESS)
 RR_FailedMsg(s_info,"SAP: ERROR initializing COM");

 SAPGuiSetCheckScreenWildcard('*');

 SYNCHRONIZE();

 BEGIN_TRANSACTION();

 DO_SetTransactionStart();

 try{

 SAPGuiConnect(s_info,"testsap620");
 }
}
```

```

SAPGuiApplication(RegisterROT);

SAPGuiVerCheckStr("6204.119.32");

//Set SapApplication = CreateObject("Sapgui.ScriptingCtrl.1")
//SapApplication.OpenConnection ("testsap620")
//Set Session = SapApplication.Children(0).Children(0)

DO_SLEEP(18);

SAPGuiPropIdStr("wnd[0]");//1057828784.513
SAPGuiCmd3(GuiMainWindow,ResizeWorkingPane,92,34,false);

DO_SLEEP(16);

SAPGuiPropIdStr("wnd[0]/usr/txtRSYST-BNAME");//1057828800.786
SAPGuiCmd1(GuiTextField,PutText,"qaload1");

SAPGuiPropIdStr("wnd[0]/usr/pwdRSYST-BCODE");//1057828800.796
SAPGuiCmd1Pwd(GuiPasswordField,PutText,"~encr~0000x_'9d");
SAPGuiCmd0(GuiPasswordField,SetFocus);
SAPGuiCmd1(GuiPasswordField,PutCaretPosition,3);

SAPGuiPropIdStr("wnd[0]");//1057828800.836
SAPGuiCmd1(GuiMainWindow,SendVKey,0);

/// Scripting: Step 1
/// Here is the command to look for in the script. Note the parameters
/// of the call, they are consistent in every SAP script.

SAPGuiCheckScreen("S000","SAPMSYST","SAP");//1057828800.856

/// Scripting: Step 2
/// Add this code snippet in bold after the SAPGuiCheckScreen which
/// confirms the login screen is present.

SAPGuiPropIdStrExists("wnd[1]/usr/radMULTI_LOGON_OPT2");

 DO_SLEEP(20);
 SAPGuiCmd0(GuiRadioButton,Select);
 SAPGuiCmd0(GuiRadioButton,SetFocus);
 SAPGuiPropIdStr("wnd[1]/tbar[0]/btn[0]");
 SAPGuiCmd0(GuiButton,Press);
 SAPGuiCheckScreen("S000","SAPMSYST","License Information for Multiple
 Logon");

SAPGuiPropIdStrExistsEnd("wnd[1]/usr/radMULTI_LOGON_OPT2");

SAPGuiPropIdStr("wnd[0]"); // sets focus back to wind[0]

DO_SLEEP(6);
SAPGuiCmd3(GuiMainWindow,ResizeWorkingPane,92,34,false);

DO_SLEEP(3);

SAPGuiPropIdStr("wnd[0]/tbar[0]/btn[15]");//1057828809.839
SAPGuiCmd0(GuiButton,Press);
SAPGuiCheckScreen("SESSION_MANAGER","SAPLSMTR_NAVIGATION","SAP Easy
Access");//1057828809.859

DO_SLEEP(2);

SAPGuiPropIdStr("wnd[1]/usr/btnSPOP-OPTION1");//1057828811.382
SAPGuiCmd0(GuiButton,Press);
SAPGuiCheckScreen("SESSION_MANAGER","SAPLSPO1","Log Off");//1057828811.402

```

## Using the Player, Script Development Workbench, and Analyze

```
 } // end try

 catch (_com_error e){
 char buffer[1024];
 sprintf(buffer,"SAP: EXCEPTION 0x%x %s for VU(%i)\n",e.Error(), (char
 *)e.Description(), S_task_id);
 SAPGui_error_handler(s_info,buffer);
 } // end catch

DO_SetTransactionCleanup();

SAPGuiApplication(RevokeROT);

END_TRANSACTION();

REPORT(SUCCESS);
EXIT();
return(0);
}

void abort_function(PPLAYER_INFO *s_info)
{
 RR__printf("Virtual User ABORTED.");
 EXIT();
}
```

### Sample: Implementing Content Check of a SAP Control

The following sample script shows the SAP commands needed to validate the information in the SAP client during replay. You can use `SAPGuiContentCheck` to check if the text field for Event name contains the string `double`.

The `SAPGuiContentCheck` command has the option to check the entire string, prefix string, substring and suffix string. It also has the option to use a case-sensitive comparison or case-insensitive comparison.

The following example uses the case insensitive comparison and substring check option.

Use `convert option` Insert SAP control comments: Textfields and Statusbars to output textfield and statusbar as comments in the script.

### Sample Script

```
SAPGuiPropIdStr("wnd[0]/usr/cntlTREE_CONTAINER/shellcont/shell"
); //1152820409.712
SAPGuiCmd1(GuiCtrlTree,ExpandNode,"Root");
SAPGuiCmd1(GuiCtrlTree,ExpandNode,"Child1");
SAPGuiCmd2(GuiCtrlTree,SelectItem,"New1","4");
SAPGuiCmd2(GuiCtrlTree,EnsureVisibleHorizontalItem,"New1","4");
SAPGuiCmd1(GuiCtrlTree,PutTopNode,"Root");
SAPGuiCmd2(GuiCtrlTree,DoubleClickItem,"New1","4");

SAPGuiCheckScreen("DWDM","SAPTLIST_TREE_CONTROL_DEMO","SAP");//1152820409.915

int nResult = SAPGuiContentCheck("wnd[0]/usr/txtG_EVENT", "GuiTextField", "double",
false, SUBSTRING);
RR__printf("Does the textfield content contains string \"double\"? -- %s",
nResult==0?"YES":"NO");
```

### Sample: SAP Script with Commands

The following sample is a SAP Script with required commands. Required commands in the script are highlighted in bold.

## Sample Script

```

/*
 * capture.cpp
 *
 * Script Converted on July 20, 2004 at 08:43:23 AM
 * Generated by Compuware QALoad convert module version 5.2.0 build 73
 *
 * This script contains support for the following middlewares:
 * - SAP
 */

/* Converted using the following options:
 * General:
 * Line Split : 132 characters
 * Sleep Seconds : 1
 * Constants to Variables : Yes
 * Remove Quotes : No
 * Tabs To Spaces : No
 * Auto Checkpoints : No
 * SAP
 * Version : 6204.119.32
 */

#define SCRIPT_VER 0x00000205UL

#include <stdio.h>
#include <windows.h>
#include <atlbase.h>
#include <objbase.h>
#include "do_SAPCCOM.h"
#include <atlwin.h>
#include <atlcom.h>
#include <atlhost.h>
#include "cscript.h"
#include "do_SapGui.h"
#include "mwCommon.h"

extern "C" {
#include "smacro.h"
}

/* set function to call on abort*/
void abort_function(PPLAYER_INFO *s_info);

#ifdef NULL
#define NULL 0
#endif

extern "C" int rrobot_script(PPLAYER_INFO *s_info)
{
 /* Declare Variables */

 /// These script functions in bold must be present and
 /// before the SYNCHRONIZE command in every SAP script.

 ACTION();

 SET_ABORT_FUNCTION(abort_function);

 DEFINE_TRANS_TYPE("capture.cpp");

 HRESULT hr = CoInitialize(0);

 if(hr != ERROR_SUCCESS)

 RR_FailedMsg(s_info,"SAP: ERROR initializing COM");
}

```

## Using the Player, Script Development Workbench, and Analyze

```
SAPGuiSetCheckScreenWildcard('');

SYNCHRONIZE();

BEGIN_TRANSDO_SetTransactionStart();

try{

 SAPGuiConnect(s_info,"testsap620");

 SAPGuiApplication(RegisterROT);

 SAPGuiVerCheckStr("6204.119.32");

 //Set SapApplication = CreateObject("Sapgui.ScriptingCtrl.1")
 //SapApplication.OpenConnection ("testsap620")
 //Set Session = SapApplication.Children(0).Children(0)

 DO_SLEEP(18);

 SAPGuiPropIdStr("wnd[0]");//1057828784.513
 SAPGuiCmd3(GuiMainWindow,ResizeWorkingPane,92,34,false);

 DO_SLEEP(16);

 SAPGuiPropIdStr("wnd[0]/usr/txtRSYST-BNAME");//1057828800.786
 SAPGuiCmd1(GuiTextField,PutText,"qaload1");

 SAPGuiPropIdStr("wnd[0]/usr/pwdRSYST-BCODE");//1057828800.796
 SAPGuiCmd1Pwd(GuiPasswordField,PutText,"~encr~0000x_'9d");
 SAPGuiCmd0(GuiPasswordField,SetFocus);
 SAPGuiCmd1(GuiPasswordField,PutCaretPosition,3);

 SAPGuiPropIdStr("wnd[0]");//1057828800.836
 SAPGuiCmd1(GuiMainWindow,SendVKey,0);
 SAPGuiCheckScreen("S000","SAPMSYST","SAP");//1057828800.856

 DO_SLEEP(6);
 SAPGuiCmd3(GuiMainWindow,ResizeWorkingPane,92,34,false);

 DO_SLEEP(3);

 SAPGuiPropIdStr("wnd[0]/tbar[0]/btn[15]");//1057828809.839
 SAPGuiCmd0(GuiButton,Press);
 SAPGuiCheckScreen("SESSION_MANAGER","SAPLSMTR_NAVIGATION","SAP Easy
Access");//1057828809.859

 DO_SLEEP(2);

 SAPGuiPropIdStr("wnd[1]/usr/btnSPOP-OPTION1");//1057828811.382
 SAPGuiCmd0(GuiButton,Press);
 SAPGuiCheckScreen("SESSION_MANAGER","SAPLSPO1","Log Off");//1057828811.402

} // end try

catch (_com_error e){
char buffer[1024];
sprintf(buffer,"SAP: EXCEPTION 0x%x %s for VU(%i)\n",e.Error(), (char
*)e.Description(), S_task_id);
SAPGui_error_handler(s_info,buffer);
} // end catch

DO_SetTransactionCleanup();

SAPGuiApplication(RevokeROT);
```

```

 END_TRANSACTION();

 REPORT(SUCCESS);
 EXIT();
 return(0);
}

void abort_function(PLAYER_INFO *s_info)
{
 RR_printf("Virtual User ABORTED.");
 EXIT();
}

```

### Sample: Original SAP Script with Counters

The following sample shows an original SAP script extract with counters. Points of interest in the script are highlighted in bold.

#### Sample Script

```

/*
 * counters.cpp
 *
 * Script Converted on July 20, 2004 at 08:43:23 AM
 * Generated by Compuware QALoad convert module version 5.2.0 build 73
 *
 * This script contains support for the following middlewares:
 * - SAP
 */

/* Converted using the following options:
 * General:
 * Line Split : 132 characters
 * Sleep Seconds : 1
 * Constants to Variables : Yes
 * Remove Quotes : No
 * Tabs To Spaces : No
 * Auto Checkpoints : No
 * SAP
 * Version : 6204.119.32
 */

#define SCRIPT_VER 0x00000205UL

#include <stdio.h>
#include <windows.h>
#include <atlbase.h>
#include <objbase.h>
#include "do_SAPCCOM.h"
#include <atlwin.h>
#include <atlcom.h>
#include <atlhost.h>
#include "cscript.h"
#include "do_SapGui.h"
#include "mwCommon.h"

extern "C" {
#include "smacro.h"
}

/* set function to call on abort*/
void abort_function(PLAYER_INFO *s_info);

#ifdef NULL
#define NULL 0
#endif

```

## Using the Player, Script Development Workbench, and Analyze

```
extern "C" int rrobot_script(PPLAYER_INFO *s_info)
{
 /* Declare Variables */

 /// Declare the SAP custom counter variable IDs
 /// Also declare any SAP counter value variables.

 SET_ABORT_FUNCTION(abort_function);

 DEFINE_TRANS_TYPE("counters.cpp");

 HRESULT hr = CoInitialize(0);

 if(hr != ERROR_SUCCESS)
 RR__FailedMsg(s_info,"SAP: ERROR initializing COM");

 SAPGuiSetCheckScreenWildcard('*');

 /// Initialize the SAP custom counter variable IDs.

 SYNCHRONIZE();

 BEGIN_TRANSACTION();

 DO_SetTransactionStart();

 try{

 SAPGuiConnect(s_info,"testsap620");

 SAPGuiApplication(RegisterROT);

 SAPGuiVerCheckStr("6204.119.32");

 //Set SapApplication = CreateObject("Sapgui.ScriptingCtrl.1")
 //SapApplication.OpenConnection ("testsap620")
 //Set Session = SapApplication.Children(0).Children(0)

 DO_SLEEP(18);

 SAPGuiPropIdStr("wnd[0]");//1057828784.513
 SAPGuiCmd3(GuiMainWindow,ResizeWorkingPane,92,34,false);

 DO_SLEEP(16);

 SAPGuiPropIdStr("wnd[0]/usr/txtRSYST-BNAME");//1057828800.786
 SAPGuiCmd1(GuiTextField,PutText,"qaload1");

 SAPGuiPropIdStr("wnd[0]/usr/pwdRSYST-BCODE");//1057828800.796
 SAPGuiCmd1Pwd(GuiPasswordField,PutText,"~encr~0000x_'9d");
 SAPGuiCmd0(GuiPasswordField,SetFocus);
 SAPGuiCmd1(GuiPasswordField,PutCaretPosition,3);

 SAPGuiPropIdStr("wnd[0]");//1057828800.836
 SAPGuiCmd1(GuiMainWindow,SendVKey,0);
 SAPGuiCheckScreen("S000","SAPMSYST","SAP");//1057828800.856

 DO_SLEEP(6);
 SAPGuiCmd3(GuiMainWindow,ResizeWorkingPane,92,34,false);

 DO_SLEEP(3);

 SAPGuiPropIdStr("wnd[0]/tbar[0]/btn[15]");//1057828809.839
 SAPGuiCmd0(GuiButton,Press);
 }
```

```

SAPGuiCheckScreen("SESSION_MANAGER", "SAPLSMTR_NAVIGATION", "SAP Easy
Access");//1057828809.859

DO_SLEEP(2);

SAPGuiPropIdStr("wnd[1]/usr/btnSPOP-OPTION1");//1057828811.382
SAPGuiCmd0(GuiButton,Press);

/// This is where we would like to retrieve the RoundTrips
/// and Flushes counter. Here the SAPGuiSessionInfo command
/// will be inserted to retrieve these SAP counter values from the server.

SAPGuiCheckScreen("SESSION_MANAGER", "SAPLSPO1", "Log Off");//1057828811.402

/// Here is where the counter information will actually be
/// written to the timing file.

} // end try

catch (_com_error e){
char buffer[1024];
sprintf(buffer, "SAP: EXCEPTION 0x%x %s for VU(%i)\n", e.Error(), (char
*)e.Description(), S_task_id);
SAPGui_error_handler(s_info,buffer);
} // end catch

DO_SetTransactionCleanup();

SAPGuiApplication(RevokeROT);

END_TRANSACTION();

REPORT(SUCCESS);
EXIT();
return(0);
}

void abort_function(PLAYER_INFO *s_info)
{
RR_printf("Virtual User ABORTED.");
EXIT();
}

```

### Sample: Modified SAP Script with Custom Counters

The following sample shows a modified SAP script with SAP custom counters. Changes to Original script are highlighted in bold.

#### Sample Script

```

/*
* counters.cpp
*
* Script Converted on July 20, 2004 at 08:43:23 AM
* Generated by Compuware QALoad convert module version 5.2.0 build 73
*
* This script contains support for the following middlewares:
* - SAP
*/

/* Converted using the following options:
* General:

```

## Using the Player, Script Development Workbench, and Analyze

```
* Line Split : 132 characters
* Sleep Seconds : 1
* Constants to Variables : Yes
* Remove Quotes : No
* Tabs To Spaces : No
* Auto Checkpoints : No
* SAP
* Version : 6204.119.32
*/
```

```
#define SCRIPT_VER 0x00000205UL

#include <stdio.h>
#include <windows.h>
#include <atlbase.h>
#include <objbase.h>
#include "do_SAPCCOM.h"
#include <atlwin.h>
#include <atlcom.h>
#include <atlhost.h>
#include "cscript.h"
#include "do_SapGui.h"
#include "mwCommon.h"

extern "C" {
#include "smacro.h"
}

/* set function to call on abort*/
void abort_function(PLAYER_INFO *s_info);

#ifndef NULL
#define NULL 0
#endif

extern "C" int rrobot_script(PLAYER_INFO *s_info)
{
 /* Declare Variables */

/// Scripting: Step 1

 int id1, id2, id3, id4;
 long lRoundTrips,lFlushes;

 SET_ABORT_FUNCTION(abort_function);

 DEFINE_TRANS_TYPE("counters.cpp");

 HRESULT hr = CoInitialize(0);

 if(hr != ERROR_SUCCESS)
 RR_FailedMsg(s_info,"SAP: ERROR initializing COM");

 SAPGuiSetCheckScreenWildcard('*');

/// Scripting: Step 2

 // "Counter Group", "Counter Name", "Counter Units
 // (Optional)", Data Type, Counter Type.

 id1 = DEFINE_COUNTER("Cumulative Group", "Cumulative RoundTrips", 0, DATA_LONG,
 COUNTER_CUMULATIVE);

 id2 = DEFINE_COUNTER("Cumulative Group", "Cumulative Flushes", 0, DATA_LONG,
 COUNTER_CUMULATIVE);
}
```

```

id3 = DEFINE_COUNTER("Instance Group", "Instance RoundTrips", 0, DATA_LONG,
COUNTER_INSTANCE);

id4 = DEFINE_COUNTER("Instance Group", "Instance Flushes", 0, DATA_LONG,
COUNTER_INSTANCE);

SYNCHRONIZE();

BEGIN_TRANSACTION();

DO_SetTransactionStart();

try{

 SAPGuiConnect(s_info,"testsap620");

 SAPGuiApplication(RegisterROT);

 SAPGuiVerCheckStr("6204.119.32");

 //Set SapApplication = CreateObject("Sapgui.ScriptingCtrl.1")
 //SapApplication.OpenConnection ("testsap620")
 //Set Session = SapApplication.Children(0).Children(0)

 DO_SLEEP(18);

 SAPGuiPropIdStr("wnd[0]");//1057828784.513
 SAPGuiCmd3(GuiMainWindow,ResizeWorkingPane,92,34,false);

 DO_SLEEP(16);

 SAPGuiPropIdStr("wnd[0]/usr/txtRSYST-BNAME");//1057828800.786
 SAPGuiCmd1(GuiTextField,PutText,"qaload1");

 SAPGuiPropIdStr("wnd[0]/usr/pwdRSYST-BCODE");//1057828800.796
 SAPGuiCmd1Pwd(GuiPasswordField,PutText,"~encr~0000x_'9d");
 SAPGuiCmd0(GuiPasswordField,SetFocus);
 SAPGuiCmd1(GuiPasswordField,PutCaretPosition,3);

 SAPGuiPropIdStr("wnd[0]");//1057828800.836
 SAPGuiCmd1(GuiMainWindow,SendVKey,0);
 SAPGuiCheckScreen("S000","SAPMSYST","SAP");//1057828800.856

 DO_SLEEP(6);
 SAPGuiCmd3(GuiMainWindow,ResizeWorkingPane,92,34,false);

 DO_SLEEP(3);

 SAPGuiPropIdStr("wnd[0]/tbar[0]/btn[15]");//1057828809.839
 SAPGuiCmd0(GuiButton,Press);
 SAPGuiCheckScreen("SESSION_MANAGER","SAPLSMTR_NAVIGATION","SAP Easy
Access");//1057828809.859

 DO_SLEEP(2);

 SAPGuiPropIdStr("wnd[1]/usr/btnSPOP-OPTION1");//1057828811.382
 SAPGuiCmd0(GuiButton,Press);

/// Scripting: Step 3

 SAPGuiSessionInfo(GetRoundTrips,lRoundTrips);
 SAPGuiSessionInfo(GetFlushes,lFlushes);

 SAPGuiCheckScreen("SESSION_MANAGER","SAPLSP01","Log Off");//1057828811.402

```

## Using the Player, Script Development Workbench, and Analyze

/// Scripting: Step 4

```
 COUNTER_VALUE(id1,lRoundTrips);
 COUNTER_VALUE(id2,lFlushes);
 COUNTER_VALUE(id3,lRoundTrips);
 COUNTER_VALUE(id4,lFlushes);

 } // end try

 catch (_com_error e){
 char buffer[1024];
 sprintf(buffer,"SAP: EXCEPTION 0x%x %s for VU(%i)\n",e.Error(), (char
 *)e.Description(), S_task_id);
 SAPGui_error_handler(s_info,buffer);
 } // end catch

 DO_SetTransactionCleanup();

 SAPGuiApplication(RevokeROT);

 END_TRANSACTION();
 REPORT(SUCCESS);
 EXIT();
 return(0);
}

void abort_function(PPLAYER_INFO *s_info)
{
 RR_printf("Virtual User ABORTED.");
 EXIT();
}
```

## Winsock

### How QALoad handles DO\_WSK\_Send commands

QALoad displays the contents of a DO\_WSK\_Send command as a string in a Winsock script. Some of these strings are very large, which can cause a compiler error (fatal error C1076: compiler limit: internal heap limit reached) if there are several large strings in a single script.

To avoid this compilation error, QALoad does not allow strings that are displayed in a Winsock script to be more than 12,000 characters. If a DO\_WSK\_Send command has a send buffer larger than 12,000 characters, its buffer is broken into smaller strings during the conversion. These smaller strings are then copied into a char buffer named "SendBuffer", which is sent in the DO\_WSK\_Send command. The size of the SendBuffer variable, by default, is declared as the size of the largest DO\_WSK\_Send + 1000. For example:

```
int rrobot_script(s_info)
PPLAYER_INFO *s_info;
{
 /* Declare Variables */
 char SendBuffer[22139]; //Largest send is 21139 + 1000

 ...

 strcpy(SendBuffer, "$$"); //Assume a large string, shortened for this example
 strcat(SendBuffer, "$$");

 /* 12675 bytes */
 DO_WSK_Send(S1, SendBuffer);

 ...
}
```

```

 strcpy(SendBuffer, "$$"); //SendBuffer is reused
 strcat(SendBuffer, "$$");
 strcat(SendBuffer, "$$");

 /* 21139 bytes */
 DO_WSK_Send(S1, SendBuffer);

 ...

 REPORT(SUCCESS);
 EXIT();
 return(0);
}

```

### Handling Winsock application data flow

Frequently, server programs return unique values (for example, a session ID) that vary with each execution of the script and may be vital to the success of subsequent transactions. To create scripts that include these values, you need to substitute the hard-coded values returned by the server with variables. The following original and modified code examples demonstrate this technique.

#### Original code

In this script, the server sends a session ID in response to a connection by the client. This session ID is required to successfully complete subsequent transactions.

```

/*
 * wsk-AdvancedTechniques_original.c
 *
 * This script contains support for the following
 * middlewares:
 * - Winsock
 */

/* Converted using the following options:
 * General:
 * Line Split : 80 characters
 * Sleep Seconds : 1
 * Auto Checkpoints : Yes
 */

#define SCRIPT_VER 0x00000005UL
#include <stdio.h>
#include "smacro.h"
#include "do_wsk.h"

/* set function to call on abort*/
void abort_function(PLAYER_INFO *s_info);

#ifdef NULL
#define NULL 0
#endif

int rrobot_script(s_info)
PLAYER_INFO *s_info;
{
 /* Declare Variables */

 SET_ABORT_FUNCTION(abort_function);
 DEFINE_TRANS_TYPE("wsk-AdvancedTech_1.c");

 // Checkpoints have been included by the convert process
 DefaultCheckpointsOn();
}

```

## Using the Player, Script Development Workbench, and Analyze

```
DO_WSK_Init(s_info);
SetTimeout(20); /* Wait up to 20 seconds for each expected pattern */
SYNCHRONIZE();
BEGIN_TRANSACTION();
DO_WSK_Socket(S1, AF_INET, SOCK_STREAM, IPPROTO_IP);
DO_WSK_Bind(S1, ANY_ADDR, ANY_PORT);
DO_WSK_Connect(S1, "172.22.24.125", 2100, AF_INET);
////////////////////////////////////
// The session id returned by the server is
// unique to each connection
////////////////////////////////////
/* 21bytes: SessionID=jrt90847\r\n */
DO_WSK_Expect(S1, "\n");
////////////////////////////////////
// This unique id is then used for subsequent
// requests
////////////////////////////////////
/* 34 bytes */
DO_WSK_Send(S1, "SessionID=jrt90847\r\n:^B^@^@^@B^@^@^A^@^@");
/* 15 bytes: ID Accepted#^@\r\n */
DO_WSK_Expect(S1, "\n");
DO_WSK_Closesocket(S1);
END_TRANSACTION();
REPORT(SUCCESS);
EXIT();
return(0);
}
void abort_function(PLAYER_INFO *s_info)
{
RR_printf("Virtual User %i:ABORTED.", S_task_id);
EXIT();
}
```

### Modified code

If the original script (wsk-AdvancedTechniques\_original.c shown above) is replayed, it will fail because the session ID will not be unique; rather, it will be the session ID that is coded in the script. To use the unique session ID received from the server, variable substitution must be used.

```
/*
 * wsk-AdvancedTechniques_modified.c
 *
 * This script contains support for the following
 * middlewares:
 * - Winsock
 */
/* Converted using the following options:
 * General:
 * Line Split : 80 characters
 * Sleep Seconds : 1
 * Auto Checkpoints : Yes
 */
```

```

#define SCRIPT_VER 0x00000005UL
#include <stdio.h>
#include "smacro.h"
#include "do_wsk.h"

/* set function to call on abort*/
void abort_function(PLAYER_INFO *s_info);

#ifdef NULL
#define NULL 0
#endif

int rrobot_script(s_info)
PLAYER_INFO *s_info;
{
/* Declare Variables */
char Buffer[64];
char SendBuffer[64];
int nBytesReceived = 0;

SET_ABORT_FUNCTION(abort_function);

DEFINE_TRANS_TYPE("wsk-AdvancedTech_1.c");

// Checkpoints have been included by the convert process
DefaultCheckpointsOn();
DO_WSK_Init(s_info);
SetTimeout(20); /* Wait up to 20 seconds for each expected pattern */
SYNCHRONIZE();
BEGIN_TRANSACTION();

DO_WSK_Socket(S1, AF_INET, SOCK_STREAM, IPPROTO_IP);
DO_WSK_Bind(S1, ANY_ADDR, ANY_PORT);
DO_WSK_Connect(S1, "172.22.24.125", 2100, AF_INET);

////////////////////////////////////
// The reply from the server is read into
// the Buffer variable. We will then have
// the unique Session ID for this connection.
// Also need to null-terminate the buffer
// after receiving.
////////////////////////////////////

DO_WSK_Recv(S1, Buffer, 64, 0, &nBytesReceived);
Buffer[nBytesReceived] = '\0';

/* 21bytes: SessionID=jrt90847\r\n */
//DO_WSK_Expect(S1, "\n");

////////////////////////////////////
// Finally, substitute the Session ID received from
// the server with the one coded in the script.
////////////////////////////////////

sprintf(SendBuffer, "%s:^B^@^@^@B^@^@^@A^@^@^@", Buffer);
DO_WSK_Send(S1, SendBuffer);

/* 34 bytes */

//DO_WSK_Send(S1, "SessionID=jrt90847:^B^@^@^@B^@^@^@A^@^@^@");

/* 15 bytes: ID Accepted#\r\n */
DO_WSK_Expect(S1, "\n");
DO_WSK_Closesocket(S1);

```

## Using the Player, Script Development Workbench, and Analyze

```
END_TRANSACTION();
REPORT(SUCCESS);
EXIT();
return(0);
}
void abort_function(PLAYER_INFO *s_info)
{
RR_printf("Virtual User %i:ABORTED.", S_task_id);
EXIT();
}
```

### Winsock Recording Options

**User Started:** Select this option if you want to start your application manually for recording, either before or after you start recording. Because this method may fail to record your application's initial calls, Compuware recommends you use the Automatic option instead. Select the User Started option when you do not know the full application startup name and command option parameters or when the application spawns off processes that generate traffic that you want recorded.

#### Notes:

If you run a character-based application in a DOS window, the Script Development Workbench does not record the API calls.

If you choose this option and the application under test generates traffic before the first Windows screen displays, you must also select the Capture Initialization Phase check box on the [Workbench Options dialog box](#).

**Automatic:** Select this option if you want QALoad to automatically start your Winsock-based client, allowing you to record early application startup activity. This is the recommended method of recording because it takes advantage of QALoad's enhanced abilities to handle various multi-threaded programming techniques. When you select this option, the QALoad Script Development Workbench records the API calls that occur before the client enters its message loop. Select this option to record traffic from just one application. This option limits the recording output to just the traffic generated by the application, not including the traffic that is generated by processes spawned by the application.

**Command Line:** Enter the command line of your Winsock-based client. Note that if you enter the full path, QALoad automatically enters the path in the Working Directory field.

**Working Directory:** Enter the working directory of your Winsock-based client, if necessary.

**Capture:** Select the Winsock version to record.

**Set IP Addresses:** Click this button to open the [Add/Delete IP Addresses dialog box](#), which you can use to specify the IP addresses and ports on which you want to record Winsock API calls or that you wish to exclude from recording.

### Winsock Conversion Options

There are no specialized conversion options for Winsock.

### Winsock Command Reference

QALoad provides descriptions and examples of the various commands available for a Winsock script. For details, refer to the Language Reference Help section for [Winsock](#).

### Winsock Running Out of Socket Resources

You may encounter a problem running out of socket resources on NT or Solaris when there are large numbers of short-lived connections.

When TCP/IP connections are shutdown, they go into a TIME\_WAIT state waiting for the specified interval to expire. While in that state the connection is looking for any stray packets that may have been sent to this connection and remain unacknowledged.

If this process was skipped, it would be possible for a new connection to be opened using the same address and port as the previous connection and to incorrectly receive data that was intended for the previous connection. When QALoad is generating many short-lived connections, during a Winsock or WWW load test, the default setting for the timed wait delay may be so high that the driver machine will run out of socket resources as all closed sockets wait in the TIME\_WAIT state.

To change the setting for the timed wait delay:

#### Windows NT

Set the registry key:

```
HKEY_LOCAL_MACHINE\System\CurrentControlSet\Services\tcpip\
Parameters\TcpTimedWaitDelay
```

to a lower value. It can be set to anything between 30 and 300. Compuware suggests using the lowest possible value (30).

#### Solaris 2.6

Using "nnd" set the "tcp\_close\_wait\_interval" to 30 seconds:

```
nnd -get /dev/tcp tcp_close_wait_interval
nnd -set /dev/tcp tcp_close_wait_interval 30000
```

#### Solaris 2.7

Use "nnd" as shown previously for Solaris 2.6, but substitute the "tcp\_time\_wait\_interval"

### Understanding Data representation in the Script

This section describes how data that is sent and received is displayed in a Winsock script. Use this section as a reference when you examine a script.

During the conversion process, QALoad determines how to represent each character in the script. This conversion process uses the following rules:

1. The character is compared to the "space" character in the ASCII table, which has a decimal value of 32. If the character's value is less than 32, the following steps are taken:
  - a. If the character is "\r", "\n", "\t", or "\f", it is represented in the script as a normal C escape character.
  - b. If the character is either "\^" or "\^", it is represented in the script as an octal character. For example, the values would be "\034" and "\036", respectively.
  - c. If the character's value is less than 32 and it does not meet the descriptions in a) and b) above, it is represented in the script as a control character. For example, if the character is a null character, it is represented in the script as "\^@".

## Using the Player, Script Development Workbench, and Analyze

2. If the character's decimal value is between 32 (the "space" character) and 126 (~), it displays in the script as a standard readable ASCII character, with the following exceptions:
- If the character is "\", which has a decimal value of 92, it is represented as "\\ " in the script.
  - If the character is "", which has a decimal value of 34, it is represented as "\" " in the script.
  - If the character is "^", which has a decimal value of 94, it is represented as "^" in the script.
3. If the character has a decimal value of 127, which corresponds to Delete (DEL), it is represented as "^" in the script.

The following table summarizes the results of rules 1-3.

| Code | Octal | Decimal | Char |
|------|-------|---------|------|
| ^@   | 000   | 0       | NUL  |
| ^A   | 001   | 1       | SOH  |
| ^B   | 002   | 2       | STX  |
| ^C   | 003   | 3       | ETX  |
| ^D   | 004   | 4       | EOT  |
| ^E   | 005   | 5       | ENQ  |
| ^F   | 006   | 6       | ACK  |
| ^G   | 007   | 7       | BEL  |
| ^H   | 010   | 8       | BS   |
| \t   | 011   | 9       | HT   |
| \n   | 012   | 10      | LF   |
| ^K   | 013   | 11      | VT   |
| \f   | 014   | 12      | FF   |
| \r   | 015   | 13      | CR   |
| ^N   | 016   | 14      | SO   |
| ^O   | 017   | 15      | S    |
| ^P   | 020   | 16      | SLE  |
| ^Q   | 021   | 17      | SC1  |
| ^R   | 022   | 18      | DC2  |
| ^S   | 023   | 19      | DC3  |
| ^T   | 024   | 20      | DC4  |

|      |     |     |     |
|------|-----|-----|-----|
| ^U   | 025 | 21  | NAK |
| ^V   | 026 | 22  | SYN |
| ^W   | 027 | 23  | ETB |
| ^X   | 030 | 24  | CAN |
| ^Y   | 031 | 25  | EM  |
| ^Z   | 032 | 26  | ␣   |
| ^[   | 033 | 27  | ESC |
| \034 | 034 | 28  | FS  |
| ^]   | 035 | 29  | GS  |
| ^_   | 037 | 31  | US  |
|      | 040 | 32  | SP  |
| \"   | 042 | 34  | "   |
| \\   | 134 | 92  | \   |
| ^^   | 136 | 94  | ^   |
| ^?   | 177 | 127 | DEL |

4. If the character is not included in the groups defined in steps 1-3, it is represented as an octal character in the script. These characters are often referred to as high ASCII characters (those with a decimal value greater than 128), and are represented in the script as "\OOO", where OOO is the octal value for the ASCII character.

### Overview: Handling Winsock Connection Problems

When a remote application is handling other tasks and is not able to accept a connection, you can modify your script so that it retries the connection. When implementing this sort of functionality, be sure you:

- ! Limit the number of connection retries so that the script doesn't execute indefinitely.
- ! Turn off the abort flag before the connection and turn it back on immediately after the connection loop. Otherwise the virtual user aborts when a connection fails.

### Conclusion

The [sample script](#) illustrates how to create a script that attempts to reconnect to a remote application if the first connection fails.



**Caution:** It is very important that you specify a limit to the number of connection retries or the script runs in an endless loop. This may create a denial of service attack on the remote application.

### Overview: Parsing Server Replies

You can find a string within the reply returned from the sever using [SkipExpr\(\)](#) and [ScanExpr\(\)](#). [SkipExpr\(\)](#) searches the internal buffer that contains the response received in the [DO\\_WSK\\_Expect\(\)](#) for the first occurrence of the string. It places the pointer in the position immediately following the string. Then use [ScanExpr\(\)](#) to search for the end of the string. This saves the buffer following the first occurrence of the

string used in `SkipExpr()`, up to and including the string in `ScanExpr()`. The first parameter of `ScanExpr()` takes a Unix-style regular expression. The following table shows some of the most common expressions.

| Character | Meaning                          |
|-----------|----------------------------------|
| "."       | Matches the end of a string      |
| "*"       | Matches any number of characters |
| "?"       | Matches any one character        |

### Conclusion

Use the `SkipExpr()` and `ScanExpr()` to find a string returned from the server. The [sample script](#) illustrates this technique.

### Accessing Local and Remote Network Addresses

You can retrieve the IP address or port to which a socket handle is connected, or retrieve the IP address and port to which a socket handle is bound. The sample script illustrates how to retrieve and store socket address and port information. The required code is shown in bold.

### Sample Script

```

...
/* Declare Variables */

//Belows are two socket structs that will store the address and port information.
struct sockaddr_in RemoteAddr;
struct sockaddr_in LocalAddr;
...
BEGIN_TRANSACTION();
DO_WSK_Socket(S1, AF_INET, SOCK_STREAM, IPPROTO_TCP);
DO_WSK_Bind(S1, ANY_ADDR, ANY_PORT);
/* Socket S2 was bound to address 0.0.0.0 on port 3320 (hibyte=12,lobyte=248) */

//Called after the DO_WSK_Bind() to see which address the socket was bound to
LocalAddr.sin_addr.s_addr = ntohl(GetLocalAddr(S1));

//Called after the DO_WSK_Bind() to see which port the socket was bound to
LocalAddr.sin_port = GetLocalPort(S1);

DO_WSK_Connect(S1, "10.4.26.24", 80, AF_INET);

//Called to retrieve the remote address that S1 is connected to.
RemoteAddr.sin_addr.s_addr = ntohl(GetRemoteAddr(S1));

//Called to retrieve the remote port that S1 is connected to.
RemoteAddr.sin_port = ntohs(GetRemotePort(S1));

//The function below will print the remote and local address and port information
// to the playerbuffer. Within the RR_printf() the script is using the socket function
// "inet_ntoa()" to convert the IP from an unsigned long to a string
// format, "XXX.XXX.XXX.XXX".
RR_printf("Remote: address=%s port=%d",inet_ntoa(RemoteAddr.sin_addr),
RemoteAddr.sin_port);
RR_printf("Local: address=%s port=%d",inet_ntoa(LocalAddr.sin_addr), LocalAddr.sin_port);

DO_WSK_Closesocket(S1);

```

...

## Conclusion

When this code is executed, a message is printed to the playerbuffer, such as:

```
VU 0 : Remote: address=10.4.26.24 port=80
VU 0 : Local: address=10.15.16.26 port=1125
```

## Parsing Server Replies Using ScanFloat and ScanInt

Sometimes local applications must interpret and act on numeric values sent from a remote application. For example, remote applications may send a port number to the local application. The local application parses the remote port from the data it receives and attempts to connect to the remote machine on the new port.

By using `ScanInt()`, you can parse the received buffer for numeric values, such as port numbers, or use `ScanFloat()` to parse for larger numeric values. The sample script illustrates how to use `ScanFloat()` and `ScanInt()`. The required code is shown in bold.

## Sample Script

```
...
/* Declare Variables */
//The variable "port" was declared to store the port# that the remote
// application sends. The variable "nID" is used to store the unique
// ID that is sent by the remote application.
unsigned short port;
float nID;
...
BEGIN_TRANSACTION();

DO_WSK_Socket(S1, AF_INET, SOCK_STREAM, IPPROTO_TCP);
DO_WSK_Socket(S2, AF_INET, SOCK_STREAM, IPPROTO_TCP);
DO_WSK_Connect(S1, "10.15.21.225", 33, AF_INET);

/* 11 bytes: "port=\nA\0\0aB" */

//Since the end of the data that is being received is dynamic, the
// script will use DO_WSK_Read() to receive the data instead
// using the DO_WSK_Expect() that was converted into the script.
//DO_WSK_Expect("B");
DO_WSK_Read(S1,11);

//Calling ScanSkip to move the pointer to the first byte of the port
ScanSkip(5);

//Calling ScanInt to copy the next two bytes into a variable that will
// store the port from the remote application.
ScanInt(MyByteOrder(),2,(char*)&port);
```

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```
//Calling ScanFloat to copy the next four bytes into a variable that will
// store the unique ID from the remote application.
ScanFloat(MyByteOrder(),4,(char*)&nID);

//Printing the port number to the playerbuffer window, and converting
// the value from network byte order to host byte order.
RR_printf("port=%d",ntohs(port));

//Printing the unique ID that the remote application sent to the
// playerbuffer.
RR_printf("float=%f",nID);

DO_WSK_Closesocket(S1);

//Below is the original DO_WSK_Connect that was converted into the script
//DO_WSK_Connect(S2,"10.15.21.225", 2526, AF_INET);

//Uses the port that was returned above to reconnect to the remote application
DO_WSK_Connect(S2, "10.15.21.225", ntohs(port), AF_INET);

DO_WSK_Send(S2,"Hello World");
DO_WSK_Closesocket(S2);
...
```

### Conclusion

In this example, the script parses the port number sent from the remote application and uses this to reconnect to the remote application. The script also uses `ScanFloat()` to parse a unique ID from the message sent by the remote application.

### Parsing Server Replies Using `ScanSkip` and `ScanString`

Data returned from the server may be too dynamic to base your parsing on actual characters. In this case, you can base your search on character positions using `ScanSkip()` and `ScanString()`.

For example, you can save characters 20 through 25 that are returned from a server. The `ScanSkip()` skips the specified number of characters in the internal buffer that stores the response received in the `DO_WSK_Expect()`. The `ScanString()` scans the number of characters you specify into a character string from the current position in the buffer.

In this sample, the buffer returned from the server is xxx123456789yyy. You are retrieving the value between xxx and yyy. The required code is shown in bold.

### Sample Script

```
...
/* Declare Variables */
//Variable to store the string that we are searching for.
char temp[15];
...
BEGIN_TRANSACTION();
...
DO_WSK_Socket(S1, AF_INET, SOCK_STREAM, IPPROTO_IP);
```

```

DO_WSK_Bind(S1, ANY_ADDR, ANY_PORT);

DO_WSK_Setsockopt(S1, SOL_SOCKET, SO_OOBINLINE, 1);

DO_WSK_Connect(S1, "127.0.0.1", 90, AF_INET);

//Below is the actual data that was returned at capture time.
/* 16 bytes: xxx0123456789yyy */
DO_WSK_Expect(S1, "yyy");

//making sure that all of the data within our variable has been initialized
memset(temp,'\0',15);
//skips 3 bytes within the buffer that was received.
ScanSkip(3);

//copies the next 10 bytes of the buffer that was received into our temp variable
ScanString(10,temp);
//Displays the string that was found to the playerbuffer window.
RR_printf("string=%s",temp);
DO_WSK_Closesocket(S1);
...

```

### Conclusion

In this example, the message “string=0123456789” is printed to the player buffer window.

### Receiving Winsock UDP Data with DO\_WSK\_Recvfrom

When the application you are capturing is using the UDP protocol, you can use the [DO\\_WSK\\_Recvfrom\(\)](#) to receive data from the remote application. The sample script illustrates how to use the [Do\\_Wsk\\_Recvfrom\(\)](#). The required code is shown in bold.

### Sample Script

```

...
/* Declare Variables */
//The variable strBuf is used to formulate the dynamic data that is
// sent in the DO_WSK_Sendto() below.
char strBuf[256];
//RemoteAddr stores the remote applications address and port
struct sockaddr_in RemoteAddr;
//nBytes is used to stor the number of bytes that were received via DO_WSK_Recvfrom()
int nBytes = 0;
...
BEGIN_TRANSACTION();

```

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```
DO_WSK_Socket(S1, AF_INET, SOCK_DGRAM, IPPROTO_UDP);

DO_WSK_Bind(S1, "10.15.16.26", 333);

//Receives data via the UDP protocol
DO_WSK_Recvfrom(S1, strBuf, (struct sockaddr*) &RemoteAddr, 256, 0, &nBytes);

//Prints to the player buffer the number of bytes that were received and
// the remote address and port that sent them.
RR_printf("Received %d bytes from %s:%d",
 nBytes, inet_ntoa(RemoteAddr.sin_addr),
 ntohs(RemoteAddr.sin_port));
...
DO_WSK_Closesocket(S1);
```

### Conclusion

This example shows how to use `DO_WSK_Recvfrom()` to receive UDP protocol data. It shows how to access the address and port of the remote application sending the data.

### [Sending Variable Data with DO\\_WSK\\_Send](#)

Captured data may not be the data you want to use while running a test. For example, you might change the user name sent during capture time to a different value during replay. You can change the value in the `DO_WSK_Send()` to make a static value within the function. However, if you want to substitute a different value each time, you can create a dynamic variable, such as a datapool value, to replace the user name.

In this example, the script includes a `DO_WSK_Send()` that sends "name=Jim" to the server as the user name. For testing purposes, you want to change the name to include a variable that represents a different name, such as "Mark". The code required for this is shown in bold.

### Sample Script

```
...
/* Declare Variables */
//Below are variables needed for the dynamic data. The size of these
//variables will depend upon how big the buffer is that you are replacing
char buffer[65];
char sendbuffer[65];
...
BEGIN_TRANSACTION();
...
DO_WSK_Socket(S1, AF_INET, SOCK_STREAM, IPPROTO_IP);

DO_WSK_Bind(S1, ANY_ADDR, ANY_PORT);

DO_WSK_Setsockopt(S1, SOL_SOCKET, SO_OOBINLINE, 1);
```

```

DO_WSK_Connect(S1, "127.0.0.1", 90, AF_INET);

//Below is the original send based upon the capture file.
// DO_WSK_Send(S1,"name=Jim");

//The script will now create a buffer that is different than what was captured,
//and if we wanted the string "Mark" could also of been a datapool value.
strcpy(buffer, "Mark");
sprintf(sendbuffer, "name=%s", buffer);

//The script will now send the variable string that was created above
DO_WSK_Send(S1, sendbuffer);

/* 2 bytes: ok */
DO_WSK_Expect(S1,"ok");
DO_WSK_Closesocket(S1);

```

### Conclusion

In this example, the user name sent to the server is changed from "name=Jim" to "name=Mark" by modifying the buffer before the DO\_WSK\_Send() and passing the new buffer as the second parameter of the DO\_WSK\_Send().

### [Sending Variable Data using DO\\_WSK\\_SendAll](#)

When only a portion of a string that the script is sending must be modified to make it dynamic, using the [DO\\_WSK\\_SendAll\(\)](#) can be easier than modifying the [DO\\_WSK\\_Send\(\)](#).

The following example sends the username "Bob" and the password "CPWR" to the server to logon. Since only one instance of this user can be logged on to the server, you must modify the script to read different user names and passwords from a datapool before sending it. In the sample script snippet, the required code is shown in bold.

### Sample Script

```

...
BEGIN_TRANSACTION();

//Reads in a datapool record to be used to make the username and password dynamic.
GET_DATA();

DO_WSK_Socket(S2, AF_INET, SOCK_STREAM, IPPROTO_TCP);

DO_WSK_Bind(S2, ANY_ADDR, ANY_PORT);

DO_WSK_Connect(S2, "10.0.6.32", 80, AF_INET);

//In the string that was sent below "Bob" and "CPWR" both need to be modified
// to allow for multiple users to execute this script.
/* 20 bytes */
//DO_WSK_Send(S2, "^@user=Bob^@pwd=CPWR^@\377");

```

## Using the Player, Script Development Workbench, and Analyze

```
//Using DO_WSK_Sendall the message that is being sent can easily be modified, so
// that the script can read in the username and password from a datapool file.
DO_WSK_SendAll(S2,5, "^@user", VARDATA(1), "@pwd=", VARDATA(2), "@\377");

/* 15 bytes: SID=1234567890^@ */
DO_WSK_Expect(S2, "^@");

DO_WSK_Closesocket(S2);
...
```

### Conclusion

In the sample modified script, the user name and password are read in from a datapool file and the data is sent using the DO\_WSK\_SendAll().

### Sending Variable Winsock UDP Data

Captured data may not be the data that you want to use while running a test. For example, you may want to substitute a user name sent during capture with a different value each time during replay. You can do this using a dynamic variable, such as a datapool variable.

 **Note:** Changing the value located in the DO\_WSK\_Sendto() makes the value static within the function.

In this sample, the code in bold below shows how change data values.

### Sample Script

```
...
/* Declare Variables */
//The variable strBuf is used to formulate the dynamic data that is
// sent in the DO_WSK_Sendto() below.
char strBuf[24];
...
BEGIN_TRANSACTION();
//Reads in a row of data from a central datapool file, and this will be
//used as part of the dynamic data that will be sent via the DO_WSK_Sendto()
GET_DATA();
DO_WSK_Socket(S1, AF_INET, SOCK_DGRAM, IPPROTO_IP);

DO_WSK_Setsockopt(S1, SOL_SOCKET, SO_BROADCAST, 1);

DO_WSK_Bind(S1, "127.0.0.1", 5634);

//Below is the original DO_WSK_Sendto() that was converted into the script
//DO_WSK_Sendto(S1, "name=Brian", "10.25.26.24", 1234);
//The example below reads a record in from a central datapool, and the value
// is then sent as part of the DO_WSK_Sendto() buffer.
memset(strBuf, 0, 24);
sprintf(strBuf, "name=%s", VARDATA(1));
```

```
DO_WSK_Sendto(S1, strBuf, "10.25.26.24", 1234);
```

```
...
```

```
DO_WSK_Closesocket(S1);
```

```
...
```

## Conclusion

In this example, the virtual user reads in a row of data from a central datapool, which is used to create a dynamic message. This message is used in the `DO_WSK_Sendto()` to send it to the address "10.25.26.24".

## [Sending Variable Data using DO\\_WSK\\_Write](#)

You can use `DO_WSK_Write()` instead of `DO_WSK_Send()` when coding scripts by hand. `DO_WSK_Write()` does not expect strings that have certain control and null characters encoded, as does `DO_WSK_Send()`. This allows you to send data without using `EscapeStr()` to encode any possible control characters.

The sample script illustrates how to use `DO_WSK_Write()`. The required code is shown in bold.

## Sample Script

```
...
/* Declare Variables */
//Variable that will be used to send data to the server via DO_WSK_Write()
char temp[24];
...
BEGIN_TRANSACTION();

DO_WSK_Socket(S2, AF_INET, SOCK_STREAM, IPPROTO_TCP);
DO_WSK_Bind(S2, ANY_ADDR, ANY_PORT);
DO_WSK_Connect(S2, "10.4.26.24", 60, AF_INET);

//The original data that was sent was... "^@user=Bob^@pwd=CPWR^@", and the
// ^@ are encoded null characters. The function below constructs the same
// data that was sent without the data being encoded.
memcpy(temp, "\0user=Bob\0pwd=CPWR\0", 19);

/* 19 bytes */
//The DO_WSK_Send() below was converted to the script from the capture file.
//DO_WSK_Send(S2, "^@user=Bob^@pwd=CPWR^@");

//Since the script is now using DO_WSK_Write() to send the data it does not
//need to call EscapeStr() to encoded the NULL characters within the string
//that is being sent.
DO_WSK_Write(S2,temp, 19);

/* 15 bytes: SID=1234567890^@ */
DO_WSK_Expect(S2, "^@");
DO_WSK_Closesocket(S2);
...
```

## Using the Player, Script Development Workbench, and Analyze

### Conclusion

In the sample script, the data was sent using the `DO_WSK_Write()` instead of the `DO_WSK_Send()`. This allows you to send data without encoding it.

### Using Central Datapools within a Winsock Script

You can use dynamic data in your script by reading data from a datapool file. However, datapool files must be in an ASCII string, and not all dynamic data are in this format. For example, when the string “\ 121\ 101\ 114\ 157\ 141\ 144” appears in a datapool file and is read in using a one of the datapool functions, you receive “\ 121\ \ 101\ \ 114\ \ 157\ \ 141\ \ 144” as the output.

You can ensure that the output string you receive is accurate by using the `OctalToChar()` to convert any octal sequences into their binary representation. In this sample script, the string “\ 121\ 101\ 114\ 157\ 141\ 144” is read in from a central datapool file and converted to its binary representation. The required code is shown in bold.

### Sample Script

```
/* Declare Variables */

//Variable declared to store the central datapool record.
char temp[40];

...
BEGIN_TRANSACTION();

//Gets a row of data from the Conductor during the test.
GET_DATA();

...
DO_WSK_Socket(S1, AF_INET, SOCK_STREAM, IPPROTO_IP);

DO_WSK_Bind(S1, ANY_ADDR, ANY_PORT);

DO_WSK_Setsockopt(S1, SOL_SOCKET, SO_OOBINLINE, 1);

//Read the first column from the central datapool row that was
//returned when the GET_DATA() was called.
strcpy(temp,VARDATA(1));

//used to convert octal strings to their binary format
OctalToChar(temp);

//The script is now setup to send the data that was read in from the
//central datapool file instead of the hard coded values that were captured.
DO_WSK_Send(S1,temp);

//Below is the original send that was captured.
//DO_WSK_Send(S1,“\121\101\122\165\156”);

DO_WSK_Closesocket(S1);
```

### Conclusion

In this example, the `DO_WSK_Send()` sends the octal representation for the string “QALoad”, “\ 121\ 101\ 114\ 157\ 141\ 144”, to the server.

### Accessing Server Replies Using Response and ResponseLength

You can save the entire reply that a server returns using `Response()` and `ResponseLength()`. When you call `Response()` directly after the `DO_WSK_Expect()`, it returns a pointer to the data received by the `DO_WSK_Expect()`. To receive the length of the received reply, call the `ResponseLength()`. This returns the number of characters received.

The sample script illustrates how to use these commands to save a server reply. In this sample, the code in bold shows how to use `Response()` and `ResponseLength()`.

#### Sample Script

```

/* Declare Variables */
//Below are variables needed for this example
int x = 0;
char *temp;
...
BEGIN_TRANSACTION();
...
DO_WSK_Socket(S1, AF_INET, SOCK_STREAM, IPPROTO_IP);

DO_WSK_Bind(S1, ANY_ADDR, ANY_PORT);

DO_WSK_Setsockopt(S1, SOL_SOCKET, SO_OOBINLINE, 1);

DO_WSK_Connect(S1, "127.0.0.1", 90, AF_INET);

//Below is the actual buffer that was returned at capture time.
/* 21 bytes: You are now connected */
DO_WSK_Expect(S1, "d");

// used to store the data that was received by the DO_WSK_Expect
temp = Response();

//used to get the size of the response that was received so far.
x = ResponseLength();

//The line below will print the length of the response to the playerbuffer
RR_printf("The size of the received buffer was %d bytes ",x,);

DO_WSK_Closesocket(S1);

```

#### Conclusion

In this example, `Response()` and `ResponseLength()` are used to print the message "The size of the received buffer was 21 bytes" to the player buffer window.

### Accessing Server Replies with DO\_WSK\_Read

When data received is too dynamic and there is nothing on which to base the unique string, you cannot use the `DO_WSK_Expect()` to access server replies. In this case, when the number of characters received is always the same, you can use `DO_WSK_Read()`.

In the following example, the user sends a logon string to the server and the server sends back a unique key that is used for subsequent calls. Since the ending characters always change, `DO_WSK_Read` is called to receive a specified number of characters. You can parse this data for any values you need. The required code is shown in bold.

#### Sample Script

```

...
BEGIN_TRANSACTION();

```

## Using the Player, Script Development Workbench, and Analyze

```
DO_WSK_Socket(S2, AF_INET, SOCK_STREAM, IPPROTO_TCP);

DO_WSK_Bind(S2, ANY_ADDR, ANY_PORT);

DO_WSK_Connect(S2, "10.4.26.24", 80, AF_INET);

/* 20 bytes */
DO_WSK_Send(S2, "^@user=Bob^@pwd=CPWR^@\377");

//The data that is being sent from the server is dynamic and the ending
// character is never the same. Since this is the case using
// DO_WSK_Expect() will not work, so the script will use DO_WSK_Read()
// to receive the same number of bytes that were originally sent.
/* 14 bytes: SID=1234567890 */
//DO_WSK_Expect(S2, "^@");

//The script will now print the response that was received by
// calling Response() to gain access to the received buffer.

If (DO_WSK_Read(S2,14) != -1)
RR_printf("String = %s",Response());
...
```

### Conclusion

Using `DO_WSK_Read()` instead of `DO_WSK_Expect()` allows the virtual user to receive a specific number of bytes instead of a sequence of characters.

### Accessing Server Replies with `DO_WSK_Recv`

When the data returned is too dynamic and the `DO_WSK_Expect()` fails, you can use `DO_WSK_Recv()` to store the reply returned from the server. This saves the response based on its size instead of on the unique character string used in the `DO_WSK_Expect()`. When you use `DO_WSK_Recv()`, you specify how much data you want to receive and where to store it.

The sample script illustrates how to use `DO_WSK_Recv` to store the reply from the server. The required code is shown in bold.

### Sample Script

```
/* Declare Variables */
//Below are variables that were declared to use with DO_WSK_Recv,
//and the size of temp will vary depending upon the buffers that your
//application is returning.
int size = 0;
char temp[45];
...
BEGIN_TRANSACTION();
...
DO_WSK_Socket(S1, AF_INET, SOCK_STREAM, IPPROTO_IP);

DO_WSK_Bind(S1, ANY_ADDR, ANY_PORT);

DO_WSK_Setsockopt(S1, SOL_SOCKET, SO_OOBINLINE, 1);

DO_WSK_Connect(S1, "127.0.0.1", 90, AF_INET);

//Below is the data that was received at capture time.
/* 21 bytes: You are now connected */

//Initializing the temp variable
memset(temp, '\0', 45);
```

```
//Instead of calling DO_WSK_Expect() to receive the data, the
//script will now call DO_WSK_Recv(). This will allow the script to
//receive a specified number of characters instead of looking at the data
//to determine if the buffer has been received entirely or not.

DO_WSK_Recv(S1,temp,45,0,&size);

//Original function that was in the script
//DO_WSK_Expect(S1, "d");

//Prints the size of the string that was received to the playerbuffer.
RR_printf("Size of the received buffer was %d bytes", size);

DO_WSK_Closesocket(S1);
```

## Conclusion

In this example, the message "Size of the received buffer was 21 bytes" is printed to the player buffer window.

 **Caution:** When using this method instead of the `DO_WSK_Expect()`, verify that you receive the correct information before moving on to the next function in your script.

## Using Local Datapools within a Winsock Script

You can use dynamic data in your script by reading data from a datapool file. However, datapool files must be in an ASCII string, and not all dynamic data are in this format. For example, when the string "\ 121\ 101\ 114\ 157\ 141\ 144" appears in a datapool file and is read in using a one of the datapool functions, you receive "\\ 121\\ \ 101\\ \ 114\\ \ 157\\ \ 141\\ \ 144" as the output.

You can ensure that the output string you receive is accurate by using the `OctalToChar()` to convert any octal sequences into their binary representation. In this sample script, the string "\ 121\ 101\ 114\ 157\ 141\ 144" is read in from a local datapool file and converted to its binary representation. The required code is shown in bold.

## Sample Script

```
//This is used as an easy to remember descriptor for the datapool file.
#define DP1 1/* Identifier for a datapool file*/

/* Declare Variables */
//Variable declared to store the local datapool record.
char temp[40];

...
//Opens the datapool file
OPEN_DATA_POOL("datapool.dat", DP1, TRUE)
BEGIN_TRANSACTION();

//Reads a row of data in from the datapool file that was opened above
READ_DATA_RECORD(DP1);

...
DO_WSK_Socket(S1, AF_INET, SOCK_STREAM, IPPROTO_IP);

DO_WSK_Bind(S1, ANY_ADDR, ANY_PORT);
```

## Using the Player, Script Development Workbench, and Analyze

```
DO_WSK_Setsockopt(S1, SOL_SOCKET, SO_OOBINLINE, 1);

//Read the first column from the local datapool row that was
//returned when the READ_DATA_RECORD () was called.
strcpy(temp, GET_DATA_FIELD(DP1, 1));

//used to convert octal strings to their binary format
OctalToChar(temp);

//The script is now setup to send the data that was read in from the
//local datapool file instead of the hard coded values that were captured.
DO_WSK_Send(S1,temp);

//Below is the original send that was captured.
//DO_WSK_Send(S1,"\121\101\122\165\156");

DO_WSK_Closesocket(S1);
```

### Conclusion

In this example, the `DO_WSK_Send()` sends the octal representation for the string "QALoad", "`\121\101\114\157\141\144`", to the server.

### Winsock Script Samples

#### Sample: Handling Winsock Connection Problems

The following script snippet shows an example of how to handle connection problems. The code in bold shows how you can limit the retries and turn off the abort flag.

#### Sample Script Snippet

```
...
/* Declare Variables */
//Declared nNumRetries to keep track of the number of retry attempts that are made
int nNumRetries = 0;
//Declared "ret" to store the return code from DO_WSK_Connect()
int ret = -1;
...
BEGIN_TRANSACTION();

DO_WSK_Socket(S2, AF_INET, SOCK_STREAM, IPPROTO_TCP);

//In order to handle the failure for the DO_WSK_Connect the script needs to
// turn off the abort on error flag. After the connection is made the flag
// should be turned back on.
s_info->bAbortOnError = 0;

//The example below will try to make a connection to the remote application,
// and if it fails it will repeat the attempt up to 5 times.
while(ret = -1 && nNumRetries < 5)
{
 //Attempts to connect to the remote application.
 ret = DO_WSK_Connect(S2, "10.4.26.24", 123, AF_INET);

 if(ret == -1)
 {
 //pause between connection attempts
 DO_MSLEEP(500);
 //increment the counter for the number of retry attempts.
 }
}
```

```

 nNumRetries++;
 }
}

//turning the abort flag back on.
s_info->bAbortOnError = 1;
//If the max number of retries has been met then this virtual user should fail.
if(nNumRetries == 5)
RR__FailedMsg(s_info,"ERROR: Max number of connection retries has been reached");
...

DO_WSK_Closesocket(S2);

```

## WWW

### Streaming Media Support

QALoad includes support for audio and video download testing of both Windows Media Player and RealOne Player and their supported media formats through a WWW session. When streaming media conversion is enabled and you record a transaction that calls streaming media, an additional command that requests the media is inserted into your script. You do not have to listen to or view the entire media you are requesting. You simply need to record its URL and ensure that the appropriate media player is installed on the Player machines that plays back the script. At run time, the script invokes your media player and requests the streaming media resource. Streaming media through a firewall or proxy server is not supported.

QALoad's streaming media support includes the following media player(s). The appropriate media player must be installed on the machine you are recording from as well as any QALoad Player machine that will be executing the script.

- ! **RealOne Player** — The media download is initiated by requesting a file that is a data type supported by the RealOne Player. Supported data types are RealAudio, RealVideo, RealText, RealPix, and SMIL. As a result, the [DownloadMediaRP](#) command will be inserted into the script at the appropriate point. At runtime, this command initiates and waits for completion of the download. RealOne Player scripts must be executed as process-based scripts.
- ! **Windows Media Player** — The media download is initiated by downloading a file with a content type of (audio|video)/(x-ms-asf|s-ms-asf) in the browser. Currently, only .asx files are supported. As a result, the [DownloadMediaFromASX](#) command is inserted into the script at the appropriate point.

 **Note:** QALoad does not support scripts that have both RealNetworks media and Windows Media in the same script. To test both types in a single load test, use a different script for each type.

Please note that asynchronous calls may not be played back exactly as they were recorded. For example, if you click on a link in the browser while recording while the media is playing, during replay that link is not requested until the media clip has finished being processed.

[How do I configure QALoad to process streaming media?](#)

### Creating a Visual Navigator Script

Using the Script Development Workbench, you can quickly and easily record a new Visual Navigator Script [How?](#)

## About User Events

### Without User Events

QALoad relies on the traffic that it captures from and to client applications. It uses this traffic to infer what user actions and events triggered the traffic in order to duplicate the activity during replay.

In some situations, the correct inference cannot be made from the event that triggered the browser traffic. For example, asynchronous traffic occurring in the AJAX model cannot be inferred from the originating action.

Additionally, the inability to determine the user action that caused the traffic sometimes results in recorded session activity that differs from the original when replayed. For example, sometimes the user actions have Javascript code associated with them, which can modify the next request.

Also, the inability to find the user action can cause the Javascript code to be executed incorrectly or not at all. In these cases, the user must modify the recorded session (script) information to correct these inaccuracies.

### With User Events

The inclusion of user event capture provides a better determination of event triggers and user actions. Scripts generated using event information from the capture resemble the user actions during capture time. This results in a more consistent replay of the original session. For example, when a user clicks on a link or button, the click is captured and placed in the capture file with the page where it occurred. This information in the capture is used to generate the action in the script rather than the alternate method of interpreting the traffic from and to the client application. This should result in scripts that more closely match the user actions at capture time.

To capture with user events, select the user event options in [General WWW Conversion Options](#) and [WWW Recording Options](#).

## Record Options

### Using the WWW Record Options

Use the WWW Record Options to determine how QALoad handles captures web page transaction data.

To set the WWW recording options:

---

1. With a WWW session open, click **Options>Record**. The Session Options dialog box appears with the WWW Record Options highlighted in the tree view control. The [WWW Record Options](#) dialog box appears on the right.
2. Select the appropriate options, then do one of the following:
  - ! Click OK to save the selections and return to the WWW session screen.

- ! Click Advanced Record Options in the tree view control. The [Advanced Recording Options](#) dialog box appears on the right.

3. Select the appropriate options.
4. Click **OK**. The basic record options and the advanced options are saved and you return to the WWW session screen.

### Configuring a Web Browser (WWW)

Before you record the WWW requests your Web browser makes, you must configure the browser to use QALoad's proxy server.

#### To configure a Web browser:

---

1. Start your Web browser.
2. Specify proxy settings:
  - ! In the field designated to specify the address of the proxy server, enter the machine name where QALoad Script Development Workbench is installed.
  - ! In the Port field, enter the port(s) that you specified on the Script Development Workbench's WWW Record Options wizard (Capture Ports fields).
3. Click **OK**.

### Recording Streaming Media

#### To record streaming media:

---

1. With a WWW session open in the Script Development Workbench, choose **Options>Convert** from the menu.
2. Under WWW Convert Options, select **General**.
3. Under Other on the General options page, select the Streaming Media option, then click **OK**.

When you record your transaction, make sure you invoke your media player through clicking a link or typing a URL in your web browser. QALoad records the URL from your web browser; therefore, you must use your browser to access your media file or else the URL will not be recorded in your script.

### Recording a Visual Navigator Script

You record a Visual Navigator script the same way you record a regular QALoad script — by setting options to determine the behavior of QALoad while recording, and then clicking through a transaction to mimic a user. QALoad will record all sent and received HTTP and SSL calls using the Script Development Workbench's Web proxy and write the activity to a capture file.

After recording, the capture file must be converted to an editable, C++-based script. Your capture file data turns into a Visual Navigator Script that allows you to view the actual Web pages you recorded in a browser-like interface, where you can manipulate the transaction and easily insert variable information into your script without directly editing a line of code. It is possible to save the script as another name to view the code instead of the Visual Navigator script. By doing this, the code is separated from the Visual Navigator script. Any changes made in the code will not appear in the Visual Navigator script just as any changes made in the Visual Navigator script will not appear in the saved as code.

#### To record a Visual Script:

---

## Using the Player, Script Development Workbench, and Analyze

If you are running your application on Windows XP SP2, Compuware recommends you turn off the 'pop-up blocker' feature before recording a transaction. The feature can be disabled via the browser window's Tools menu in Internet Options>Privacy.

1. Open a WWW session in the Script Development Workbench.
2. Click **Options>Record**. The WWW Record Options dialog box opens. Set any [relevant options](#).
3. Click **OK**.
4. For convenience, set conversion options now also. (You can set conversion options after recording your transaction, if you prefer, or even change pre-set options at any time after recording and then re-convert the capture file to apply the changes.):
  - a. Click **Options>Convert**. The Universal Convert Options dialog box opens.
  - b. Set any applicable options.
  - c. Click **OK**.
5. From the toolbar, click the **Start Record** button. QALoad launches your application and any proxies, if necessary, and begins recording calls.
6. Record the transaction.
7. When you are finished, click the **Stop Record** button. You will be prompted to save your capture file. By default, capture files (.cap) are saved in the directory QALoad\Middlewares\WWW\captures.
8. If you previously set options to prompt automatic conversion, your capture file will be converted to a Visual Script and will open automatically in the editor. For more information about setting up automatic conversion, see [Configuring the Script Development Workbench](#).

If not, you will be prompted to save and name your file. When you are finished, click OK.

9. Click the Script Development Workbench's Captures tab and locate the capture file you just saved.
10. Right-click the file and choose **Convert**. QALoad will convert your capture file to a Visual Navigator script and open it in the editor.

## Convert Options

### Using the WWW Convert Options

Use the WWW Convert Options to control how QALoad produces scripts from recorded transaction data. You can also choose the convert and playback mode for WWW middleware sessions. The convert and playback mode determines the amount of memory and processor QALoad uses during replay.

To select the processing mode:

---

1. With the WWW session open, click **Options>Convert**. The Session Options dialog box displays.
2. Click **WWW Convert Options** in the tree view control. The WWW Convert Options dialog box appears on the right side of the screen.
3. Select the convert mode to use for the WWW middleware sessions. You can choose:
  - ! [HTML Mode](#) - to reduce the amount of scripting.
  - ! [HTTP Mode](#) - to control processor and memory usage.

**Tip:** Compuware recommends that you use the WWW Convert Options dialog box to convert between modes, rather than manually edit the script.

4. Click each of the following to display the associated dialog box and select the appropriate options:

**Note:** The options available for Parsing depend on whether you select HTTP or HTML mode.

- ! [Parsing](#)

- ! [Verification](#)
- ! [Caching](#)
- ! [Traffic Filters](#)
- ! [Rule Filters](#)
- ! [Connection Settings](#)
- ! [Content Type Handling](#)
- ! [General](#)
- ! [Sebel](#)

5. Click **OK** to save the settings and return to the main WWW session screen.

**Caution:** Once you convert a script using HTTP mode or HTML mode, you must reconvert the script to change the convert mode. This is necessary so that the convert and replay methods match. Failure to change modes by reconvert the script can cause the script to replay incorrectly.

## Using the WWW Playback Options

The WWW Playback options you select affect the entire script.

To select the WWW Playback Options:

1. With a script open in a WWW session, double-click **Playback Options** in the tree view. The available session options display in the tree view.
2. Double-click **WWW Playback Options** in the tree view.
3. Click each playback option in the tree view to display the associated dialog box on the right.
4. Click each of the following to display the associated dialog box and select the appropriate options:

 **Note:** The options displayed for Parsing depend on the mode you select in the [WWW Convert Options](#) dialog box.

- ! [Parsing \(HTML Mode or HTML Mode\)](#)
- ! [Caching](#)
- ! [Traffic Filters](#)
- ! [Connection Settings](#)
- ! [Proxy](#)
- ! [General](#)
- ! [Sebel](#)

## Comparison of HTTP Mode and HTML Mode

Choosing HTML mode or HTTP mode for script conversion enables you to control how much automated processing is performed during test execution. Typical HTML processing uses more processor cycles and memory during test execution, but requires less scripting. HTTP processing instructs QALoad to disable most of its automatic HTML handling engine during replay, and it also affects how the script is generated.

Using the Player, Script Development Workbench, and Analyze

| Features Available for Selection  | HTTP Mode | HTML Mode      | Convert Options Page  |
|-----------------------------------|-----------|----------------|-----------------------|
| Parsing                           | Yes       | No (Always On) | Parsing               |
| Dynamic Cookie Handling           | Yes       | No (Always On) | Parsing               |
| Dynamic Redirects                 | Yes       | No (Always On) | Parsing               |
| Authentication                    | Yes       | Yes            | N/A                   |
| HTTPS                             | Yes       | Yes            | N/A                   |
| Extracts                          | Yes       | Yes            | N/A                   |
| Title Verification                | Yes       | Yes            | Verification          |
| Content Check                     | Yes       | Yes            | Content Type Handling |
| Chunked Data                      | Yes       | Yes            | N/A                   |
| Streaming Media                   | Yes       | Yes            | General               |
| Traffic Filters                   | Yes       | Yes            | Traffic Filters       |
| Parameterization Rules            | Yes       | Yes            | Rule Filters          |
| Allow JavaScript Execution        | Yes       | No             | Parsing               |
| Click_Ons                         | No        | Yes            | N/A                   |
| Fill In Forms                     | No        | Yes            | N/A                   |
| Caching                           | Yes       | Yes            | Caching               |
| Expert User                       | Yes       | Yes            | N/A                   |
| Universal Mode                    | Yes       | Yes            | N/A                   |
| Represent CJK as Octal Characters | Yes       | Yes            | General               |
| UTF-8                             | Yes       | Yes            | N/A                   |
| XML Requests                      | Yes       | Yes            | General               |
| Meta Refresh                      | Yes       | Yes            | General               |
| Automatic Sub-request Processing  | Yes       | No (Always On) | Parsing               |
| Set JavaScript Execution          | No        | Yes            | Parsing               |

|                                      |     |     |                     |
|--------------------------------------|-----|-----|---------------------|
| Level                                |     |     |                     |
| Set JavaScript Loop Timeout          | Yes | Yes | Parsing             |
| Manually Select Sub-requests         | Yes | Yes | Parsing             |
| Persistent Connections During Replay | Yes | Yes | Connection Settings |
| Graceful Socket Shutdown             | Yes | Yes | Connection Settings |
| Baud Rate Emulation                  | Yes | Yes | Connection Settings |
| Reuse SSL Session ID                 | Yes | Yes | Connection Settings |
| Siebel Support                       | Yes | Yes | Siebel              |
| Anchor and Form Extraction           | Yes | Yes | General             |
| Strip All Cookies                    | Yes | Yes | General             |

### Using HTML Mode

HTML mode converts and replays scripts using full Document Object Model (DOM) and JavaScript engine. HTML documents are fully parsed in HTML mode. JavaScript can be executed at different levels, including NONE, LIMITED, and FULL. Because HTML mode uses full DOM and JavaScript engine, it uses more processor cycles and memory during test execution, but requires less scripting.

Use HTML mode to create load testing scripts quickly and easily, and for load tests requiring fewer virtual users (VU) running on any player machine. You can use HTML mode to create scripts for heavier load testing, but the scripts may require more player machines on which to run the VUs.

### Considerations

- ! **Javascript** - Javascript can be executed at different levels, including None, Limited, and Full.
- ! **CPU usage** - Uses more processor cycles during test execution
- ! **Memory** - Uses more memory during test execution
- ! **Parameterization** - Requires less scripting and less parameterization than HTTP mode because QALoad is better able to infer user actions using its DOM.

### Use this mode if you are:

- ! testing a web site that uses complex JavaScript with complex HTML pages that contains a significant number of links, tables or HTML objects
- ! a novice tester and wish to work with scripts that more closely resemble the user's interactions with the application under test
- ! only testing with a low number of virtual users or have significant hardware resources available for load testing execution

Tip: Compuware recommends that you use the WWW Convert Options dialog box to convert between modes, rather than edit the script manually.

### Sample Script

The following shows a sample of a script with HTML mode selected:

```
...
...
SET_SCRIPT_LANGUAGE(SLID_English);
DO_WWWInitialize(s_info, HTML_MODE);
...
...
BEGIN_TRANSACTION();
...
...
```

### Using HTTP Mode

HTTP mode converts and replays scripts using a simplified HTML parser and limited JavaScript engine. You can control the level of HTML document parsing, and whether JavaScript should be executed. HTTP mode does less processing during replay and uses less memory because it does not create Document Object Models (DOM) for each processed HTML page.

HTTP mode may require more parameterization than HTML mode. During conversion, actions are represented in the visual script by NavigateTo or PostTo tree items instead of ClickOn or Fill-In Form tree items. This means that any dynamic variables passed from reply to request must be managed in the script. Use the [Variable Replacement Wizard](#) to develop rules to find parameters in your script and replace them with variables.

### Considerations

- ! **JavaScript** — Because JavaScript execution is limited, some scripts may require customization to emulate Javascript operations not executed by QALoad.
- ! **Automatic Sub-requests** — When Parsing is selected, automatic Sub-requests are enabled. When not enabled, QALoad executes the same sub-requests made during the capture phase (instead of parsing the server responses). This makes playback highly scalable, but very dynamic web applications may require additional scripting. All subrequests and additional subrequests are selected by default during the convert.
- ! **Functions** — Converted scripts use only the Navigate\_To() and Post\_To functions; the Click\_On() function is disabled.
- ! **Parameterization** — May require more parameterization than HTML mode.
- ! **Memory and CPU Usage** — Does less processing and uses less memory during replay.
- ! **Dynamic variables** — Dynamic variables passed from reply to request must be managed in the script.

Use this mode if you are:

- ! testing a web site that makes little use of Javascript and creates pages with few HTML options on them
- ! an experienced load tester and wish to work with scripts that more closely resemble the applications HTTP interactions with the server under test
- ! you are testing for high virtual user throughput or simulating high numbers of concurrent virtual users from limited hardware resources

Tip: Compuware recommends that you use the WWW Convert Options dialog box to convert between modes, rather than edit the script manually.

### Sample Script

The following shows a sample script with HTTP mode selected:

```
...
...
SET_SCRIPT_LANGUAGE(SLID_English);
DO_WWWInitialize(s_info, HTTP_MODE);
...
...
BEGIN_TRANSACTION();
...
...
```

### Using the Verification Option

Enables document title verification for main requests of type HTML or TEXT.

#### Considerations

There are three supported methods for verifying a document title: search for the Entire Document Title, the Prefix of the document title, or the Suffix of the document title.

Use this option to:

- ! Create scripts that verify characters contained in document titles.
- ! Detect and handle error messages that are returned in an HTML page.

### Script Samples

The following are examples of a search for the Entire document title.

#### [Example Web Page](#)

#### [Script Examples with Option Selected](#)

#### [Script Examples with Option Not Selected](#)

#### Example Web Page

```
<HTML>
<HEAD>
<title>Welcome to The Main Page</title>
</head>
<body>
<p>
WWW Capture Examples (relative link)
</p>
</body>
</HTML>
```

## Using the Player, Script Development Workbench, and Analyze

### Script Example with the Document Title Verification Option Selected

The following example has the Document Title Verification check box selected and compares by the entire document title.

```
...
...
DO_Http("GET http://www.host.com/ HTTP/1.0\r\n\r\n");
DO_VerifyDocTitle("Welcome to The Main Page", TITLE);
...
...
```

### Script Example that Matches the First 5 Characters

The following example compares by prefix.

```
...
...
DO_Http("GET http://www.host.com/ HTTP/1.0\r\n\r\n");
DO_VerifyDocTitle("Welco", PREFIX);
DO_SetTransactionCleanup();
...
...
```

### Script Example that Matches the Last 4 Characters

The following example compares by suffix.

```
...
...
DO_Http("GET http://www.host.com/ HTTP/1.0\r\n\r\n");
DO_VerifyDocTitle("Page", SUFFIX);
DO_SetTransactionCleanup();
...
...
```

### Document Title Verification – No

The following example has the Document Title Verification check box cleared.

```
...
...
DO_Http("GET http://www.host.com/ HTTP/1.0\r\n\r\n");
DO_SetTransactionCleanup();
...
...
```

## About Caching

HTTP protocol has two caching models, which browsers implement.

**Expiration model:** The Web server sends information in the reply header asking the client to save the reply in the cache for a particular duration. There is no need to send request for this resource again unless the duration has expired.

**Validation model:** A request is sent to the Web server to check the validity of the cached resource. The resource is saved in the cache, but a request is sent by the client to the server to check if this cache is valid.

QALoad supports the validation models, whereas, it simulates the expiration model.

Since the validation model sends a request each time the site is accessed, it behaves like a first time user. The expiration model mimics a returning user because of its ability to store the reply in the cache. To run a script as if it were a first time users, use the [Caching options](#). To run a script as if it were a returning user, use the non-cacheable option in the [Parsing options dialog box](#).

### Using the Caching Option

When a caching option is enabled, requested images, .css, or .js files are cached at playback time.

#### Considerations

- ! Types of documents that QALoad caches on the virtual user during replay are: **None, Images, CSS, JS, and Images**, or **All**.
- ! The caching level names denote the types of documents that QALoad caches on the virtual user during replay.
- ! If these documents are referenced after the virtual user has already requested and received the document once, they are not requested from the target server again by that virtual user.

Use this option to:

Select the type of caching you would like the WWW replay engine to use during playback.

#### Script Samples

##### Caching Option: None

```
Set (EVERY_REQUEST, CACHING, NO_CACHING);
```

##### Caching Option: Images

```
Set (EVERY_REQUEST, CACHING, IMAGES);
```

##### Caching Option: CSS, JS, and Images

```
Set (EVERY_REQUEST, CACHING, IMAGES_JS_AND_CSS);
```

##### Caching Option: All

```
Set (EVERY_REQUEST, CACHING, ALL);
```

### Using Traffic Filters

Traffic Filters allows you to filter out certain requests while playing back a script.

#### Considerations

Traffic filters do not affect XML requests that are written to the Visual Navigator tree when a capture file is converted.

Use this option to:

- ! Determine which traffic should be:
  - included in your script
  - blocked from your script
  - converted to subrequests in the script
- ! Also block specific substrings in the path of URLs, such as .jpg to block all JPEG images.

## Using the Player, Script Development Workbench, and Analyze

### Script Samples

#### Script Example with a Traffic Filter Set

In the following example, a traffic filter has been set to exclude requests with URLs that contain the string "www.host.com".

```
...
...
DO_InitHttp(s_info);

...
...
/* Exclude requests with URLs containing */
DO_BlockRequestsFrom("www.host.com;");

...
...
BEGIN_TRANSACTION();

...
...
DO_Http("GET http://rm.host.com:8099/ramgen/realmp3.mp3 "
 "HTTP/1.0\r\n"
 "Referer: http://www.host.com/index.htm\r\n\r\n");

...
...
END_TRANSACTION();

...
...
```

#### Script Example without a Traffic Filter Set

The following example does not use traffic filters.

```
...
...
DO_InitHttp(s_info);

...
...
BEGIN_TRANSACTION();

...
...
DO_Http("GET http://www.host.com/ HTTP/1.0\r\n\r\n");
DO_VerifyDocTitle("Welcome to The Main Page", TITLE);
DO_Http("GET http://www.host.com/index.htm HTTP/ 1.0\r\n\r\n");
DO_VerifyDocTitle(" QALoad WWW Capture Examples", TITLE);
DO_Http("GET http://rm.host.com:8099/ramgen/realmp3.mp3 HTTP/1.0\r\n\r\n");

...
...
END_TRANSACTION();

...
...
```

## Using Rule Filters

Selects the Rule Folders that are scanned for matching rules when converting a WWW capture file into a Visual Navigator script.

### Considerations

- ! Rules are sets of parameters that are established to substitute certain pre-established variables for system generated variables.
- ! Parameters and Rules are established using the [Variable Replacement Wizard](#).

Use this option to:

Control the rules QALoad uses during the convert process to help parameterize scripts.

### Overview — Best Practices Sample Scripts

This section shows samples of how the WWW convert options appear in a script. Compuware recommends that you use the [WWW Convert Options](#) dialog box to convert between modes, rather than edit the script manually.

Once you convert a script using HTTP mode or HTML mode, you must reconvert the script to change the convert mode. This is necessary so that the convert and replay methods match. Failure to change modes by reconvert the script can cause the script to replay incorrectly.

## Enable Siebel Support Option

The Enable Siebel Support option allows QALoad to identify if the capture file to be converted is a Siebel file.

### Considerations

- ! This option results in adding a new command in the script called [SiebelInitialize](#), which identifies the script as a Siebel script.
- ! Two additional commands are also inserted into the script: [SiebelUpdatePage](#) and [GetSiebelValue](#). These two commands are only added if there were HTML responses in the capture file, which resulted in generation of Siebel variables.
- ! When the convert process is complete, all HTML pages with Siebel variables attached to them at the convert process are output into the script file so playback can retrieve values from the Siebel Library.

Use this option to:

Record, modify, and play back scripts for the purpose of performance testing against Siebel applications and environments.

### Script Samples

#### Script Example with the Enable Siebel Support Option Selected

The following example has the Enable Siebel Support check box selected.

```
CLoadString __Siebel_1 = "VRId-3";
CLoadString __Siebel_2 = "";
CLoadString __Siebel_3 = "SWERowId0=1-7BZ";
CLoadString __Siebel_4 = "";
CLoadString __Siebel_5 = "1-136";
CLoadString __Siebel_6 = "SWERowId0=1-7BZ";
CLoadString __Siebel_7 = "";
```

## Using the Player, Script Development Workbench, and Analyze

```
CLoadString __Siebel_8 = "1-1UY";
CLoadString __Siebel_9 = "";
CLoadString __Siebel_10 = "1-1UY";
CLoadString __Siebel_11 = "";
CLoadString __Siebel_12 = "1-1UY";
...
...
// WWW General Options
Set(EVERY_REQUEST, HTTP_VERSION, "1.1");
SiebelInitialize(); // Siebel support is enabled

...
...
Post_To("http://dtw-siebel78/callcenter_enu/start.swe");
// Get the Siebel parameters from this page
SiebelUpdatePage();
__Siebel_5 = GetSiebelValue(" S_BC3_S09_R06_FID ");
__Siebel_8 = GetSiebelValue(" S_BC3_S09_R05_FID ");
__Siebel_10 = GetSiebelValue(" S_BC3_S09_R05_FID ");
__Siebel_12 = GetSiebelValue(" S_BC3_S09_R05_FID ");
...
...
// Original string was:
// "1-136"
// Variablized string is:
// "${ VAR:Siebel-5 $}"
//
Set(NEXT_REQUEST_ONLY, POST_DATA, "SWERowId", __Siebel_5);
Set(NEXT_REQUEST_ONLY, POST_DATA, "SWEC", "7");
Set(NEXT_REQUEST_ONLY, POST_DATA, "SWEMethod", "PositionOnRow");
Set(NEXT_REQUEST_ONLY, POST_DATA, "SWEReqRowId", "1");
Set(NEXT_REQUEST_ONLY, POST_DATA, "SWERPC", "1");
Set(NEXT_REQUEST_ONLY, POST_DATA, "SWEApplet", "Contact Assoc Applet");
Set(NEXT_REQUEST_ONLY, POST_DATA, "SWEView", "Account Detail - Contacts View");
Set(NEXT_REQUEST_ONLY, POST_DATA, "SWECmd", "InvokeMethod");
Set(NEXT_REQUEST_ONLY, POST_DATA, "SWESP", "false");

// Original string was:
// "1156341790828"
// Variablized string is:
// "${ DATETIME:MS1970 $}"
//
Set(NEXT_REQUEST_ONLY, POST_DATA, "SWETS", TIME_SINCE_1970("milliseconds"));
Set(NEXT_REQUEST_ONLY, POST_DATA, "SWEIgnoreCtrlShift", "0");
Set(NEXT_REQUEST_ONLY, POST_DATA, "SWEP", "1B_Account Contact List
Applet9_NewRecord0_0_1_7");

// Original string was:
// "SWERowId0=1-7BZ"
// Variablized string is:
// "${ VAR:Siebel-7 $}"
//
//-- Update the Calculation Variable Siebel-7 --
//
// Variablized string is:
// "SWERowId0=${ VAR: Siebel-6 $}"
//
__Siebel_7 = "SWERowId0=";
__Siebel_7 += __Siebel_6;
__Siebel_7 = __Siebel_7;
Set(NEXT_REQUEST_ONLY, POST_DATA, "SWERowIds", __Siebel_7);
Set(NEXT_REQUEST_ONLY, CHECKPOINT_NAME, "Page 20 - http://dtw-siebel78/callcenter");

Post_To("http://dtw-siebel78/callcenter_enu/start.swe");
DO_SLEEP(1);
```

### Script Example with the Enable Siebel Support Option Not Selected

The following example has the Enable Siebel Support check box cleared.

```

Siebel_off
extern "C" int rrobot_script(PLAYER_INFO* s_info)
{
// Declare Variables
//

SET_ABORT_FUNCTION(abort_function);

DEFINE_TRANS_TYPE("cap_siebel_on.cpp");

SET_SCRIPT_LANGUAGE(SLID_English);
DO_InitHttp(s_info);

// Playback Options
//
Set(EVERY_REQUEST, PROXY_MODE, PROXY_AUTOMATIC_CONFIGURATION);
Set(EVERY_REQUEST, PROXY_SCRIPT, "http://proxyconf.compuware.com");
Set(EVERY_REQUEST, HTTP_VERSION, "1.1");
Set(EVERY_REQUEST, PROXY_HTTP_VERSION, "1.0");
Set(EVERY_REQUEST, JAVASCRIPT_LEVEL, FULL);
Set(EVERY_REQUEST, USER_PATIENCE, 120); // Maximum time to wait for an HTTP Reply
Set(EVERY_REQUEST, CONNECTION_RETRIES, 4); // maximum attempts to connect
Set(EVERY_REQUEST, BROWSER_THREADS, 2); // total browser threads to simulate
Set(EVERY_REQUEST, CACHING, NO_CACHING); // Enable/Disable cache
Set(EVERY_REQUEST, REUSE_CONNECTION, TRUE); // maintain socket connection if possible
Set(EVERY_REQUEST, REUSE_SECURE_SESSION, TRUE);
..
..
..
Navigate_To("http://dtw-siebel78/callcenter_enu/start.swe");

//----- REQUEST # 6 -----
//
// current page url is http://dtw-
siebel78/callcenter_enu/start.swe?SWECmd=GetCachedFrame&SWEACn=....
//
Set(NEXT_REQUEST_ONLY, HEADER, "Accept", "image/gif, image/x-xbitmap, image/jpeg"
", image/pjpeg, application/x-shockwave-flash, */*");
Set(NEXT_REQUEST_ONLY, POST_DATA, "s_2_1_57_0", "Business");
Set(NEXT_REQUEST_ONLY, POST_DATA, "s_2_1_27_0", "sdfasdf");
Set(NEXT_REQUEST_ONLY, POST_DATA, "s_2_1_28_0", "sfdasfd");
}

```

### Represent CJK as Octal Characters

When this option is selected, the double-byte characters used for Chinese, Japanese, and Korean (CJK) scripts are converted into octal format.

### Considerations

- ! Since CJK characters use Double Byte Character Sets (DBCS), encoding must be enabled for a capture with CJK characters, so that the double-byte characters can be viewed in a legible format.
- ! Data stays in encoded format throughout the load test: from capture, through convert and replay, to the analysis of the timing file.

## Using the Player, Script Development Workbench, and Analyze

Use this option to:

- ! Enable the encoding of captured data from web applications containing Double Byte Character Sets (DBCS) such as Chinese, Japanese, or Korean.
- ! Encode all native characters when native character support cannot be used.

### Sample Scripts

#### Example Web Page

```
<html>
<head>
<title> </title>
<meta http-equiv="Content-type" content="text/html; charset=euc-kr">
<meta http-equiv="Cache-Control" content="no-cache">
<meta http-equiv="Pragma" content="no-cache">
<meta http-equiv="Expires" content="Wed, 04 Jul 1973 16:00:00 GMT">

<!--CSS-->
<style type='text/css'>
</style>

<!--/CSS-->
</head>
<body onload="document.search.p.focus();" topmargin=8>

...
...
</body>
</html>
```

#### Script Example with the Represent CJK as Octal Characters Option Selected

The following example has the Represent CJK as Octal Characters check box selected.

```
...
...
/* Request: 1 */
DO_Http("GET http://kr.yahoo.com/ HTTP/1.0\r\n\r\n");
DO_VerifyDocTitle("\276\337\310\304!\304\332\270\256\276\306", TITLE);
...
...
```

#### Script Example with the Represent CJK as Octal Characters Option Not Selected

The following example has the Represent CJK as Octal Characters check box cleared.

```
...
...
/* Request: 1 */
DO_Http("GET http://kr.yahoo.com/ HTTP/1.0\r\n\r\n");
DO_VerifyDocTitle(, TITLE);
...
...
```

## Parsing

### Using the Parsing Option

When the Page Parsing option is selected on the WWW Convert Options, QALoad performs limited parsing operations on incoming HTML pages. This option only applies to HTTP mode, and is disabled if HTML mode is selected as the convert mode.

You should disable this option if you find that you need to fit more HTTP mode virtual users on a single player machine. Disabling this option can decrease the processor usage required by a virtual user.

#### Considerations

- ! When selected, limited parsing is performed on incoming HTML pages.
- ! Must be selected to enable the Allow Javascript execution option.
- ! Must be selected to enable the Automatically process sub-requests option.
- ! May increase processor usage required by a virtual user.

#### Use this option to:

- ! Enable execution of Javascript in HTTP mode.
- ! Enable automatic sub-requesting in HTTP mode.
- ! Enable document verification in HTTP mode.

#### Allow JavaScript Execution

This option is only enabled when the Parse Pages option is selected in HTTP conversion mode. QALoad executes JavaScript in replay as if the LIMITED JavaScript Execution Level is used. Since JavaScript is always executed in HTML mode, this option is disabled if HTML mode is selected as the convert mode.

#### Considerations

- ! The option to turn on or turn off JavaScript execution is available only in HTTP mode. JavaScript is always executed in HTML mode.
- ! When enabled, QALoad executes JavaScript at the [Limited execution level](#).
- ! May decrease the amount of parameterization required for certain scripts.
- ! May increase the processor time required by a virtual user.

#### Use this option to:

Decrease the amount of parameterization required.

#### Automatically Process Sub-requests in HTTP Mode

When this option is selected, QALoad does not insert sub-requests (such as .jpg, .gif, .css, .js, etc.) directly into the script file, but automatically makes these requests during replay by parsing them out of the HTML pages.

This option is only enabled when HTTP mode is selected and the Parse Pages option is enabled. HTML mode always processes sub-requests automatically.

#### Considerations

## Using the Player, Script Development Workbench, and Analyze

- ! When this option is disabled, QALoad executes the same sub-requests made during the capture phase instead of parsing the server response.
- ! Very dynamic web applications may require additional scripting.
- ! All sub-requests and additional sub-requests are selected by default during convert.
- ! Enabling this option requires more processing during playback.

Use this option to:

- ! Allow QALoad to manage sub-requests.
- ! Reduce the length of .cpp script files.
- ! Increase .cpp script file readability.

### Sample Script

#### Example Web Page

```
<html>
<head>
<title>Page Of Subs</title>
</head>
<body>
<p>The page of subrequests</p>
<p>.</p>
</body>
</html>
```

#### Script Example with the Automatically Process Subrequests Option Selected

In the following example, the Automatically Process Subrequests check box is selected.

```
...
...
BEGIN_TRANSACTION();
DO_AutomaticSubRequests(TRUE);

...
...

DO_Http("GET http://www.host.com/subs.htm HTTP/1.0\r\n\r\n");
DO_VerifyDocTitle("Page Of Subs", TITLE);

...
...

END_TRANSACTION();

...
...
```

#### Script Example with the Automatically Process Subrequests Option Not Selected

In the following example, the Automatically Process SubRequests check box is cleared.

```
...
...
BEGIN_TRANSACTION();

...
...

DO_AutomaticSubRequests(FALSE);
```

```

...
...
DO_Http("GET http://www.host.com/subs.htm HTTP/1.0\r\n\r\n");
DO_VerifyDocTitle("Page Of Subs", TITLE);

/* Request: 2 From: Page Of Subs */
DO_Http("GET http://www.host.com/win2000.gif HTTP/1.0\r\n\r\n");

/* Request: 3 From: Page Of Subs */
DO_Http("GET http://www.host.com/web.gif HTTP/1.0\r\n\r\n");

/* Request: 4 From: Page Of Subs */
DO_Http("GET http://www.host.com/APACHE.GIF HTTP/1.0\r\n\r\n");

/* Request: 5 From: Page Of Subs */
DO_Http("GET http://www.host.com/COLORS.GIF HTTP/1.0\r\n\r\n");

...
...
END_TRANSACTION();

...
...

```

### Dynamic Redirect Handling

Selecting this option enables the QALoad replay engine to dynamically handle 3XX redirects. When a 3XX redirect page is returned during replay, QALoad processes the redirect and requests the redirected page as well. This option only applies to HTTP mode, and is disabled if HTML mode is selected as the convert mode.

### Considerations

- ! This option should normally only be disabled if you do not want the script to follow 3XX redirects.
- ! Dynamic redirect handling does not handle JavaScript redirects.
- ! Dynamic redirect handling does not handle meta refresh redirects.

### Use this option to:

- ! Dynamically handle 3XX redirects.
- ! Process the redirect and also request the redirected page.

### Examples

Consider a Web page with a link to 'Redirected Webpage' (<http://www.host.com/cgi-bin/dynredir.exe>). When this link is clicked, the server generates a 302 return value with a new redirected location of [http://172.22.24.39/cgi-bin/aperl\\_8.pl](http://172.22.24.39/cgi-bin/aperl_8.pl).

#### Script Example with the Dynamic Redirect Handling Option Selected

When this option is selected, the script contains only the request for <http://www.host.com/cgi-bin/dynredir.exe>. Replay handles the 302 return value and calls [http://172.22.24.39/cgi-bin/aperl\\_8.pl](http://172.22.24.39/cgi-bin/aperl_8.pl) automatically.

The following example has the Dynamic Redirect Handling check box selected.

```

...
...

```

## Using the Player, Script Development Workbench, and Analyze

```
/* Declare Variables */
int i;
char *Anchor[1];

...
...

for(i=0;i<1;i++)
Anchor[i]=NULL;

...
...

BEGIN_TRANSACTION();

...
...

DO_DynamicRedirectHandling(TRUE);

...
...

DO_Http("GET http://www.host.com/index.htm HTTP/" "1.0\r\n\r\n");
DO_VerifyDocTitle(" QALoad WWW Capture Examples", TITLE);

...
...

DO_GetAnchorHREF("Redirected Webpage", &Anchor[0]);

...
...

DO_SetValue("Anchor000", Anchor[0]);
DO_Http("GET {*Anchor000} HTTP/1.0\r\n\r\n");
DO_VerifyDocTitle("Successful Test of Dynamic Redirect Sample", TITLE);

...
...

for(i=0; i<1; i++)
{
free(Anchor[i]);
Anchor[i]=NULL;
}

END_TRANSACTION();

...
...
```

### Script Example with the Dynamic Redirect Handling Option Not Selected

In this example, the script contains the request for <http://www.host.com/cgi-bin/dynredir.exe> as well as [http://172.22.24.39/cgi-bin/aperl\\_8.pl](http://172.22.24.39/cgi-bin/aperl_8.pl). The following example has the Dynamic Redirect Handling check box cleared.

```
...
...

/* Declare Variables */
int i;
char *Anchor[1];

...
...

for(i=0;i<1;i++)
Anchor[i]=NULL;

...
...
```

```

BEGIN_TRANSACTION();
DO_DynamicRedirectHandling(FALSE);

...
...

DO_Http("GET http://www.host.com/index.htm HTTP/1.0\r\n\r\n");
DO_VerifyDocTitle(" QALoad WWW Capture Examples", TITLE);
DO_GetAnchorHREF("Redirected Webpage", &Anchor[0]);
DO_SetValue("Anchor000", Anchor[0]);
DO_Http("GET {*Anchor000} HTTP/1.0\r\n\r\n");
DO_VerifyDocTitle("Document Moved", TITLE);
DO_Http("GET http://www.host.com/udir/frm.pl HTTP/1.0\r\n\r\n");
DO_VerifyDocTitle("Successful Test of Dynamic Redirect Sample", TITLE);
DO_SetTransactionCleanup();

/* Clear up some internal storage used for DO_SetValue() */
DO_HttpCleanup();
for(i=0; i<1; i++)
{
free(Anchor[i]);
Anchor[i]=NULL;
}

END_TRANSACTION();

...
...

```

## Dynamic Cookie Handling

When you select this option, QALoad automatically processes dynamic cookies during replay. This option only applies to HTTP mode, and is disabled if HTML mode is selected as the convert mode. QALoad always handles dynamic cookies in HTML mode.

### Considerations

- ! Not selecting this option hard codes cookie values from the capture file into the script file.
- ! When this option is not selected in HTTP mode, QALoad places Set(NEXT\_REQUEST, COOKIE) commands into the generated script file.
- ! When this option is enabled, and you still can insert Set(NEXT\_REQUEST\_ONLY, COOKIE) statements. This can override the cookie value that QALoad sends for any cookie that is being dynamically handled.
- ! You should only disable this option if you require more control over the cookies that QALoad sends during replay.

### Use this option to:

- ! Ensure that dynamic cookies are processed during replay.
- ! Ensure that dynamic cookies are not automatically inserted into the script during convert.

### Example Web Page

The cookies for this site are:

```

Set-Cookie: SaneID=172.22.24.180-4728804960004
Set-Cookie: SITESERVER=ID=f0544199a6c5970a7d087775f83b23af
<html>
<head></head>
<body>

```

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```

RELOAD PAGE TO INCREMENT COUNTER

</body>
</html>
Script example with the Dynamic Cookie Handling option selected
The following example has the "Handle Dynamic Cookies" check box selected.
...
...
Set(EVERY_REQUEST, HTTP_MODE_HANDLE_DYNAMIC_COOKIES, TRUE);
BEGIN_TRANSACTION();
...
...
Navigate_To("http://www.host.com/cgi-bin/cookies5.pl ");
Navigate_To("http://www.host.com/cgi-bin/cookies5.pl ");
...
...
END_TRANSACTION();
...
...
```

### Script Example with the Dynamic Cookie Handling Option Selected

The following example has the Dynamic Cookie Handling check box selected.

```
...
...
Set(EVERY_REQUEST, HTTP_MODE_HANDLE_DYNAMIC_COOKIES, TRUE);
BEGIN_TRANSACTION();
...
...
Navigate_To("http://www.host.com/cgi-bin/cookies5.pl ");
Navigate_To("http://www.host.com/cgi-bin/cookies5.pl ");
...
...
END_TRANSACTION();
...
...
```

### Script Example with the Dynamic Cookie Handling Option Not Selected

The following example has the Dynamic Cookie Handling check box cleared.

```
...
...
Set(EVERY_REQUEST, HTTP_MODE_HANDLE_DYNAMIC_COOKIES, FALSE);
BEGIN_TRANSACTION();
...
...
Navigate_To("http://www.host.com/cgi-bin/cookies5.pl ");
/* Request: 2 */
Set(NEXT_REQUEST_ONLY, COOKIE, "SaneID",
"172.22.24.180-4728804960004");
Set(NEXT_REQUEST_ONLY, COOKIE, "SITESERVER ",
" ID=f0544199a6c5970a7d087775f83b23af ");
Navigate_To("http://www.host.com/cgi-bin/cookies5.pl ");
...
...
END_TRANSACTION();
...
...
```

## JavaScript Execution Level

This option controls the types of JavaScript statements that QALoad executes while running in HTML mode. The levels are None, Limited, and Full. Limited is selected by default.

This option only applies when HTML is selected as the convert mode. In HTTP mode, this option is disabled and there is only a single level of JavaScript execution.

 **Caution:** Always make changes to the JavaScript Execution Level using the WWW Convert Options dialog box, then re-convert the capture file to create a new script. Changing the JavaScript Execution Level directly in the script will affect script replay.

The following table explains each JavaScript Execution Level:

Execution Level	Description
None	No JavaScript is executed during replay.
Limited	<p>Only the following JavaScript statements are executed during replay:</p> <ul style="list-style-type: none"> <li>! document.cookie =</li> <li>! window.document.cookie =</li> <li>! document.write()</li> <li>! window.document.write()</li> </ul> <p>Images are also requested where the image.src statement occurs.</p>
Full	All JavaScript statements are executed during replay. Full must be selected to process <a href="#">XMLHttpRequests</a> .

#### Considerations

- ! When using the Limited JavaScript Execution Level, you may need to do further parameterization and edit the script.
- ! In HTTP mode, only the Limited level of JavaScript execution is available.
- ! Using no JavaScript execution or a Limited level execution requires less processing time and memory usage than the Full level of JavaScript execution.

Use this option to:

Control the amount of processor and memory usage.

#### JavaScript Loop Timeout

This option controls the amount of time that a JavaScript runs before QALoad terminates the JavaScript code. JavaScript can run into infinite loops, or take a very long time to run. This option applies to both HTML and HTTP mode.

#### Considerations

- ! The timeout value should be decreased if you find that an unnecessary JavaScript is running longer than the timeout value.
- ! The timeout value should be increased if you find that a necessary JavaScript is running longer than the timeout value.
- ! Make sure that a necessary JavaScript is able to complete before the timeout value of time is reached.

Use this option to:

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Prevent JavaScripts from running into infinite loops or from running indefinitely .

## Connection Settings

### Reuse SSL session ID

This option is available only on an SSL installation of QALoad . By default, this option is not selected and SSL session IDs are not re-used, which reflects standard browser behavior. If your application re-uses SSL session IDs, consider selecting this option.

The Reuse SSL session ID option is used by the replay engine at replay time and the current session's ID is re-used for all the requests within the transaction.

### Script example with the Reuse SSL Session ID option selected

The following example has the Reuse SSL session ID check box selected.

```
...
...
SYNCHRONIZE();

/* Select following statement for reuse of Session ID with */
/* SSL. If session ID needs only to be reused within */
/* a transaction insert after the BEGIN_TRANSACTION */
/* statement */

/* DO_SSLReuseSession(TRUE); */
BEGIN_TRANSACTION();

...
...

/* Request: 1 */
DO_Http("GET http://www.host.com/subs.htm HTTP/1.0\r\n\r\n");
DO_VerifyDocTitle("Page Of Subs", TITLE);

...
...

END_TRANSACTION();

...
...
```

### Script example with the Reuse SSL Session ID not selected

The following example has the Reuse SSL session ID check box cleared.

```
...
...
SYNCHRONIZE();

/* Select following statement for reuse of Session ID */
/* with SSL. If session ID needs only to be reused within */
/* a transaction, insert after the BEGIN_TRANSACTION */
/* statement */

/* DO_SSLReuseSession(FALSE); */
BEGIN_TRANSACTION();

...
...
```

```

/* Request: 1 */
DO_Http("GET http://www.host.com/subs.htm HTTP/1.0\r\n\r\n");
DO_VerifyDocTitle("Page Of Subs", TITLE);

...
...
END_TRANSACTION();

...
...

```

## Connection Settings

These options control how QALoad handles connections to target servers during replay. You can select connection settings from the Convert Options dialog box or by selecting Playback Options in the Visual Navigator tree.

### Connection Options

**Persistent connections during replay:** Select this check box to keep the connection to the server open for each request sent to the server. By keeping connections open (persistent), you can increase the speed at which requests are sent to the server.

**Max concurrent connections:** Type the maximum number of connections to the server QALoad should have open at a time. The minimum and default number is 2. The maximum number of connections is 4. These simultaneous connections are only used if sub-requesting is enabled. This field only accepts valid positive integers.

**Max connection retries:** Type the number of times QALoad should attempt to connect to the Web server after timing out. This field only accepts valid positive integers.

**Connection retry wait time:** Type the number of seconds during replay that QALoad waits before attempting to reconnect to the server after failing to connect. This field only accepts valid positive integers.

**Server response timeout:** Type a length of time, in seconds, QALoad should wait for a reply from the server before timing out.

### Graceful Socket Shutdown

**On:** Indicates that QALoad should attempt to terminate socket connections gracefully in the presence of unexpected conditions.

**Off:** Indicates that QALoad should NOT attempt to terminate socket connections gracefully in the presence of unexpected conditions.

### Baud Rate Emulation

**Emulate transmission baud rate:** Select to simulate a specific baud rate for transmission of requests, and then select a rate from the Baud Rate drop-down field. QALoad then slows the transmission of requests appropriately in order to emulate the transaction rate to a web server, such as a 56 Kbps modem or DSL.

**Baud rate:** The default is 112000. Options include: 112000, 57600, 33600, 28800, 14400, and 9600.

**Emulate reception baud rate:** Select to simulate a specific baud rate for reception of requests, and then select a rate from the Baud Rate drop-down field. QALoad then slows the reception of requests appropriately in order to emulate the transaction rate from a web server, such as a 56 Kbps modem or DSL.

**Baud rate:** The default is 112000. Options include: 112000, 57600, 33600, 28800, 14400, and 9600.

### SSL Session

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Reuse SSL session id: Select to instruct QALoad to reuse the current session's communication information (session ID) for all page requests within the transaction.

Restore defaults for this page: (Convert only) Click this link to restore all control values on this page to their default values.

#### Persistent Connections During Replay

This is an option placed in the script to be used at replay time. Selecting this option keeps the connection to the server open for each request sent to the server.

#### Considerations

Keeping connections open (persistent) can increase the speed at which requests are sent to the server.

Use this option to:

Control processor and memory usage for requests.

#### Max Concurrent Connections

This option indicates the maximum number of connections that a DO\_Http or DO\_Https command opens to the server at any time. These simultaneous connections are only used if sub-requesting is enabled.

#### Considerations

- ! Keeping the maximum number of connections open can increase the speed at which requests are sent to the server.
- ! In HTTP mode, if the Automatically process subrequests option on the Parsing Options page is NOT selected, this option is disabled.

Use this option to:

Control processor and memory usage for requests.

#### Max Connection Retries

This option specifies the number of times during replay that QALoad will attempt to connect to the server after timing out.

#### Considerations

You must select Persistent connections during replay to enable this option.

Use this option to:

Control processor and memory usage for requests.

#### Server Response Timeout

This option specifies, in seconds, the length of time during replay that QALoad waits for data from the server before timing out.

#### Considerations

You must select Persistent connections during replay to enable this option.

Use this option to:

Control processor and memory usage for requests.

### Baud Rate

Use this option to simulate slower connections to a Web server, such as 56 Kbps modem or DSL.

Specify a baud rate when enabling baud rate emulation in the Convert Options dialog box.

### Considerations

- ! The `DO_SetBaudRate` command is inserted into the script with the specified baud rate as its only parameter.
- ! If baud rate emulation must be asymmetric (the upload rate is different than the download rate), use the `DO_SetBaudRateEx` command.
- ! `DO_SetBaudRateEx` takes two parameters: the upload baud rate and the download baud rate.

Use this option to:

- ! Simulate a specific baud rate for transmission of requests.
- ! Simulate a specific baud rate for reception of requests.

### General

#### Proxy HTTP version

A WWW script can be set to 1.1 or 1.0. When set to 1.1, all proxy HTTP requests and subrequests are sent as HTTP/1.1. When set to 1.0, all proxy HTTP requests and subrequests are sent as HTTP/1.0.

#### Consideration

HTTP 1.1 requests receive chunked replies.

Use this option to:

Specify the HTTP version of requests and sub-requests sent to the server.

#### META Refresh Threshold

When this option is selected, the time value that you specify in the seconds field is compared to a Web page's META Refresh value (e.g. `<META HTTP-EQUIV=Refresh CONTENT="10"; URL="http://www.compuware.com">`).

#### Considerations

- ! If the CONTENT field value is less than the time value you specify, the page is treated as a redirected page.
- ! If the CONTENT field value is greater than the time value you specify, the page is treated as a regular page.

Use this option to:

Avoid infinite loops in the script. Infinite loops can occur if a page refreshes periodically to update data.

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### Sample Scripts

#### Script Example with the META Refresh Threshold Option Selected

The following example has the META Refresh Threshold check box selected and is set to a value greater than 5.

```
...
...
Set(EVERY_REQUEST, HTTP_VERSION, "1.1");
Set(EVERY_REQUEST, META_REFRESH_THRESHOLD, 5);
BEGIN_TRANSACTION();
...
...
/* Request: 1 */
Navigate_To("http://host/path/to/page.pl");
Verify(PAGE_TITLE, "You have reached the final page!!");
```

#### Script Example with META Refresh Threshold Option Not Selected

The following example has the META Refresh Threshold check box cleared. The example also applies to having the option selected and set to a value less than 5.

```
...
...
// WWW General Options
Set(EVERY_REQUEST, HTTP_VERSION, "1.1");
BEGIN_TRANSACTION();
...
...
/* Request: 1 */
Navigate_To("http://host/path/to/page.pl");
Verify(PAGE_TITLE, "Just Wait");
DO_SLEEP(5);
/* Request: 2 */
Navigate_To("http://host/path/to/realpage.pl");
Verify(PAGE_TITLE, "You have reached the final page!!");
```

#### Represent CJK as Octal Characters

When this option is selected, the double-byte characters used for Chinese, Japanese, and Korean (CJK) scripts are converted into octal format.

#### Considerations

- ! Since CJK characters use Double Byte Character Sets (DBCS), encoding must be enabled for a capture with CJK characters, so that the double-byte characters can be viewed in a legible format.
- ! Data stays in encoded format throughout the load test: from capture, through convert and replay, to the analysis of the timing file.

Use this option to:

- ! Enable the encoding of captured data from web applications containing Double Byte Character Sets (DBCS) such as Chinese, Japanese, or Korean.
- ! Encode all native characters when native character support cannot be used.

## Sample Scripts

### Example Web Page

```
<html>
<head>
<title> </title>
<meta http-equiv="Content-type" content="text/html; charset=euc-kr">
<meta http-equiv="Cache-Control" content="no-cache">
<meta http-equiv="Pragma" content="no-cache">
<meta http-equiv="Expires" content="Wed, 04 Jul 1973 16:00:00 GMT">
<!--CSS-->
<style type='text/css'>
</style>
<!--/CSS-->
</head>
<body onload="document.search.p.focus();" topmargin=8>

...
...
</body>
</html>
```

### Script Example with the Represent CJK as Octal Characters Option Selected

The following example has the Represent CJK as Octal Characters check box selected.

```
...
...
/* Request: 1 */
DO_Http("GET http://kr.yahoo.com/ HTTP/1.0\r\n\r\n");
DO_VerifyDocTitle("\276\337\310\304!\304\332\270\256\276\306", TITLE);
...
...
```

### Script Example with the Represent CJK as Octal Characters Option Not Selected

The following example has the Represent CJK as Octal Characters check box cleared.

```
...
...
/* Request: 1 */
DO_Http("GET http://kr.yahoo.com/ HTTP/1.0\r\n\r\n");
DO_VerifyDocTitle(, TITLE);
...
...
```

## Using the Player, Script Development Workbench, and Analyze

### Streaming Media

QALoad supports two types of streaming media:

- ! RealOne Player
- ! Windows Media Player

### Considerations

- ! Streaming media is not supported through firewalls and across proxies.
- ! When streaming media conversion is enabled and you record a transaction that calls streaming media, an additional command is inserted into the script that requests the media.
- ! You do not have to listen to or view the entire media you are requesting. Simply record its URL and ensure that the appropriate media player is installed on the QALoad Player machines that will execute playback of the script.
- ! At run time, the script invokes the media player and requests the streaming media resource.

Use this option:

For audio and video download testing of scripts with Windows Media Player or RealOne Player and their supported media formats through a WWW session.

### Sample Scripts

#### Advanced RealOne Player Media Options

The following statements are examples of how additional RealOne Player streaming media commands can be used in a script.

- ! void ShowMediaRP(BOOL displayAudio, BOOL displayVideo);  
Enable/disable client audio and video for RealNetworks Streaming Media.
- ! void EnableStatisticsRP(int statisticFlags, int interval, BOOL traceOutput);  
Enable client-side performance statistics for RealNetworks Streaming Media.
- ! void DisableStatisticsRP(void);  
Disable client side performance statistics for RealNetworks Streaming Media.

#### Script Examples with Streaming Media Option Selected

The following example has the Streaming Media check box selected and uses RealOne Player.

```
...
...
#include "do_www.h"
#include "RPlayer.h"
...
...
BEGIN_TRANSACTION();
...
...
DO_Http("GET http://www.host.com/index.htm HTTP/1.0\r\n\r\n");
DO_VerifyDocTitle(" QALoad WWW Capture Examples", TITLE);
DownloadMediaRP("http://rm.host.com:8099/ramgen/demo.rm", 0);
...
...
END_TRANSACTION();
```

```
...
...
```

The following example has the Streaming Media check box selected and uses Windows Media Player.

```
...
...
#include "do_www.h"
#include "SMPLayer.h"

...
...
BEGIN_TRANSACTION();

...
...
DO_Http("GET http://www.host.com/index.htm HTTP/1.0\r\n\r\n");
DO_VerifyDocTitle(" QALoad WWW Capture Examples", TITLE);
DO_Http("GET http://www.host.com/wmp-test.asx HTTP/1.0\r\n\r\n");
DownloadMediaFromASX(0);

...
...
END_TRANSACTION();

...
...
```

#### Script Examples with Streaming Media Option Not Selected

The following example has the Streaming Media check box cleared and uses RealOne Player.

```
...
...
#include "do_www.h"

...
...
BEGIN_TRANSACTION();

...
...
DO_Http("GET http://www.host.com/index.htm HTTP/1.0\r\n\r\n");
DO_VerifyDocTitle(" QALoad WWW Capture Examples", TITLE);
DO_Http("GET http://rm.host.com:8099/ramgen/demo.rm HTTP/1.0\r\n\r\n");

...
...
END_TRANSACTION();

...
...
```

The following example has the Streaming Media check box cleared and uses Windows Media Player.

```
...
...
#include "do_www.h"
```

## Using the Player, Script Development Workbench, and Analyze

```
...
...
BEGIN_TRANSACTION();

...
...
DO_Http("GET http://www.host.com/index.htm HTTP/1.0\r\n\r\n");
DO_VerifyDocTitle(" QALoad WWW Capture Examples", TITLE);
DO_Http("GET http://www.host.com/wmp-test.aspx HTTP/1.0\r\n\r\n");

...
...
END_TRANSACTION();

...
...
```

### Strip All Cookies from Request

When this option is selected, no cookies are sent with requests.

Use this option to:

Specify whether cookies are sent with requests.

### Sample Scripts

#### Script Example with the Strip All Cookies from Request Option Selected

The following example has the Strip All Cookies From Request check box selected.

```
...
...
DO_Http("GET http://qawbserv.compuware.com/cgi-bin/cookies5.pl HTTP/1.0\r\n\r\n");
DO_Http("GET http://www.host.com/cgi-bin/cookies5.pl HTTP/1.0\r\n\r\n");
DO_Http("GET http://www.host.com/cgi-bin/cookies5.pl HTTP/1.0\r\n\r\n");

...
...
```

#### Script Example with the Strip All Cookies from Request Option Not Selected

The following example has the Strip All Cookies From Request check box cleared.

```
...
...
DO_Http("GET http://www.host.com/cgi-bin/cookies5.pl HTTP/1.0\r\n Cookie:
username=username\r\n\r\n");

...
...
```

## Scripting Options

### Simulating Variable IP Addresses

While QALoad can simulate multiple virtual users from a single system, it generally does so using a single source IP address. In most testing situations this isn't a problem, but with a small set of HTTP-based applications, it may not be the best way to simulate real-life activity. For QALoad Player machines with more than one static IP address, QALoad can direct each virtual user to use a different source IP address.

To accomplish this, a local datapool file containing a list of local static IP addresses must be created on each QALoad Player machine. When you enable IP spoofing in the QALoad Conductor, the QALoad Conductor instructs each QALoad Player to create the appropriate datapool file at run time. The QALoad Player uses these addresses for connections to HTTP and SSL servers. Each virtual user receives one address for use with all its connections. If there are more virtual users than addresses, IP addresses are re-used starting from the beginning of the datapool file.

#### Modifying a Script to Use Variable IP Addresses

In the Script Development Workbench, select Visual Navigator>Insert Tree Item>IPSpoofer to insert the [IPSpoofer](#) item into the Visual Navigator tree-view. You can then use the var... button in the form view pane to set the data record to use during playback.

#### Creating a Datapool of IP Addresses

Use the following procedure to create a datapool of valid IP addresses from the QALoad Conductor. This file is automatically created on the QALoad Player workstations (Windows and UNIX) at run time.

To create a datapool of IP addresses:

1. Start QALoad Conductor.
2. In the Visual Designer menu bar, select **Tools>Manage Players**. The Manage Players/Groups dialog box displays.
3. Select a Player in the **Players** pane.
4. Expand the **Machine Settings** area on the right-hand side of the dialog box.
5. Select the **Generate IP Spoofer Data (machines with multiple IP addresses only)** option in the Player Machine settings field.
6. Click **OK**.

At run time, the QALoad Conductor sends a command to each QALoad Player Agent to create the datapool file of IP addresses, and the script is sent to the server using the different IP addresses.

The Generate IP Spoofer Data check box is valid only for WWW scripts.

 **Note:** The machine on which the QALoad Conductor resides must have static IP addresses assigned to it. If no static IP addresses are found, the QALoad Conductor displays a warning and the datapool file is not generated. The datapool file is named ipspoofer.dat, and is saved in the \Compuware\QALoad\Datapools directory.

#### Converting a WWW Script

QALoad has been enhanced to enable you to control how much automated processing is performed during test execution by choosing HTML mode or HTTP mode for script conversion. When going through the WWW convert for the first time, you are now prompted to choose between HTML mode and HTTP mode.

 **Tip:** Compuware recommends that you use the WWW Convert Options dialog box to convert between modes, rather than manually edit the script.

Typical HTML processing uses more processor cycles and memory during test execution, but requires less scripting. The Visual Navigator is generated using QALoad's Document Object Mode (DOM) approach, which also is used for playback.

HTTP processing instructs QALoad to disable most of its automatic HTML handling engine during replay, and it also affects how the script is generated. In this mode, the convert process uses some HTML parsing to generate the Visual Navigator. This parsing method also is used for playback instead of the DOM. The HTTP mode replaces Minimized Processor mode. Scripts converted before QALoad release 5.6 using Minimized Processor mode will replay in HTTP mode.

 **Caution:** Once you convert a script using HTTP mode or HTML mode, you must reconvert the script to change the convert mode. This is necessary so that the convert and replay methods match. Failure to change modes by reconvert the script can cause the script to replay incorrectly.

### Streaming Media in Visual Navigator

If you selected the Streaming Media option on the WWW Advanced conversion options dialog box before recording your script, and the recorded transaction contains RealOne Player or Windows Media streaming requests, your streaming media request will be presented as a Page in the tree-view, similar to the following graphic:

The form-view (bottom pane) for a streaming media page shows the title Real Media Request or Windows Media Request to indicate the type of request you recorded, and lists the following fields:

**Requested URI:** Lists the requested URI that invoked the media player. For Real Media the file typically is an RM file, while for Windows Media it is typically an ASX file.

**Play Media Request:** Select this check box for the virtual user to process the RM or ASX file that is received and make the necessary requests to duplicate what the client performed while receiving the streaming media. If this checkbox is not selected, then no further processing is performed after receiving the RM or ASX file.

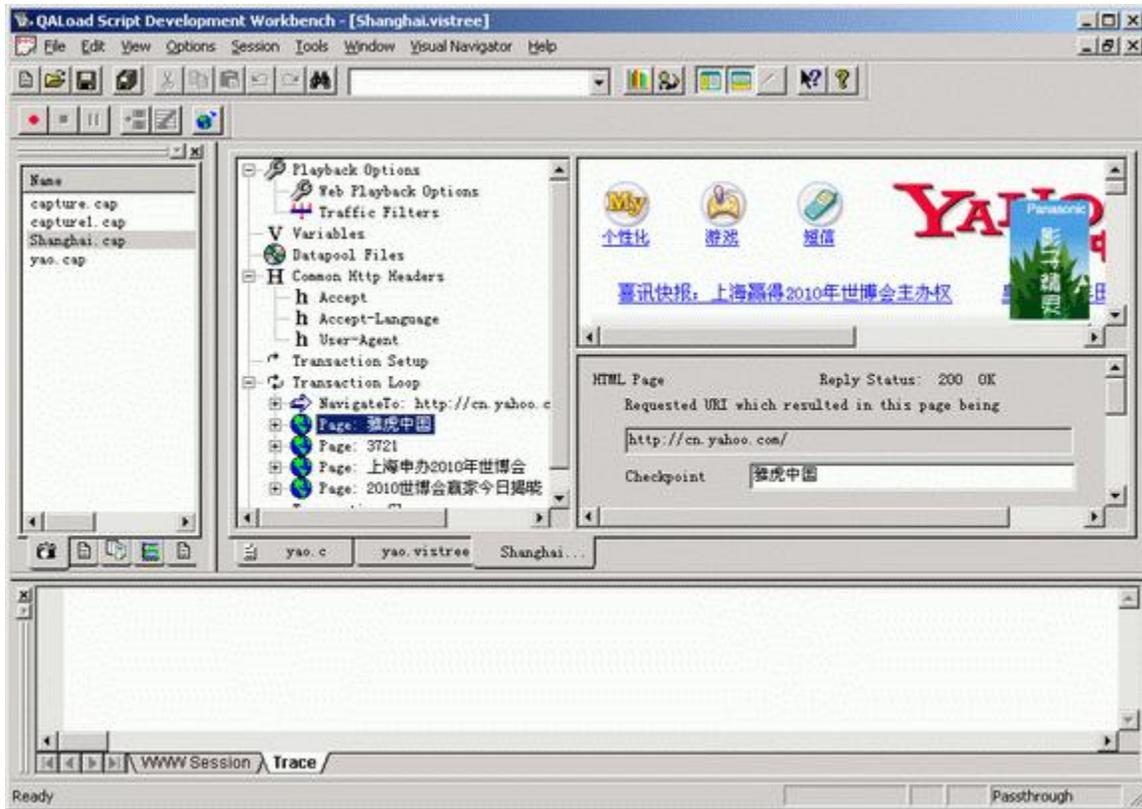
**Play Requested Media for N seconds:** You can specify how much of the streaming media file the virtual user should play, in seconds, before moving on to the next request. A value of zero indicates that the entire media stream should be played.

 **Note:** While a virtual user is playing a media request it will not make any other requests in the transaction loop. This may be different than what the user performed when recording the transaction because a browser is capable of spawning the streaming media player as a separate executable which can execute at the same time that the user continues to make further web requests in the browser.

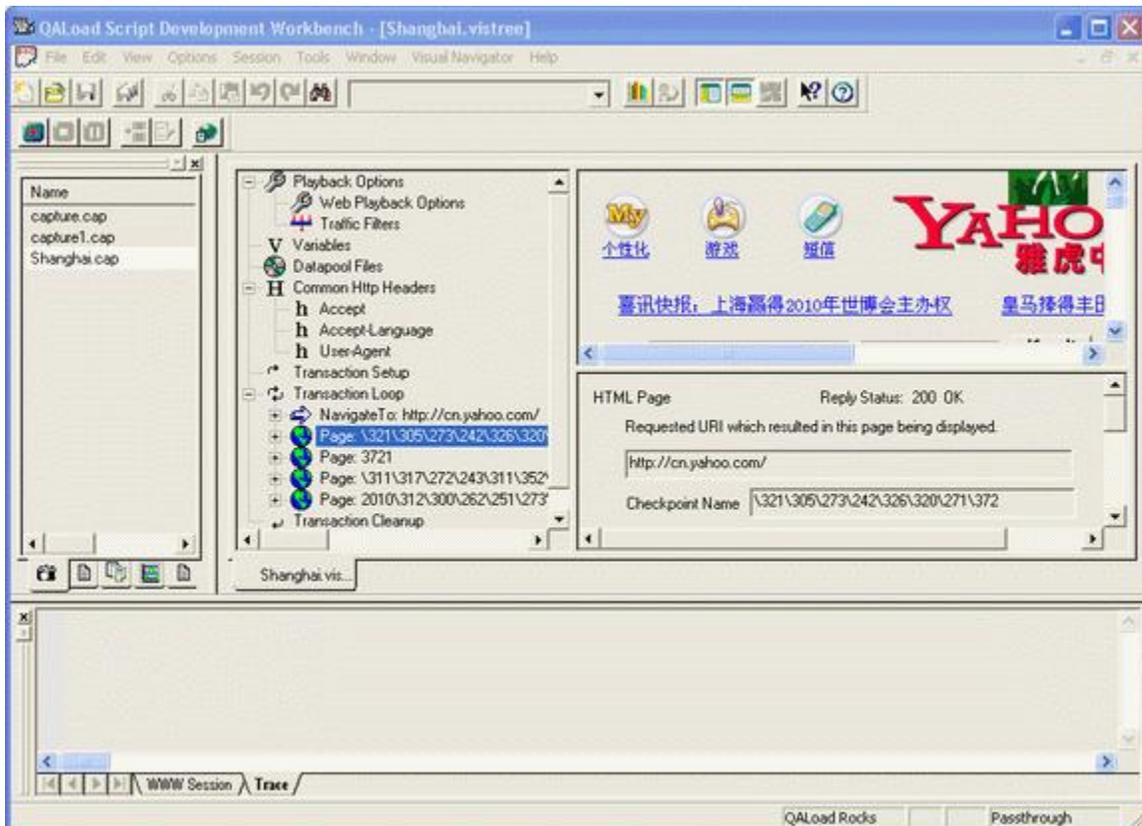
### CJK and Visual Navigator

The Visual Navigator handles both native and encoded Chinese, Japanese, and Korean (CJK) characters. (See [CJK Support in QALoad](#) for more information about CJK support.)

The following graphic shows how the Visual Navigator provides native character support. Both English and Chinese characters are displayed in the Workbook Pane.



The same capture file, Shanghai.cap, is open in the graphic below. Here, the Visual Navigator displays the Chinese characters in encoded format.



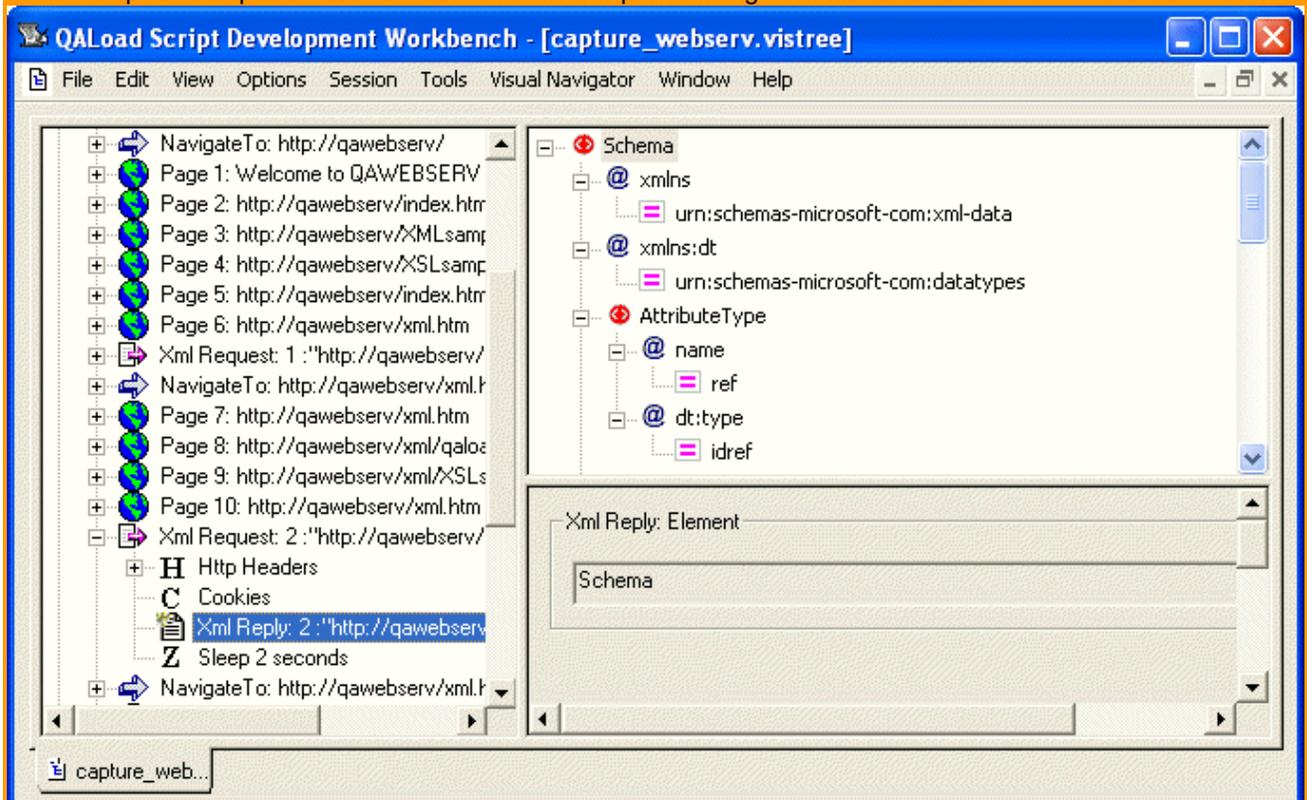
## XML Support

### XML Support

QALoad's XML support is handled through the Script Development Workbench's Visual Navigator, which displays your script's HTTP or XML requests in an easy-to-use, visually-based interface that offers you point-and-click script editing. Although XML is supported through the Visual Navigator, Compuware recommends you read through this help topic as well as the [Visual Navigator](#) help topics to become familiar with the features that are unique to QALoad's XML support.

When an HTTP request is made for an XML document, either in the form of an HTTP GET request or an HTTP POST request with an XML document as the post data, the data is displayed in the three Visual Navigator panes as illustrated below. Click on a pane in the graphic for a description of its contents and functionality.

Note: To make the following graphic fit better in this help window, the Script Development Workbench toolbars and panes that are not directly related to this help topic are not displayed. You can hide/show many of the Script Development Workbench toolbars and panes using commands available from the View menu.



### XML Requests

When an HTTP request is for an XML document, either in the form of an HTTP GET request, or an HTTP POST request with an XML document as the post data, then an XML Request tree item is displayed in the tree-view (left pane). The form-view (bottom pane) for an XML Request item includes the following fields:

Reply Status: The reply status code. The status code is 200 OK for most pages that return correctly.

Request URI: This read-only field shows the URI requested, which resulted in this page being displayed.

**Checkpoint Name:** If the page has a title, it is used as the checkpoint name. If not, the word Checkpoint is used. To make sure all checkpoint names are unique, QALoad adds a number to the beginning of the checkpoint name.

#### XML Request Sub-items

An XML Request item can contain the following sub-items.

#### XML Reply

The URI of the document returned as a result of the XML request. XML data corresponding to the reply is displayed in the browser-view.

#### HTTP Headers

If a header exists under an action item, it is sent for that request only. If the header has the same name as one of the common headers, it overrides the common header for this request only. The form-view (bottom pane) for an HTTP header lists its name and value. Because there is no XML data recorded for a header, the browser-view remains empty. It is possible to insert additional HTTP Headers.

#### Cookies CGI Parameter

The Cookies tree item contains a list of Cookie items that were sent in the header of the request that this item made while being recorded. Cookies are added automatically by the browser based on the URI that is being requested. They are either set as a result of the previous reply (server returned a Set-Cookie command), or they are set by JavaScript contained in the previous reply. The form-view for a cookie item lists its name and value. Because there is no XML data recorded for a header, the browser-view remains empty.

#### XML Document-view

When you click on an XML Request item in the tree-view (left pane) the right pane becomes a document-view displaying a tree-view of details about the XML document requested or returned as the result of an XML request. Each individual XML item appears as a node in the XML document tree. XML elements can have child elements and these appear as child nodes of the XML element. Attributes of an element appear as child nodes of the element, with the attribute value appearing as a child of the attribute name.

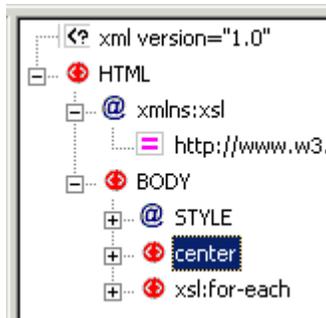
What if no XML data is associated with a request?

If there is no XML document associated with the XML request (for example, an HTTP GET) a message indicating that there is no XML to be displayed is shown in the XML document-view.

How does the document-view relate to the form-view?

Selecting an item in the XML document tree displays the form-view details corresponding to that XML element type in the bottom pane.

Following is an example of XML request data displayed in a portion of the XML document-view:



### XML Form-view

When an XML request is displayed in the document-view (top pane) — as a result of an XML request item or XML reply child item being selected in the Visual Navigator tree-view — you can click on items in the document-view to display information about each in the form-view (bottom pane). If no XML item is selected in the document-view, the XML Page form-view displays instead. For XML items, the form view display options depend on two things:

- ! what type of XML item is selected in the Visual Navigator tree-view (left pane): an XML request or an XML reply
- ! what type of XML item is subsequently selected in the XML document-view (top pane)

When an XML item is selected in the XML document-view, the value of that XML item is displayed in an edit box in the form-view. Some values — attribute values and text values — can be edited or variablized (that is, substituting one or more variables for the value in an XML request or selecting the return value from an XML reply item to be received by a variable for later use in the script). Text items, which are values between element tags, and attribute values represent volatile items in an XML document structure, used for passing values to and from Web Services, for example.

The following tables list the possible actions for XML items displayed in a form-view. Valid actions are determined by the XML item type and whether the item is from an HTTP POST request or from an HTTP reply.

In the following tables:

- ! If an item is *editable*, the value in the form-view can be changed and the new value is used during replay.
- ! If a value can be *variablized*, a variable can be substituted for all or part of the value. The variable's value is placed in the variable's location at replay. An example is a value received from an item from a previous XML document reply.
- ! If a variable can *receive* a replay value, the return value for the item can be placed into a selected variable during replay. The variable can then be substituted for an input value in a later XML request.

XML Request Items		
XML Request Item	Editable?	Can the Value be Variablized?
Declaration	No	No
DTD (Document Type Definition)	No	No
PI (Processing Instruction)	No	No
Comment	No	No

Element	No	No
Attribute (Name)	No	No
Attribute (Value)	Yes	Yes
Text	Yes	Yes

XML Reply Items	
XML Request Item	Can Variable Receive Replay Value
Declaration	No
DTD (Document Type Definition)	No
PI (Processing Instruction)	No
Comment	No
Element	No
Attribute (Name)	No
Attribute (Value)	Yes
Text	Yes

## Common Scripting Scenarios

### CGI Parameter Encoding

Common Gateway Interface (CGI) is widely used on World Wide Web sites to provide the ability to run server-side scripts that can take variable input from a Web browser. QALoad recognizes when the browser has communicated to a CGI site and automatically creates variables for parameters whenever necessary. For example, many CGI submission forms contain hidden parameters that the user cannot modify, but are always sent in the WWW request. Because these values can contain variable data, QALoad inserts statements into the script to store these hidden parameters in variables and append them automatically to CGI requests.

CGI requests also include parameters that the browser has allowed the user to modify. For example, a CGI form might require a user to enter a name and address and click a submit button to continue. QALoad does not automatically store these types of parameters in variables, but instead provides an easy way to modify the content of the parameters that are being sent in the CGI request using the [DO\\_SetValue](#) command.

When you modify parameters that are passed into a QALoad CGI request, ensure that all CGI parameters containing characters that are not alphanumeric (a-Z, 0-9) are encoded before being sent to the server. CGI encoding entails inserting the ASCII value of a character, prefixed with the “%” character, into the parameter. QALoad automatically CGI-encodes any values that it detects during the recording and

conversion process; however, to manually add or modify any CGI parameter strings after your script is created, you must manually encode special characters to ensure that the CGI parameter data is sent to the Web server properly. For example, to insert the “=” character into a CGI parameter, first determine its ASCII hexadecimal value (3D), and insert that value into the CGI parameter prefixed with “%”. In the CGI parameter string, “%3D” would replace “=”. All CGI parameter encoding is handled by this method, except for spaces. Blank spaces must be specified in the encoded CGI string by the character “+”, rather than the ASCII value.

QALoad provides an automatic way of performing this encoding using the [DO\\_EncodeString](#) command.

### CGI Get Requests

Get requests are handled by the following process:

1. The browser makes a request to a server for a URL that contains a call to a Common Gateway Interface (CGI) program.
2. The server calls the CGI program, which usually returns a Web page. The returned page is called a dynamic page because it is created by the CGI program.
3. The browser accepts the resulting dynamic page and displays it.

### Example Web Page

The following Web page contains an anchor (link) that references a CGI program. The reference results in a CGI Get request.

The anchor calls the CGI program named perl\_1.pl with some parameters. In perl\_1.pl?name=FRANK, the question mark (?) denotes the start of parameters that need to be passed to the program. The name/value pair being passed to the perl\_1.pl program is name=FRANK.

When you click the anchor text (dynamic HTML page), the browser makes a CGI Get request. A Get request, when executed by the server, passes parameters in an environment variable to the CGI program. This type of parameter handling is limited to 255 characters.

```
<HTML>
<HEAD>
<TITLE> QALoad WWW Capture Examples</TITLE>
</HEAD>
<BODY>
Dynamic HTML Page
</BODY>
</HTML>
```

### Example Script

QALoad automatically generates all constructs that are necessary for a CGI Get request. The following script uses a DO\_Http call for the CGI Get request.

**How It Works:** The script processes a CGI Get request the same way it processes URL links to a page. In the example script below, note that the parameters passed to the Web server on the CGI call are recorded unchanged. The parameters do not change unless the page is dynamically generated.

```
char *Anchor[1];
for(i=0;i<1;i++)
Anchor[i]=NULL;

DO_InitHttp(s_info);

SYNCHRONIZE();
BEGIN_TRANSACTION();

...

...
```

```

DO_Http("GET http://www.host.com/ HTTP/1.0\r\n\r\n");
/*
 * Anchor 'http://www.host.com/cgi-bin/perl_1.pl?name=FRANK'
 * 'Dynamic HTML Page'
 */
DO_GetAnchorHREF("Dynamic HTML Page", &Anchor[0]);
DO_SetValue("Anchor000", Anchor[0]);
DO_Http("GET {*Anchor000} HTTP/1.0\r\n\r\n");
DO_VerifyDocTitle("Perl Example Page", TITLE);

...

...
for(i=0; i<1; i++)
{
free(Anchor[i]);
Anchor[i]=NULL;
}
END_TRANSACTION();

```

## CGI Post Requests

Post requests are handled by the following process:

1. The browser makes a request to a server for an HTML page that contains a form that uses an action statement with a Post call to a CGI program.
2. When you click the Submit button on a CGI form, the browser makes a Post request and the server returns a Web page.
3. The browser accepts the dynamic page and displays it. Because it is a CGI Post request, the browser passes the parameters of the program to the CGI script as command line options.

## Example Web Page

The following Web page contains a form that calls a CGI script with a Post Request.

```

<html>
<head><title> QALoad's Perl Example Page</title>
</head><body><center> QALoad's Perl Example Page</center>
<form name = myform method = POST action = perl_1.pl>
<input type = text name = yourname size = 50>

<input type = submit value = "Submit Request">
<input type = reset>
</form>
</body></html>

```

## Example Script

QALoad automatically generates all the constructs that are necessary for a CGI Post request. The following script features a DO\_HTTP request that executes a CGI Post request :

```

char *ActionURL[1];
...
...
for(i=0;i<1;i++)
ActionURL[i]=NULL;
...
...
BEGIN_TRANSACTION();
/* Request: 1 */
DO_SetValue("name", "FRANK");

```

## Using the Player, Script Development Workbench, and Analyze

```
DO_Http("GET http://www.host.com/cgi-bin/perl_1.pl?{name} "
 "HTTP/1.0\r\n\r\n");

DO_VerifyDocTitle(" QALoad's Perl Example Page", TITLE);
/* ActionURL[0]="http://www.host.com/cgi-bin/perl_1.pl" */
DO_GetFormActionStatement(FORM(1), &ActionURL[0]);

...

/* Request: 2 From: QALoad's Perl Example Page */
DO_SetValue("action_statement0", ActionURL[0]);
DO_SetValue("yourname", "PostFrank");
DO_SetValue("function", "View the log of previous visitors.");
DO_Http("POST {*action_statement0} HTTP/1.0\r\n"
 "Content-Type: application/x-www-form-urlencoded\r\n"
 "Content-Length: {*content-length}\r\n\r\n"
 "{yourname}&{function}");

DO_VerifyDocTitle(" QALoad's Perl Example Page", TITLE);

...
...

for(i=0; i<1; i++)
{
free(ActionURL[i]);
ActionURL[i]=NULL;
}

END_TRANSACTION();
```

### Requesting Password-protected Directories

Web developers use password-protected directories to protect access to some pages. When the browser requests a page in a password-protected directory, the server returns a special response that specifies the page is password-protected. When the browser receives this type of reply, it gathers the user ID and password, encrypts them, and passes them back to the server in a subsequent request.

#### Example Script

QALoad automatically generates all the constructs that are necessary to execute a request of a password-protected directory.

The example script features the following elements:

- ! DO\_BasicAuthorization, which takes the user ID and password as parameters
- ! DO\_Http request to the password-protected directory

```
BEGIN_TRANSACTION();
DO_BasicAuthorization("frank", "~encr~557A2549474E57444A");

...
...

DO_Http("GET http://www.host.com/access_controlled/secure.htm HTTP/1.0\r\n\r\n");
DO_VerifyDocTitle("Successful Test of a Secured Page", TITLE);

...
...

END_TRANSACTION();
```

#### Example Script

QALoad also handles Integrated Windows Authentication (formerly NTLM).

The example script features the following elements:

! A DO\_NTLMAuthorization call, which takes the domain, user ID, and password as parameters

! DO\_Http request to the Integrated Windows Authentication-protected directory

```
BEGIN_TRANSACTION();
DO_NTLMAuthorization("dom1\\frank", "~encr~557A2549474E57444A");
...
...
DO_Http("GET http://www.host.com/ntlm_controlled/secure.htm HTTP/1.0\r\n\r\n");
DO_VerifyDocTitle("Successful Test of a NTLM Page", TITLE);
...
...
END_TRANSACTION();
```

### Handling error messages from the Web server

When a server returns an error message, it returns it in one of two ways. It either returns an error message with a response code (for example, 404 Not Found) or returns an HTML page that contains an error message. The following sections provide examples of code that you can use in your script to handle errors that the Web server returns to the browser.

#### Handling error messages with response codes

The example below demonstrates how to write code to handle error messages that include response codes that the Web server returns to the browser. The code performs the following actions:

- ! Checks for an error code using the DO\_GetLastHttpError command
- ! Aborts or continues script execution, based on the WWW\_FATAL\_ERROR statement

#### Example

```
int error;
char errorString[30];

DO_Http("GET http://www.host.com/ HTTP/1.0\r\n\r\n");
if((error = DO_GetLastHttpError()) > 399)
{
 sprintf(errorString, "Error in response: %d\n", error);
 WWW_FATAL_ERROR("Request-host", errorString);
}
```

#### Handling error messages returned in an HTML page

The examples below demonstrate how to write code to handle error messages that the Web server returns to the browser in an HTML page.

#### Using DO\_VerifyDocTitle to verify page requests

By inserting the DO\_VerifyDocTitle command into your script, you can compare the HTML document titles in your load test script with the document titles you originally captured. The code performs the following actions:

- ! Calls DO\_Http to request an HTML page from the Web server
- ! Calls DO\_VerifyDocTitle with the original HTML document title. If the titles do not match, DO\_VerifyDocTitle exits the script

#### Example

## Using the Player, Script Development Workbench, and Analyze

```
DO_Http("GET http://www.host.com/ HTTP/1.0\r\n\r\n");
DO_VerifyDocTitle("Welcome to The Main Page", TITLE);
```

### Searching response text for error messages

In some scripts, error messages are displayed as text in an HTML page. The following example demonstrates how to detect these messages in a script. The code performs the following actions:

- ! Searches for errors returned as HTML from the Web server
- ! Branches to error handling code

#### Example

```
int response;
response = DO_Http("GET http://www.host.com/ HTTP/1.0\r\n\r\n");
if (strstr(response, "200 OK") == NULL)
 WWW_FATAL_ERROR("host", "Response did not have 200 OK");
```

## Simulating JavaScript

JavaScript is handled by the following process:

1. The browser makes a page request to a server for a page that contains JavaScript.
2. Because JavaScript is simply uncompiled code, the browser downloads and immediately executes this code upon receipt of the page.

### Supported Objects

QALoad supports the built-in JavaScript objects (global, object, function, array, string, boolean, number, math, date, regexp, and error), document objects, image objects, and XMLHttpRequest Objects.

### Supported Properties

The only document properties that QALoad supports are cookies, title, and the images array. The only image property that QALoad supports is src.

### Evaluation Errors

If an object, property, or function used within a block of JavaScript code is not defined, it causes a JavaScript exception. The exception stops evaluation of that block.

### Example Web Page

The following Web page contains the JavaScript function and an onLoad tag that calls the scrollit function. The onLoad tag tells the browser to execute the JavaScript immediately after loading the page. The scrollit function displays a scrolling banner region on the Web page.

```
<HTML>
<HEAD>
<TITLE>Java Script Example</TITLE></HEAD>

<SCRIPT LANGUAGE="JavaScript" src="js_do_nothing.js">

function scrollit_r21(seed)
{
var m1 = " Welcome to Compuware's QALoad homepage.";
var m2 = " Glad to see you.";
var m3 = " Thanks for coming. ";
var msg = m1 + m2 + m3;
var out = " ";
var c = 1;
```

```

if (seed > 100) {
seed--;
var cmd="scrollit_r2l(" + seed + ")";
timerTwo=window.setTimeout(cmd,100);
}

else if (seed <= 100 && seed > 0) {
for (c=0 ; c < seed ; c++) {
out+=" ";
}
out+=msg;
seed--;
var cmd="scrollit_r2l(" + seed + ")";
window.status=out;
timerTwo=window.setTimeout(cmd,100);
}

else if (seed <= 0) {
if (-seed < msg.length) {
out+=msg.substring(-seed,msg.length);
seed--;
var cmd="scrollit_r2l(" + seed + ")";
window.status=out;
timerTwo=window.setTimeout(cmd,100);
}
}
else {
window.status=" ";
timerTwo = window.setTimeout("scrollit_r2l(100)", 75);
}
}
}

</script>

<BODY onLoad="timerONE=window.setTimeout('scrollit_r2l(100)',500);">
<!-- End scrolltext -->

<center><h2>Java Script Example</h2><hr>Check out the browser's scrolling status
bar.

</center>

</BODY></HTML>

```

### Example script

The following script features a DO\_Http call to retrieve the JavaScript page.

**How It Works:** QALoad evaluates the JavaScript in the context of script blocks, onLoad tags, and src and then executes them.

```

DO_InitHttp(s_info);

...
...

BEGIN_TRANSACTION();
DO_AutomaticSubRequests(TRUE);

...
...

DO_Http("GET http://www.host.com/js.htm HTTP/1.0\r\n\r\n");
DO_VerifyDocTitle("Java Script Example", TITLE);

...
...

END_TRANSACTION();

```

## Using the Player, Script Development Workbench, and Analyze

### Simulating Cookies

This section describes how QALoad handles cookies. Cookies are handled by the following process:

1. The browser makes a CGI request to a server for a dynamic page.
2. When the server sends the page back to the browser, the page includes a cookie in the header. The browser saves the cookie along with information that ties it to the Web server.
3. On all subsequent requests to that Web server, the browser passes the cookie along with the request.

### Example Web page

The following CGI Perl script generates a Set-Cookie header as a part of subsequent HTTP requests.

```
Set-Cookie: SaneID=172.22.24.180-4728804960004
Set-Cookie: SITESERVER=ID=f0544199a6c5970a7d087775f83b23af

<html>
...
The cookies for this site are:

SaneID=172.22.24.180-4728804960004; SITESERVER=ID=f0544199a6c5970a7d087775f83b23af
<P>
Next cookie for this URL will be : 1

RELOAD PAGE TO INCREMENT COUNTER

Return to
previous homepage.
```

### Example script when Dynamic Cookie Handling is turned on

This is the default method by which QALoad handles cookies. The example script features the following elements:

```
! Two CGI requests that return dynamic pages
! Cookies are handled by the replay engine

BEGIN_TRANSACTION();
DO_DynamicCookieHandling(TRUE);

...
...

/* Request: 1 */
DO_Http("GET http://www.host.com/cgi-bin/cookies5.pl"
 "HTTP/1.0\r\n\r\n");

/* Request: 2 */
DO_Http("GET http://www.host.com/cgi-bin/cookies5.pl"
 "HTTP/1.0\r\n\r\n");

...
...

END_TRANSACTION();
```

### Example script when Dynamic Cookie Handling is turned off

The example script features the following elements:

- ! A CGI request that returns a dynamic page
- ! Two DO\_GetCookieFromReply calls to retrieve the cookie from reply
- ! Two DO\_SetValue calls to set the cookie
- ! A free cookie

How It Works: For cookies that are set with CGI scripts, the script stores incoming cookies in a variable and passes them back to the Web browser in the reply from the CGI script. The script handles these cookies by executing a DO\_GetCookieFromReply command after the CGI request.

DO\_GetCookieFromReply stores the cookie values in variables, which the script then passes back to subsequent CGI requests using the DO\_SetValue command.

```
int i;
char *Cookie[4];

...
...

for(i=0;i<4;i++)
Cookie[i]=NULL;
DO_InitHttp(s_info);

...
...

BEGIN_TRANSACTION();
DO_DynamicCookieHandling(FALSE);

...
...

/* Request: 1 */
DO_Http("GET http://www.host.com/cgi-bin/cookies5.pl
 "HTTP/1.0\r\n\r\n");

/*Set-Cookie: NUM=1 */
DO_GetCookieFromReplyEx("NUM", &Cookie[0], '*');

/*Set-Cookie: SQUARE=1 */
DO_GetCookieFromReplyEx("SQUARE", &Cookie[1], '*');

/* Request: 2 */
DO_SetValue("cookie000", Cookie[0]); /* NUM=1 */
DO_SetValue("cookie001", Cookie[1]); /* SQUARE=1 */
DO_Http("GET http://www.host.com/cgi-bin/cookies5.pl "
 "HTTP/1.0\r\n"
 "Cookie: {*cookie000}; {*cookie001}\r\n\r\n");

...
...

DO_HttpCleanup();
for(i=0; i<4; i++)
{
free(Cookie[i]);
Cookie[i]=NULL;
}

END_TRANSACTION();
```

### Executing a Visual Basic script

QALoad does not evaluate a Visual Basic script. However, any Visual Basic script request that occurs is inserted into the script as a main request.

### Simulating Frames

Frames are handled by the following process:

1. The browser makes a main page request to a Web server for a page that contains frames.
2. The browser parses the frame pages and places them in sub-windows within the browser, each of which displays the frame content.

## Using the Player, Script Development Workbench, and Analyze

### Example Web Page

The following Web page contains four frames.

```
<HTML>
<HEAD>
<TITLE>FRAME Example</TITLE>
</HEAD>

<!-- Here is the FRAME information for browsers with frames -->

<FRAMESET Rows="*,*"><!-- Two rows, each equal height -->
 <FRAMESET Cols="*,*"><!-- Two columns, equal width -->
 <FRAME Src="findex.htm" Name="ul-frame">
 <FRAME Src="findex.htm" Name="ur-frame">
 </FRAMESET>

 <FRAMESET Cols="*,*"><!-- Two columns, equal width -->
 <FRAME Src="findex.htm" Name="ll-frame">
 <FRAME Src="findex.htm" Name="lr-frame">
 </FRAMESET>
</FRAMESET>

</HTML>
```

### Example Script

QALoad automatically generates all constructs necessary to request frames. The example script features the following element:

! A DO\_Http call to retrieve the main page.

How It Works: The frames are treated as sub-requests and are evaluated and requested by QALoad .

```
BEGIN_TRANSACTION();
DO_AutomaticSubRequests(TRUE);

...
...

DO_Http("GET http://www.host.com/frameset.htm HTTP/1.0\r\n\r\n");
DO_VerifyDocTitle("FRAME Example", TITLE);

...
...

END_TRANSACTION();
```

### Simulating Browser Caching

Browser caching is handled by the following process:

1. When the browser makes a request for static HTML pages, it may include an option to retrieve the page only if it is newer than the one held in the browser's cache.
2. If browser caching is enabled, the server returns only newer versions of the page. If browser caching is not enabled, the server always returns the page.

How It Works: The QALoad Script Development Workbench disables browser caching while recording, which means a page is always retrieved.

### CGI Forms

Common Gateway Interface (CGI) forms are handled by the following process:

1. The browser requests a page that contains a CGI form. It displays the page and provides the interaction for input fields that the CGI form specifies.
2. A user enters data into the CGI form and clicks the submit button. This action causes the browser to process the CGI form's action statement.
3. The browser processes the action statement, gathers all input fields as name value pairs, and passes them to a CGI call contained in the action statement.

### Example Web page

The following Web page contains a CGI form with:

- ! An action statement
- ! Input fields
- ! Hidden fields

```
<HTML>
<HEAD><TITLE>Forms Example</TITLE>
</HEAD>
<BODY>
<FORM ACTION="http://www.host.com/cgi-bin/perl_9.pl" method=post>

<TABLE>
<TR>
<TD>Name:
<TD><INPUT NAME="name" SIZE="20" MAXLENGTH=20>
<TR>
<TD>Password:
<TD><INPUT TYPE =password NAME="password" SIZE="20" MAXLENGTH=20>

There is a hidden field containing data here: <INPUT TYPE=hidden NAME="hidden" VALUE="This
rocks!">

Here is another hidden field: <INPUT TYPE=hidden NAME="hidden1" VALUE="Web testing is fun">

</FORM>
</BODY>
</HTML>
```

### Example script

QALoad automatically generates all the constructs that are necessary to make a CGI form request.

The example includes the following features:

- ! A DO\_Http call to retrieve the forms page.
- ! Commented description of the input fields on the page.
- ! GetFormValueByName commands to retrieve the values of the hidden fields from the form.
- ! DO\_SetValue calls to store the field names and their user-entered values.
- ! A DO\_Http call for the CGI get request.

```
char *Field[2];
char *ActionURL[1];

...
...

for(i=0;i<2;i++)
Field[i]=NULL;

for(i=0;i<1;i++)
ActionURL[i]=NULL;
```

## Using the Player, Script Development Workbench, and Analyze

```
...
...
BEGIN_TRANSACTION();

...
...
/* Request: 1 */
DO_Http("GET http://www.host.com/forms.htm HTTP/1.0\r\n\r\n");
DO_VerifyDocTitle("Forms Example", TITLE);

/* ActionURL[0]="http://www.host.com/cgi-bin/perl_9.pl" */
DO_GetFormActionStatement(FORM(1), &ActionURL[0]);

/* Form:1 text Name: name, Value: , Desc: */
/* Form:1 text Name: password, Value: , Desc: */
/* Form:1 hidden Name: hidden, Value: This rocks! */
DO_GetFormValueByName(FORM(1), "hidden", "hidden", 1, &Field[0]);

/* Form:1 hidden Name: hidden1, Value: Web testing is fun */
DO_GetFormValueByName(FORM(1), "hidden", "hidden1", 1, &Field[1]);

/* Request: 2 From: Forms Example */
DO_SetValue("action_statement0", ActionURL[0]);
DO_SetValue("name", "form-name");
DO_SetValue("password", "form-password");
DO_SetValue("hidden", Field[0]);
DO_SetValue("hidden1", Field[1]);
DO_Http("POST {*action_statement0} HTTP/1.0\r\n"
 "Content-Type: application/x-www-form-urlencoded\r\n"
 "Content-Length: {*content-length}\r\n\r\n"
 "{name}&{password}");

DO_VerifyDocTitle("Forms Example - Results", TITLE);

...
...

for(i=0; i<2; i++)
{
free(Field[i]);
Field[i]=NULL;
}

for(i=0; i<1; i++)
{
free(ActionURL[i]);
ActionURL[i]=NULL;
}

END_TRANSACTION();
```

### Overview: Extracting and Reusing a String as a CGI Parameter

Page requests sometimes use CGI parameter values received in a previous page response. Since the value is received dynamically, the script must extract that value from the previous response and insert it into the CGI parameter list at runtime.

#### Scripting

When you script for string extraction and reuse, you must:

- ! Create the variables to store the extracted string value.

- ! Modify the script to extract the string values from the page response.
- ! Insert the variables into the CGI parameter list.

## Visual Navigator

When you use [Visual Navigator](#), you can use the Rule Library Wizard for this task.

## Conclusion

By following these scripting techniques, you can modify a Visual Script to extract values from page requests and reuse the string's CGI parameter values in later page requests. You can use similar scripting techniques for reusing extracted strings in form values.

The [sample original script](#) and the [sample modified script](#) illustrate the procedure for extracting and reusing a string.

## Overview: Extracting and Reusing a Cookie

In some load tests, you may need to extract a cookie and use it later in the script.

## Scripting

To extract the cookie, use the [DO\\_GetCookie\(\)](#). Reuse the value with [DO\\_SetValue](#).

## Conclusion

The [sample script](#) snippet illustrates extracting and reusing a cookie.

## Overview: Extracting and Reusing Web Service XML Values

When testing Web services, data dependencies may exist between XML request data values and XML values returned as part of an XML document reply earlier in the script. You can retrieve values from a response containing an XML document and store the values in a variable, by using a version of the Get command. You can reuse this value as a CGI parameter, as post data, or you can substitute it into an XML document string sent as part of a Web Services XML request.

## To modify the script:

---

1. Extract an XML value by inserting a [Get](#) command in the script after the request.
2. Ensure that the XPATH attribute is set and that the XML element is specified. Use the modified XPath syntax used by QALoad to extract text and attribute values from an XML document response page.

## Visual Navigator

[Visual Navigator](#) provides a GUI interface in the Visual tree pane. You can use this to extract text and attribute values from XML documents returned as a reply, and to parameterize text and attribute values sent as part of an XML request.

## Conclusion

By following these techniques, you can extract XML text and attribute values from XML documents into variables for later use.

The [sample original script](#) and the [sample modified script](#) illustrate these techniques. The modified script reuses the value in a subsequent XML request.

### Overview: Forcing a Subrequest that is not Being Made Automatically

Occasionally, one of the necessary subrequests that is recorded is not requested automatically at playback time. This can be caused by complex javascript code not executing correctly, or by an ActiveX control that cannot be used at playback time. You can force this subrequest by inserting an `ADDITIONAL_SUBREQUEST` statement.

#### Scripting

To request an additional subrequest, insert a command like the one below before the action statement (`Click_On`, `Navigate_To`, or `Post_To`).

```
Set (NEXT_REQUEST_ONLY, ADDITIONAL_SUBREQUEST, "http://xyz.com/onsale.aspx");
```

This adds the specified URL to the list of subrequests automatically generated when the requested page is parsed.

#### Conclusion

Using these techniques, you can modify a script to force a subrequest. The [sample modified script](#) illustrates forcing a subrequest.

### IP Spoofing with a Local Datapool

Datapools can provide IP spoofing addresses to scripts on playback machines. By creating a special IP spoofing datapool for the particular playback machine, you can spoof the correct addresses at runtime.

 **Note:** For the script to execute properly, the IP addresses in the local datapool must match the IP addresses bound to the network cards on the playback machine.

#### Scripting

When you modify a Visual Script to allow for IP spoofing for a local playback machine, you must:

- ! Create a datapool file with the IP addresses associated with the network cards on the playback machine.
- ! Insert the required scripting code for datapool access into the script.
- ! Retrieve and use the spoofed IP address.

#### Visual Navigator

[Visual Navigator](#) provides GUI interfaces in the tree view for creating datapool files and using spoofed IP addresses. You can use the datapool variables as IP spoofing addresses in the IP spoof interface.

#### Conclusion

By following these scripting techniques, you can modify a Visual Script to extract IP addresses from datapool files for use as spoofed addresses. The [modified script sample](#) illustrates the modifications required in the script.

### Moving the Transaction Loop Statements

Load testing a web site can require you to log on and log out when you want to perform multiple transactions during a single session. You can move the `BEGIN_TRANSACTION` statement and the `END_TRANSACTION` statement so that the virtual user does not log on and log out with every transaction.

To modify the script:

---

1. Move the BEGIN\_TRANSACTION and RESTART\_TRANSACTION\_TOP statements so that they are just below any statements that log the user onto the system.
2. Keep the RESTART\_TRANSACTION\_BOTTOM, Clear(TRANSACTION), and END\_TRANSACTION statements together and move them so that they are immediately above the Logout requests.

 **Tip:** When moving the transaction loop, you often have to add additional code to clean up memory. This may involve using the [Clear](#) or [DO\\_Clear](#) statement to clear cookies, headers, values, cache, and so on. If a session ID cookie is set at login, it may need to be manually handled in order to clear out the rest of the cookies set during the transaction.

Visual Navigator

If you are using [Visual Navigator](#), you can move the Transaction Loop statements in the tree view rather than in the C++ script. Simply select the Begin Transaction item and click the Move Down button until it moves below the Logon pages. Do the same for the End Transaction by selecting the Transaction Cleanup tree item and moving it. Any pages after the Transaction Cleanup, such as the Logout, take place after all transaction in the main loop have finished executing.

Sample Scripts

The following [original script sample](#) and [modified script sample](#) show a script that logs into a newsgroup forum, performs actions, such as reading threads and replying to them, and then logs out. The scripts identify the Logon and Logout requests and show the old and new locations of the transaction statements.

Inserting cookies into a script

Cookie items can be added directly to the Html Page item they apply to, under the Action item (for example, a Click on Link item).

To insert a cookie item:

---

1. In the Visual Navigator tree-view (left pane), navigate to the Html Page item requiring the cookie and then click on it to select it.
2. From the menu, choose **Visual Navigator>Insert Tree Item>Cookie**. A Cookie form-view opens in the bottom pane.
3. In the **Name** field, type a name for the new Cookie or click **Var Wiz...** to access the Select Variable dialog box where you can select a value from a datapool file or create a variable for this field.
4. In the **Value** field, type a value for the new Cookie or click **Var Wiz...** to access the Select Variable dialog box where you can select a value from a datapool file or create a variable for this field.
5. Click **Save** to save your changes.

The Cookie item is added to the script for the selected Html Page item.

Inserting HTTP headers into a Visual Navigator script

You can insert HTTP headers under the Common Http Headers tree item.

To insert a new Http Header item:

---

1. In the Visual Navigator tree-view (left pane), navigate to the **Common Http Headers** script item, and then click on it.

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2. From the menu, choose **Visual Navigator>Insert Tree Item>Http Header**. An **Http Header** form-view opens in the bottom pane.
3. In the **Name** field, type a name for the new header or click **Var Wiz...** to access the Select Variable dialog box where you can select a value from a datapool file or create a variable for this field.
4. In the **Value** field, type a value for the new header or click **Var Wiz...** to access the Select Variable dialog box where you can select a value from a datapool file or create a variable for this field.
5. Click **Save** to save your changes.

The header item is added to the script, and will be used for all requests at playback unless it is overwritten by a header with the same name underneath an individual request action.

## Script Examples

### Sample Scripts: Persistent Connections During Replay

This is an option placed in the script to be used at replay time. Selecting this option keeps the connection to the server open for each request sent to the server.

 **Tip:** The following samples show the option as it appears in a script. Compuware recommends that you use the WWW Convert Options dialog box to convert between HTML and HTTP modes, rather than edit the script manually.

### C++ Script Samples

#### Script Example with the Persistent Connections During Replay Option Selected

```
...
// WWW Connection Settings
Set(EVERY_REQUEST, REUSE_CONNECTION, TRUE); // maintain socket connection if possible
...
```

#### Script Example with the Persistent Connections During Replay Option Not Selected

```
...
// WWW Connection Settings
Set(EVERY_REQUEST, REUSE_CONNECTION, FALSE); // maintain socket connection if possible
...
```

### Sample Scripts: Max Concurrent Connections

This option indicates the maximum number of connections that a DO\_Http or DO\_Https command opens to the server at any time. These simultaneous connections are only used if sub-requesting is enabled.

**Tip:** The following samples show the option as it appears in a script. Compuware recommends that you use the WWW Convert Options dialog box to convert between HTML and HTTP modes, rather than edit the script manually.

The following example has the Max Concurrent Connections field set at 4.

### C++ Script Sample

```
...
// WWW Connection Settings
Set(EVERY_REQUEST, REUSE_CONNECTION, TRUE); // maintain socket connection if possible
Set(EVERY_REQUEST, MAX_BROWSER_THREADS, 4); // total browser threads to simulate
...
```

### Sample Scripts: Max Connection Retries

This option specifies the number of times during replay that QALoad will attempt to connect to the server after timing out.

**Tip:** The following samples show the option as it appears in a script. Compuware recommends that you use the WWW Convert Options dialog box to convert between HTML and HTTP modes, rather than edit the script manually.

The following example has the Max Connection Retries field set at 4.

#### C++ Script Sample

```
...
// WWW Connection Settings
...
Set(EVERY_REQUEST, MAX_CONNECTION_RETRIES, 4); // maximum attempts to connect
...
Navigate_To("http://www.host.com/index.htm");
...
```

### Sample: Server Response Timeout

This option specifies, in seconds, the length of time during replay that QALoad waits for data from the server before timing out.

**Tip:** The following samples show the option as it appears in a script. Compuware recommends that you use the WWW Convert Options dialog box to convert between HTML and HTTP modes, rather than edit the script manually.

The following examples have the Server Response Timeout field set at 120.

#### C++ Script Sample

```
...
// WWW Connection Settings
...
Set(EVERY_REQUEST, SERVER_RESPONSE_TIMEOUT, 120); // Maximum time to wait for an HTTP Reply
...
Navigate_To("http://www.host.com/index.htm");
...
```

### Sample Scripts: Baud Rate Emulation

Use this option to simulate slower connections to a Web server, such as 56 Kbps modem or DSL.

**Tip:** The following samples show the option as it appears in a script. Compuware recommends that you use the WWW Convert Options dialog box to convert between HTML and HTTP modes, rather than edit the script manually.

#### C++ Script Samples

In the following example, the Emulate transmission baud rate check box is selected and set to 112000.

```
Set(EVERY_REQUEST, RECEPTION_BAUD_RATE, 14400);
...
// WWW Connection Settings
...
Set(EVERY_REQUEST, TRANSMISSION_BAUD_RATE, 112000);
```

## Using the Player, Script Development Workbench, and Analyze

```
...
Navigate_To("http://www.host.com/index.htm");
...
```

In the following example, the Emulate reception baud rate check box is selected and set to 14400.

```
...
// WWW Connection Settings
...
Set(EVERY_REQUEST, RECEPTION_BAUD_RATE, 14400);
...
Navigate_To("http://www.host.com/index.htm");
...
```

### Sample: Extracting and Reusing a Cookie

The following sample is a portion of a script that extracts and reuses a cookie.

#### Sample Script

```
char * userid;
char * aspsessionId;
...
...
BEGIN_TRANSACTION();
...
...
/* Request: 1 */
DO_Http ("GET http://company.com/ HTTP/1.0\r\n\r\n");
/*
 * Get a cookie named USER_ID
 */
DO_GetCookie ("USER_ID", 1, &userid);
/*
 * Get the second ASPSESSIONID cookie. ASPSESSIONID
 * cookies always have extra characters on the end to make
 * them unique.
 *
 * An example ASPSESSIONID: ASPSESSIONIDQQGGQDO=EBOONBBFH
 * BBELAJIMEFAKAP
 */
DO_GetCookie ("ASPSESSIONID*", 2, &aspsessionId);
DO_SetValue("User", userid)
DO_Http("POST http://company.com/ HTTP/1.0\r\n\r\n"
"Content-Type: application/x-www-form-urlencoded\r\n"
"Content-Length: {*content-length}\r\n"
"{User}");
```

### Sample: Modified WWW Script for Extracting and Reusing Web Service XML Values

The following sample is a script snippet that is modified to extract and reuse Web service XML values. Code added to the script is highlighted in bold. Modified code is in bold and italicized.

#### Sample Script Snippet

```
... beginning of script ...
extern "C" int robot_script(PPLAYER_INFO* s_info)
{
 // Declare Variables
 //
 CLoadString __QALTmpVars[4];
 CLoadString __Sum = "";

```

```

... more script to Request 1...
//----- REQUEST # 1 -----
//
Set (NEXT_REQUEST_ONLY, HEADER, "SOAPAction",
 "\"http://tempuri.org/Calc/action/Calc.Add\"");
_QALTmpVars[0] = "<?xml version=\"1.0\" encoding=\"UTF-8\"
standalone=\"no\"?>";
_QALTmpVars[0] += "<SOAP-ENV:Envelope SOAP-ENV:encodingStyle=\"\"
xmlns:SOAPSDK1=\"
 \"http://www.w3.org/2001/XMLSchema\" xmlns:SOAPSDK2=\"
 \"http://www.w3.org/2001/XMLSchema-instance\" xmlns:SOAPSDK3=\"
 \"http://schemas.xmlsoap.org/soap/encoding/\"
xmlns:SOAP-ENV=\"
 \"http://schemas.xml\";
_QALTmpVars[0] += "lsoap.org/soap/envelope/\">";
_QALTmpVars[0] += "<SOAP-ENV:Body SOAP-ENV:encodingStyle=\"
 \"http://schemas.xmlsoap.org/soap/encoding/\">";
_QALTmpVars[0] += " <m:Add
xmlns:m=\"http://tempuri.org/Calc/message/\" \"
 \"SOAP-ENV:encodingStyle=\"\">";
_QALTmpVars[0] += " <A SOAP-ENV:encodingStyle=\"\">10";
_QALTmpVars[0] += " <B SOAP-ENV:encodingStyle=\"\">5";
_QALTmpVars[0] += " </m:Add>";
_QALTmpVars[0] += " </SOAP-ENV:Body>";
_QALTmpVars[0] += " </SOAP-ENV:Envelope>";

Set(NEXT_REQUEST_ONLY, XML_DATA, (char *)_QALTmpVars[0]);
XmlRequest("POST",
 "http://mssoapsampleserver/MSSoapSamples30/Calc/Service/SrSz/AspVbsCpp/Calc.
 \"asp\");
strSum = Get (XML, TEXT,
\"/SOAP-ENV:Envelope[1]/SOAP-ENV:Body[1]/m:AddResponse[1]/Result[1] \");

//----- REQUEST # 2 -----
//
Set (NEXT_REQUEST_ONLY, HEADER, "SOAPAction",
 "\"http://tempuri.org/Calc/action/Calc.Multiply\"");
_QALTmpVars[1] = "<?xml version=\"1.0\" encoding=\"UTF-8\"
standalone=\"no\"?>";
_QALTmpVars[1] += "<SOAP-ENV:Envelope SOAP-ENV:encodingStyle=\"\"
xmlns:SOAPSDK1=\"
 \"http://www.w3.org/2001/XMLSchema\" xmlns:SOAPSDK2=\"
 \"http://www.w3.org/2001/XMLSchema-instance\" xmlns:SOAPSDK3=\"
 \"http://schemas.xmlsoap.org/soap/encoding/\" xmlns:SOAP-ENV=\"
 \"http://schemas.xml\";
_QALTmpVars[1] += "lsoap.org/soap/envelope/\">";
_QALTmpVars[1] += "<SOAP-ENV:Body SOAP-ENV:encodingStyle=\"
 \"http://schemas.xmlsoap.org/soap/encoding/\">";
_QALTmpVars[1] += " <m:Multiply
xmlns:m=\"http://tempuri.org/Calc/message/\" \"
 \"SOAP-ENV:encodingStyle=\"\">";
// Original value: <A SOAP-ENV:encodingStyle=\"\">10
// Variablized value: <A SOAP-ENV:encodingStyle=\"\">{$ VAR:Sum $}
_QALTmpVars[1] += " <A SOAP-ENV:encodingStyle=\"\">";
_QALTmpVars[1] += " __Sum;";
_QALTmpVars[1] += " ";
_QALTmpVars[1] += " <B SOAP-ENV:encodingStyle=\"\">5";
_QALTmpVars[1] += " </m:Multiply>";
_QALTmpVars[1] += " </SOAP-ENV:Body>";
_QALTmpVars[1] += " </SOAP-ENV:Envelope>";
Set(NEXT_REQUEST_ONLY, XML_DATA, (char *)_QALTmpVars[1]);
XmlRequest("POST",
 "http://mssoapsampleserver/MSSoapSamples30/Calc/Service/SrSz/AspVbsCpp/Calc.asp\");
... rest of script ...

```

## Using the Player, Script Development Workbench, and Analyze

### Sample: Modified Script for Forcing a Subrequest

In this example, one of the pages has an ActiveX object associated with it that automatically generates a request for items that are on sale. However, at playback this request is not made because ActiveX objects are not executed at playback time. To force this subrequest, you can insert an Additional Subrequest item just before the action statement. Relevant statements are shown in bold.

#### Sample Script

```
//----- REQUEST # 5 (see action item on Page 4) -----
//
// current page url is http://xyz.com/chairs.htm
//
Set (NEXT_REQUEST_ONLY, ADDITIONAL_SUBREQUEST, "http://xyz.com/onsale.aspx");
Click_On(LINK, 1, DESCRIPTION, "Nuts and Bolts");
Verify(PAGE_TITLE, "Nuts and Bolts");
```

### Sample: Modified Script for IP Spoofing with a Local Datapool

This sample snippet shows the scripting required to open and access the datapool and use the extracted IP address as a spoofed address. Points of interest and modified code in the script are highlighted in bold.

#### Sample Script Snippet

```
... beginning of script ...
// Before the SYNCHRONIZE command, add a #define to
// identify the datapool file and a call to
// OPEN_DATA_POOL to open the datapool file
// (Note: the datapool file name is "ipspoof.dat")
#define IPSPOOF_DP 1 /* identifier for datapool file */
OPEN_DATA_POOL("ipspoof.dat", IPSPOOF_DP, TRUE);
SYNCHRONIZE();
BEGIN_TRANSACTION();
 RESTART_TRANSACTION_TOP(); // do not modify this statement
// After the start of transaction, read the data record, and
// use the Set command to specify that this value is to
// be used as the spoofed IP address for every request.
 READ_DATA_RECORD(IPSPOOF_DP);
 Set (EVERY_REQUEST, SPOOFED_IP_ADDRESS,
 GET_DATA_FIELD (IPSPOOF_DP, 1));
... rest of script ...
```

### Sample: Original WWW Script Showing the Transaction Loop

The following sample shows the original script. The sections in italics are the requests involved with the Login and Logout. The original locations of the transaction statements are shown in bold.

#### Sample Script

```
SYNCHRONIZE();
BEGIN_TRANSACTION();
RESTART_TRANSACTION_TOP(); // do not modify this statement

//----- REQUEST # 1 -----
//
Set (NEXT_REQUEST_ONLY, CHECKPOINT_NAME, "Page 1 - ");

Navigate_To("http://www.myforum.org/");
Verify(PAGE_TITLE, "My woodworking forum - powered by vBulletin");

DO_SLEEP(9);
```

```

//----- REQUEST # 2 (see action item on Page 1) -----
//
// current page url is http://www.myforum.org/
//
// The submit button for this form could not be positively identified so
// an appropriate action has been added (Post_To or Navigate_To). The
// values for the form fields will be set using Set() statement.
//
Set(NEXT_REQUEST_ONLY, POST_DATA, "vb_login_username", "John Smith");
Set(NEXT_REQUEST_ONLY, POST_DATA, "cookieuser", "1");
Set(NEXT_REQUEST_ONLY, POST_DATA, "vb_login_password", "");
Set (NEXT_REQUEST_ONLY, POST_DATA, "s", "3669625a913735e99e31ec9a866a2f28");
Set (NEXT_REQUEST_ONLY, POST_DATA, "do", "login");
Set (NEXT_REQUEST_ONLY, POST_DATA, "forceredirect", "1");
Set (NEXT_REQUEST_ONLY, APPEND_CRLF_AFTER_POST_BODY, TRUE);
Set (NEXT_REQUEST_ONLY, POST_DATA, "vb_login_md5password",
 "df0349ce110b69f03b4def8012ae4970");
Set (NEXT_REQUEST_ONLY, CHECKPOINT_NAME, "Page 2 - ");

Post_To("http://www.myforum.org/login.php");
Verify(PAGE_TITLE, "My Woodworking Forum");

DO_SLEEP(3);

//----- REQUEST # 4 (see action item on Page 3) -----
//
// current page url is http://www.myforum.org/
//
Set (NEXT_REQUEST_ONLY, CHECKPOINT_NAME, "Page 4 - ");

Click_On(LINK, 1, DESCRIPTION, "Tables and Chairs");
Verify(PAGE_TITLE, "My Woodworking Forum - Tables and Chairs");

DO_SLEEP(2);

//----- REQUEST # 5 (see action item on Page 4) -----
//
// current page url is http://www.myforum.org/forumdisplay.php?f=17
//
Set (NEXT_REQUEST_ONLY, CHECKPOINT_NAME, "Page 5 - ");

Click_On(LINK, 1, DESCRIPTION, "Log Out");
Verify(PAGE_TITLE, "My Woodworking Forum");

RESTART_TRANSACTION_BOTTOM(); // do not modify this statement
Clear (TRANSACTION);
END_TRANSACTION();

DO_FreeHttp();

EXIT();
return(0);

```

### Sample: Modified WWW Script for Moving the Transaction Loop Statements

The following sample shows the script modified to move the transaction loop statements. The sections in italics are the requests involved with the Logon and Logout. The new locations of the transaction statements are shown in bold.

## Using the Player, Script Development Workbench, and Analyze

### Sample Script

```
SYNCHRONIZE();

//----- REQUEST # 1 -----
//
Set (NEXT_REQUEST_ONLY, CHECKPOINT_NAME, "Page 1 - ");

Navigate_To("http://www.myforum.org/");
Verify(PAGE_TITLE, "My woodworking forum - powered by vBulletin");

DO_SLEEP(9);

//----- REQUEST # 2 (see action item on Page 1) -----
//
// current page url is http://www.myforum.org/
//
// The submit button for this form could not be positively identified so
// an appropriate action has been added (Post_To or Navigate_To). The
// values for the form fields will be set using Set() statement.
//
Set(NEXT_REQUEST_ONLY, POST_DATA, "vb_login_username", "John Smith");
Set(NEXT_REQUEST_ONLY, POST_DATA, "cookieuser", "1");
Set(NEXT_REQUEST_ONLY, POST_DATA, "vb_login_password", "");
Set (NEXT_REQUEST_ONLY, POST_DATA, "s", "3669625a913735e99e31ec9a866a2f28");
Set (NEXT_REQUEST_ONLY, POST_DATA, "do", "login");
Set (NEXT_REQUEST_ONLY, POST_DATA, "forceredirect", "1");
Set (NEXT_REQUEST_ONLY, APPEND_CRLF_AFTER_POST_BODY, TRUE);
Set (NEXT_REQUEST_ONLY, POST_DATA, "vb_login_md5password",
 "df0349ce110b69f03b4def8012ae4970");
Set (NEXT_REQUEST_ONLY, CHECKPOINT_NAME, "Page 2 - ");

Post_To("http://www.myforum.org/login.php");
Verify(PAGE_TITLE, "My Woodworking Forum");

BEGIN_TRANSACTION();
RESTART_TRANSACTION_TOP(); // do not modify this statement
DO_SLEEP(3);

//----- REQUEST # 4 (see action item on Page 3) -----
//
// current page url is http://www.myforum.org/
//
Set (NEXT_REQUEST_ONLY, CHECKPOINT_NAME, "Page 4 - ");

Click_On(LINK, 1, DESCRIPTION, "Tables and Chairs");
Verify(PAGE_TITLE, "My Woodworking Forum - Tables and Chairs");

DO_SLEEP(2);

All additional Requests that will occur every transaction

RESTART_TRANSACTION_BOTTOM(); // do not modify this statement
Clear (TRANSACTION);
END_TRANSACTION();

//----- REQUEST # 5 (see action item on Page 4) -----
//
// current page url is http://www.myforum.org/forumdisplay.php?f=17
//
Set (NEXT_REQUEST_ONLY, CHECKPOINT_NAME, "Page 5 - ");

Click_On(LINK, 1, DESCRIPTION, "Log Out");
Verify(PAGE_TITLE, "My Woodworking Forum");

DO_FreeHttp();

EXIT();
```

```
return(0);
```

### Sample: Preventing Unwanted Subrequests

The following sample uses a filter string to prevent the unwanted subrequest. Points of interest are highlighted in bold.

#### Sample Script

```
Set (EVERY_REQUEST, BLOCK_TRAFFIC_FROM, "AcmeAds");
SYNCHRONIZE();

BEGIN_TRANSACTION();
RESTART_TRANSACTION_TOP(); // do not modify this statement

//----- REQUEST # 1 -----
//
Set (NEXT_REQUEST_ONLY, CHECKPOINT_NAME, "Page 1 - ");

Navigate_To("http://www.mystore.com/");
Verify(PAGE_TITLE, "Jack's Hardware Store");
etc.
```

## SSL

### EasyScript Sessions

EasyScript for Secure WWW supports SSL/HTTPS requests when used in conjunction with the WWW middleware.

When you first open the Script Development Workbench, you can set general options related to which panes to display, your compiler, and so on, but you cannot begin any middleware-specific activities, such as recording a transaction, until you open an EasyScript Session. Opening an EasyScript Session tailors the Script Development Workbench to a specific middleware environment, providing you with all the appropriate options and functions for your scripting needs.

To open an EasyScript Session, choose your middleware type from the Session menu, or click the appropriate toolbar button. Once a session is open, the [Workbench interface](#) changes.

 **Note:** The .NET session opens in Microsoft Visual Studio. For more information on .NET sessions, see [Overview of the QALoad .NET Sessions](#).

You can also open a [Universal session](#) to record calls from multiple middlewares within a single session.

### Importing a Client Certificate from a Web Browser (SSL)

You can import and convert a Client Certificate for any Web site you plan to visit.

#### To import a client certificate:

---

1. Start your Web browser.
2. From the browser, select the Client Certificate for the Web site you plan to visit.

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3. Export the Client Certificate (.p12 or .pfx file) to a directory where you can access it using the Script Development Workbench.

 **Note:** When the browser prompts you to enter a password, do not enter a password. If you enter a password, QALoad cannot process the file.

4. Start a WWW Session in the QALoad Script Development Workbench.
5. Click **Tools>Maintain Certificates** to open the SSL Certificate Maintenance dialog box.
6. On the **Client Certificates** tab, click the browse button [...] to browse for the Client Certificate you want to convert. The Select the Exported Client Certificate to Convert dialog box opens.
7. Make sure **Files of Type** specifies P12 files (\*.p12) or PFX files (\*.pfx).
8. Select the appropriate Client Certificate and click **Open**. The path and file name of the selected Client Certificate appears in **Enter Certificate to Convert** on the Client Certificates tab.
9. On the **Client Certificates** tab, click **Convert**.
10. Click **Close** to exit the SSL Certificate Maintenance dialog box.

### Creating a Client Certificate in QALoad (SSL)

This procedure assumes you have a WWW session active.

To create a client certificate:

---

1. From the **Tools** menu, select **Maintain Certificates** to open the **SSL Certificate Maintenance** dialog box.
2. On the Client Certificates tab, enter a name in the **Certificate Name** field.
3. Enter the number of certificates to create.
4. Click the **Create** button to create the QALoad Client Certificate. QALoad stores it in the QALoad\Certificates directory.

 **Note:** On the Unix player platform, you must create the `Certificates` sub-directory in the QALoad directory. The directory name is case sensitive.

5. If necessary, configure your Web server to accept QALoad as the Certificate Authority. Refer to your Web server documentation for more information.

### Creating an SSL Certificate Authority

Note that creating a new CA invalidates all previously created client certificates.

To create an SSL Certificate Authority:

---

1. Start a WWW session.
2. From the **Tools** menu, select **Maintain Certificates**.
3. Click the Certificate Authority tab.
4. Click the **Create** button to create a new Certificate Authority with the expiration date shown in the field.
5. Exit and re-start the Script Development Workbench.
6. After creating a new Certificate Authority, re-import the CA to your Web server and then create new Client Certificates.

### Creating an SSL Server Certificate

To create an SSL Server Certificate:

---

1. Start a WWW session.
2. From the **Tools** menu, select **Maintain Certificates**.
3. Click the Server Certificate tab.
4. Click the **Create** button to create a new Server Certificate with the expiration date shown in the field.

## Editing Scripts

### Introducing Visual Scripting

Visual Navigator for WWW is QALoad's easy-to-use visual interface to QALoad's powerful script development tools. Visual Navigator for WWW renders your recorded C++-based transaction in a tri-paned, browser-like environment similar to popular visually-oriented development tools, with icons representing all the elements of your script. In fact, you could set up and run a WWW script without ever having to modify a C++-based script.

With Visual Navigator's advanced editing features, you don't have to know the syntax of QALoad's command set or your HTML requests or responses to customize your script. You can quickly and easily:

- ! See what URL calls were made and what type they were (for example a POST or GET statement)
- ! See what information was passed in a call
- ! See what replies/pages were returned
- ! Add checkpoints or comments into your script
- ! Move the begin/end transaction statement
- ! Move the synchronize statement
- ! Edit an HTTP header
- ! Set particular flags and commands
- ! Add datapools
- ! Parameterizing your script
- ! Extract information from a reply to use in subsequent calls
- ! Save your script and go back to it at any time for further editing
- ! Create a C++-based script file, if you like

### Visual Navigator Menus

The Visual Navigator has a number of special menu commands to help you develop your script.

[Visual Navigator Menu](#)

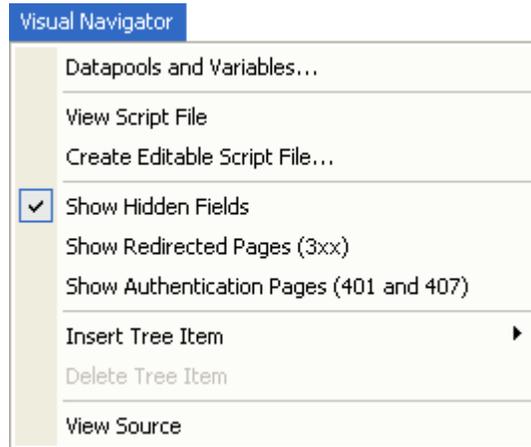
[Edit Menu](#)

[Tools Menu](#)

[Visual Navigator Menu](#)

## Using the Player, Script Development Workbench, and Analyze

The Visual Navigator menu is the main menu for Visual Scripting. Access the Visual Navigator menu from the Script Development Workbench's main menu, or right-click on any item in the Visual Navigator tree-view (left pane).



**Datapools and Variables:** Opens the Datapools and Variables dialog box, where you can add, delete, or modify datapool files or variables.

**View Script File:** Opens a window showing the C++ (.cpp) file based on what is currently showing in the Visual Navigator's tree-view. This is a read-only script.

**Create Editable Script File:** Creates an editable C++ (.cpp) script based on the current Visual Script. You can modify this script directly; however, any changes made to the script will not be reflected in the tree and vice-versa.

**Show Hidden Fields:** Displays form fields that are hidden by the browser.

**Show Redirected Pages (3xx):** Toggles whether or not redirected pages are displayed. These are pages that come back with a reply status code of 3xx, for example: 302 Not Found.

**Show Authentication Pages (401 and 407):** Toggles whether or not Authentication pages are displayed. These are pages that come back with a reply status code of 401 Unauthorized or 407 Proxy Authentication Required.

**Insert Tree Item:** Opens a sub-menu where you can choose to insert certain tree items into your script. For details, see [Inserting script items](#).

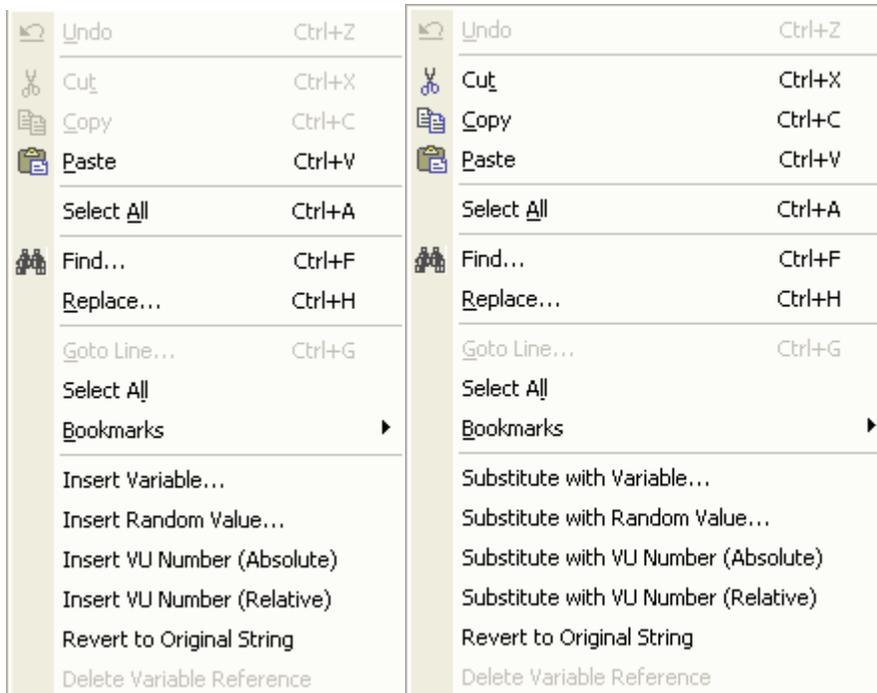
**Delete Tree Item:** Deletes the currently selected tree item. If the selected item may not be deleted from the script, this command is unavailable.

**View Source:** Opens a text window displaying the source code of the currently active HTML Page or Subrequest in the tree view.

### Edit Menu

The Script Development Workbench Edit menu provides special commands for Visual Navigator functionality as well as common Edit menu commands. Access the Edit menu from the main menu, or right-click on an edit box that can be variablized in the Visual Navigator form-view (bottom pane). Fields that can be variablized are denoted with a Var button.

The commands on the Edit menu are dynamic and the availability of certain commands depends upon whether you have text selected and where your cursor is. The following graphics illustrate the difference:



Insert Variable/Substitute with Variable: Opens the Datapools and Variables dialog, allowing you to insert a variable or replace the selected text with a variable. Substituted text will refer to a local variable or datapool variable and will look similar to one of the following examples:

```
{ $ VAR:Customer Number $ }
{ $ VAR>Last Name:Customer Data $ }
```

These commands are only available when the cursor is placed in an edit box on a tree-view item that can be variablized (you will see Var or Var Wiz next to it).

Insert Random Value/Substitute with Random Value: Opens the Random Number Tag dialog box where you can specify a range within which a random number should be generated for this value. The substituted text looks like this:

```
{ $ RANDOM:0:100 $ }
```

and it produces a random number between the lower and upper limit each time it is executed.

These commands are only available when the cursor is placed in an edit box on a tree-view item that can be variablized (you will see Var next to it).

Insert VU Number/Substitute with VU Number (Absolute): Inserts or replaces the highlighted text with the following text:

```
{ $ VU:ABS $ }
```

This is the virtual user number at runtime. The absolute virtual user number is assigned depending on the number of Players in use. For example, two Player machines with 50 virtual users on each, would assign numbers 0 through 49 for Player 1 and 50 through 99 for Player 2. Typically, the VU number is combined with other text to form a larger string, such as:

```
Customer{ $ VU:ABS $ }
```

In this example, Player 1 has values of Customer0 through Customer49, and Player 2 has values of Customer50 through Customer99. These commands are only available when the cursor is placed in an edit box on a tree-view item that can be variablized (you will see Var or Var Wiz next to it).

Insert VU Number/Substitute with VU Number (Relative): Inserts or replaces the highlighted text with the following text:

## Using the Player, Script Development Workbench, and Analyze

```
{ $ VU:REL $ }
```

This is the virtual user number at runtime. The relative virtual user number is assigned to each Player in use. Each Player has relative numbers from 0 to N, where N is the total number of VUs run on that Player. For example, two Player machines with 50 virtual users on each, would assign numbers 0 through 49 to each Player. Typically, the VU number is combined with other text to form a larger string, such as:

```
Customer{ $ VU:REL $ }
```

In this example, Player 1 has values of Customer0 through Customer49, and Player 2 has values of Customer0 through Customer49. These commands are only available when the cursor is placed in an edit box on a tree-view item that can be variablized (you will see Var next to it).

**Revert to Original String:** Rolls the contents of the selected edit box back to when it was first created, usually when the recording was converted to a Visual Script.

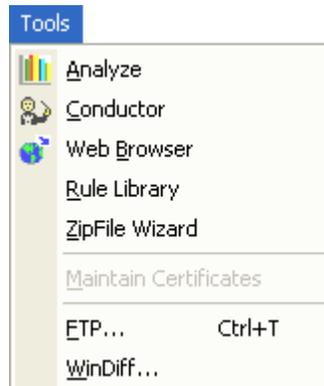
This menu item is enabled only if the edit box within the form can be variablized and it has been changed at some point.

**Delete Variable Reference:** Deletes the variable from the selected edit box. Note that you can also highlight a variable and press the Delete key to delete a variable within an edit box.

This menu item becomes enabled when you highlight a variable inside of an edit box.

### Tools Menu

The Script Development Workbench Tools menu provides access to the Rule Library for parameterization, the ZipFile wizard for collecting files needed by the Technical Support team to analyze and resolve a problem, and common Tools menu commands. Access the Tools menu from the Script Development Workbench main menu.



**Rule Library:** Opens the Rule Library dialog box, where you can add, delete, or modify saved Variable Replacement Rules.

### Visual Navigator's Find and Replace Feature

Visual Navigator has an enhanced Find/Replace feature that allows you to find occurrences of strings within the tree-view, allowing you to quickly locate and/or replace text. For example, you could find occurrences of Smith and replace them all with the datapool variable { \$ Last Name:User Info \$ }.

To access Visual Navigator's Find feature:

1. Select Edit>Find in the toolbar. The Find and Replace dialog box displays with the Find tab on top.

2. Enter the appropriate options and click Find Next. When all matches are found, close the dialog box or click Replace to use the Replace feature.

To access Visual Navigator's Replace feature:

---

1. Select **Edit>Replace** in the toolbar. The Find and Replace dialog box displays with the Replace tab on top.
2. Enter the appropriate options.
3. Do one of the following:
  - ! Click Find Next to review each identified variable before replacing it.
  - ! Click Replace All to replace all variables without reviewing them.
4. Close the Find Replace dialog box.

### Cut, Copy, and Paste in the Visual Navigator Tree

Cut, copy, and paste is available for the Extract String, Cookie, Http Header, Content Check, CGI Parameter, Print Values (debugging), and Comment tree items.

Cut, copy, and paste considerations:

- ! It is possible to cut, copy, and paste across different scripts.
- ! An error message appears if it is not possible to paste in selected location.
- ! With Extract String items, variables are not copied and paste results in new variable assignments in the selected paste location.
- ! With Extract String items, the instance match in the copied item defaults to 1 regardless of the number of instances in the source if the target does not have the same number of instances as the source.
- ! CGI Parameter items are copied exactly, including variables.

To cut, copy, and paste an item:

---

1. Select the item to cut or copy.
2. Either right-click and select **Cut** or **Copy**, choose **Edit>Cut** or **Edit>Copy**, or press **<CTL>+X** or **<CTL>+C**.
3. Choose destination for copied or cut item.
4. Either right-click and select **Paste**, chose **Edit>Paste**, or press **<CTL>+V**.

### Looking at a Transaction Loop

The transaction loop is the portion of your script that is played back repeatedly, representing multiple users making requests. The elements in your transaction loop depend on what was originally recorded on each page you requested. You can [move the transaction loop](#) up or down in the tree-view using the arrow buttons, to allow certain requests to be moved in or out of the Transaction Setup area, where they will be executed before beginning the transaction loop.

 Note: The following graphic does not show all the possible script elements, but gives a good representation of what your transaction loop might look like in the Visual Navigator.

### High-level script items

## Using the Player, Script Development Workbench, and Analyze

There are three high-level script items in the transaction loop that represent the web pages you've recorded. NavigateTo, HTML Pages, and XML Requests:

**NavigateTo:** This is always the first item under the Transaction Loop element, and is always denoted with an arrow icon. It lists the URL that was typed into the web browser at the start of recording. This specifies the first request to be made. The result of this request is the next item in the tree, which is generally an HTML Page item.

If the first item is an HTTP request for XML data, it will appear as an XML Request item in the tree.

**Page (HTML):** Following NavigateTo there will typically be a set of HTML Page items, which are always denoted with a globe icon underneath the Transaction Loop element. These represent pages visited while the transaction was being recorded.

The form-view (bottom pane) lists the request's reply status, the requested URI, and the associated checkpoint name for the page returned.

HTML Page items can be parent to a number of script items in the tree-view, such as Action items. For more information about sub-items that can exist under a Page item, see [HTML Page sub-items](#).

**XML Request:** Requests for XML documents are denoted by a document/arrow icon underneath the Transaction Loop element. These represent the requests for XML data made during the transaction that was recorded. XML Request items can be parent to a number of lower-level script sub-items in the tree-view, such as Header and Cookie items and the XmlReply document item. See [XML requests](#) to learn about sub-items that can exist under an XML Request item.

## Streaming Media in Visual Navigator

If you selected the Streaming Media option on the WWW Advanced conversion options dialog box before recording your script, and the recorded transaction contains RealOne Player or Windows Media streaming requests, your streaming media request will be presented as a Page in the tree-view, similar to the following graphic:

The form-view (bottom pane) for a streaming media page shows the title Real Media Request or Windows Media Request to indicate the type of request you recorded, and lists the following fields:

**Requested URI:** Lists the requested URI that invoked the media player. For Real Media the file typically is an RM file, while for Windows Media it is typically an ASX file.

**Play Media Request:** Select this check box for the virtual user to process the RM or ASX file that is received and make the necessary requests to duplicate what the client performed while receiving the streaming media. If this checkbox is not selected, then no further processing is performed after receiving the RM or ASX file.

**Play Requested Media for N seconds:** You can specify how much of the streaming media file the virtual user should play, in seconds, before moving on to the next request. A value of zero indicates that the entire media stream should be played.

 **Note:** While a virtual user is playing a media request it will not make any other requests in the transaction loop. This may be different than what the user performed when recording the transaction because a browser is capable of spawning the streaming media player as a separate executable which can execute at the same time that the user continues to make further web requests in the browser.

## Configurations Settings

### Variables

These are local variables that have been created for this script. When you highlight a variable in the tree view, the fields display data related to the variable type you selected. For information about parameterization, see [Parameterization](#).

### WWW Playback Options

This item contains settings related to playback such as proxy settings, time out value, number of concurrent connections, baud rate emulation, and filters.

#### [Parsing](#)

#### [Caching](#)

#### [Traffic Filters](#)

#### [Connection Settings](#)

#### [Content Type Handling](#)

#### [Proxy](#)

#### [General](#)

#### [Sebel](#)

### Parameterization Rules

Lists Parameterization Rules that you create when you define a variable to substitute for a value. Saving the variable as a rule enables you to reuse it for other instances of the variable.

When you click Parameterization Rules in the Visual Navigator tree-view, details of the rules stored in the Rule Library appears in the right-hand pane.

#### Notes:

- ! Properties for the rules are defined using the Rule Library Wizard or the Variable Replacement Wizard.
- ! An exclamation mark (!) in the first column, signifies that the rule matches the same parameter as another rule defined in the script. The rule applied first prevents the other rules from being applied. Rules are applied in the order they are displayed in the table.

**Rule Name:** Name of the rule.

**Matching Item:** Name of the item within the script that matches the parameters defined in the rule and that will be replaced with the rule.

**Matching Type:** The type of item within a script that is replaced by this rule. Item types include:

- ! CGI Parameter
- ! Cookie
- ! Header
- ! EditBox
- ! RadioButton
- ! TextBox

**Fields Replaced:** Fields of the matching item that are replaced by this rule. Fields may be:

- ! Name
- ! Value

## Using the Player, Script Development Workbench, and Analyze

! Both name and value

Apply: Apply the selected rule.

Apply All: Apply the rule to all matching items in the script.

Undo Apply: Remove the rule from matching items in the script.

Edit: Opens the Rule Library Wizard so you can edit the rule.

Duplicate: Duplicates the selected rule in the list.

Delete: Deletes the rule from the script. The rule remains in the library.

Add to Library: Adds the rule to the Rule Library. Only rules in the Rule Library can be applied to future scripts.

 Note: You can create a rule using the Variable Replacement Wizard without adding it to the library.

Goto Rule: Displays details for the selected rule.

Get from Library: Opens the Get Rule from Library dialog box. Select a rule to add to the visual tree.

### Datapool Files

Lists datapool files being called by the script. Each datapool listed has a list of variables under it representing columns in the datapool file. Datapools can be Local (specific to a single Player), Shared (shared with other players on a workstation), or Central (available to all Players).

### Virtual Users Actions

#### Transaction Setup

Lists any actions that occurred before the main transaction loop. Any items/actions that occur under this heading will be executed after the Synchronize but before the BEGIN\_TRANSACTION(); statement at playback. For example, you may have logged in to a particular Web site and do not want to log in and out with every transaction at playback. You can move the Transaction Setup item in the tree-view by highlighting it and clicking the Move UP/Move DOWN buttons. The Transaction Setup can contain [client certificate tree items](#).

#### Sleep Sub-item

Every page has a Sleep item immediately before its Action item. The sleep value specifies how many seconds were spent viewing this page (or filling out a form) before an action was taken (such as clicking on a link or button).

### Transaction Cleanup

Lists actions that occur after the script has finished executing the appropriate number of transactions. Any items that occur under this heading are placed after the END\_TRANSACTION statement. For example, you may want to log out of a particular Web site after completing the appropriate number of transactions.

Move UP/Move DOWN: Click the arrow to move the selected transaction cleanup item in the tree-view up or down.

### Comment

Inserts a Comment item after the currently selected HTML page. Type your comment into the form-view (bottom pane).

### Print Values (debugging)

Inserts a Debug Print item after the currently selected HTML Page. This causes a string to be output to the Player window during playback. This can be useful for debugging a script while you are trying to variabilize it so that it replays correctly with multiple virtual users.

### Increment Variable/Decrement Variable/Reset Variable

Opens the Datapools and Variables dialog box, which allows you to select which variable to increment, decrement, or reset. It then inserts the appropriate item (Increment Variable, Decrement Variable, Reset Variable) after the currently selected HTML page.

### Checkpoint Pair

Inserts a Begin Checkpoint item before the currently selected HTML Page and an End Checkpoint after the currently selected HTML Page.

Checkpoints are used to measure duration times for certain actions to be completed. You can move either the Begin or End checkpoint item to encompass several requests, if necessary. To move either item, highlight it and then click Move Up/Move Down in the form-view.

### Read Datapool

## Using the Player, Script Development Workbench, and Analyze

Opens the Datapool and Variables dialog box, allowing you to choose which datapool to use, and then inserts a Read Datapool item immediately after the currently selected HTML Page.

You can move this item up or down the tree-view by clicking Up/Down in the form-view.

### Synch

Inserts a Synch item immediately after the currently selected HTML Page. A Synch item represents a spot where all virtual users will pause during replay until all active virtual users have reached the same point. Once the virtual users are synchronized this way, the Conductor will instruct them all to continue.

A Synch item can be moved up or down the tree using Up/Down in the form-view.

### Transaction Loop

Lists the requests in your transaction. All items/actions that occur under this heading are placed between the BEGIN\_TRANSACTION and END\_TRANSACTION statements, causing them to be repeated for as many times as the Conductor tells them to be. The transaction loop has a number of possible sub-elements, depending on the Web site you tested. For detailed descriptions of the elements that can be listed in a transaction loop, see [Looking at a transaction loop](#).

### WWW Request Actions

#### CGI Parameters Sub-item

Lists CGI parameters sent along with the request made by the Action item. If the Enable Anchor and Form Field Extraction option is selected in the [General WWW Conversion Options](#), hidden fields appear in as sub-items of CGI parameters.

#### Cookies sub-item

When a Cookie item is a sub-element of an Action item, it contains a list of cookie items that were sent in the header of the request that the Action item made when recording. Cookies are added automatically by the browser based on the URI that is being requested. They are either set as a result of the previous reply (the server returned a Set-Cookie command), or they are set by JavaScript contained in the previous reply.

If the Cookie shown has a matching Set-Cookie item, then nothing will display in the script since the cookie is created automatically during playback. If there is no matching Set-Cookie item, then a Set-Cookie type statement will be generated in the script.

You can insert additional cookies into the Cookies section of a page as another means of variablizing the playback. [How?](#)

#### Http Headers sub-item

If a header exists under an Action item, then it will be sent for that request only. If the header has the same name as one of the common headers, then it will override the common header for this request only. It is possible to [insert additional HTTP headers](#).

#### Basic Authentication Sub-item

Sometimes the pages being requested require Basic Authentication, that is, the user is presented with a dialog box asking for a UserID and Password. This information is recorded and presented in the tree-view under the Action item that requires it.

#### Integrated Windows Authentication Sub-item

Sometimes the pages being requested require Integrated Windows Authentication, that is, you are presented with a dialog box asking for a User ID, Password, and Domain. This information is recorded and listed in the tree-view under the Action item that requires it.

 **Note:** Integrated Windows Authentication includes support for NTLM, Negotiate, and Microsoft Active Directory.

To configure Web Authentication, select the Integrated Windows Authentication tree node to view the Integrated Windows Authentication dialog box.

#### PostTo sub-item

If the recorded request was a POST request rather than a GET request and the Script Development Workbench could not find a matching Submit type button, then a PostTo tree action item will be inserted under the page. This can sometimes happen if the request is initiated by JavaScript.

#### Click On Button sub-item

Clicking on Submit is usually associated with entering values into a form (Fill In Form item). When the Click On Button tree-view item is selected, the associated button in the browser window (top pane) will be highlighted with a blinking frame, making it easier to locate.

### Form View Fields

The form-view (bottom pane) for Click On Buttons (submits) lists the following information:

Identify by: Click the appropriate button to choose whether to identify the button by Name (internal name as indicated in the HTML), by Label (the text on the button), by Occurrence (e.g. the 3rd button), or by Image Source (in case this submit button is really an image). The edit Identify by buttons will change appropriately, depending upon which option you choose.

Prev Button/Next Button: If there are other submit buttons on the page, use Prev Button/Next Button to choose to use one of those other submit buttons. The name, label, or occurrence will be updated automatically.

Label: The Label field (or Name, Occurrence, or Image Source field) can be modified or variablized. If you variablize the field, clicking Next Button or Prev Button will not affect its contents. However if you choose to use one of the other options, different text will be displayed because variablization is specific to each method of identification.

If multiple matches to URL are found, use match: If QALoad finds multiple matches (for example, two buttons labeled Buy Me) then you can use this field to specify which match to use. For example you could specify that you want to click on the 4th button with a label of Buy Me when looking at a page with a lot of items for sale.

Original Label: The original label associated with the button that was clicked while recording.

Original Name: The original name (from the HTML source) for this button.

Form Action: The URL associated with a form. This is the address for the request that will sent when the submit button is clicked.

Submit Method: Whether this submit item was a GET or POST.

Convert ClickOn: Converts the ClickOnSubmit action to a PostTo or NavigateTo action, depending on whether the ClickOnSubmit will be converted into a PostTo or NavigateTo action.



**Caution:** This action is not reversible. If you convert the ClickOnSubmit action, it is permanently changed. You must create a new capture file with a ClickOnSubmit action if you want this action in your script.

### Click On Link sub-item

When the user clicks on a text link or an image link, then a Click On Link action item is inserted under that page. This is used to describe the action that was taken while on this page that resulted in the next page being requested.

When a Click On Link tree-view item is selected, the text or image in the browser-view (top pane) is highlighted by a blinking frame to make it easier to locate. There are several types of Click On Links:

- Text Links – One of the more common links in web pages are Text based links. These usually appear as underlined text.
- Image Links – An image can have a link, similar to text.
- Client-Side Image Map – A Client-Side Image Map is an image on a page that has multiple links associated with it. Each link is associated with a region, which can be any shape. When the user clicks on the image, the browser determines which region was clicked on and requests the page linked to that region.

- **Server-Side Image Map** – A Server-Side Image Map is an image on a page that has multiple links associated with it. Unlike Client-Side Image Maps, these links are stored on the server rather than the client. When a user clicks on the image, the browser sends the server the mouse coordinate relative to the top-left corner of the image. The server then replies with the appropriate page.

#### NavigateTo sub-item

Specifies a URI to be requested. If the Script Development Workbench cannot determine how the next page was requested (typically due to a JavaScript making the request) then it will use a NavigateTo tree item instead of something more specific such as a Click On Link.

#### Fill In Form Sub-item

If a requested page contains a Form (html element) that was filled in by the user, then a Fill In Form item and its associated elements will be created in the tree-view. When this tree item is selected, a blinking frame will appear around the form in the browser-view (top pane).

#### Form View Fields

The form-view (bottom pane) for a Form element lists the following information:

**Form Action String:** The Action String associated with this form. For example, the URI which will be requested.

**Form Number:** The number assigned to the form, indicating which form will be used.

A Fill In Form item in the tree-view can include a number of sub elements. For details, see [Form sub-items](#).

#### IP Spoof

Inserts an IP Spoof item immediately after the currently selected HTML page.

In order for IP Spoofing to work with Visual Navigator, it is necessary to create or insert an existing local datapool file called IPSPOOF.dat in the Visual Navigator tree-view. For more information about creating this datapool file and inserting it, see [Setting Up IP Spoofing](#).

#### Common Http Headers

Lists headers that were recorded from at least 50% of your requests. These headers will be sent out with every request that is made at playback unless they are overwritten by a header of the same name underneath an individual request action.

You can insert new header items from the tree-view by clicking Visual Navigator>Insert Tree Item>Http Header. In addition, you can modify the values in the Http Header form in the right pane.

### Client Certificate Tree Item

If the recorded transaction contains a line with a `ssl-clientcert` command, then Visual Navigator will create a Client Certificate tree item and place it directly beneath the Transaction Setup tree item.

The Client Certificate string can be modified or variablized in the form-view.

The Client Certificate item can also be moved up and down the tree like other tree items, such as checkpoints. This allows you to move it into the Transaction Loop area if you wish to change the certificate with each transaction.

A Client Certificate item will generate a script line similar to the following:

```
Set (EVERY_REQUEST, CERTIFICATE, "qaload_cl");
```

If the Requires Password check box is selected, the generated script line is similar to the following:

```
Set (EVERY_REQUEST, CERTIFICATE_PASSWORD, "~encr~250F7641455876");
```

### WWW Reply Actions

#### Radio sub-item

#### Form View Fields

The form-view (bottom pane) for a Radio Button element lists the following information:

#### General

**Group Name:** The Group Name is shared by all radio buttons that belong to the same group.

**Value:** The Value field is what differentiates one radio button from another. The group name and value of the selected radio button will be sent along with the request to the server. The Value of a radio button can be, and often is, different than the text shown in the browser.

**use this value button:** When you select a radio button in the browser-view (top pane) its value will display in this text box. Click this button to transfer this value into the above Value field.

#### Matching Parameter Rules

**Rule:** Lists the rules that have been created for this variable type. These rules may or may not have been placed in the [Rule Library](#).

**Applied to Item:** Indicates whether the rule is applied to this variable.

**GoTo Rule:** Goes to the individual rule under the Parameterization Rules tree item. In the right-hand pane, information in the Matching Item tab of the [Rule Details](#) dialog box displays.

**Previous Match:** Goes to the next matching variable immediately preceding the current item in the script.

**Next Match:** Goes to the next matching variable immediately following the current item in the script.

**Apply:** Applies the rule highlighted in the listbox to this variable. Only one rule can be applied to an instance of a variable.

**Undo Apply:** Removes application of the rule highlighted in the listbox from this variable. Other matching variables to which this rule is applied are not affected.

### TextArea sub-item

A Text Area item is a multi-line text box.

### Form View Fields

The form-view (bottom pane) for a TextArea element lists the following information:

#### General

**Name:** The name of the Text Area field.

**Value:** The value of the Text Area field. Any changes you enter into this edit box are reflected in the browser-view (top pane). To enter a linefeed, press **Ctrl+Enter**.

#### Matching Parameter Rules

**Rule:** Lists the rules that have been created for this variable type. These rules may or may not have been placed in the [Rule Library](#).

**Applied to Item:** Indicates whether the rule is applied to this variable.

**GoTo Rule:** Goes to the individual rule under the Parameterization Rules tree item. In the right-hand pane, information in the Matching Item tab of the [Rule Details](#) dialog box displays.

**Previous Match:** Goes to the next matching variable immediately preceding the current item in the script.

**Next Match:** Goes to the next matching variable immediately following the current item in the script.

**Apply:** Applies the rule highlighted in the listbox to this variable. Only one rule can be applied to an instance of a variable.

**Undo Apply:** Removes application of the rule highlighted in the listbox from this variable. Other matching variables to which this rule is applied are not affected.

### Selectbox sub-item

A select box is often called a drop down selection box or list box. The form-view will appear slightly different depending upon whether the Select Box is capable of supporting multiple selections or not.

### Form View Fields

The form-view (bottom pane) for a Select Box element lists the following information:

**Name:** The name (in the HTML) of the select box.

**Items from the Select Box:** Lists the items present in the Select Box in the browser-view. An item has a checkbox next to it to indicate if it has been selected. To change a selection, select or clear the checkbox. Your choices will be reflected in the browser. If the Select Box only supports one selection, then only the most recent selection is selected.

**Variablized Selections:** Edit boxes that allow the use of variables (local or from a datapool) to specify what options are chosen from the Select Box. For a multiple selection Select Box, it is possible to add up to six variables in addition to any item chosen using the check boxes.

For a single selection Select Box, a single edit box is provided to allow you to use a variable (local or from a datapool) to specify the option you want chosen from the Select Box.

### Checkbox Sub-item

The form-view (bottom pane) for a Checkbox element lists the following information:

**Name:** Name of the Checkbox.

**Value:** Value of the Checkbox.

**State:** Reflects whether the box is checked (selected) or not. If the State is 1 (checked), then the Name and Value are passed along in the request to the server. If the State is 0 (not checked) then the Name and Value are not passed along. You can change the value of the State by clicking on the checkbox control in the browser-view (top pane).

### Editbox sub-item

One of the more common elements in a form is an edit box. When this tree item is selected, QALoad will draw a blinking frame around the appropriate edit box in the browser-view (top pane). The edit box in the browser-view will show the value that was originally typed in when the transaction was recorded.

### Form View Fields

The form-view (bottom pane) for an Edit Box element lists the following information:

#### General

**Name:** The name of the edit box.

**Value:** The value of the edit box. Any changes made to this field will be reflected in the edit box in the browser window.

#### Matching Parameter Rules

**Rule:** Lists the rules that have been created for this variable type. These rules may or may not have been placed in the [Rule Library](#).

**Applied to Item:** Indicates whether the rule is applied to this variable.

**GoTo Rule:** Goes to the individual rule under the Parameterization Rules tree item. In the right-hand pane, information in the Matching Item tab of the [Rule Details](#) dialog box displays.

**Previous Match:** Goes to the next matching variable immediately preceding the current item in the script.

**Next Match:** Goes to the next matching variable immediately following the current item in the script.

**Apply:** Applies the rule highlighted in the listbox to this variable. Only one rule can be applied to an instance of a variable.

**Undo Apply:** Removes application of the rule highlighted in the listbox from this variable. Other matching variables to which this rule is applied are not affected.

### Hidden sub-item

Forms can contain hidden fields that do not show up on the page. These fields are not visible to the end user interacting with the browser, but they may need to be variablized for a load test, for example a field that contains a session ID may need to be variablized.

### Form View Fields

The form-view (bottom pane) for a Hidden Field element lists the following information:

Name: The name of the hidden field

Value: The value of the hidden field.

Allow this hidden field to be variablized: Select to variablize this field. Click the var... button to select a variable.

### Content Check Sub-item

Inserts a Content Check item for the currently-selected HTML page. This verifies that the correct page was returned based on the existence or absence of a particular search string in the server's reply for that page. Content checks can include variables. The search string is compared to the raw HTML returned by the server, so you may need to include HTML tags in your search to match the text that appears in the browser.

The top pane displays the source for the HTML page. You can easily select text in the top pane and add it to the content check definition by clicking the Copy from Source button.

### GetFormActionStatement

If a click on event occurs that leads from the existing page to the next page, GetFormActionStatement appears in the Visual Navigator Tree as a Page sub-item. If Let Convert Handle Paramteraization is not selected in [Post to](#), the value will remain static from the capture time and the script replay could fail.

### GetFormValue

If the page contains a form that requires dynamic interaction, the request parameters are set as variables to extract dynamic data from the appropriate Web page. The variables appear as a sub-item of the page. If Let Convert Handle Paramteraization is not selected in the [CGI Parameters](#), the value will remain static from the capture time and the script replay could fail.

### Frames

If an HTML page that is recorded contained frames, they will be represented in the tree-view (left pane) with a circle icon containing a capital F. A frame page will be indented beneath the page that is its parent. If you click on a frame icon in the tree-view, the corresponding frame will be highlighted in the browser-view (top pane) with a blinking frame around it for identification.

### Duplicated frameset pages

Sometimes when a user clicks on a link or takes some other action inside of a frame, the new page that was requested simply replaces the contents of one of the frames already shown in the browser. To indicate that the frameset page (the main page that holds the frames) has not changed, Visual Navigator renames it Duplicated Frameset n. Where n is an identifying number for the frameset that is incremented as more frameset pages are duplicated.

### SubRequests Sub-item

Lists all subrequests (such as images) that the page performed in order to be fully rendered in the browser. Subrequests cannot be changed and are shown strictly to provide detailed information about the requests that were made during the recording session.

### Cookies Set by Server Sub-item

If the reply from the server for the requested page contains a Set-Cookie command, it is listed here. This item cannot be modified, it is listed for your information only.

### AdditionalSubRequests Sub-item

Some requests are contained in applets, ActiveX components, or other objects that are captured, but not played back by QALoad . These subrequests, which are not recognized as normal subrequests, are listed in the AdditionalSubRequests tree item.

Each additional subrequest item appears in the script as a pre-loaded subrequest just before the main action. As a result, the playback engine requests the main page, regular subrequests, and then the pre-loaded subrequests.

For example:

```
//----- REQUEST # 2 -----
//
// current page url is http://c96852d01/pda/
//
// Pre-load the following image requests before the next request is made.
// These requests seem to have been made by javascript or applets associated
// with the next page but will not be made automatically by the replay engine,
// hence they are here in the script.
//
Set (NEXT_REQUEST_ONLY, ADDITIONAL_SUBREQUEST,
 "http://c96852d01/pda/images/LeftBackgrnd.jpg");

Set (NEXT_REQUEST_ONLY, ADDITIONAL_SUBREQUEST,
 "http://c96852d01/pda/menuopen.gif");
Set (NEXT_REQUEST_ONLY, ADDITIONAL_SUBREQUEST,
 "http://c96852d01/pda/menuclose.gif");
Set (NEXT_REQUEST_ONLY, ADDITIONAL_SUBREQUEST,
 "http://c96852d01/pda/menuclose.gif");
Set (NEXT_REQUEST_ONLY, ADDITIONAL_SUBREQUEST,
 "http://c96852d01/pda/images/browse.gif");

Click_On (IMAGE, 1, SRC_ATTRIBUTE, "http://c96852d01/pda/images/browse.gif");
```

### PageCheck Sub-item

Allows you to verify that the title of the page that was requested is correct.

## HTML Page sub-items

The following script items can exist under a Page (HTML) item in the Visual Navigator's tree-view. Each possible page sub-item is listed below, along with descriptions for the fields that appear in the form-view in the right pane when you select the item in the tree-view.

In addition, a Page item can contain sub-items that you [insert manually](#) after recording the transaction.

[Content Check sub-item](#)

[PageCheck sub-item](#)

[AdditionalSubRequests sub-item](#)

[SubRequests sub-item](#)

[Cookies Set by Server sub-item](#)

[Sleep sub-item](#)

[Fill In Form sub-item](#)

[Action sub-items](#)

## Extract String Sub-item

Inserts an Extract String item when you need to extract information from the script and store it in a variable to use later in the script.

When an Extract String item is inserted into the tree-view, the browser-view displays the HTML source for the page in which the item is inserted. The string to extract is recognized by the text preceding it and the text following it. The text string in between is extracted and saved into a local variable. You must specify the local variable that receives the extracted string at run time by clicking on [Select Var](#).

## Common Content Checks

Lists common content checks, which apply to all replies sent by the server. Content checks enable you to verify whether the correct page was returned based on the existence or absence of a specific search string. You can also set content checks at the [page level](#). Click the Add New Content Check Item button in the form-view to add new common content checks.

Common content checks can include variables. Common content checks enable you to generate an error code on a set condition even if no individual page-level content checks are enabled. The search string is compared to the raw HTML returned by the server, so you may need to include HTML tags in your search to match the text that appears in the browser.

## Parameterization in the Visual Navigator

### Parameterization

Parameterization is the process of substituting certain values in a script with variables you define. Parameterization is used in Visual Scripting for WWW scripts.

When you modify QALoad scripts before replaying them, the modifications usually are repetitive and consistent. Parameterization provides the means for replacing values with system-generated variables throughout your scripts. The values for variables are derived from a [datapool](#), an [extract string](#), or a [calculated](#) value.

### Methods for Parameterizing a Script

Values in a script that you can parameterize are noted in the form-view (bottom pane) with the var... button next to the field. This gives you access to the [Datapool and Variables](#) dialog box, where you can define values for variables.

Certain values in the script support the [Variable Replacement Wizard](#). The Variable Replacement Wizard simplifies the process of parameterization by taking you through the necessary steps for defining variables for the fields you want to replace. Fields for which the Variable Replacement Wizard is available are shown in the form-view with Var Wiz... button next to the field.

### Saving Parameters as Rules

You can create and maintain a table of the variables you define by storing them as rules in the [Rule Library](#). Once stored, the script looks for these rules and replaces the value with the parameters you assign to that rule.

## Using Variables with Visual Navigator

### Overview of Variables

When you record a transaction, the resulting script is a recording of the actions of a single end-user. When you play back that script multiple times during a load test, you probably want it to emulate the actions of multiple users making differing requests of your server instead of the single user that was recorded. One way to achieve that is to replace certain data with a variable that draws its value from a list of values that you provide. Here are some examples of why and how you might use variables in a script:

- ! If your original script recorded a user logging on to a site using an ID and password, you can replace the ID and password with variables in the script. At test time, those variables draw their values from a datapool file of acceptable values, using a different set of values for each transaction run. In other words, that one script could emulate a number of different users by utilizing a different user ID/password combination for each transaction.
- ! If your script inserted new records into a customer database, you might want the names to be unique each time the script is run (each transaction). You could create a datapool file of names, and then insert a variable into the script where the name was typed. At test time, the variable inserts a different name from the datapool file with each transaction.
- ! If an ID string is returned from the server and that ID is then used as part of future requests to the server, and each virtual user may get back a different ID from the server, you can use a variable to use a specific ID. You could extract an ID from the reply, place it into a variable, and then use the value in that variable in place of the actual ID for future requests, ensuring you only use the ID you specify.

There are a number of values in your script that can be replaced with variables. Those values are noted in the form view (bottom pane) with var.... Values that use the Variable Replacement Wizard are shown in the form view with Var Wiz. Typically variables derive their values from a datapool an extracted string, or a calculated value.

## Using Variables in a Visual Script

This topic describes several methods of working with variable data in a script.

### Using Variables in a string

Suppose you are testing a site where users must register themselves with a server. To register, they must type a name, password, address, and so on into a form. The resulting Visual Script contains a Fill In Form item in the tree-view under the appropriate Page item. Clicking on a form item opens the item's form-view in the bottom pane, which might look like the following graphic:

Name	name	
Value	Kim Walker	var...

In this example, the edit box requires the user to type their name. Assume that a second edit box requires the user to type their password. Each edit box on the form results in a separate item under the Fill In Form tree item. At runtime, you might want to parameterize the name and password edit boxes, so that a different user name and corresponding password is entered for every transaction. One way of variablizing these two fields is to create a datapool file containing two variables (columns) named Name (user ID) and Password, populated with valid user names and passwords.

To parameterize the name edit box:

---

1. Highlight the text in the form-view. In this example, that would be *Kim Walker*.
2. Right-click on the highlighted text and choose **Substitute with Variable**, or simply click on the **var...** button.
3. On the Datapools and Variables dialog box that opens, click on the Name (user ID) variable and click **OK**.
4. The **Value** field in the form-view for that particular field will look something like the following:

Name	name	
Value	<i>{\$User name:User names and Passwords\$}</i>	var...

At run time, this form field will be filled in with a value from the User name column of the datapool file named User names and Passwords.

### Working with an inserted variable

Here are some hints for working with variables:

- ! Clicking anywhere on an inserted variable selects the entire variable.
- ! You can delete a variable by clicking on it to select it, and then pressing the Delete key on your keyboard. Alternately, you can right-click on a variable and choose Delete Variable Reference from the menu to delete it.
- ! Rename a variable easily by double-clicking on it to open the Datapools and Variables dialog box with that variable highlighted. You can easily rename the variable from there.
- ! You can restore the contents of an edit box to whatever its contents were immediately after being converted by right-clicking on it and choosing Revert to Original String... from the menu. This will automatically delete any variables that have been inserted since the most recent conversion.

### Mixing regular text with variables

## Using the Player, Script Development Workbench, and Analyze

An edit box can contain a combination of regular text and any number of variables, depending upon how complicated the string needs to be.

### Using local variables

Another method of variablizing data, for instance the user ID and password describe previously, is to use local variables to create a unique name and password on each pass through the transaction loop with a format of User1 and Pass1, User2 and Pass2, and so on.

You could accomplish this using a combination of regular text and a local variable:

---

1. In the edit box for the User ID, type: `User`.
2. Then while the cursor is still at the end of the text you just typed, click the **var...** button to open the Datapools and Variables dialog box.
3. On the Datapools and Variables dialog box, create a local variable by clicking the **New Variable** button. Name the variable User Number. In the **Initial Value** field, assign the variable an initial value of 0 (zero).
4. Click **OK**. The **Value** field in the form-view will now display this value: `User{$User Number$}`

At run time, QALoad will create a value for that field that will be a concatenation of `User` and the value of the local variable named User Number.

5. Assume that the value should be 1 (one) for the first transaction, 2 (two) for the second transaction, and so on. To accomplish that, the value of User Number must be incremented before each iteration of the transaction. To increment the value before each transaction, insert an Increment Variable item before the Page item that uses the User Number variable.

### Variablizing with a random value

Another method of variablization is to insert or substitute selected text with a Random Value tag.

1. Select text or position your cursor and then click the **var...** button.
2. On the Datapools and Variables dialog box, click the **Random Number** button. The Random Number Tag dialog box opens.
3. Type values in the **Lower** and **Upper** fields to specify a range from which the number should be drawn.
4. Click **OK**. The Value field in the form-view will now display a value similar to the following: `User{$Random:1:500$}`
5. At run time, this variable will create strings similar to the following: User17, User394, and so on.

To modify a range, double-click on the Random tag to open the Random Number Tag dialog box where you can adjust the ranges as needed.

### Variablizing with a VU number

Another method of variablization is to insert or substitute selected text with a virtual user number tag.

1. Highlight the text to replace or position your cursor in a field and then click the **var...** button.
2. On the Datapools and Variables dialog box, click the VU Number (Absolute) or VU Number (Relative) button. The Value field in the form-view will be filled in with something similar to the following: `{$VU NUM ABS$}` or `{$VU NUM REL$}`.

At run time, the VU Number tag will be substituted with the number of the particular virtual user that is running this script. The string created will look similar to this: User45, User187, and so on.

### Find/replace a variable

Visual Navigator has a Find/Replace feature that allows you to quickly find occurrences of strings within the tree-view and replace them with other strings. For example, you could find all occurrences of Smith and

replace them with the datapool variable `{$Last Name:User Info$}`. For details about the find/replace feature, see [Visual Navigator's Find and Replace feature](#).

### Naming Variables

When you first create a datapool file, the included variables are automatically assigned the default names Var1, Var2, Var3, and so forth.

QALoad allows you to rename those variables with meaningful names that can even include spaces. This makes it much easier to work with datapools. For example, you could name a datapool variable something logical like City, rather than trying to remember that Var4 in your datapool is the City variable.

### Renaming Variables

You can quickly and easily rename local or datapool variables from the tree-view. Simply highlight the variable under the Datapool Files or Variables tree-view item, and then change the variable name in the resulting form-view (bottom pane).

You can also edit from the Datapools and Variables dialog box. To access it, right-click anywhere in the tree-view and then choose Datapools and Variables from the shortcut menu. Highlight the variable to rename and click Rename.

### Datapools and Variables

Datapools and variables can be added or modified by several methods. To simply create, delete, or modify datapool files and variables at any time while a script is open in the editor, choose Visual Navigator>Datapools and Variables from the menu to access the Datapools and Variables dialog box.

Alternately, the same dialog box will open automatically whenever you are asked to choose a variable or datapool file while working with the script, allowing you to create the variables you need on-the-fly.

Data that can be variablized is denoted in the form-view (bottom pane) by the var... button. Clicking the var... button will open the Datapools and Variables dialog box.

### Types of Variables

#### Types of Variables

When values in a script are replaced with variables, the variables typically are derived from extract strings, datapools, or calculated variables.

#### Extract Strings

Insert an Extract String item when you need to extract information from a reply and store it in a variable to use in future requests or simply for logging the information. For example, if a string is located inside a JavaScript or in a hidden tag that is not visible in the browser, and it might change each time this page is requested, use an Extract String to extract the value. Extract strings search on the text preceding and the text following the string you want to extract.

#### Datapools

Datapools draw values from a file of acceptable values and use a different set of values each time a parameter is replaced. You can select an existing datapool file or create a new datapool file to add to your

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script from your datapool directory. Each datapool has a list of variables under it representing columns in the datapool file. When you create a datapool, you specify the number of columns (variables) and rows (values) it contains.

The datapool file you choose is added to your script and is listed under Datapool Files in the Visual Navigator tree-view. You can choose to add a central or local datapool to a script.

 Note: You can have only one central datapool file associated with a script, but can have any number of local datapool files.

### Central

Central datapools are Conductor-based. They reside on the same workstation as the QALoad Conductor, and are available to any Player system on the network that requests it from the Conductor. You can apply only one central datapool file to a script.

### Local

Local datapools are Player-based. They reside on a Player workstation, and are only available to that Player. You can apply any number of local datapool files to a script.

### Shared

A shared datapool is a datapool that resided on the Player workstation and is available to the players assigned to the Player workstation. Because a shared datapool resided locally and is only available to the Player agent and its Players, it does not generate any network traffic. You can apply any number of shared datapool files to a script.

### Calculated Variables

Calculated variables are generated dynamically at runtime and are based on a formula you define. For example, you might want each virtual user to have a unique string, such as Smith1, Smith2, and so forth, or you may want to calculate a new value each time through the transaction loop.

Calculated variables are strings built from one or more elements. These can include datapools, local variables, and text, as well as the following:

#### Date and Time

Insert the date and time in the format you select.

#### Random Alphanumeric

Substitutes the value with random alphanumeric characters at runtime. Specify the type and length of characters to use. You can select: letters only, numbers only, or both letters and numbers.

The value can be a fixed length, where you specify the number of characters, or variable length, where you specify the minimum and maximum number of characters.

#### Random Numeric

Substitutes the value with a random number at runtime. You specify the minimum value, maximum value, the number of decimal places, and the number of leading digits. Numbers generated with fewer leading digits are padded with zeros.

#### Local Variable

A variable with a static value that you set when you create it.

#### Virtual User Number

The number used to identify the virtual users during a test. You can include a virtual user number (VU) in the calculation. VUs may be absolute (assigned by the Conductor) or relative (assigned by the Player at runtime).

#### Absolute

The absolute virtual user number is assigned by the Conductor based on the total number of virtual users on all Players. Each virtual user is assigned a number and no numbers are repeated. Insert an absolute virtual user number when it is necessary to use a completely unique virtual user number in place of a variable.

#### Relative

The relative virtual user number is the number assigned to the virtual user by its Player. Because a test has multiple Players and each Player assigns virtual user numbers from 0-n, a relative virtual user number is only unique on a single Player.

#### Local Variable

A local variable is a static value that you can substitute wherever variables can be used. You can quickly add local variables to your script from the Visual Navigator tree-view. Insert Increment Variable, Decrement Variable, and Reset Variable items into the tree-view to manipulate the value of any variables.

#### About Calculated Variables

Calculated variables generate their values dynamically at runtime based on the formula you define for them. They can generate strings that contain any combination of text, random alphanumeric characters, time and date values, and values from other variables, such as datapool values, extract strings, or other alphanumeric and numeric elements.

Build a calculated variable by choosing the elements you want to include and inserting them in the calculation. For example, you might want to calculate a new value dynamically each time through the transaction loop rather than use a datapool file of different values. Another example is when you want each virtual user (VU) to have a unique ID string, such as Smith1, Smith2, and so forth. Using calculated variables serves this purpose.

#### About Datapool Variables

Datapools are text files containing data records that you can use to replace variable data in your script. Each datapool comprises a set of variables representing columns in the datapool file.

For data that you can parameterize, the var... button appears in the form-view (bottom pane). Clicking the var... button opens the Datapools and Variables dialog box. Datapools can be Local (specific to a single Player), Shared (shared by Players on a workstation), or Central (available to all Players on all workstations).

 **Note:** You can parameterize certain variables using the [Variable Replacement Wizard](#).

#### Central Datapool

A central datapool is a datapool that resides on the same workstation as the QALoad Conductor. Its data is available to any Player system on the network that requests it from the Conductor. A central datapool is controlled by the Conductor, and you use the Conductor to set any options relating to it. You can apply only one central datapool file to a script.

## Local Datapool

A local datapool is a datapool file that resides on a Player workstation and is only available to Player instances on that workstation. Each Player instance on that workstation reads the file individually without regard for file reads done by other Player instances.

 Note: Each script is limited to a combined total of 64 local and/or shared datapools.

Because a local datapool resides locally and is only available to the local Player instances, it does not generate any network traffic.

## Shared Datapool

A shared datapool is a datapool file that resides on a Player workstation and is only available to Player instances on that workstation. Unlike a local datapool file, a shared datapool file has a single 'reader' on the Player workstation. Each Player instance obtains data records from the 'reader' thus preventing records from being used by multiple Player instances.

 Note: Each script is limited to a combined total of 64 local and/or shared datapools.

Because a shared datapool resides locally and is only available to the local Player instances, it does not generate any network traffic.

## About Extract Strings

Insert an Extract String item in your script when you need to replace a system-generated value or reuse a system-created value later in a script. You can extract information from a reply and store it in a variable to use in future requests. For example, if a system-created order number is assigned during a transaction that must be used again later in the transaction, you can use an Extract String to store the value and insert it into the script at the appropriate point.

When you select text to store in an extract string, Visual Navigator uses 10 or more characters on either side of the extracted text to make the search string unique and find this copy of the extracted text. You can increase or decrease the size of the strings. You also can specify which occurrence of the search strings to find in the responses before extracting the text between them.

## About Local Variables

A local variable has a constant value that you assign when you create the variable. It can be substituted wherever variables can be used. You can quickly [add local variables](#) to your script by right-clicking in the Visual Navigator tree-view and selecting Datapools and Variables.

 Note: You can insert [Increment Variable](#), [Decrement Variable](#), and [Reset Variable](#) items into the tree-view to manipulate the value of any variables.

## Adding a Variable

Add variables to the script from the Visual Navigator tree-view. Types of variables are:

- ! [Local variables](#)
- ! [Datapools](#)
- ! [Calculated variables](#)
- ! [Extract Strings](#)

 Note: You can insert Increment Variable, Decrement Variable, and Reset Variable items into the tree-view to manipulate the value of any variables.

## Creating a Calculated Variable

The following procedure provides step-by-step instructions for creating and editing a new calculated variable using the Datapools and Variables dialog box.

 Note: You can also use the [Variable Replacement Wizard](#) to create calculated variables.

To create a calculated variable:

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1. Access the **Datapools and Variables** dialog box by doing one of the following:
  - ! Click Visual Navigator>Datapools and Variables.
  - ! Right-click in the Visual Navigator tree-view, then select Datapools and Variables.
  - ! In the Visual Navigator tree-view, click the value you want to replace, and then click var... in the form-view.
2. Click **New Calc Variable**. A new calculated variable name appears in the list box with all the other variables assigned to the script. The new variable is added to the Variables section in the Visual Navigator tree-view (left pane).
3. Type a name for the variable, then click **OK**.
4. In the Visual Navigator tree-view, scroll to the Variables section and select the name of the variable you just created. Details of the calculation variable display in the right-hand pane.
5. Click Edit Calculation. The [Edit Calculation Variable](#) dialog box displays.
6. Build the calculation variable by clicking a form in the Templates area.
7. Select or type the associated information in the Details area.
8. Click Insert into Calculation, then click OK to save the changes.

## Adding a Variable to a Datapool

Add datapool variables to the script from the Visual Navigator tree-view.

 Note: You can insert [Increment Variable](#), [Decrement Variable](#), and [Reset Variable](#) items into the tree-view to manipulate the value of any variables.

To add a variable to a datapool:

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1. Right-click anywhere in the Visual Navigator tree-view.
2. From the shortcut menu, select **Datapools and Variables**. The **Datapools and Variables** dialog box displays.
3. Select a Datapool in the tree-view.
4. Click the **New Variable** button. A variable with the default name *Var#* is added to the list of variables in the selected datapool. Rename the new variable or accept the default name.
5. Click **OK**. In the Visual Navigator, the new variable is added to the datapool in the tree-view, and a new column for the variable displays in the form-view.
6. Type a value for the variable in each cell of the column.

## Creating, Editing, and Importing Datapools

The following sections provide step-by-step instructions for creating and editing datapools, and for importing a datapool file into a script.

### To create a new datapool:

---

1. With a script open, choose Visual Navigator>Datapools and Variables from the menu. The Datapools and Variables dialog box displays.
2. Click New Datapool File.
3. The Choose Datapool Type dialog box opens. Specify whether the datapool you are about to create should be central (Conductor-based), local (Player-based), or shared (Workstation-based) then click OK. The Create New Datapool File dialog box appears.
4. In the Filename field, type the name for the new datapool.
5. Type the number of rows and columns for the datapool file.
6. Click OK to create the datapool. You are returned to the Datapools and Variables dialog box. The Datapools and Variables dialog box now displays all datapool files assigned to the script, including the one you just created. The new datapool is added to the Datapool Files section in the Visual Navigator tree-view (left pane).
7. Click **OK**.
8. In the Visual Navigator tree-view, scroll to the Datapool Files section of the script and click the name of the datapool file you just created.
9. In the right-hand pane, type values into the datapool fields to be used at test time.

### To import a datapool file:

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1. Copy your datapool file, which must be in .dat format, to the `Datapools` directory of the QALoad installation.
2. **Insert** the datapool into a script.

### To edit a datapool file:

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If you need to make changes to a datapool file, Compuware recommends that you make a backup copy of the file first. If a backup copy is not available, you may need to check all other scripts that use that datapool file and make appropriate changes.

 **Caution:** Because it is possible for more than one script to use the same datapool file, care should be taken when modifying a datapool file's contents. Doing so for one script may cause errors in other scripts that use the datapool file.

1. With your script open, scroll to the Datapool Files section in the Visual Navigator tree-view (left pane).
2. Select the datapool file you want to edit. A table opens in the right-hand pane displaying the contents of the datapool file.
3. Perform any of the following functions:
  - ! Edit a cell's contents: Click in a cell and type over the existing contents to edit the value.

- ! Insert columns or rows: Right-click on a row or column header and choose **Insert Row** or **Insert Column** from the menu. Choose whether to insert the new item before or after the selected item, and type the number of items to insert.
  - ! Delete columns or rows: Right-click on a row or column and choose **Delete Row** or **Delete Column** from the menu. (Press **SHIFT** to select multiple contiguous items or **CTRL** to select multiple non-contiguous items.)
  - ! Rearrange columns or rows: Select one or more columns or rows by clicking on the headers (press **SHIFT** first to select multiple items). Drag the rows or columns to a new position. As you drag them, a thin red line indicates where the selection are moved.
  - ! Rename a column header (variable): Click on the column name and then type the new name in the **Variable Name** field.
4. Click **File>Save** to save your changes.

### Inserting a Datapool into a Script

You can quickly add an existing datapool to your script from the Visual Navigator tree-view.

 **Note:** Data that can be parameterized is denoted in the form-view (bottom pane) by the **var...** button or the **Var Wiz...** button. Clicking the **var...** button opens the **Datapools and Variables** dialog box. Clicking the **Var Wiz...** button opens the **Parameterization Wizard**.

### To insert a datapool from the Visual Navigator:

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1. Right-click anywhere in the tree-view. From the shortcut menu, choose **Datapools and Variables**. The **Datapools and Variables** dialog box appears.
2. Click **Insert Datapool File**.
3. The **Choose Datapool Type** dialog box opens, where you can designate your datapool file as a central, local, or shared datapool. If your script already includes a central datapool, you can designate your datapool file as either local or shared.
4. Click **OK**, the **Open** dialog box appears.
5. From the **Open** dialog box, navigate to the datapool file to add to your script. Datapool files are normally located in the directory `\Compuware\QALoad\Datapools`.
6. Select the appropriate file and click **Open**.

The file you selected is added to your script and is listed in your **Datapools and Variables** dialog box, where you can edit or delete it as necessary. If you expand the view of the file in the **Datapools and Variables** dialog box, you can see the variables (columns) saved in the file. The names for those columns are stored in the datapool file as a comment line. If they are not named, Visual Navigator assigns them the default name `Var#`.

### Creating Extract Strings

You can extract a value from the web page where it first occurs and place it into a variable using an **ExtractString** tree item. When you insert the tree item, the HTML source for the page appears in the browser-view so that you can highlight the text to extract. When you highlight the string, some of the text preceding and following the string is selected to identify where the string occurs during playback.

To create an extract string by inserting a tree item:

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1. Right-click in the Visual Tree where you want to place the extract string. The HTML source for the page appears in the right-hand pane.
  2. In the shortcut menu, click **Insert Tree Item>ExtractString**.
  3. In the form\_view (bottom pane), type the text you want to extract in the **Search for** field. Select **Match Case** to make your search case-sensitive.
  4. Click **Find prev** and **Find next** to select the occurrence of the variable you want to replace.
  5. Click **Select var...** The **Datapool and Variable** dialog box displays.
  6. Select the variable in which to store the extract string, and click **OK**.
  7. Do one of the following:
    - ! Highlight the desired text in the HTML page (top pane) and click Copy from source. This copies the selected text from the source window into the edit boxes. The text immediately before the selected text appears in the Preceded by field. The text immediately after the selected appears in the Followed by field.
-  **Note:** Use the arrows next to the fields to include more or less of the preceding and following text.
- ! Click Enter strings manually and type the text before and after the string in the Preceded by and Followed by fields.
8. In the **Extracted** field, click **Next** to view each instance of the variable in the page. The extracted string is added to the Visual Tree.
  9. In the **Extract Nth Occurrence** area, specify the occurrence of the search string to find in the responses before extracting the text between them. Do one of the following:
    - ! Type the number of the occurrence in the occurrence edit box. This is the occurrence of the search string to find in the responses before extracting the text between them. Click Prev or Next to find the previous and next occurrence of the search string in the source pane. This increments or decrements the occurrence number in the edit box.
    - ! Click Extract Last to search for the last occurrence of the search strings in the source pane and place the keyword LAST in the edit box. Click Prev to change the occurrence in the edit box to LAST-1, LAST-2, and so forth.
-  **Note:** You cannot edit the occurrence field manually when the LAST keyword is in the field.
- ! Click Extract Random to search for a random occurrence of the search strings in the source pane and place the keyword RANDOM in the edit box.
  - ! Click Reset to restore 1 in the occurrence edit box and find the first occurrence of the search strings in the source pane.
10. Select **Search includes Redirects and Additional Subrequests** to add the source for any Redirect pages preceding this main page, and any Additional Subrequests it may contain to the source pane.
-  **Note:** This is always selected for scripts generated in HTTP mode.
11. Click **OK** to return to the Replace Parameter with Variable page of the Variable Replacement Wizard.

## Adding a Local Variable

Add local variables to the script from the Visual Navigator tree-view. A local variable can be substituted wherever variables can be used.

 **Note:** Insert **Increment Variable**, **Decrement Variable**, and **Reset Variable** items into the tree-view to manipulate the value of any variables.

To add a local variable:

---

1. Right-click anywhere in the Visual Navigator tree-view.
2. From the shortcut menu, select **Datapools and Variables**. The **Datapools and Variables** dialog box displays.
3. Select the Variables item in the tree-view.
4. Click New Variable. An unnamed variable is added to your list of local variables.
5. Type a name for the new variable.
6. In the Initial Value field, type the value for the variable.
7. Click OK. The local variable is added to the Visual Navigator tree-view under Variables.

Using the Variable Replacement Wizard

Using the Variable Replacement Wizard

The Variable Replacement Wizard guides you through the process of defining variables and substituting them for parameters in the script. Using the wizard, you choose which fields of a parameter to replace with variables, define the variable that replaces the field, and select additional parameters to replace with the variable.

When you use the Variable Replacement Wizard, the variable you define is saved as a rule. When you save the rule in the [Rule Library](#), you can apply the same parameters to future scripts. Subsequent captures use the stored rules during the convert process to identify matching parameters.

The Variable Replacement Wizard is available for the Visual Navigator tree items that have a Var Wiz... button associated with them in the form-view (bottom pane). These include:

- ! CGI Parameter
- ! Cookie
- ! Editbox
- ! TextArea
- ! Radio button
- ! Header

Step 2: Define the Variable that Replaces the Name or Value Field

To define the variable that replaces the Name or Value field:

---

 Notes:

- ! The variable you define can replace the entire original value or portions of it.
  - ! When you choose to replace Both name and value fields in the previous step, the current step becomes Step 2.1: Define the variable to replace the Name field. When you complete this step and click Next, the dialog box appears again as Step 2.2: Define the variable to replace the Value field. Complete this step for the Value field and click Next to proceed to Step 3.
1. In the **Variable Name** box, type a name for the variable or accept the default name. The default name is *name#*, where # is the number incremented by one for each new variable.

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2. Click the down arrow on the **Frequency** box to display selections for when the original value is replaced with the variable. You can select:
    - ! Once per test
    - ! Once per transaction (default)
    - ! Every usage
  3. Do one of the following:
    - ! Type a value for the variable in the Calculation field.
    - ! In the Templates area, click the type of value you want to use, then select or type the associated details in the Details area of the dialog box. Click a template below to display the associated detail fields:
      - o [Date and Time](#)
      - o [Random Alphanumeric](#)
      - o [Random Number](#)
      - o [Datapool Variable](#)
      - o [Local Variable](#)
      - o [Virtual User Number](#)
      - o [Extract String](#)
-  **Note:** The text you type or the template you select can represent the entire variable, or you can combine it with other elements.
4. Repeat Step 3 until you include all elements for the calculation.
  5. Click **Insert into Calculation**.
  6. Click **Next** to proceed to the next step, where you select additional parameters to replace. Click **Back** to edit fields in the preceding dialog box.

### To review and create the variable:

---

1. In the **Summary** dialog box, review the information you entered for the variable. The information appears in three tabs:
  - ! **Variable Properties** - Shows the elements you used to define the variable and its frequency of use. Clicking **Details** displays the Calculation Details dialog box.
  - ! **Items to Replace** - Shows the parameters with the same name in the script that you chose to replace with this variable definition.
  - ! **Rule Properties** - Shows details of the variable and rule.
2. Click **Back** to return to the appropriate dialog box to edit information.
3. Click **Finish** to create the variable, apply it as a rule, and use it in the script.

## Using the Rule Library

### Overview of the Rule Library

You can save variable replacements you define as rules. These are stored in the Rule Library, where you can use them in future recordings and reduce repetitive parameterization tasks.

When subsequent captures are converted, the Visual Navigator scans the Rule Library for matching parameters. For example, if a rule parameterizes the value of a CGI Parameter named `SessionID`, the Visual Navigator scans through the Visual Tree for any CGI Parameters that match the description defined in the rule. If a match is found, the rule is added to the Visual Tree, where you can apply it to the script.

From the Rule Library, you can create rules, edit rules, and view details of individual rules and the folders in which they are stored.

### Elements of the Rule Library Dialog Box

Create or modify parameter rules from the Rule Library dialog box. The dialog box contains the following areas:

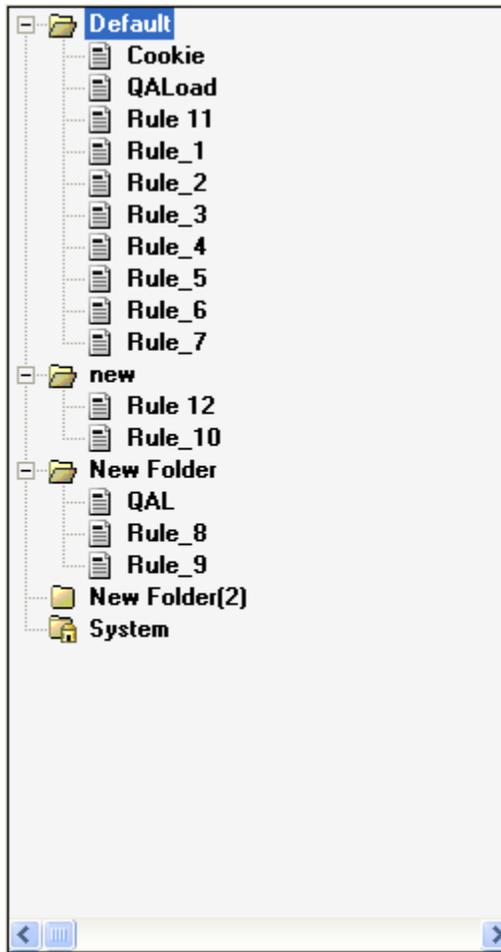
- ! [Menus](#)
- ! [Tree view](#)
- ! [Details](#)

### Rule Library Menus

Menu Command	Description
File	New Rule - Opens the Rule Creation Wizard. Use the wizard to define a rule that you can use to parameterize future scripts. New Folder - Creates a new folder in the tree-view.
Edit	Use the Edit menu to cut, copy, paste, delete, or rename rules.
Rule	Edit Rule - Opens the Rule Creation Wizard so you can edit a rule you select in the Rule Library.
Help	Displays QALoad help.

### Rule Library Tree-View

The Rule Library tree-view displays a hierarchical view of all rules and folders within the Rule Library.



### Rule Library Dialog Box Details

The Details area of the Rule Library dialog box displays information on the rules defined in the Rule Library. There are two levels of detail:

- ! **Folder** - When you select a folder name in the Rule tree, the **Details** area of the dialog box displays information for each rule in the folder.
- ! **Individual Rule** - When you select a rule in a folder in the Rule tree, the **Details** area of the dialog box displays information for the individual rule in three tabs.

### Applying a Rule

When you define values to replace variables in a script, you can save them as rules and apply them to other scripts.

To apply a rule from the Visual Tree:

1. In the Visual Navigator vistree, click the **Parameterization Rules** script item and select the rule to apply. A description of the rule displays in the form-view.
2. Click the **Matching Items** tab. The properties that determine the matching items and each matching item found in the script display.

3. Do one of the following:

! Click **Apply Rule** on the left-hand side of the dialog box to apply the rule to all the matching items.

! Select an item or items in the table and click **Apply to Item** on the right-hand side of the dialog box.

 **Note:** When a different rule has been applied to an individual item, a red exclamation mark (!) appears next to the item in the table. Only one rule can be applied at a time. Click **Go to Item** and review the information in the **Matching Parameter Rules** area of the form-view to view the rule applied to the item.

To apply a rule from the form-view for a variable:

---

1. In the Visual Navigator vistree, select the variable to which you want to apply the rule.
2. In the **Matching Parameter Rules** area at the bottom of the form-view (right-hand pane), select the rule you want to apply.
3. Click **Apply**. The rule is applied to the variable.

Editing a Rule

Follow these steps to edit rules stored in the Rule Library.

To edit a rule:

---

1. Select a rule in the Rule Library visual tree, and click **Rule>Edit Rule**. The Rule Creation Wizard opens and displays the information on the rule you selected.
2. Follow the procedure for [creating a rule](#) to make changes to the rule elements.

Creating Rules from the Rule Library

Create a new rule from the Rule Library using the Rule Creation Wizard.

To open the Rule Library Wizard:

---

1. Select **Tools>Rule Library**. The **QALoad Rule Library** opens.
2. Select the folder in the tree-view where you want to store the new rule.
3. Click **File>New Rule**. The **Welcome** dialog box of the **Rule Creation Wizard** displays.

Using the Rule Library Wizard

Step 1 of 3: Choose the Fields to be Replaced

To choose the fields to replace:

---

1. Choose which fields of the matching item get their values from this rule. You can select:
  - ! Name field
  - ! Value field
  - ! Both name and value fields

## Using the Player, Script Development Workbench, and Analyze

2. Click the down arrow on the **Item Name** box to display options for how the item you are replacing is identified in the script. This enables the wizard to find and replace similar matching items. You can select:
  - ! is equal to (variable to replace)
  - ! starts with (variable to replace\_XXX)
  - ! ends with (YYY\_variable to replace)
  - ! contains (YYY\_variable to replace\_XXX)
3. Select the parameter type to which you want the rule applied. Choose:
  - ! Only items of the specified type
  - ! All parameter types
4. Select the URLs from which the item should be matched. Choose:
  - ! Match any items of the specified host URL and type the name of the URL.
  - ! Any host
5. Click **Next** to proceed to the next step, where you define the variable.

### Step 2 of 3: Define the Variable

To define the variable:

 **Note:** The variable you define can replace the entire original value or portions of it.

1. In the **Variable Name** box, type a name for the variable or accept the default name. The default name depends on the field you chose to replace in the previous step. The default name is:
  - ! NameVar - if you chose to replace the Name field in the previous step.
  - ! ValueVar - if you chose to replace the Value field in the previous step.

 **Note:** When you choose to replace both the Name and Value in the previous step, the default is NameVar. When you complete this step and click Next, the dialog box displays again with ValueVar in the Variable Name field. Complete Step 1 through Step 5 for the Value variable.
2. Click the down arrow on the **Frequency** box to display selections for when the original value is replaced with the rule. You can select:
  - ! Once per test
  - ! Once per transaction (default)
  - ! Every usage
3. In the **Templates** area, click the type of value you want to use, then select or type the associated details in the **Details** area of the dialog box. Click a template below to display the associated detail fields:
  - ! [Date and Time](#)
  - ! [Random Alphanumeric](#)
  - ! [Random Numeric](#)
  - ! [Datapool Variable](#)
  - ! [Local Variable](#)
  - ! [Virtual User Number](#)
  - ! [Extract String](#)

 Note: The text you type or the template you select can represent the entire variable, or you can combine it with other elements from the templates.

4. Repeat Step 3 and Step 4 until you include all elements for the calculation.
5. Click **Insert into Calculation**.
6. Click **Next** to proceed to the next step, where you select additional parameters to replace. Click **Back** to edit fields in the preceding dialog box.

 Note: When you choose to replace Both name and value fields in the previous step, clicking Next repeats the current step so you can define the variable for the Value field. Complete Step 1 through Step 5 for the Value field and click Next to proceed to the next step.

[< Previous](#) [Next >](#)

### Step 3 of 3: Rule Description

Review the rule you created.

To view the rule:

---

1. Review the details in the **Description** box. This is a summary of the elements you used to define the rule.
 

 Note: A default name is provided in the Rule Name field. You can type a new, descriptive name for the rule or accept the default.
2. Store the rule in a folder by doing one of the following:
  - ! Click the down arrow in the Rule Folder list and select the folder name where the rule will be stored.
  - ! Click New Folder. The Create New Rule Folder dialog box appears. In the Folder Name field, type the name of the new folder, then click OK.
3. Click **Next** to proceed to the **Summary** dialog box.

### Summary

To review and create the rule:

---

1. In the **Summary** dialog box, review the information you entered for the rule. The information is displayed in two tabs:
  - ! Variable Properties - Shows the elements you used to define the rule and its frequency of use. Clicking Details displays the Variable Details dialog box.
  - ! Rule Properties - Shows details of the variable and rule.
2. Click **Back** to return to the appropriate dialog box and edit any elements of the rule.
3. Click **Finish** to create the rule and store it in the Rule Library.

## Developing a Script Using the Visual Navigator (WWW)

### Recording a Visual Navigator Script

## Using the Player, Script Development Workbench, and Analyze

You record a Visual Navigator script the same way you record a regular QALoad script — by setting options to determine the behavior of QALoad while recording, and then clicking through a transaction to mimic a user. QALoad will record all sent and received HTTP and SSL calls using the Script Development Workbench's Web proxy and write the activity to a capture file.

After recording, the capture file must be converted to an editable, C++-based script. Your capture file data turns into a Visual Navigator Script that allows you to view the actual Web pages you recorded in a browser-like interface, where you can manipulate the transaction and easily insert variable information into your script without directly editing a line of code. It is possible to save the script as another name to view the code instead of the Visual Navigator script. By doing this, the code is separated from the Visual Navigator script. Any changes made in the code will not appear in the Visual Navigator script just as any changes made in the Visual Navigator script will not appear in the saved as code.

### To record a Visual Script:

---

If you are running your application on Windows XP SP2, Compuware recommends you turn off the 'pop-up blocker' feature before recording a transaction. The feature can be disabled via the browser window's Tools menu in Internet Options>Privacy.

1. Open a WWW session in the Script Development Workbench.
2. Click **Options>Record**. The WWW Record Options dialog box opens. Set any [relevant options](#).
3. Click **OK**.
4. For convenience, set conversion options now also. (You can set conversion options after recording your transaction, if you prefer, or even change pre-set options at any time after recording and then re-convert the capture file to apply the changes.):
  - a. Click **Options>Convert**. The Universal Convert Options dialog box opens.
  - b. Set any applicable options.
  - c. Click **OK**.
5. From the toolbar, click the **Start Record** button. QALoad launches your application and any proxies, if necessary, and begins recording calls.
6. Record the transaction.
7. When you are finished, click the **Stop Record** button. You will be prompted to save your capture file. By default, capture files (.cap) are saved in the directory QALoad\Middlewares\WWW\captures.
8. If you previously set options to prompt automatic conversion, your capture file will be converted to a Visual Script and will open automatically in the editor. For more information about setting up automatic conversion, see [Configuring the Script Development Workbench](#).

If not, you will be prompted to save and name your file. When you are finished, click OK.
9. Click the Script Development Workbench's Captures tab and locate the capture file you just saved.
10. Right-click the file and choose **Convert**. QALoad will convert your capture file to a Visual Navigator script and open it in the editor.

### Visual Navigator Files

When you create a script using Visual Navigator, QALoad saves important information about your script in the following files. These files are saved in the directory \Compuware\QALoad\Middlewares\WWW in the subdirectories \Scripts and \Captures. Some of these files can be modified, and can be opened from the Script Development Workbench's Workspace pane, if necessary.

 **Note:** If you choose to enable support for Siebel while converting a capture file, you must copy the ssdtcorr.hpp, ssdtcorr.lib, and ssdtcorr.dll Siebel files from the Siebel installation folder to the C:\Program

Files\Compuware\QALoad\BinaryFiles. If you do not modify the Siebel instance, you only have to move the ssdtcorr.dll file.

Filename	Description
Files Generated From Recording	
<code>&lt;filename&gt;.cap</code>	A file containing all of the requests and responses that were recorded.
<code>&lt;filename&gt;.rfd</code>	Replies to subrequests, which mostly consist of images, style sheets, and javascripts. This data is used to visually recreate the pages as they appeared when recording.
Files Generated From Conversion to a Visual Script	
<code>&lt;filename&gt;.vistree</code>	Contains most of the elements of the Visual Navigator tree, including any elements that you modify later or add to your script.
<code>&lt;filename&gt;.VisHtml</code>	Contains the HTML pages of all the main requests as well as images, stylesheets, and other subrequested pages. This data is used to visually recreate the pages as they appeared when recording.
<code>&lt;filename&gt;.VisXml</code>	Contains any XML/SOAP information that was recorded.
<code>&lt;filename&gt;.cpp</code>	A C++ representation of your script.

## Inserting Script Items

### Inserting Script Items

You can insert a number of script items into your converted script.

To insert tree items:

1. Do one of the following:
  - ! From the Script Development Workbench main menu, choose Visual Navigator>Insert Tree Item.
  - ! Right-click in the tree-view (left pane) and choose Insert Tree Item.
2. Choose the item to insert.

Most of the inserted items can be moved up and down the tree using the Up/Down arrows in the form-view (bottom pane) for that item. You can also delete an item highlighted in the tree-view by choosing Delete Tree Item from the menu.

Using the Player, Script Development Workbench, and Analyze

The following script items can be inserted from the Visual Navigator menu:

Extract String

Cookie

Http Header

Content Check

CGI Parameter

Synch

IP Spoof

Read Datapool

Checkpoint pair

Increment Variable/Decrement Variable/Reset Variable

Print Values (debugging)

Comment

Inserting cookies into a script

Cookie items can be added directly to the HTML Page item they apply to, under the Action item (for example, a Click on Link item).

To insert a cookie item:

---

1. In the Visual Navigator tree-view (left pane), navigate to the HTML Page item requiring the cookie and then click on it to select it.
2. From the menu, choose **Visual Navigator>Insert Tree Item>Cookie**. A Cookie form-view opens in the bottom pane.
3. In the **Name** field, type a name for the new Cookie or click **Var Wiz...** to access the Select Variable dialog box where you can select a value from a datapool file or create a variable for this field.
4. In the **Value** field, type a value for the new Cookie or click **Var Wiz...** to access the Select Variable dialog box where you can select a value from a datapool file or create a variable for this field.
5. Click **Save** to save your changes.

The Cookie item is added to the script for the selected HTML Page item.

Inserting HTTP headers into a Visual Navigator script

You can insert HTTP headers under the Common Http Headers tree item.

To insert a new Http Header item:

---

1. In the Visual Navigator tree-view (left pane), navigate to the **Common Http Headers** script item, and then click on it.
2. From the menu, choose **Visual Navigator>Insert Tree Item>Http Header**. An **Http Header** form-view opens in the bottom pane.
3. In the **Name** field, type a name for the new header or click **Var Wiz...** to access the Select Variable dialog box where you can select a value from a datapool file or create a variable for this field.

4. In the **Value** field, type a value for the new header or click **Var Wiz...** to access the Select Variable dialog box where you can select a value from a datapool file or create a variable for this field.
5. Click **Save** to save your changes.

The header item is added to the script, and will be used for all requests at playback unless it is overwritten by a header with the same name underneath an individual request action.

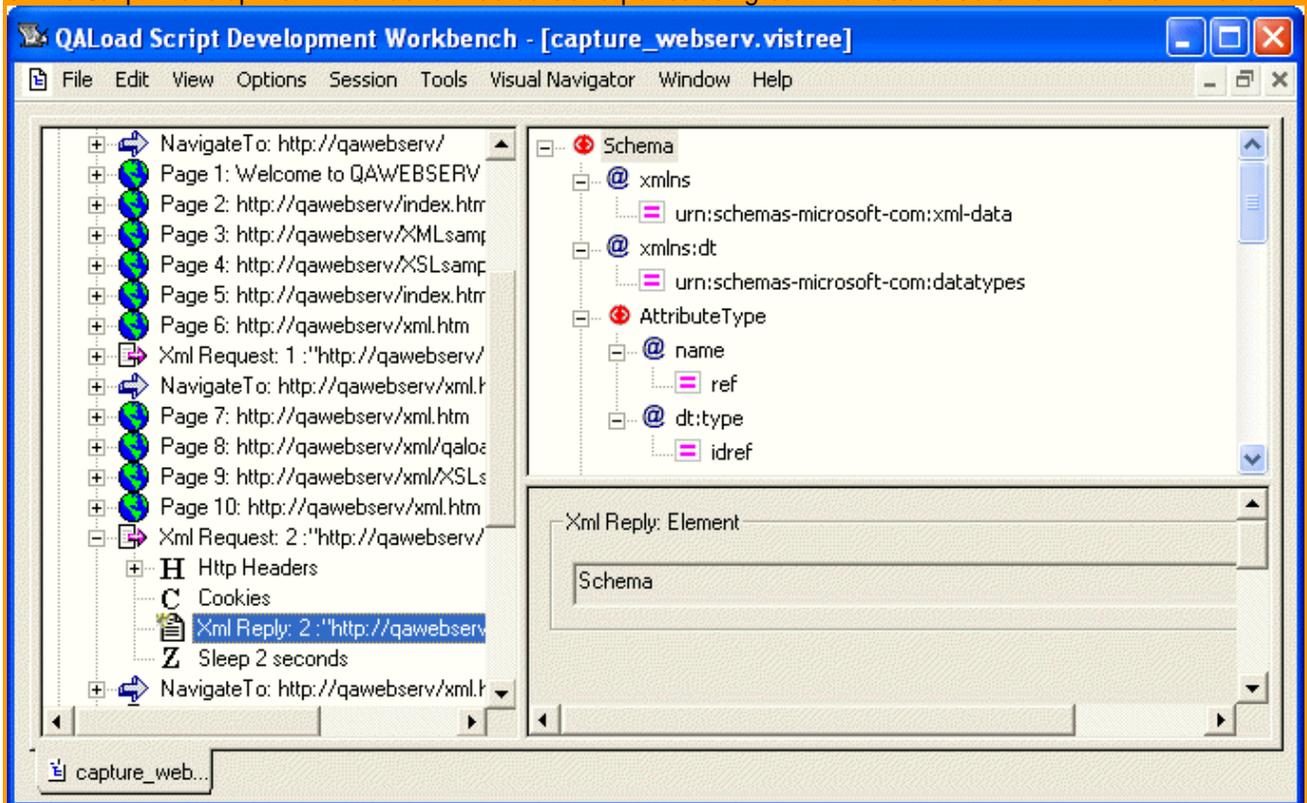
## XML Support

### XML Support

QALoad's XML support is handled through the Script Development Workbench's Visual Navigator, which displays your script's HTTP or XML requests in an easy-to-use, visually-based interface that offers you point-and-click script editing. Although XML is supported through the Visual Navigator, Compuware recommends you read through this help topic as well as the [Visual Navigator](#) help topics to become familiar with the features that are unique to QALoad's XML support.

When an HTTP request is made for an XML document, either in the form of an HTTP GET request or an HTTP POST request with an XML document as the post data, the data is displayed in the three Visual Navigator panes as illustrated below. Click on a pane in the graphic for a description of its contents and functionality.

**Note:** To make the following graphic fit better in this help window, the Script Development Workbench toolbars and panes that are not directly related to this help topic are not displayed. You can hide/show many of the Script Development Workbench toolbars and panes using commands available from the View menu.



### XML Support

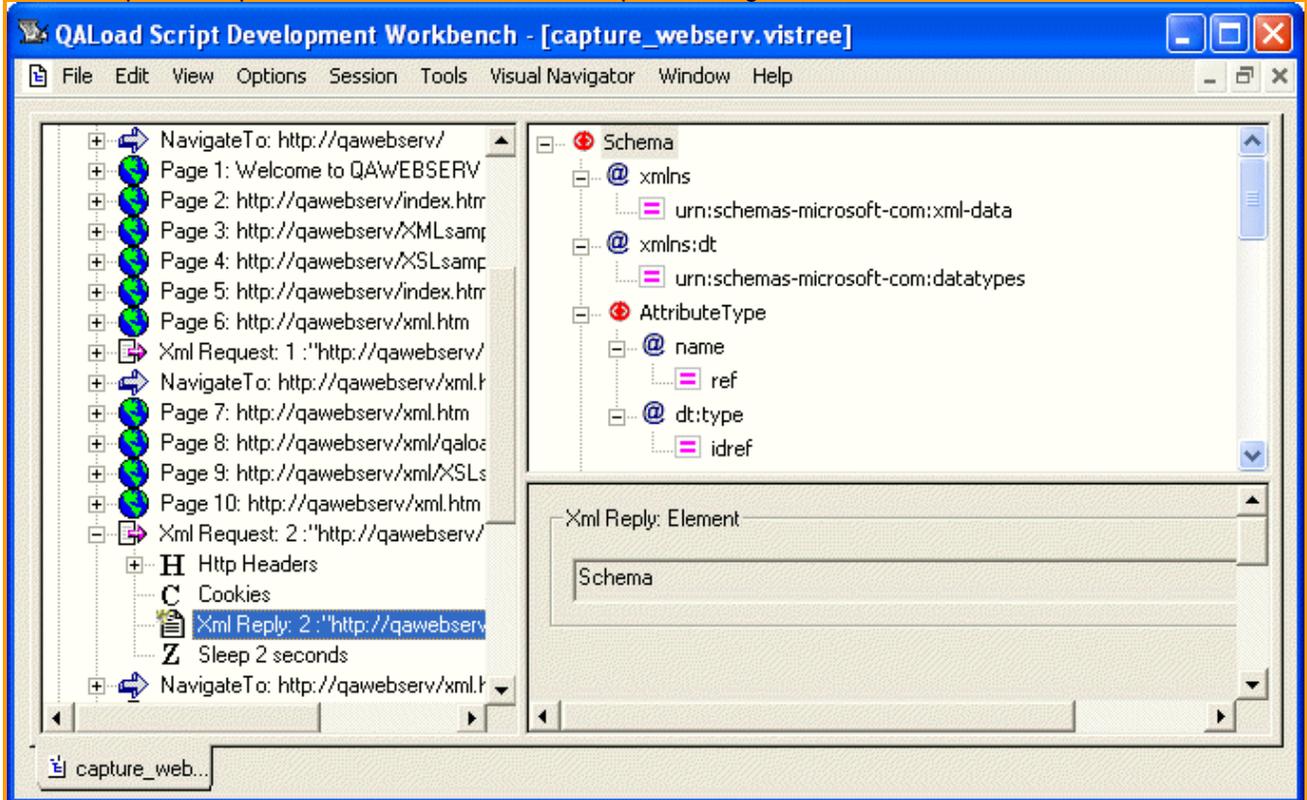
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## Using the Player, Script Development Workbench, and Analyze

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### XML Requests

When an HTTP request is for an XML document, either in the form of an HTTP GET request, or an HTTP POST request with an XML document as the post data, then an XML Request tree item is displayed in the tree-view (left pane). The form-view (bottom pane) for an XML Request item includes the following fields:

**Reply Status:** The reply status code. The status code is 200 OK for most pages that return correctly.

**Request URI:** This read-only field shows the URI requested, which resulted in this page being displayed.

**Checkpoint Name:** If the page has a title, it is used as the checkpoint name. If not, the word Checkpoint is used. To make sure all checkpoint names are unique, QALoad adds a number to the beginning of the checkpoint name.

### XML Request Sub-items

An XML Request item can contain the following sub-items.

### XML Reply

The URI of the document returned as a result of the XML request. XML data corresponding to the reply is displayed in the browser-view.

## HTTP Headers

If a header exists under an action item, it is sent for that request only. If the header has the same name as one of the common headers, it overrides the common header for this request only. The form-view (bottom pane) for an HTTP header lists its name and value. Because there is no XML data recorded for a header, the browser-view remains empty. It is possible to insert additional HTTP Headers.

## Cookies CGI Parameter

The Cookies tree item contains a list of Cookie items that were sent in the header of the request that this item made while being recorded. Cookies are added automatically by the browser based on the URI that is being requested. They are either set as a result of the previous reply (server returned a Set-Cookie command), or they are set by JavaScript contained in the previous reply. The form-view for a cookie item lists its name and value. Because there is no XML data recorded for a header, the browser-view remains empty.

## XML Document-view

When you click on an XML Request item in the tree-view (left pane) the right pane becomes a document-view displaying a tree-view of details about the XML document requested or returned as the result of an XML request. Each individual XML item appears as a node in the XML document tree. XML elements can have child elements and these appear as child nodes of the XML element. Attributes of an element appear as child nodes of the element, with the attribute value appearing as a child of the attribute name.

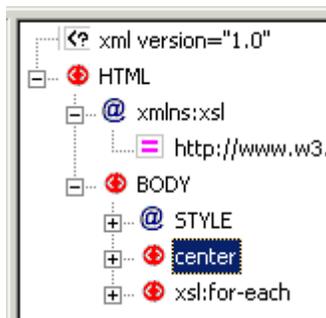
### What if no XML data is associated with a request?

If there is no XML document associated with the XML request (for example, an HTTP GET) a message indicating that there is no XML to be displayed is shown in the XML document-view.

### How does the document-view relate to the form-view?

Selecting an item in the XML document tree displays the form-view details corresponding to that XML element type in the bottom pane.

Following is an example of XML request data displayed in a portion of the XML document-view:



## XML Form-view

When an XML request is displayed in the document-view (top pane) — as a result of an XML request item or XML reply child item being selected in the Visual Navigator tree-view — you can click on items in the document-view to display information about each in the form-view (bottom pane). If no XML item is

selected in the document-view, the XML Page form-view displays instead. For XML items, the form view display options depend on two things:

- ! what type of XML item is selected in the Visual Navigator tree-view (left pane): an XML request or an XML reply
- ! what type of XML item is subsequently selected in the XML document-view (top pane)

When an XML item is selected in the XML document-view, the value of that XML item is displayed in an edit box in the form-view. Some values — attribute values and text values — can be edited or variablized (that is, substituting one or more variables for the value in an XML request or selecting the return value from an XML reply item to be received by a variable for later use in the script). Text items, which are values between element tags, and attribute values represent volatile items in an XML document structure, used for passing values to and from Web Services, for example.

The following tables list the possible actions for XML items displayed in a form-view. Valid actions are determined by the XML item type and whether the item is from an HTTP POST request or from an HTTP reply.

In the following tables:

- ! If an item is *editable*, the value in the form-view can be changed and the new value is used during replay.
- ! If a value can be *variablized*, a variable can be substituted for all or part of the value. The variable's value is placed in the variable's location at replay. An example is a value received from an item from a previous XML document reply.
- ! If a variable can *receive* a replay value, the return value for the item can be placed into a selected variable during replay. The variable can then be substituted for an input value in a later XML request.

XML Request Items		
XML Request Item	Editable?	Can the Value be Variablized?
Declaration	No	No
DTD (Document Type Definition)	No	No
PI (Processing Instruction)	No	No
Comment	No	No
Element	No	No
Attribute (Name)	No	No
Attribute (Value)	Yes	Yes
Text	Yes	Yes

XML Reply Items	
XML Request Item	Can Variable Receive Replay Value
Declaration	No
DTD (Document Type)	No

Definition)	
PI (Processing Instruction)	No
Comment	No
Element	No
Attribute (Name)	No
Attribute (Value)	Yes
Text	Yes

## TestPartner

### Creating a TestPartner Script

To create a TestPartner script, insert any number of TestPartner transactions (TestPartner scripts) into a QALoad template script accessible from the QALoad Script Development Workbench. The template script is a simple QALoad script that can be compiled and run; however, it contains no functionality until you insert the TestPartner transactions appropriate for your testing needs.

 **Note:** TestPartner must be installed and properly configured on your machine to create a TestPartner script.

To create a QALoad script to execute a TestPartner transaction, follow the steps below.

To create a new TestPartner script:

1. With a TestPartner session open, choose **Session>Generate Script** from the menu. The Create New TestPartner Execution Script dialog box opens.
2. In the **DSN** drop-down list, select the DSN, which gets populated from the DSNConfiguration.ini file in TestPartner.
3. In the **Userid** and **Password** fields, type the user id and password associated with the DSN. Click **Connect**. The TestPartner Script Selection fields are enabled.
4. In the **Project Name** drop-down list, select a project that exists in the selected DSN. The Available Scripts list displays all the scripts and visual tests that belong to the selected project name.
5. Select the **Automatically include Checkpoint** check box to automatically insert checkpoints in the script when it is created. If you do not want checkpoints inserted, clear this check box.
6. In the **Available Scripts** list, select a script or visual test name to add it to the Selected Scripts list. Click **Add** to add the selected script. Repeat this step to continue adding individual scripts. To add all scripts at once, click Add All.

 **Tip:** You can add multiple scripts and visual tests to the Selected Scripts list. The scripts and tests can be from the same or different projects and also from different DSNs.

7. (optional) In the **Selected Scripts** list, move the script up or down on the list by selecting the script and clicking Up or Down to execute scripts in a certain order. To remove a script, select a script and click **Remove** to delete the selected script from the list. To remove all scripts at once, click Remove All.
8. In the **QALoad Script Name** field, type a new script name. To edit an existing script, click the **...(Browse)** button to open the Choose Script Name dialog box and select an existing script.
9. Click **Create Script** to generate the QALoad script.

10. To compile the script for testing, select **Session>Compile**.

 **Caution:** When [validating the script](#), you may need to increase the value in the Wait up to field, which is the amount of time needed for the script to execute before timing out.

### Inserting a TestPartner Script

You can insert any number of TestPartner transactions (TestPartner scripts) into a QALoad template script accessible from the QALoad Script Development Workbench.

 **Note:** TestPartner must be installed and properly configured on your machine to insert a TestPartner script.

#### To insert a TestPartner script:

---

1. Start the Script Development Workbench and open a TestPartner session. From the **Session** menu, choose **New Template** to create a new script from the QALoad template script.
2. In the **Choose Script Name** dialog box, type a name for the QALoad script in the **Script Name** field and click **OK**. The script is saved in the directory `\Program Files\Compuware\QALoad\Middlewares\TestPartner\Scripts`, and the script opens in the script editor.
3. Edit the script as necessary. You can manually enter any transactions or scripting commands directly in the script.
4. To insert a TestPartner transaction in the script, position your cursor anywhere after the SYNCHRONIZE() or before the TP\_Uninit() command.
5. From the **Session** menu, choose **Insert>TestPartner Script**. The Insert New TestPartner Execution Script dialog box appears.
6. In the **DSN** drop-down list, select the DSN, which gets populated from the DSNConfiguration.ini file in TestPartner.
7. In the **Userid** and **Password** fields, type the user id and password associated with the DSN. Click **Connect**. The TestPartner Script Selection fields are enabled.
8. In the **Project Name** drop-down list, select a project that exists in the selected DSN. The Available Scripts list displays all the scripts and visual tests that belong to the selected project name.
9. Select the **Automatically include Checkpoint** check box to automatically insert checkpoints in the script. If you do not want checkpoints inserted, clear this check box.
10. In the **Available Scripts** list, select a script or visual test name to add it to the Selected Scripts list. Click **Add** to add the selected script. Repeat this step to continue adding individual scripts. To add all scripts at once, click Add All.

 **Tip:** You can add multiple scripts and visual tests to the Selected Scripts list. The scripts and tests can be from the same or different projects and also from different DSNs.

11. (optional) In the **Selected Scripts** list, move the script up or down on the list by selecting the script and clicking Up or Down to execute scripts in a certain order. To remove a script, select a script and click **Remove** to delete the selected script from the list. To remove all scripts at once, click Remove All.
12. Click **OK**. When you are finished, save any changes.
13. To compile the script for testing, select **Session>Compile**.

 **Caution:** When [validating the script](#), you may need to increase the value in the Wait up to field, which is the amount of time needed for the script to execute before timing out.

### Selecting Multiple TestPartner Scripts

You can insert any number of TestPartner transactions (scripts) into a QALoad template script accessible from the QALoad Script Development Workbench. These TestPartner scripts and visual tests can have the same name and can be from the same or different projects or from different DSNs.

The wrapping of each execute script command in a QALoad checkpoint has the same script name, but is automatically labeled by a dash (-) and a number. For example, if the script name called 'TestScript1' exists

more than one time, QALoad assigns the names, `checkpoint (TestScript1-1)`, `checkpoint (TestScript1-2)`, and so on.

### Example

```
BeginCheckpoint("TestScript1");
TPExecuteScript("Adain", "adain", "TestPartner_SQL", "TestScript1", "Common");
EndCheckpoint("TestScript1");

BeginCheckpoint("TestScript1-1");
TPExecuteScript("Adain", "adain", "TestPartner_SQL", "TestScript1", "TestPartnerScripts");
EndCheckpoint("TestScript1-1");

BeginCheckpoint("TestScript2");
TPExecuteScript("Adain", "adain", "TestPartner_SQL", "TestScript2", "Common");
EndCheckpoint("TestScript2");

BeginCheckpoint("TestScript2-1");
TPExecuteScript("Adain", "adain", "TestPartner_SQL", "TestScript2", "TestPartnerScripts");
EndCheckpoint("TestScript2-1");

BeginCheckpoint("TestExplorer");
```

## Developing a Script

### Recording a Transaction

#### Recording Middleware Calls

QALoad begins recording before starting your application, ensuring that any early startup activity is recorded.

 **Hint:** You can save yourself some steps later by [setting options now](#) to automatically convert your recorded capture file and compile it into a script.

To record a middleware call:

(WWW only) If you are running your application on Windows XP SP2, Compuware recommends you turn the 'pop-up blocker' feature off before recording a transaction. The feature can be disabled via the browser window's Tools menu in Internet Options>Privacy.

1. Open an appropriate middleware session in the QALoad Script Development Workbench.
2. (Oracle Forms Server only) Choose **Options>Workbench**, then click the **Compiler Settings** tab. In the **Java** section of the dialog box, set the location of your Java files for recording.
3. Select **Session>Record>Start**. QALoad launches your application and any proxies, if necessary, and begins recording any calls.
4. Run the desired user operations using your application.
5. (WWW only) If you are capturing SSL requests using EasyScript for Secure WWW, the browser generates one or more prompts indicating the following:

! It does not recognize the authority who signed the server certificate.

! The server certificate presented by the Web site does not contain the correct site name.

When you receive these prompts, click the browser's Next or Continue button so you can connect to and exchange information with the desired Web site.

6. (Optional) At any time during the recording process, you can [insert any necessary commands or comments into the capture file](#).
7. When you have recorded a complete transaction, stop the application from which you are recording.
8. When you finish, click **Stop Record**. You are prompted to save your capture file. By default, capture files (.cap) are saved in the QALoad\Middlewares\

 **Note:** If QALoad is not able to record from your application, try QALoad's [alternate procedure for recording](#).

The Script Development Workbench automatically converts a capture file to a script file when you stop the recording process. You are prompted if a script by the same name already exists, so that you can decide whether to overwrite an existing script or to save your script under a different name.

### Inserting Commands/Comments into a Capture File

You can insert commands or comments while recording a capture file.

#### To insert commands/ comments into a capture file:

---

1. On the Recording toolbar, click **Insert Command**. The toolbar expands into a window where you can select options for inserting commands into your capture file.
2. In the **Command Type** area, select whether you want to insert a comment or a begin/end checkpoint.
3. In the **Command Info** area, type your comment or a description of the checkpoint.
4. Do one of the following:
  - ! Click Insert to insert your comment or checkpoint command into your capture file.
  - ! Click Insert Command again to close the expanded window without inserting a command.
5. Continue recording your transaction as usual.

### Recording with Manual Program Startup

Use this procedure to manually start your application and the Record facility. You can start your application at any time before or after starting to record.

This procedure only applies to Winsock and SAP.

#### To record with manual program startup:

---

1. Access the QALoad Script Development Workbench. [Details](#)
2. Choose the appropriate session from the **Session** menu.
3. From the **Options** menu, choose **Record** to open the Record Options wizard.
4. On your middleware tab, select the **User Started Program** option. Click **OK**.

5. **WWW Only:** Start your browser.
6. Click **Start Record**.
7. Start your application (SAP only: start QALSAP.EXE, which is located in the \QALoad directory).
8. Run the user operations you want to record. As you execute the operations, QALoad records the operations in a capture file (.cap).
9. (Optional) At any time during the recording process, you can insert any necessary commands or comments into the capture file. [Details](#)
10. When you finish, click **Stop Record**. You must stop recording *before* you shut down the application from which you are recording. QALoad prompts you to save your capture file. By default, capture files are saved in the QALoad\Middlewares\*middleware\_name*\Captures directory .

### Changing recording options without recording

You can view and change recording options at any time without recording a capture file.

#### To change recording options without recording:

---

1. Access the QALoad Script Development Workbench. [Details](#)
2. From the **Session** menu, select the appropriate middleware or start a Universal session.
3. From the **Options** menu, choose **Record**. The Record Options wizard opens, showing a page of recording options for the middleware you selected.
4. On the middleware page, select options and enter information as appropriate.
5. Click **OK**.

For a description of available recording options, see [Record Options Wizard](#).

## Converting a Transaction to a Script

### Converting

A capture file contains all the raw data that was recorded, but it needs to be converted into an editable script file before you can proceed. The script file can then be open in the Script Development Workbench editor and edited as needed.

#### To convert a capture file to a script:

---

1. Access the QALoad Script Development Workbench. [Details](#).
2. From the **Session** menu, choose the session you want to start.
3. If you have not already done so, [set conversion options](#).
4. In the **Workspace Pane**, click the **Captures** tab.
5. Click the capture file you want to convert and click **Session>Convert**. The capture file is converted to a script. In the Workspace Pane, click the Scripts tab to view the list of scripts you have converted.

 **Note:** If an Error/Warning Summary opens in the Output Pane, resolve any errors.

6. [Compile](#) the script.

 **Note:** You can set an option to automatically convert your recorded transactions into scripts. [How?](#)

## Setting Conversion Options

Before you begin recording, you can set options to automatically customize your script during conversion. Compuware recommends you set conversion options before recording, then use the option to automatically convert your capture files to scripts. [Details](#)

1. Access the Script Development Workbench. [Details](#)
2. From the **Session** menu, select the appropriate middleware or start a Universal session.
3. Select **Options>Convert** to open the appropriate Convert Options dialog box.
4. Choose **General>Convert Options** from the options tree and set any applicable options. This tree-view contains common options that apply to all the middleware environments QALoad supports.
5. Click the middleware-specific convert options in the Session Options tree, and set any appropriate middleware-specific options.

### Notes:

- For the Citrix Web Interface environment, you must select options in both the Citrix Convert Options and the WWW Convert Options in the tree view.
  - For WWW, refer to [Using the WWW Convert Options](#).
6. When you are finished, click **OK** to save the current settings.

 Hint: Press F1 from any middleware options tab for a description of available options.

## Set Up Automatic Conversion and Compilation of a Script

The Script Development Workbench automatically converts a capture file when you stop the recording process and compile the resulting script. You are prompted if a script by the same name already exists, so that you can decide whether to overwrite an existing script or to save your script under a different name.

If the default settings to automatically convert a capture file have been changed, follow the steps below to reset the automatic conversion and compilation.

To set up automatic conversion and compilation:

---

1. From the **Script Development Workbench** menu, choose **Options>Workbench**.
2. Click the **Convert Options** item, and select the check box **Automatically Convert Capture**.
3. Click the **Record Options** tree item.
4. Select the check box **Automatically compile scripts**.
5. Select the check box **Prompt before overwriting script** to ensure that a script is not overwritten accidentally.
6. Click **OK** to save your settings.

## Editing a Script

### Editing a Script

The Function Wizard allows you to quickly and easily edit your script by choosing from the QALoad commands available to your script and inserting them with a click of your mouse.

The Function Wizard is located in the Script Development Workbench in a pane on the right side of the window. You can enable or disable the Function Wizard from the View menu or by clicking the Show or Hide Function Wizard button on the toolbar.

The Function Wizard lists all functions that are valid to use in your open script. Functions are grouped in logical sections within the top window of the wizard. When you highlight a function in the top window of the wizard, the lower window lists a description of that function and its parameters.

To insert a function into your script, locate it in the Function Wizard and then simply drag-and-drop the function into your script.

The function will be written into your script at the point you chose. When you insert a function using the wizard, a text box opens showing the proper syntax and parameter options. (The text box may not appear if an associated variable or object has not been declared in the script.) As you edit the function's parameters, the text box highlights the parameter that is currently being edited.

### Using Custom Counters and Messages

QALoad allows you to define your own counters and insert messages into your script, where they are written to your timing file and are viewable in Analyze or at runtime in the Conductor.

Counters can be either cumulative or instance. This determines how they are graphed in Analyze:

- ! For a cumulative counter, Analyze keeps a running sum of the counter while graphing verses elapsed time. This type of counter is used for all the WWW error counters. Each time a WWW error occurs, a value of 1 (one) is written for that counter. When looking at a detailed view in Analyze, you can see at what times that error occurred. When you graph a counter in Analyze, the graph shows the total number of occurrences verses the elapsed time.
- ! For an instance counter, Analyze graphs each value directly. No summing of previous values is done.

Counters must be added manually using the QALoad commands `DEFINE_COUNTER` and `COUNTER_VALUE`. Messages must be added manually using the QALoad command `SCRIPT_MESSAGE`.

The following sample script illustrates both script counters and messages:

```
#include <stdio.h>
#include "smacro.h"
#include "do_www.h"

int rhobot_script(PLAYER_INFO *s_info)
{
char buf1[256];
int id1, id2, id3, id4;

DEFINE_TRANS_TYPE("ScriptCounters ");
DO_InitHttp(s_info);
```

## Using the Player, Script Development Workbench, and Analyze

```
// "Counter Group", "Counter Name", "Counter Units (Optional)",
// Data Type, Counter Type.

id1 = DEFINE_COUNTER("Cumulative Group", "Cumulative long",
 0, DATA_LONG, COUNTER_CUMULATIVE);
id2 = DEFINE_COUNTER("Cumulative Group", "Cumulative float",
 0, DATA_FLOAT, COUNTER_CUMULATIVE);
id3 = DEFINE_COUNTER("Instance Group", "Instance long",
 0, DATA_LONG, COUNTER_INSTANCE);
id4 = DEFINE_COUNTER("Instance Group", "Instance float",
 0, DATA_FLOAT, COUNTER_INSTANCE);

SYNCHRONIZE();
BEGIN_TRANSACTION();

// add value to cumulative counter 1
COUNTER_VALUE(id1, 1);
DO_SLEEP(2);

// add value to cumulative counter 2
COUNTER_VALUE(id2, 1.5);
RND_DELAY(6);

// add value to instance counter 1
COUNTER_VALUE(id3, s_info->nRndDelay);

// add custom message for this user
wsprintf(buf1, "User %d slept for %d milliseconds during transaction %d",
 s_info->nAbsVUNum, s_info->nRndDelay, s_info->s_trans_count);
SCRIPT_MESSAGE("User Messages", buf1);
DO_SLEEP(2);

// add value to instance counter 2
// relative user number plus pi times the current transaction number
COUNTER_VALUE(id4, s_info->nRelVUNum + (3.14159 * s_info->s_trans_count));

END_TRANSACTION();
DO_FreeHttp();
REPORT(SUCCESS);
EXIT();
}
```

### Defining Checkpoints

Checkpoint statements collect timings of events, such as the execution of SQL statements. If you manually insert checkpoint statements into your capture file during the recording process, or if you select the Include Default Checkpoint Statements conversion option before converting a script, your script includes checkpoints.

Otherwise, you must manually insert checkpoints in your scripts to collect timings.

### Defining Transaction Loops

If you did not insert begin-and end-transaction commands into your capture file, QALoad's Convert facility automatically places begin-and end-transaction commands at the start and end of the recorded sequence. QALoad scripts execute the code between the begin-and end-transaction commands in a loop according to the number of times you specify in the QALoad Conductor when setting up a test.

Depending on how you completed your recording, you may want to move one or both of these transaction commands to another place in the script to more accurately define the transaction that runs during the load test.

For example, let's say during the recording process you log in and log out as part of the procedure. However, during the load test you do not want to log in and log out as part of every transaction. To avoid a login and logout with every procedure, move the begin- and end-transaction commands so the login and logout commands are outside of the transaction loop.

### Simulating User-Entered Data

When you create a script, you probably have some constant data embedded in the script, for example, an employee number, that automatically enters your application's input fields while recording. If you run a load test using this script, the script uses the same data for each transaction. To run a realistic test, you can modify the script to use variable data from a datapool file. By varying the data input over the course of a test, the behavior more realistically emulates the behavior of multiple users. You can use the QALoad Script Development Workbench to create, maintain, and use datapool files (.dat) to insert variable data into your scripts.

A datapool can be defined as either central or local:

- ! **Central:** a datapool that resides on the same workstation as the QALoad Conductor, and is available to any Player system on the network that requests it from the QALoad Conductor. A central datapool is controlled by the QALoad Conductor, and you use the QALoad Conductor to set any options relating to a central datapool.
- ! **Local:** a datapool that resides on a Player workstation, and is only available to that Player. Because a local datapool resides locally and is only available to the local Player, it does not generate any network traffic. Use the QALoad Script Development Workbench to insert local datapools into a script.

The following sections describe how to create and use central and local datapools.

#### Creating a Datapool File

You can create a datapool file using the Script Development Workbench.

To create a datapool file:

---

1. Open a middleware session in the QALoad Script Development Workbench.
2. From the **File** menu, choose **New**.
3. On the **New** dialog box that opens, select **New** from the **Datapools** tree item.
4. In the **Filename** field, type a unique name for your datapool file.
5. In the **Rows:** and **Cols:** fields, type the number of rows and columns your new datapool should have.
6. Click **OK**.
7. Enter your datapool records in the grid that opens in the Workbook Pane.
8. When you are finished entering datapool records, click **File>Save As** to name your datapool file.
9. Click **OK** to save the file. QALoad saves the file in your \QALoad\Datapools directory.

#### Modifying a Datapool File

You can modify a datapool file using the Script Development Workbench.

To modify a datapool file:

---

1. In the Workspace Pane, click the **Datapools** tab.
2. Double-click the datapool file you want to modify. The datapool file opens in the Workbook pane.
3. Make the appropriate changes and save the file.

## Using the Player, Script Development Workbench, and Analyze

### Using a Central Datapool File in a Script

You assign a central datapool file to a specific script by selecting the datapool file and setting any appropriate options using the Conductor. Each script can use a single central datapool. The central datapool is available to all Player workstations running the test. The following procedures describe how to assign and extract data from a central datapool. These procedures assume you have already created the datapool file as described above.

To assign a central datapool file:

---

1. With a session ID file open in the QALoad Conductor, click the script icon  in the Visual Designer to display the script Properties panel on the right-hand side of the window.
2. In the **External Data** section for the selected script, click the **browse [...]** button in the **Central Datapools** field. The Central Datapools page of the Script Properties dialog box appears.
3. Click **Browse**, select the correct datapool file, then click **Open**.
4. (Optional) If you wish to re-use the datapool records when the script reaches the end of the file, select **Rewind**. To only use each record once, and then discard it, select **Strip**.
5. When you are done, click **OK**. The Central Datapools field in the Properties panel now displays the number of central datapool files you've attached to the script.

### Using Data Records from a Central Datapool File

To use data from a central datapool in your load test, you will have to modify your script. Typically, you will read one record per transaction.

To add datapool statements to your script:

---

1. With your script open in the QALoad Script Development Workbench, navigate to the place where you want to insert a datapool variable and highlight the text to replace.
2. From the **Session** menu, choose **Insert>Datapool**. The **Insert New Datapool** dialog box appears.
3. Select a datapool from the list and click **OK**, or click **Add** to open the **Select Datapool** dialog box where you can choose a datapool file to add to your test.
4. When you are finished, the QALoad Script Development Workbench places several datapool functions into your script, denoting them with markers so you can easily identify them.

### Using Local Datapool Files in a Script

You assign a local datapool file to a specific script by selecting the datapool file and setting any appropriate options using the QALoad Script Development Workbench. Each script can use up to 64 local datapools. Use the following procedures to assign and extract data from a local datapool file. These procedures assume you have created a datapool as described above.

To assign a local datapool:

---

1. Open a session in the QALoad Script Development Workbench.
2. In the Workspace pane, click the **Scripts** tab, then double-click a script to open in the Workbook pane.
3. From the **Session** menu, choose **Insert>Datapool**. The **Insert Datapool Commands** dialog box appears.
4. On the **Insert Datapool Commands** dialog box, click **Add**. The **Select Datapool** dialog box opens.
5. In the **Type** field, select **Local**. Note that you can also choose to insert a central datapool from this dialog box. If you choose to insert a central datapool from here, the QALoad Script Development Workbench places the Conductor

command `GET_DATA` into the script just after the `BEGIN_TRANSACTION` command, bookmarks the command in the margin of the script, and uses any options set for the specified datapool in the QALoad Conductor.

6. In the **ID** field, give the datapool a unique identifier. The name can contain alphanumeric characters only. Use underscores ( `_` ) for spaces. This ID will help you identify the datapool in your script, for example `"ACCOUNT_NUMS"`.
7. In the **Filename** field, type (or browse for) the fully qualified path of your datapool file. For example: `c:\Program Files\Compuware\QALoad\Workbench\`
8. If you wish to re-use the datapool records when the script reaches the end of the file, select **Rewind at End of File**. To only use each record once, and then discard it, clear this option.
9. When you are finished, click **OK**. The selected datapool is displayed on the **Insert New Datapool** dialog box.
10. Click **OK**. The QALoad Script Development Workbench will place a `#define` statement identifying the datapool file near the beginning of your script, and place the datapool commands `OPEN_DATA_POOL`, `READ_DATA_RECORD`, and `CLOSE_DATA_POOL` at the default locations in the script. These statements will be bookmarked in the margin for easy identification.
11. When you are finished modifying the script, save any changes.

For detailed information about any of these commands, refer to the [Language Reference](#) section.

### Using Data Records from a Local Datapool File

To use data from a local datapool file you will have to modify your script to read data records and fields at the appropriate place in the script. Datapool files should typically be opened with the statement `OPEN_DATA_POOL` just before the `BEGIN_TRANSACTION` statement, then datapool fields can be called into the script to replace variable strings. The `OPEN_DATA_POOL` statement is automatically inserted into your script when you use the QALoad Script Development Workbench to insert your datapool.

1. Read a record from the datapool file using the following command, which reads a single record from the local datapool file you specify:  
`READ_DATA_RECORD(<LOCAL DATAPOOL ID>);`
2. To access the fields of this record, substitute `GET_DATA_FIELD(ACCOUNT_NUMS, n)` expressions in place of variable strings.
3. After the `END_TRANSACTION` statement, close the local datapool file by using the following statement:  
`CLOSE_DATA_POOL( LOCAL DATAPOOL ID );`

Note that this statement is added automatically if you use the QALoad Script Development Workbench to insert your datapool.

For detailed information about any of these commands, refer to the [Language Reference](#) section.

### Inserting Variable Data with ActiveData Substitution

The QALoad Script Development Workbench allows you to transform string data from quoted constants or substrings into variables. ActiveData variable substitution lets you identify and right-click on a string to declare the selected string a variable within the QALoad script. This facility also lets you select or edit datapool entries more dynamically, making script development easier and more efficient.

To substitute a datapool value or a variable in place of a selected string in your script:

---

1. Start the appropriate session in the QALoad Script Development Workbench.
2. In the Workspace pane, click the **Scripts** tab.
3. On the **Script** tab, double-click the script you wish to open. The script opens in the Workbook pane.
4. In the script, highlight the string you wish to replace.
5. Right-click anywhere in the highlighted string.

! To substitute a value from a datapool:

- ! — Click **ActiveData>Datapool Substitution** in the shortcut menu that opens. The **ActiveData Datapool Substitution** dialog box opens.
- ! In the **Datapool(s)** area, highlight the datapool to use. The contents of the datapool file display below. If the datapool you want to use is not listed, click the **Add** button to add it to the list of available datapools.
- ! In the **Field: ID** field, type the field number of the specific value to use from the datapool.
- ! When you are finished, click **OK**. The **QALoad Script Development Workbench** will place a `#define` statement identifying the datapool file at the beginning of your script. It will also insert the datapool commands `OPEN_DATA_POOL`, `READ_DATA_RECORD`, `GET_DATA_FIELD` and `CLOSE_DATA_POOL` at the default locations in the script, and bookmark them in the margin for easy identification. Refer to the [Language Reference](#) section for detailed information about any of those commands.
- ! To substitute a variable:
  - ! Click **ActiveData>Variable Substitution** from the shortcut menu that appears. The **ActiveData Variable Substitution** dialog box opens.
  - ! Assign a variable name for the selected string in the **Variable Name** field.
  - ! Click **OK**. The **QALoad Script Development Workbench** will declare the variable at the beginning of your script and substitute the named variable for the selected string. It will also bookmark both locations for easy identification.
- 6. When you are finished, save your script changes. Compuware recommends that you also compile your script to check for any errors.

### Compiling a Test Script

A QALoad script is a real C++- or Java-based script, and therefore needs to be compiled before it can be used. QALoad works with your existing compiler to compile usable test scripts. If you make changes to an existing script, you must re-compile it before you can successfully use it in a test. If you add an uncompiled or out-of-date script to a load test, the QALoad Conductor will prompt you to compile the script.

### Set Up Automatic Conversion and Compilation of a Script

The Script Development Workbench automatically converts a capture file when you stop the recording process and compile the resulting script. You are prompted if a script by the same name already exists, so that you can decide whether to overwrite an existing script or to save your script under a different name.

If the default settings to automatically convert a capture file have been changed, follow the steps below to reset the automatic conversion and compilation.

To set up automatic conversion and compilation:

---

1. From the **Script Development Workbench** menu, choose **Options>Workbench**.
2. Click the **Convert Options** item, and select the check box **Automatically Convert Capture**.
3. Click the **Record Options** tree item.
4. Select the check box **Automatically compile scripts**.
5. Select the check box **Prompt before overwriting script** to ensure that a script is not overwritten accidentally.
6. Click **OK** to save your settings.

## Validating Scripts in Workbench

Before adding a script to a load test, validate it to ensure that it runs without problems. The following procedure is only valid for Win32 scripts. To validate a UNIX script, see [Validating a UNIX script](#).

 **Note:** During validation of SAP scripts, do not minimize the SAP window. If the window is minimized, the validation may fail. This problem does not occur if you de-select the Show Graphical User Interface for SAP Users [middleware option](#) in the Conductor. This SAPGUI option runs SAP on an alternate desktop that is not visible.

To configure the Script Development Workbench for validation:

---

1. Click **Options>Workbench** and select the **Validation** item.
2. Select the **Automatically Recompile** check box if you want QALoad to compile a script before attempting to validate it. QALoad lists any compilation errors in the editor after compiling.
3. Select the **Only Display Player Output on Script Failure** check box to view only Player messages upon script failure, if applicable.
4. Select **Display mouse coordinates on right-click in validation window** if using Citrix, select this option to display the window coordinates in a tooltip window when right-clicking in the virtual replay window during validation.
5. Type a value in the **Script Validation Timeout** field. This is the number of seconds that the QALoad Script Development Workbench should wait for a script to execute before timing out.
6. In the Player Settings area, select the **Abort on Error** check box for QALoad to stop script execution upon encountering an error.
7. Select the **Debug Data** check box for the script to display a debug message indicating which command the script is executing.
8. In the **Run As** area, indicate whether the transaction should be run as **thread-** or **process-based**.

 **Note:** Oracle Forms Server, Citrix, and Java scripts are limited to process-based validation only.

9. In the **Number of users** field, type a number of virtual users to run this script for validation. The default is 1.
10. Enter a value in the **Transactions** field. For validation, Compuware recommends that you accept the default value of 1 transaction.
11. In the **Sleep Factor %** field, type the percentage of each [DO\\_SLEEP](#) (pause in the script) to maintain. For validation, you may not need to run every pause in the script at its full length. The value can be a percentage between 0 and 100. The default is 0.
12. Click **OK** to save your changes.

To validate a script in Workbench:

---

1. In the Workspace Pane, click the **Scripts** tab.
2. Double-click on the appropriate script name to open the script.
3. From the **Session** menu, choose **Validate Script**.

You receive a message and trace information in the Output pane. When the script executes successfully, you receive a confirmation message. If it does not execute successfully, use the trace information to help you identify errors.

Using the Player, Script Development Workbench, and Analyze

## Using Datapools

### Creating a Datapool File

To create a datapool file using the Script Development Workbench, follow the steps below.

To create a datapool file:

---

1. Open a middleware session in the QALoad Script Development Workbench.
2. From the **File** menu, choose **New**.
3. On the **New** dialog box that opens, select **New** from the **Datapools** tree item.
4. In the **Filename** field, type a unique name for your datapool file.
5. In the **Rows:** and **Cols:** fields, type the number of rows and columns your new datapool should have.
6. Click **OK**.
7. Enter your datapool records in the grid that opens in the Workbook Pane.
8. When you are finished entering datapool records, click **File>Save As** to name your datapool file.
9. Click **OK** to save the file. QALoad saves the file in your `\QALoad\Datapools` directory.

### Modifying a Datapool File

To modify a datapool file using the Script Development Workbench, follow the steps below.

To modify a datapool file:

---

1. In the Workspace Pane, click the **Datapools** tab.
2. Double-click the datapool file you want to modify. The datapool file opens in the Workbook pane.
3. Make the appropriate changes and save the file.

### Using a Central Datapool File in a Script

Assign a central datapool file to a specific script by selecting the datapool file and setting any appropriate options using the Conductor. Each script can use a single central datapool. The central datapool is available to all Player workstations running the test. The following procedures describe how to assign and extract data from a central datapool. These procedures assume you have already created the datapool file.

To assign a central datapool file:

---

1. With a session ID file open in the QALoad Conductor, click the **Script Assignment** tab.
2. In the **External Data** column for the selected script, click **Browse**.
3. In the **External Data** dialog box, navigate to the datapool you wish to use. Select it and click **Open**.
4. If you wish to re-use the datapool records when the script reaches the end of the file, select **Rewind**. To only use each record once, and then discard it, select **Strip**.

5. When you are done, click **OK**.

### Using Data Records from a Central Datapool File

To use data from a central datapool in your load test, modify your script. Typically, you read one record per transaction.

#### To insert datapool statements to your script:

---

1. With your script open in the QALoad Script Development Workbench, navigate to the place where you want to insert a datapool variable and highlight the text to replace.
2. From the **Session** menu, choose **Insert>Datapool**. The **Insert New Datapool** dialog box appears.
3. Select a datapool from the list and click **OK**, or click **Add** to open the **Select Datapool** dialog box where you can choose a datapool file to add to your test.
4. When you are finished, the QALoad Script Development Workbench places several datapool functions into your script, denoting them with markers so you can easily identify them.

### Using a Local Datapool File in a Script

Assign a local datapool file to a specific script by selecting the datapool file and setting any appropriate options using the QALoad Script Development Workbench. Each script can use up to 64 local/shared datapools. Use the following procedures to assign and extract data from a local datapool file. These procedures assume you have created a datapool.

#### To assign a local datapool:

---

1. Open a session in the QALoad Script Development Workbench.
2. In the Workspace pane, click the **Scripts** tab.
3. On the **Scripts** tab, double-click on the appropriate script name to open it in the Workbook pane.
4. From the **Session** menu, choose **Insert>Datapool**. The **Insert Datapool Commands** dialog box appears.
5. On the **Insert Datapool Commands** dialog box, click **Add**. The **Select Datapool** dialog box opens.
6. In the **Type** field, select **Local**. You can also choose to insert a central datapool from this dialog box. If you choose to insert a central datapool from here, the QALoad Script Development Workbench places the Conductor command `GET_DATA` into the script just after the `BEGIN_TRANSACTION` command, bookmarks the command in the margin of the script, and uses any options set for the specified datapool in the QALoad Conductor.
7. In the **ID** field, give the datapool a unique identifier. The name can contain alphanumeric characters only. Use underscores ( `_` ) for spaces. This ID helps you identify the datapool in your script, for example `"ACCOUNT_NUMS"`.
8. In the **Filename** field, type (or browse for) the fully qualified path of your datapool file. For example: `c:\Program Files\Compuware\QALoad\Workbench\<middleware_name>\Scripts\datapool.dat`
9. If you wish to re-use the datapool records when the script reaches the end of the file, select **Rewind at End of File**. To only use each record once, and then discard it, select **Do not rewind file**. Note that the strip option is not available to local datapools.
10. When you are finished, click **OK**. The selected datapool is displayed on the **Insert New Datapool** dialog box.
11. Click **OK**. The QALoad Script Development Workbench places a `#define` statement identifying the datapool file near the beginning of your script, and place the datapool commands `OPEN_DATA_POOL`, `READ_DATA_RECORD`, and `CLOSE_DATA_POOL` at the default locations in the script. These statements are bookmarked in the margin for easy identification.
12. When you are finished modifying the script, save any changes.

## Using the Player, Script Development Workbench, and Analyze

For detailed information about any of these commands, refer to the [Language Reference](#) section.

### Using Data Records from a Local Datapool File

To use data from a local datapool file you have to modify your script to read data records and fields at the appropriate place in the script. Datapool files should typically be opened with the statement `OPEN_DATA_POOL` just before the `BEGIN_TRANSACTION` statement, then datapool fields can be called into the script to replace variable strings. The `OPEN_DATA_POOL` statement is automatically inserted into your script when you use the QALoad Script Development Workbench to insert your datapool.

1. Read a record from the datapool file using the following command, which reads a single record from the local datapool file you specify:  
`READ_DATA_RECORD(<LOCAL DATAPool ID>);`
2. To access the fields of this record, substitute `GET_DATA_FIELD(ACCOUNT_NUMS, n)` expressions in place of variable strings.
3. After the `END_TRANSACTION` statement, close the local datapool file by using the following statement:  
`CLOSE_DATA_POOL( LOCAL DATAPool ID ).` This statement is added automatically if you use the QALoad Script Development Workbench to insert your datapool.

For detailed information about any of these commands, refer to the [Language Reference](#) section.

### Using a Shared Datapool File in a Script

Assign a shared datapool file to a specific script by selecting the datapool file and setting any appropriate options using the QALoad Script Development Workbench. Each script can use up to 64 shared and local datapools. Use the following procedures to assign and extract data from a shared datapool file. These procedures assume you have created a datapool.

#### To assign a shared datapool:

---

1. Open a session in the QALoad Script Development Workbench.
2. In the Workspace pane, click the **Scripts** tab.
3. On the **Scripts** tab, double-click on the appropriate script name to open it in the Workbook pane.
4. From the **Session** menu, choose **Insert>Datapool**. The **Insert Datapool Commands** dialog box appears.
5. On the **Insert Datapool Commands** dialog box, click **Add**. The **Select Datapool** dialog box opens.
6. In the **Type** field, select **Shared**. You can also choose to insert a central datapool from this dialog box. If you choose to insert a central datapool from here, the QALoad Script Development Workbench places the Conductor command `GET_DATA` into the script just after the `BEGIN_TRANSACTION` command, bookmarks the command in the margin of the script, and uses any options set for the specified datapool in the QALoad Conductor.
7. In the **ID** field, give the datapool a unique identifier. The name can contain alphanumeric characters only. Use underscores ( `_` ) for spaces. This ID helps you identify the datapool in your script, for example "ACCOUNT\_NUMS".
8. In the **Filename** field, type (or browse for) the fully qualified path of your datapool file. For example: `c:\Program Files\Compuware\QALoad\Workbench\<middleware_name>\Scripts\datapool.dat`
9. If you wish to re-use the datapool records when the script reaches the end of the file, select **Rewind at End of File**. To only use each record once, and then discard it, select **Do not rewind file**.
10. If you wish to remove used datapool records after a test completes, select **Strip file at end of test**. Note that rewinding the datapool is not possible if you choose this option.
11. When you are finished, click **OK**. The selected datapool is displayed on the **Insert New Datapool** dialog box.
12. Click **OK**. The QALoad Script Development Workbench places a `#define` statement identifying the datapool file near the beginning of your script, and places the datapool commands `OPEN_DATA_POOL`, `READ_DATA_RECORD`,

and `CLOSE_DATA_POOL` at the default locations in the script. These statements are bookmarked in the margin for easy identification.

13. When you are finished modifying the script, save any changes.

For detailed information about any of these commands, refer to the [Language Reference](#) section.

#### Using Data Records from a Shared Datapool File

To use data from a shared datapool file you have to modify your script to read data records and fields at the appropriate place in the script. Datapool files should typically be opened with the statement `OPEN_DATA_POOL` just before the `BEGIN_TRANSACTION` statement, then datapool fields can be called into the script to replace variable strings. The `OPEN_DATA_POOL` statement is automatically inserted into your script when you use the QALoad Script Development Workbench to insert your datapool.

1. Read a record from the datapool file using the following command, which reads a single record from the shared datapool file you specify:  
`READ_DATA_RECORD(<SHARED DATAPPOOL ID>);`
2. To access the fields of this record, substitute `GET_DATA_FIELD(ACCOUNT_NUMS, n)` expressions in place of variable strings.
3. After the `END_TRANSACTION` statement, close the shared datapool file by using the following statement:  
`CLOSE_DATA_POOL( <SHARED DATAPPOOL ID> ).` This statement is added automatically if you use the QALoad Script Development Workbench to insert your datapool.

For detailed information about any of these commands, refer to the [Language Reference](#) section.

#### Used Shared Datapool Records Removal

Unlike the central datapool, the user is not prompted to remove used records from a shared datapool. Instead, the used records are automatically removed from the shared datapool at the end of a test.

#### Inserting Variable Data with ActiveData Substitution

The QALoad Script Development Workbench allows you to transform string data from quoted constants or substrings into variables. ActiveData variable substitution lets you identify and right-click on a string to declare the selected string a variable within the QALoad script. This facility also lets you select or edit datapool entries more dynamically, making script development easier and more efficient.

To substitute a datapool value or a variable in place of a selected string in your script:

1. Start the appropriate session in the QALoad Script Development Workbench.
2. In the Workspace pane, click the **Scripts** tab.
3. On the **Script** tab, double-click the script you wish to open. The script opens in the Workbook pane.
4. In the script, highlight the string you wish to replace.
5. Right-click anywhere in the highlighted string.
  - ! To substitute a value from a datapool:
    - ! Click `ActiveData>Datapool Substitution` in the shortcut menu that opens. The `ActiveData Datapool Substitution` dialog box opens.
    - ! In the `Datapool(s)` area, highlight the datapool to use. The contents of the datapool file display below. If the datapool you want to use is not listed, click the `Add` button to add it to the list of available datapools.
    - ! In the `Field: ID` field, type the field number of the specific value to use from the datapool.

- ! When you are finished, click OK. The QALoad Script Development Workbench places a `#define` statement identifying the datapool file at the beginning of your script. It also inserts the datapool commands `OPEN_DATA_POOL`, `READ_DATA_RECORD`, `GET_DATA_FIELD` and `CLOSE_DATA_POOL` at the default locations in the script, and bookmarks them in the margin for easy identification. Refer to the [Language Reference](#) section for detailed information about any of those commands.
  - ! To substitute a variable:
    - ! Click `ActiveData>Variable Substitution` from the shortcut menu that appears. The `ActiveData Variable Substitution` dialog box opens.
    - ! Assign a variable name for the selected string in the `Variable Name` field.
    - ! Click OK. The QALoad Script Development Workbench declares the variable at the beginning of your script and substitutes the named variable for the selected string. It also bookmarks both locations for easy identification.
6. When you are finished, save your script changes. Compuware recommends that you also compile your script to check for any errors.

## Debugging a Script

### Setting Debugging Options for a Script

If you encountered errors while validating or testing a script, use QALoad's debugging options to monitor the Player(s) that generated errors while they are running or after the test.

You can watch a virtual user execute a script on a Player Workstation while it is running. To monitor selected virtual users at runtime, enable the `Debug Trace` option before you run your test. Each virtual user for which you enabled `Debug Trace` displays messages on its assigned Player workstation indicating which commands are being executed.

You can instruct the Conductor to generate and save details about the script execution of selected virtual users by enabling `Logfile Generation` before you run your test. This applies to Citrix, ODBC, Oracle, Oracle Forms Server, SAP, Winsock, or WWW only.

You can set the `Debug Options` using the `Script Properties` panel in the `Visual Designer`, or using the `Grid View` window.

To enable the `Debug` options:

---

1. Do one of the following:
  - ! In the `Visual Designer`, click the script icon  for the appropriate script to display the `Script Properties` panel on the right-hand side of the window, then click the `browse [...]` button in the `Debug Options` field. The `Debug` window of the `Script Properties` dialog box appears.
  - OR
  - ! In the `Grid View` window, select the `Script Assignment` tab, then click the `browse [...]` button in the `Debug Options` column, for the appropriate script. The `Debug` window of the `Script Properties` dialog box appears.
2. On the `Debug Options` dialog box, you can choose the following options:
  - ! To enable the `Debug Trace` option: in the `Debug Trace Virtual User Range` area, choose which virtual users (if any) to monitor. You can choose `None` or `All Virtual Users`, or choose `Virtual User(s)` and then type the numbers assigned to the virtual users you want to monitor. You can monitor individual virtual users or ranges of virtual users.

- ! To enable Logfile Generation: in the Logfile Generation Virtual User Range area, choose which virtual users (if any) to monitor. You can choose None or All Virtual Users, or choose Virtual User(s) and then type the numbers assigned to the virtual users you want to monitor. You can monitor individual virtual users or ranges of virtual users.
- 3. Click **OK** to save your changes.
- 4. From the Conductor's main menu, click **File>Save** to save your test session ID.
- 5. Run your test as usual.

 Note: Some log files are generated automatically when you run a test in the Script Development Workbench or Player.

### QALoad Support Log Files

The table below identifies the QALoad log (support) files that are generated automatically during a test.

 Note: Some log files are generated automatically when you run a test in the Script Development Workbench or Player.

Each virtual user for which you enabled Logfile Generation in Conductor creates a file containing information about their performance. After the test is finished, the Conductor requests all log files from the Players and save them in the directory \Program Files\Compuware\QALoad\LogFiles on the workstation where the Conductor is installed.

Log files are named <scriptname>\_<middleware>\_vu<AbsoluteVirtualUserNumber>.<ext>, where:

- ! <scriptname> is the name of the script the virtual user ran
- ! <middleware> is the name of your middleware application
- ! <AbsoluteVirtualUserNumber> is the identification number assigned to the virtual user
- ! <.ext> is the file extension, dependent upon which middleware application you are testing

Middleware	.RIP File	.CAP File (Replay Capture)	.TRC File (Player Trace)	.LOG File
Citrix	Yes	Yes	Yes	No
ODBC	No	No	Yes	*Yes
Oracle Forms Server	Yes	Yes	Yes	No
SAP	No	No	Yes	Yes
Winsock	No	No	Yes	*Yes
WWW	Yes	Yes	Yes	No

 Note: \*This middleware also uses the .log file in replay capture.

### Verifying script checkpoints

You can quickly verify the syntax of the checkpoint commands BeginCheckpoint() and EndCheckpoint() in your script every time you compile your script by setting a single option, or on-the-fly with a single menu command.

## Using the Player, Script Development Workbench, and Analyze

To automatically verify script checkpoints, every time you compile a script:

---

1. From the Script Development Workbench's main menu, click **Options>Workbench**.
2. On the Configuration Options dialog box, click the **Compilation** item.
3. Select the **Verify Checkpoints** option.
4. Click **OK**.

Every time you compile your script, the Script Development Workbench verifies the syntax of your checkpoint statements, and ensures the parameters passed in each pair match. If any errors are encountered, an error message displays in the Output pane. You can click on any error line to go directly to that line in the script.

To manually verify script checkpoints, for the open script only:

---

With your script open in the Workbook pane, click **Session>Verify Checkpoints**.

The Script Development Workbench verifies the syntax of your checkpoint statements, and ensures the parameters passed in each pair match. If any errors are encountered, an error message displays in the Output pane. You can click on any error line to go directly to that line in the script.

# Player

## Overview of the QALoad Player

The QALoad Player simulates one or more virtual users running C++-based scripts. These scripts mimic user activities to load test the application, network, and server components of a client-server system.

The QALoad Player simulates multiple clients sending middleware calls back to a server. Different types of middleware layers can be tested. When running virtual user simulation, QALoad Player can emulate multiple users from a single platform using the multi-tasking features of 32-bit Windows. The number of users that a single hardware system can emulate is determined by the processor speed, main memory size, middleware layer, and simulated transaction rate. Please contact your QALoad distributor for further sizing information.

Once started, QALoad Player functions entirely in the background without any direct user interaction. All commands to QALoad Player come from the QALoad Conductor. In fact, once QALoad Player has been started, the only interaction you may have with it is to change startup parameters or to save the contents of the display window to a file. When the Conductor process closes for any reason during a load test, the associated Player processes terminate.

Citrix and SAP scripts play back in a virtual user window on the desktop. It is possible to enable or disable the VU window from the Conductor's [Middleware Options](#) dialog box.

For information about installing UNIX Players, refer to the QALoad Installation and Configuration Guide.

You can access this guide by clicking `Start>All Programs>Compuware>QALoad>Documentation>Installation Guide`.

## Installing UNIX Players

For information about installing UNIX Players, please refer to the QALoad Installation and Configuration Guide.

You can access this guide by clicking `Start>All Programs>Compuware>QALoad>Documentation>Installation Guide`.

## Transferring Scripts to a UNIX Player

Normally, the appropriate script is automatically uploaded from the QALoad Conductor to the Players and compiled at runtime. However, if it is ever necessary to manually transfer a script, use the procedure that follows.

 **Note:** The machine where the QALoad Script Development Workbench is installed must have Winsock-based TCP/IP to transfer a script to the UNIX machine where you wish to run it.

To transfer a script:

---

The following procedure describes how to transfer a script file from the Windows workstation where the QALoad Script Development Workbench resides to the system running the QALoad Player.

1. [Access the Script Development Workbench](#).

## Using the Player, Script Development Workbench, and Analyze

2. From the **Session** menu, choose the middleware session you want to start.
3. In the **Workspace Pane**, click the **Scripts** tab.
4. On the **Scripts** tab, select the script you want to transfer.
5. From the **Tools** menu, choose **FTP** to open the FTP Transfer dialog box. Note that the file name you selected to transfer appears in the **File to Transfer** field.
6. Enter the **Host Name**, **User Name**, **Password**, and **Destination Directory**.
7. Click **Transfer** to send the file to the system where your QALoad Player is installed.
8. If you want to save the information you have entered for subsequent transfers, click **Save Settings**.
9. Click **Close/Abort** to exit the FTP Transfer dialog box.

## Validating Scripts in the Player

Before adding a script to a load test, validate it to ensure that it runs without problems. The following procedure is only valid for Win32 scripts. To validate a UNIX script, see [Validating a UNIX script](#).

 **Note:** During validation of SAP scripts, do not minimize the SAP window. If the window is minimized, the validation may fail. This problem does not occur if you select the Hide Graphical User Interface for SAP Users option by clicking Browse [...] in the Type column of the Script Assignment tab in the Conductor. This SAPGUI option runs SAP on an alternate desktop that is not visible.

### To configure the Player for validation:

---

1. In the Script Development Workbench, click **Options>Workbench** and select the **Script Validation** tab.
2. Select the **Automatically Recompile** check box if you want QALoad to compile a script before attempting to validate it. QALoad lists any compilation errors in the editor after compiling.
3. (For Java and OFS) select **Ask for Automatic Validation of Java and OFS Scripts**.
4. Select the **Only Display Player Output on Script Failure** check box to view only Player messages upon script failure, if applicable.
5. Type a value in the **Wait up to** field. This is the number of seconds that the QALoad Script Development Workbench should wait for a script to execute before timing out.
6. In the Player Settings area, select the **Abort on Error** check box for QALoad to stop script execution upon encountering an error.
7. Select the **Debug Data** check box for the script to display a debug message indicating which command the script is executing.
8. In the Run As area, indicate whether the transaction should be run as **thread-** or **process-based**.

 **Note:** Oracle Forms Server, Citrix, and Java scripts are limited to process-based validation only.

9. In the **Number of users** field, type a number of virtual users to run this script for validation. The default is 1.
10. Enter a value in the **Transactions** field. For validation, Compuware recommends that you accept the default value of 1 transaction.
11. In the **Sleep Factor %** field, type the percentage of each **DO\_SLEEP** (pause in the script) to maintain. For validation, you may not need to run every pause in the script at its full length. The value can be a percentage between 0 and 100. The default is 0.
12. Click **OK** to save your changes.

### To validate a script in the Player:

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1. In the Compiled Script field, browse for the compiled script DLL you want to validate. Compiled scripts are usually located in the directory `\Program Files\Compuware\QALoad\Scripts`.
2. Type a value in the Number of Users field. Compuware recommends one user for script validation.
3. Type a value in the Transactions field. Compuware recommends one transaction for script validation.
4. Select any appropriate options to the right of the Compiled Script field. These options determine the type and amount of data that will display in the Player Main Window. For descriptions of each option, see the topic [QALoad Player Main Window](#).
5. In the Run As area, select whether the transaction should run as thread- or process-based.
6. Click Start to run the script. The Player Main Window will show the script's progress. If the script runs successfully, it is valid to use in a load test.

## Player Main Window

### QALoad Player Main Window

The QALoad Player Main Window is divided into two parts:

- ! The top portion contains fields, buttons, and options that help you configure the Player for script validation. When an actual load test is in progress, this area displays the following information:
  - Version: The version of the QALoad Player.
  - Player Name: The network name assigned to the Player workstation.
  - Player Address: The network address of the Player workstation.
  - Player Port: The port number on this Player workstation being monitored by the QALoad Conductor.
  - Player is running... the type of virtual users this Player is running.
  - The number of virtual users and transactions this Player is running.
- ! The bottom portion of the Player Main Window displays Player messages while a script is running.

This section describes the configuration options on the top portion of the Main Window.

#### Fields and Buttons

##### Compiled Script

Navigate to the compiled script (.dll) to validate.

##### Users

Type the number of users to emulate when validating the selected script. Compuware recommends one user for script validation.

##### Transactions

Type the number of transactions to run when validating the selected script. Compuware recommends one transaction for script validation.

Using the Player, Script Development Workbench, and Analyze

#### Start

Click the Start button to begin script validation. Player messages will display below.

#### Abort

Click the Abort button to stop all virtual users immediately.

#### Exit

Click the Exit button to exit the load test gracefully, when each virtual user is finished.

#### Debug Data

Select this check box to have the Player display a debug message indicating which command the script is executing and to generate WWW replay log files.

#### RR\_\_FailedMsg

Select this check box to view, in the Player window, the point where a middleware command within your script fails.

#### Check Points

Select this check box if you want to display the Check Point command response times in the Player window.

#### Auto Clear

Select this check box to automatically clear any messages from the bottom portion of the window before running a new script.

#### Abort on Error

Select this check box to abort script execution when an error is encountered.

#### Create Timing File

Select this check box to create and save a Player timing file for this Player to the default QALoad timing file directory (normally `\Program Files\Compuware\QALoad\TimingFiles`).

#### Run As

Select if this Player should run scripts as thread- or process-based.

### QALoad Player menus

The following menus are available from the QALoad Player:

[File menu](#)

[Edit menu](#)

[View menu](#)

[Options menu](#)

[Help menu](#)

## Player Configuration

Use this dialog box to set startup parameters for Player.

Access this dialog box from the Options menu by selecting Player Configuration.

### Runtime tab

**Player Name:** (Read only) This is the name that the Player will report to the QALoad Conductor during a request. It may be any string of alphanumeric characters, provided that the length does not exceed 10 characters and there are no embedded spaces.

**Compiled Scripts:** This field points to the directory which will hold the compiled scripts. When a test is started, Player looks for scripts in this directory. The configuration screen will verify that the directory exists.

Compuware recommends that you use a directory on a networked drive to hold the compiled scripts. Otherwise you will need to manually copy the script files to each Player system whenever a script changes.

**Timing File:** (Read only) This field points to the default directory where the timing files are located.

### Java tab

**jvm.dll directory:** (optional) This is the directory where the JVM.DLL file is located. If specified, this JVM.DLL will be used to run the Java scripts from a standalone Player; otherwise, the entry specified in the [Java Options page of the Workbench Options dialog box](#) will be used.

# Analyze

## Overview of Analyze

QALoad Analyze is the QALoad component used to create summary statistics and graphs from timing data collected during a load test. Set criteria for collecting and displaying test data in Analyze before or after opening a test's timing file (.tim). For example, alter output options, time ranges, and graphics display options.

Analyze stores the state of a timing file when it is closed so that next time you open it, you see the same reports and graphs that were present last time you viewed it. You also have the ability to easily create templates, which enable you to specify the reports and graphs that are automatically generated for any new timing file you open.

In addition, Analyze generates a working folder where all files and reports related to the timing file are stored. Analyze provides [pre-defined reports](#) as well as the ability to create custom reports using XML file (.xml), XSL translation file (.xsl), and HTM file (.htm) formats. View these reports in Analyze or in a web browser.

Analyze displays a timing file tab in the [Workspace](#), with each tab containing groups. Use Analyze's interactive view to sort test data, produce detailed checkpoint data, produce a variety of graphs and reports (with drag and drop functionality), export data to different formats, and email test results and pre-defined reports.

## Accessing Analyze

The following procedures describe how to start QALoad Analyze.

To access Analyze from the QALoad Conductor:

---

1. In the QALoad Conductor, click **Tools>Options**. The Options dialog box appears.
2. Click the **General** tab. In the General Options area, select the **Launch Analyze After Test** check box.

At the end of each test run, QALoad Conductor automatically launches QALoad Analyze and opens the most recent timing file. If you did not select the Launch Analyze After Test check box before the test, follow the steps below.

1. Click **Tools>Analyze**.
2. In QALoad Analyze, click **File>Open**. The Open Timing File dialog box appears. Select a timing file to work with by double-clicking the file name in the list of available timing files.

To access Analyze from the Windows Start menu:

---

Click Start>Program Files>Compuware> QALoad >Analyze.

## Understanding Durations

When you begin to analyze your test results, it is important to understand how durations are calculated by QALoad.

## Transaction Duration

Transaction duration is the time that the script being tested takes to complete a transaction, from the `BEGIN_TRANSACTION` command to the `END_TRANSACTION` command.

Three factors comprise transaction duration:

- ! The script processing time including, but not limited to, added script logic, QALoad processing of server replies, and other QALoad processing.
- ! Sleep time.
- ! The response time of the application under test including, but not limited to, the application server, database access, and network.

## Checkpoint Duration

Checkpoint duration is the amount of time between begin and end checkpoint statements. The following factors comprise checkpoint duration and apply to both automatic checkpoints and user-defined checkpoints.

If you select the Conductor's `Enable timing of automatic middleware checkpoints` option or use the `BeginCheckpoint` and `EndCheckpoint` functions in the script, the following factors comprise checkpoint duration:

- ! The response time of the application under test, including, but not limited to, the application server, database access, and network.
- ! Sleep time, if the Conductor's **Include sleep time when calculating checkpoint timings** option is selected in the Timing page of the Script Properties dialog box. For more information, see [Setting Options for Timing Data](#)
- ! QALoad processing time is not included within these checkpoints in order to provide a more accurate value of server, database, and network response times.

Checkpoint durations do not always sum to the same value as the transaction duration. For more information, see [comparing checkpoint durations to transaction duration](#).

## QALoad Analyze Menus and Toolbar Buttons

Click a menu or toolbar name in the following list for a description.

[File](#)

[Edit](#)

[View](#)

[Template](#)

[Tools](#)

[Window](#)

[Help](#)

[Analyze Toolbar Buttons](#)

[Graph Toolbar Buttons](#)

## Accessing Test Data via Groups

The QALoad Analyze Workspace displays timing file data in groups. Each group displays different aspects of the data from a timing file. The data displayed and the groups available may vary, depending on the type of data collected during the load test.

Click a group name below to view the type of data displayed in each group.

Reports

Top Processes

Checkpoints

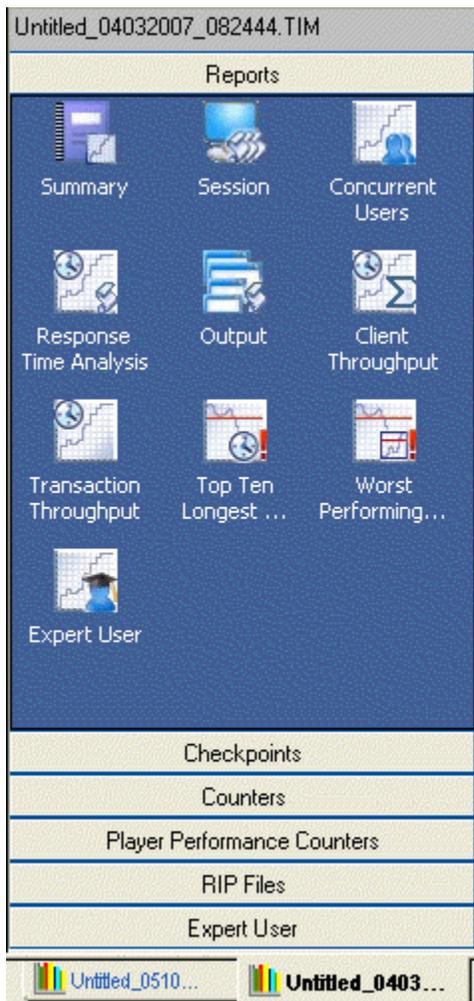
RIP Files

Counters

[Application Vantage](#)

Player Performance Counters

[Expert User](#)



## Accessing Test Data

When you open a timing file, QALoad's Analyze program summarizes the checkpoints recorded in the file during the load test and presents the data in a report format called the Summary report.

You can access QALoad Analyze and open a timing file containing test results from each of the QALoad components.

To access a previously-created timing file in Analyze from the Windows Start menu:

---

1. Click **Start>Program Files>Compuware> QALoad >Analyze**.
2. Click **File>Open**. The Open Timing File dialog box appears. Select a timing file to work with by double-clicking the file name in the list of available timing files.
3. Select the [template](#) to use for viewing the timing file.

To access a previously created timing file in the Script Development Workbench:

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1. In the QALoad Script Development Workbench, click **Tools>Analyze**.
2. In QALoad Analyze, click **File>Open**. The Open Timing File dialog box appears. Select a timing file to work with by double-clicking the file name in the list of available timing files.
3. Select the [template](#) to use for viewing the timing file.

## Displaying Detail Data

### Displaying Detail Data

Display detailed statistics from a timing file such as checkpoints, counters, in the QALoad Analyze Data window. View statistics for not only the active timing file, but also for other timing files and drag and drop onto the active timing file detail view.

To display detailed statistics:

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1. In the workspace, with the appropriate Timing File tab selected, click the [group](#) for which you want to view statistics.
2. Select the appropriate checkpoints or counters (depending on which group you choose).
3. From the Analyze toolbar, click the **Detail** button or right-click on a selected checkpoint or counter and choose **Detail**.

Detail information is presented in the Data window in both a summary and data table. The information displayed varies based on the group selected.

 **Note:** If the test aborts, complete data for all the checkpoints and counters may not display.

The following detail views are available:

[Checkpoints Detail Data](#)

[Counters Detail Data](#)

[Player Performance Counters Detail Data](#)

[RIP File Detail Data](#)

Using the Player, Script Development Workbench, and Analyze

[Expert User Detail Data](#)

[ServerVantage Detail Data](#)

## Detail Views

The detail view displays data from a timing file. You can view detail data by right-clicking a script or group and selecting Detail. The data displayed and the groups available may vary, depending on the type of data that was collected during the load test. Detail data is displayed in two panes: a summary table and a data table.

You can view details for the following groups:

[Checkpoints](#)

[Counters](#)

[RIP File](#)

[Player Performance Counters](#)

[Expert Users](#)

[ServerVantage Detail Data](#)

## Sorting Test Data

A Detail view potentially contains a large number of checkpoints, counters, and so forth, especially if a load test had many virtual users. To make information manageable, specify up to three levels of criteria to sort by, in ascending or descending order.

For example, if a test ran using five scripts on 100 virtual users, sort the data by script name. Suppose each virtual user ran more than one transaction using a particular script, then sort by both script name and by virtual user. Or, to quickly locate any timing bottlenecks, sort by response time.

Use the Sort Details dialog box to sort a detail view. To access this dialog box, select Tools>Sort from the Analyze menu or click Sort on the Analyze toolbar.

## Graphing QALoad Timing Data

Starting in the Workspace of the Analyze [split window view](#), you can graph timing data in a number of formats and styles.

 **Tip:** A timing file can potentially contain enough data that graphing all of it at one time results in an unreadable graph. Before beginning, consider thinning the amount of data to be shown on a single graph. [Details](#)

Select the group to graph:

---

In the Workspace, with the appropriate Timing File tab selected, click the [group](#) for which to create a graph.

 Note: If the test aborts, complete data may not be available for all checkpoints and counters.

The following groups are available, depending on the timing file:

Checkpoints

Counters

Server Monitoring

Player Performance Counters

Expert User

 Note: For each Group except Checkpoints and Expert User, the graph type is a line graph. For graphing multiple checkpoints or expert users, the graph type is either a line or bar graph. For graphing a single checkpoint only, in addition to line and bar graphs, you can also create Response Time Distribution and Cumulative Response Time Distribution graphs.

## Displaying ServerVantage Agent Data

If you set options to integrate ServerVantage resource utilization data before running a test, that data is included in the resulting timing file. It can be sorted and displayed in QALoad Analyze in much the same way as QALoad timing data. ServerVantage data provides a summary of all the Agents that ServerVantage monitored during the load test and details aggregate statistics for Agent data points including minimum, maximum, and mean data values.

When you open a timing file containing ServerVantage Agent data, QALoad Analyze displays test data with QALoad timing data two ways:

- ! ServerVantage Agent workstations are listed in the Server Monitoring group in the Workspace tree-view, under the Resource Trends (ServerVantage) branch. From the Workspace, select **Agent workstations** to create detail or graphical views of the Agent data points. Specifically, you can:
  - ! Display Agent data point details.
    - Graph Agent data point details.
- ! Detailed data point information is displayed in the Data window. The ServerVantage detail view includes data such as the name of the machine where you ran the ServerVantage Agent; the Agent name; and the minimum, maximum, and mean data values for the Agent.

 Note: ServerVantage resource utilization data is available only if you set the ServerVantage integration options on the QALoad Conductor's Test Information window before executing a load test.

## Displaying Vantage Analyzer Agent Data and Reports

If you set options to integrate Vantage Analyzer performance testing data before running a test, that data is included in the resulting timing file. It can be sorted and displayed in QALoad Analyze in much the same way as QALoad timing data.

You can access Vantage Analyzer canned reports and metrics that correlate to a specified performance testing time period. The metrics are displayed in the Vantage Analyzer Performance Console, which is launched through QALoad Analyze and the Vantage Analyzer reports can be viewed in Analyze.

 Note: Vantage Analyzer performance testing data is available only if you set the Vantage Analyzer integration options in the QALoad Conductor's before executing a load test.

There are two types of data you can retrieve from Vantage Analyzer: transaction data and reports.

To display Vantage Analyzer transaction data and reports:

---

Your input on the Retrieve Vantage Analyzer Data dialog box is saved and displays again when you re-open the dialog box.

1. Start **Analyze** and open a timing file containing Vantage Analyzer agent data.
2. From the **Tools** menu select **Vantage Analyzer**. The Retrieve Vantage Analyzer Data dialog box displays.
3. In the **COS server** field, type the name of the machine where the Compuware Open Server resides.
4. In the **Port** field, type the port number where the COS server listens to incoming requests. The default port is 18080.
5. Click **Connect**. In the Connection table, Vantage Analyzer agents that are available through the COS display.
6. Select the check box next to the Vantage Analyzer agent you want to retrieve data from. You can now edit the Date/Time Range Selection field. The Active data source field displays the data source name associated with the agent name.
7. In the Date/Time Range Selection field select either **Use QALoad Testing Time Range** or **Use Custom Data/Time Range** to set your start and end times for Vantage Analyzer data falling within the time range specified.
  - ! Use QALoad Testing Time Range: Select to use a slider to set your start and end times for Vantage Analyzer data falling within the time range specified.
    - a. **Use the sliders below to set your start and end times:** Select and drag the start or end arrow to change the Start time and End time for the duration of the test.
    - b. **Reset:** Click to restore to the time range previously selected.
      - ! Use Custom Data/Time Range: Select to specify exact start and end times.
        - a. **Start time:** Click the drop-down arrows to display a calendar where you can navigate to specify a date when the transaction started. To change the time, highlight the text in the field and type a new time.
        - b. **End time:** Click the drop-down arrows to display a calendar where you can navigate to specify a date when the transaction ended. To change the time, highlight the text in the field and type a new time.
8. Select the **Transaction data** check box to access Vantage Analyzer detailed metrics from the server displayed in the Active data source field. Additionally, selecting the **Transaction data** check box provides access to Vantage Analyzer data in QALoad Conductor through the Vantage Analyzer PConsole.
9. Select **Report data** to access the list of Vantage Analyzer reports from the reports listed on the right. Select the check box next to the report type you want to generate.
10. In the Top N count field, type a number or use the arrows to select the number to specify the top N (number) count represented in the report(s) selected. Top N range is 3-15, with a default value of 10.
11. In the Steps field, type a number or use the arrows to determine how many sets of throughput and response data are retrieved between start time and end time. The higher the steps, the more accurate the graph is, but more time is used for retrieving the data and generating the report. Steps range is 5-100, with a default value of 30.
12. Click OK.
  - ! If you selected the Transaction data check box, the Vantage Analyzer Performance Console opens. Refer to the online documentation for Vantage Analyzer for more information.
  - ! If you selected the Report data check box, the VA Reports dialog box appears and displays the data in graph format. Tabs display each type of report you selected with the name of the report on the tab.

 **Note:** After you close a Vantage Analyzer report, you can re-open the report you just generated by selecting **Tools>Load VA Reports**.

## Using Templates

### Using Timing File Templates

Timing file templates enable you to save current views of an open timing file. All open views, such as reports, graphs, and thresholds are stored in the template. When you reopen a timing file or open a new timing file and apply a template, it appears with the set of views defined for the template.

Every time you close a timing file in Analyze, a Last Viewed State template for the timing file is created. This file stores the reports and graphs that are open, their positions and sizes, and any thresholds you defined. You can use an option in the Open menu or in the Tools>Options menu to choose to reopen a timing file in the same state its last viewed state.

Use the Template menu to:

- ! Save the current views of a timing file to create a template.
- ! Select an existing template and apply it to the open timing file.
- ! Remove the template from the current timing file or from disk.
- ! Create system-wide thresholds for counters and checkpoints.

You can apply a template to any timing file you open. If any part of the template cannot be applied to the timing file, for example, if the template references a script that doesn't exist in the current file, a dialog box displays with the name of the report or graph that doesn't apply. The default name for the template is the SessionID portion of the file name of the open timing file.

 Note: Only one timing file is saved to a template. If more than one timing file is open, the option to define a template is disabled.

### Creating a New Template

Create a template to save the views of an open timing file. This saves reports and graphs that are open, as well any thresholds that have been defined. When you open other timing files using the template, the files display in the views saved to the template.

To create a new template:

1. Click Template>Save current views. The Specify Template to Save current views and thresholds dialog box appears.

 Note: This menu option is available only if a single timing file is open.

2. Select a folder in the Save in field. By default, all templates are stored in the Templates folder. The default template name is the Session ID portion of the timing file name.

3. Do one of the following:

- ! Click Create to accept the Session ID as the template name. When you use this name for the template, all future timing files created by this Conductor session automatically open with the views specified in the template.

- ! Type a name for the new template in the File name field, and click Create.

 Note: You can choose template options that globally set how timing files open using the options in the Analyze Options dialog box .

### Opening a Timing File in a Template

When you open a timing file, you can select how it displays by opening it in a template. Specifying a template opens the reports, graphs, and thresholds defined in the template.

To open a timing file in a template:

---

1. Click **File>Open**. The **Open Timing File** dialog box displays.
2. In the **File name** field, select the timing file to open.
3. Select one of the following:
  - ! Open last viewed state if available - (Default) Opens the timing file in the same views that were displayed when you last closed it. This restores all reports and graphs that were open, their positions and sizes, as well as any defined thresholds for graphs. If there is no last viewed state or if you do not select this option, the file opens using the option you select in the Template area below.
  - ! In the Template area, click one of the following options:
    - o Do NOT use a template when opening timing file - No template is applied and only the Summary report for the timing file displays.
    - o Use template associated with Session ID file name - (Default) Applies the template with the same Session ID name as the timing file. Use this option to open all future timing files created by this Conductor session with the views specified in the template. If no match is found, only the Summary report displays.
    - o Use this template for opening the timing file - Enables the Browse (...) button. Select a saved template to apply to all timing files when they are opened.

 **Note:** By default, both the Open in last viewed state if available and Use template associated with the Session ID file name are selected. This way if there is no last viewed state, the template associated with the Session ID file name is applied to the timing file.

4. Click **Open**. The timing file you selected appears in the views defined for the selected template.

### Applying a Template to an Open Timing File

You can select an existing template and apply it to all open timing files. This closes all reports and graphs that are open and displays the timing file in the views defined in the template.

To apply a template to an open timing file:

---

1. Click **Template>Use existing**. The **Select Template to Use for Open Timing Files** dialog box appears.
2. Select a template and click **Apply**.

All open reports and graphs are closed and those specified in the template are opened.

 **Note:** If any part of the template cannot be applied to the timing file, for example, if the template references a script that does not exist in the current file, a dialog box appears with the name of the report or graph that cannot be displayed.

### Applying Templates Globally with the Options Dialog Box

Use the Analyze Options dialog box to select template options that globally set how timing files open. Using a template saves the reports, graphs, and thresholds defined in the template.

 Note: Use **Template>Use Existing** to apply a template to an individual open timing file.

To specify a template:

---

1. Click **Tools>Options**.
2. Click the **Templates** tab and select one of the following:
  - ! Open last viewed state if available - (Default) Opens the timing file in the same views that were displayed when you last closed it. This restores all reports and graphs that were open, their positions and sizes, as well as any defined thresholds for graphs. If there is no last viewed state or if you do not select this option, the file opens using the option selected in the Template area below.
  - ! In the Template area, select one of the following:
    - o Do NOT use a template when opening timing files - No template is applied. The Summary report for the timing file displays.
    - o Use template associated with the Session ID file name - (Default) Applies the template with the same Session ID name as the timing file. Use this option to open all future timing files created by this Conductor session with the views specified in the template. If no match is found, only the Summary report displays.
    - o Use this template for opening timing files - Enables the Browse (...) button. Select a saved template to apply to all timing files when they are opened.

 Note: By default, both **Open in last viewed state if available** and **Use template associated with the Session ID file name** are selected. This way if there is no last viewed state, the template associated with the Session ID file name is applied to the timing file.

## Thresholds

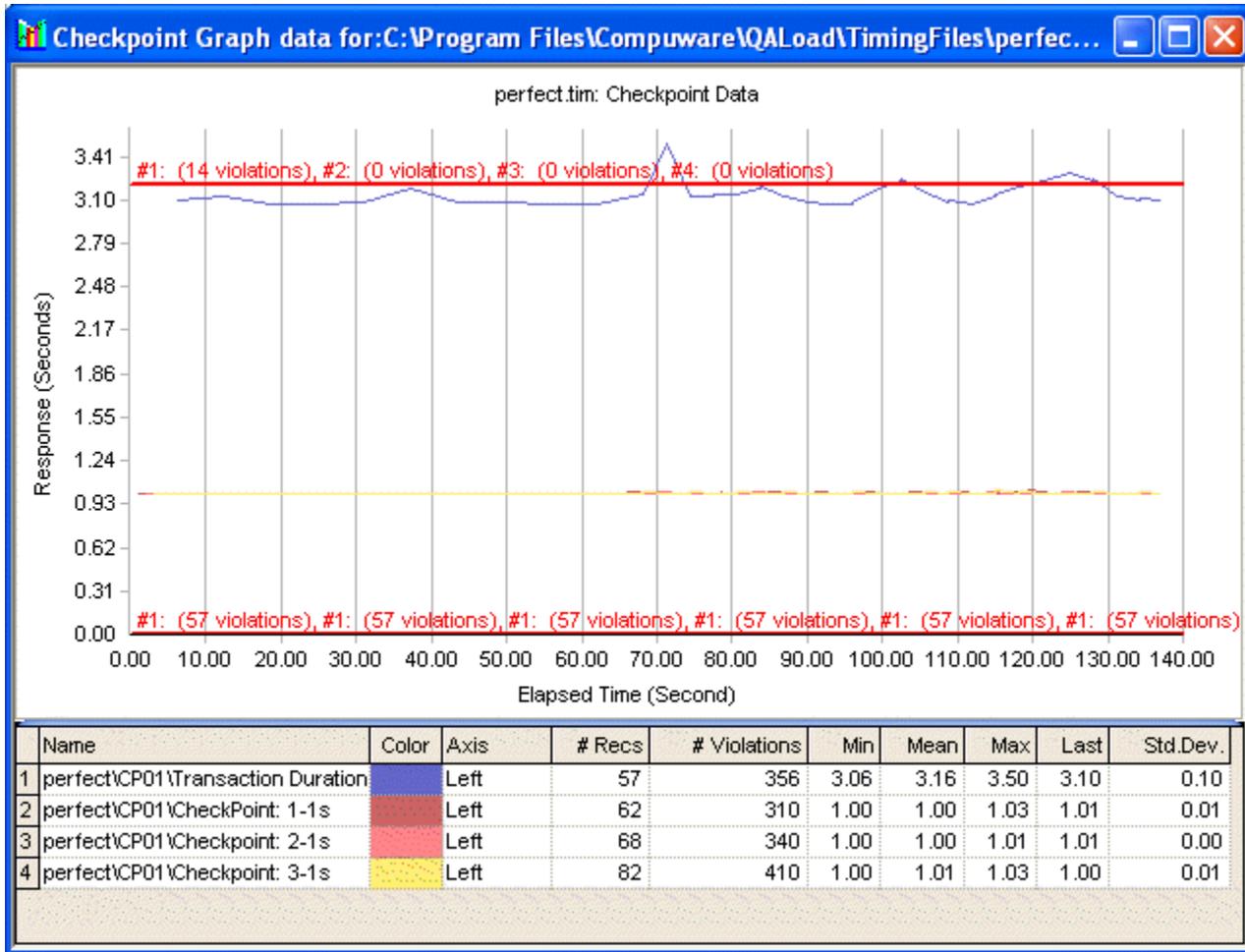
### Using Thresholds

Thresholds are user-defined values that show the expected warning and critical limits for a counter or checkpoint. Thresholds help identify problem areas in the test, such as checkpoints or counters that go above or below a specified number. They actively monitor response times by indicating whether data records are surpassing user-defined expected warning and critical levels.

Thresholds are saved in the Template file. The information displays in graphs and detail reports in the detail data view.

### Graphs

The selected data is displayed in a line graph format in the Data window. Graphs show thresholds as horizontal lines with the number of failed points.



### Detail Reports

Detail reports display thresholds in a Summary table and a Data table. The Summary table is a summary of raw data collected from a load test. The defined threshold limits, the percentage of failures for the threshold, and the total violations are displayed. In the Data table, the failed points are shown in red.

	Timing File	Script	Player	Checkpoint	Type	Group	#Thinned Trans	#Thinned Recs	Data Thin	Min	Mean	Max	StdDev	Median	90th Percentile	Pacing (Seconds)	VU's	Threshold	Failure Rate	Total Violations
1	perfect	CP01	ARCHIE	Transaction Duration	---	---	2048	1024	Every 2 trans	3.0640	3.1821	3.5050	0.1177	3.1390	3.2440	1	2	< 3.200000	63.77 %	653
2	perfect	CP01	ARCHIE	CheckPoint: 1-1s	---	---	2048	1024	Every 2 trans	1.0010	1.0027	1.0320	0.0037	1.0020	1.0110	---	---			
3	perfect	CP01	ARCHIE	CheckPoint: 2-1s	---	---	2048	1024	Every 2 trans	1.0010	1.0019	1.0120	0.0022	1.0010	1.0020	---	---			
4	perfect	CP01	ARCHIE	CheckPoint: 3-1s	---	---	2048	1024	Every 2 trans	1.0010	1.0047	1.0310	0.0052	1.0020	1.0120	---	---			

Checkpoint by Player Summary

	Timing File	Script	Group	Checkpoint	Type	VU	Player	#Recs	Elapsed (Seconds)	Response (Seconds)	Threshold
1	perfect	CP01	---	Transaction Duration	---	0	ARCHIE/34566	---	12.4380	3.1240	< 3.2
2	perfect	CP01	---	Transaction Duration	---	0	ARCHIE/34566	---	30.8740	3.0840	< 3.2
3	perfect	CP01	---	Transaction Duration	---	0	ARCHIE/34566	---	49.5510	3.1790	< 3.2
4	perfect	CP01	---	Transaction Duration	---	0	ARCHIE/34566	---	68.0980	3.1340	< 3.2
5	perfect	CP01	---	Transaction Duration	---	30	ARCHIE/34566	---	71.1720	3.5000	---
6	perfect	CP01	---	Transaction Duration	---	31	ARCHIE/34566	---	71.1720	3.5000	---
7	perfect	CP01	---	Transaction Duration	---	32	ARCHIE/34566	---	71.1720	3.5000	---
8	perfect	CP01	---	Transaction Duration	---	23	ARCHIE/34566	---	71.1720	3.5000	---
9	perfect	CP01	---	Transaction Duration	---	25	ARCHIE/34566	---	71.1720	3.5000	---
10	perfect	CP01	---	Transaction Duration	---	26	ARCHIE/34566	---	71.1720	3.5000	---
11	perfect	CP01	---	Transaction Duration	---	18	ARCHIE/34566	---	71.1720	3.5000	---
12	perfect	CP01	---	Transaction Duration	---	9	ARCHIE/34566	---	71.1720	3.5000	---
13	perfect	CP01	---	Transaction Duration	---	10	ARCHIE/34566	---	71.1720	3.5000	---
14	perfect	CP01	---	Transaction Duration	---	12	ARCHIE/34566	---	71.1720	3.5000	---
15	perfect	CP01	---	Transaction Duration	---	4	ARCHIE/34566	---	71.1720	3.5000	---
16	perfect	CP01	---	Transaction Duration	---	6	ARCHIE/34566	---	71.1720	3.5000	---

Checkpoint by Player Data

## Creating Thresholds

Define thresholds to show the expected warning and critical limits for a counter or checkpoint.

To create Thresholds:

---

1. Select **Template>Thresholds**. The **Thresholds** dialog box appears.
2. Click the appropriate group in the Workspace. Data within each group is listed in a tree-view.
3. Highlight a counter or checkpoint and drag it to the **Threshold** dialog box.

 **Note:** You can drag entire groups or individual items to the Threshold dialog box.

4. Click **Edit** to name the threshold and set the threshold limits and conditions.
5. Do one of the following:
  - ! Click the check box in the Active column for the thresholds you want to use, then click Apply.
  - ! Click Activate All to use all of the thresholds, then click Apply.

## Editing Thresholds

Once you create the threshold, set the threshold properties using the Edit function.

To edit Thresholds:

---

1. In the **Thresholds** dialog box, do one of the following:
  - ! Double-click the threshold you want to edit.
  - ! Highlight the appropriate threshold and click Edit.
 The Threshold Properties dialog box appears.
2. In the **Threshold Label** field, type a name for the threshold. This is optional.
3. In the **Limit** field, type the number for the threshold. This is used with the **Condition** you select to calculate violations.
4. In the **Limit Condition** section, choose how the threshold violations are calculated. You can select:
  - ! Greater than the threshold limit you defined (>)
  - ! Equal to the threshold limit you defined (=)
  - ! Less than the threshold limit you defined (<)
5. Click **OK**. The **Threshold** dialog box appears showing the limit and condition you specified.

## Viewing Thresholds

Threshold information displays in graphs and detail reports in the detail data view .

 **Note:** The data displayed and the groups available may vary, depending on the type of data that is collected during the load test.

To view thresholds in graphs:

---

1. In the Workspace, click the appropriate Timing File tab. Data is listed in a tree-view.

## Using the Player, Script Development Workbench, and Analyze

2. Click the group to view, and select the appropriate checkpoints or counters to display in the graph.

 **Note:** You can select an entire group or individual data files.

3. Click **View> Graph** or right-click and choose **Graph** from the context menu.

The selected data displays in a line graph format in the Data window. Graphs show thresholds as horizontal lines with the number of failed points.

To view thresholds in detail reports:

---

1. In the Workspace, click the appropriate Timing File tab. Data is listed in a tree-view.
2. Click the group to view, and select the appropriate checkpoints or counters to display in the detail report.

 **Note:** You can select an entire group or individual data files.

3. Click **View> Detail** or right-click and choose **Detail** from the context menu.

The detail report for the selected data displays. Detail reports display thresholds in a Summary table and a Data table. The Summary table is a summary of raw data collected from a load test. In the Data table, the failed points are shown in red.

## Creating a Chart or Graph

### Analyze Graph Types

The following basic graph types are available in QALoad Analyze.

#### Line Graph

A line graph plots response times versus elapsed times for the selected checkpoints. It provides a good representation of how much fluctuation there is in response times over the course of a test.

#### Bar Graph

A bar graph shows the median, mean, or percentile response times for the selected checkpoints.

#### Transaction Throughput Graph

This type of graph shows the cumulative number of transactions that occurred within the user-specified time range over the duration of the test.

#### Response Time Distribution Graph

This type of graph shows the percentage of checkpoint timings that fall within a particular response time range. A response time distribution graph shows if response times tend to fall within a range or are widely dispersed. A response time distribution graph only shows results for a single checkpoint, although it can compare results from multiple timing files.

#### Cumulative Response Time Distribution Graph

This type of graph shows the percentage of transactions for a single checkpoint that have a response time equal to or less than a specified value.

#### Virtual User Distribution Graph

This type of graph shows the value of checkpoint timings grouped by a user-specified range of virtual users running the script at that point in the test. A virtual user distribution graph shows if timings degraded

when the number of virtual users ramped up during a load test. The virtual user distribution graph only shows results for a single checkpoint and is only valid for tests where the number of virtual users running the script ramped up during the load test.

## Adding Text or an Object to a Graph

To create explanatory text or an object on a graph, use any of the text or object buttons on the [Graph Annotate toolbar](#).

To add a note or object to a graph template:

---

1. Display the Annotate toolbar.
2. Add text and/or an object to the graph.

### Storing a Note or Object in a Template

You can add explanatory text or objects to a graph to be utilized as part of a template when the template is applied to future timing files. For text, use the Text Box or the Balloon with Text button . To create an object, use the Rectangle or Circle button .

 **Note:** These are the only objects that can be stored in a template.

To save the information in a template:

---

1. Complete the steps above for adding a note or object.
2. Follow the instructions for [Creating a New Template](#). The saved note or object is available when the template is applied to future timing files.

## Graphing QALoad Timing Data

Starting in the Workspace of the Analyze [split window view](#), you can graph timing data in a number of formats and styles.

 **Tip:** A timing file can potentially contain enough data that graphing all of it at one time results in an unreadable graph. Before beginning, consider thinning the amount of data to be shown on a single graph. [Details](#)

Select the group to graph:

---

In the Workspace, with the appropriate Timing File tab selected, click the [group](#) for which to create a graph.

 **Note:** If the test aborts, complete data may not be available for all checkpoints and counters.

The following groups are available, depending on the timing file:

[Checkpoints](#)

[Counters](#)

[Server Monitoring](#)

## Player Performance Counters

### Expert User

 Note: For each Group except Checkpoints and Expert User, the graph type is a line graph. For graphing multiple checkpoints or expert users, the graph type is either a line or bar graph. For graphing a single checkpoint only, in addition to line and bar graphs, you can also create Response Time Distribution and Cumulative Response Time Distribution graphs.

## Thinning Data Before Graphing

Test results may contain more data than can reasonably be graphed. Thinning data before graphing provides a clearer and more manageable graph.

### To thin timing data in Conductor:

---

1. With your test session ID file open, click the **Script Assignment** tab.
2. For each script for which you would like to thin your test data, click the button in the **Timing Options** column.
3. On the Timing Options dialog box, click the **Enable Timing Data Thinning** check box.
4. In the **Thin Every...** field, type the number of transactions to average. The average is sent to the Conductor for inclusion in the timing file, rather than every value.
5. Click **OK**.
6. Save your changes to your test session ID file by choosing **File>Save** from the Conductor menu.

For more details about the Timing Options dialog box, see [Timing Options](#).

### To set up data thinning in Analyze:

---

1. With a timing file open, click **Tools>Options**.
2. Click the **Data Thinning** tab.
3. Type the number of data points to plot on each graph and select the method by which to graph the data points.
4. Click **OK**.

For a description of the options on this dialog box, see [Options Dialog Box - Data Thinning Tab](#).

## Graphing Checkpoints in Analyze

A timing file can potentially contain enough data that graphing all of it at one time results in an unreadable graph. Before beginning, consider thinning the amount of data to be shown on a single graph.

### Details

 Note: Use the Graphs view of the runtime Conductor to create real-time graphs of checkpoint response times during script execution.

### To graph checkpoints:

---

1. Open the appropriate .tim file in QALoad Analyze. In the Workspace, click the **Checkpoints** group. Checkpoint data is listed in a tree-view.

2. Select the checkpoints to graph.
3. From the **View** menu, choose **Graph**. The Graph Type dialog box appears.
4. In the Graph Type drop-down list, select from the following:

! **Line** (response times versus elapsed times for the selected data.)

! **Bar** (median, mean, or a percentile response time of the selected checkpoints.)

 Note: The BAR graph displays only one data point for each selected counter. The data point represents the mean, median, or percentile response time. When you select a LINE graph after a BAR graph through the BAR graph's context menu, the LINE graph displays the data of the BAR graph, not the data from the tree control on the left pane. Since there is only one data point per selected counter, the line graph does not display a line. This display is different from the LINE graph that you request from the tree control, which displays all the data points for each selected counter.

The following graph types are only available when graphing a single checkpoint:

! **Response Time Distribution** (The distribution of response times of a single checkpoint.)

! **Cumulative Response Time Distribution** (The percentage of checkpoint timings that were equal to or less than a specified value.)

! **Virtual User Distribution** (The distribution of checkpoint timings based on the number of virtual users running the script at that point in the test.)

Data for the selected checkpoint(s) is graphed in the Data window in the format selected in step 4.

## Graphing Counters

 Note: A timing file can potentially contain enough data that graphing all of it at one time results in an unreadable graph. Before beginning, consider thinning the amount of data to be shown on a single graph.  
[Details](#)

To graph counters:

---

1. Open the appropriate .tim file in QALoad Analyze. In the Workspace, click the **Counters** group. Counter data is listed in a tree-view.
2. Select the counter(s) to graph.
3. From the **View** menu, choose **Graph**. Data for the selected counter(s) is graphed in a line graph format in the Data window.

## Graphing Player Performance Counters

 Note: A timing file can potentially contain enough data that graphing all of it at one time results in an unreadable graph. Before beginning, consider thinning the amount of data to be shown on a single graph.  
[Details](#)

To graph Player performance counters:

---

1. Open the appropriate .tim file in QALoad Analyze. Select the **Player Performance Counters** group.
2. In the Workspace, select the performance counter(s) to graph.
3. Click the **View Graph** button or right-click and choose **Graph** from the context menu. Data for the selected Agent(s) is graphed in a line graph format in the Data window.

## Graphing Server Monitoring Data

Monitoring servers is a method of load testing. QALoad provides performance counter data through three server monitoring methods:

- ! **Remote Monitoring** - Performs the monitoring of performance counters from a machine under test without the use of agent software on the machine.
- ! **ServerVantage** - An Availability Management application complementary to QALoad for service level monitoring of performance counters for applications, servers, and databases during production. ServerVantage also provides notification, event management, and reporting features.

## Graphing Expert User Data

 **Note:** A timing file can potentially contain enough data that graphing all of it at one time results in an unreadable graph. Before beginning, consider thinning the amount of data to be shown on a single graph. [Details](#)

To graph expert user data:

---

1. Open the appropriate .tim file in QALoad Analyze.
2. Select the **Expert User** group in the Workspace tree-view.
3. In the Workspace, select the **data point(s)** to graph.
4. Click the **View Graph** button or right-click and choose **Graph** from the context menu. Data for the selected Agent(s) is graphed in a line graph format in the Data window.

## Creating a Scatter Chart

To create a scatter chart:

---

1. Click the **View Graph** button () or choose **Graph** from the **View** menu. The Graph Type dialog box appears.
2. Select the **Line** graph type.
3. Click **OK**. Data for the selected checkpoints is presented in a line graph format in QALoad Analyze's data window.
4. Right-click anywhere in the graph, and select **Gallery** from the menu. The gallery of graph types displays.
5. Click the Scatter  type graph.
6. Right-click anywhere in the graph.
7. Select **Properties** from the menu. The Chart FX Properties dialog box displays.
8. Click the **Series** tab.
9. In the **Show every:** field, click the up or down arrow to increase or decrease the number of data points displayed, for example, show every 5th point.
10. In the **Size:** field, click the up or down arrow to increase or decrease the size of the scatter points.
11. Click **Apply**.
12. In the **Shape:** field, click the arrow and select the shape for the scatter points.
13. Click **Apply**, then click **OK**.

## Vantage Analyzer Drill Down Menu Items

If Vantage Analyzer parameters such as agents, report type, top N, and steps are set, the following menu items are available from the right-click menu in any graph view.

**Set Start Time:** Choose this option to set the start time. A line is drawn in the mouse click point of the graph.

**Set End Time:** Choose this option to set the end time. A line is drawn in the mouse click point of the graph.

**Launch Reports:** Choose to generate the Vantage Analyzer report or detailed transaction data within the selected time range.

**Clear Selection:** Choose this option to clear the start and end lines from the graph.

## Viewing Reports

### Viewing Reports

View reports generated by QALoad Analyze on a machine with QALoad installed or on any machine with a Web browser. In order to save the contents of a timing file's working folder, when viewing reports, clear the Remove XML Working Folder option. To properly set this option, see the Workspace tab on the Options dialog box. For more information, see [Options Dialog Box - Workspace Tab](#).

#### Viewing reports on a machine with QALoad Analyze

To view reports in QALoad Analyze, click the Summary report button or any of the pre-defined report buttons in the QALoad Analyze Workspace. See [Load Test Summary](#) for a quick introduction to viewing reports.

#### Viewing reports on a machine without QALoad Analyze

To view reports in a Web browser, copy the entire working folder for the timing file onto the machine. The following files are required (where <Summary> represents the name of the report):

- ! <Summary>.htm
- ! <Summary>.xml
- ! <Summary>.xsl

In addition, the Microsoft XML version 4.0 parser (provided with QALoad ) is required to view QALoad reports. View any of the pre-defined reports by clicking the <Summary>.htm file to launch a report with the assistance of the associated XML and XSL support files.

#### Other ways to view test data

View not only pre-defined reports, but also timing file detail views and graphs by exporting or sending email messages with test data to another machine. Click the following links for more information:

- ! [Exporting Test Data](#)
- ! [Sending Email Messages with Test Data](#)

## Automated Reporting

After you complete a series of performance tests, you can prepare high-level and detailed reports in QALoad Analyze.

You can create a base report framework, which for example, can assist you in determining whether your tested applications are ready for production. You can include key sections in the report which can be populated with text and graphics you determine. This report can be customized further after initial creation to more accurately reflect the results of your testing.

The generated report is a Microsoft Word document, created from a series of XML documents which include the timing file data. Your machine must have a valid version of Microsoft Word residing on it for this feature to work.

To view the generated report:

---

1. Open a timing file in **Analyze**.
2. From the **Tools** menu, choose **Generate Report** and select a timing file. Microsoft Word opens and a generated report appears, ready for editing.

## Pre-Defined Reports

QALoad Analyze provides pre-defined reports for viewing load test results without time-consuming data manipulation.

In the Workspace, select the Reports [group](#) and click the appropriate report. The reports are in HTML generated by XSL files. View them in QALoad Analyze, or [directly in a Web browser](#).

 Note: Compuware provides each of the available pre-defined reports as convenience to view the results of a load test without any data manipulation. In addition, create customized versions of these reports by selecting the appropriate [group](#) and creating [detail reports](#) and [graphs](#).

The following reports are available. Click a report name for details.

[Summary](#)

[Session](#)

[Concurrent Users](#)

[Response Time Analysis](#)

[Output](#)

[Client Throughput](#)

[Transaction Throughput](#)

[Top Ten Longest Checkpoint Durations](#)

[Worst Performing Checkpoints and Counters](#)

[Player Performance](#)

[Application Vantage](#)

[Expert User](#)

## Summary Report

The Summary report is the primary output from each test run, one of the pre-defined reports QALoad Analyze makes available. When you open a timing file, QALoad Analyze automatically displays the Load Test Summary in the Data window. It presents timing information for each transaction in the timing file and the minimum, maximum, and median response times for each checkpoint. The output is divided into two sections.

The first section presents the Summary Test Information, Test Time information, and Data Thinning and Time Range information. The second section presents the Script Information for each script. It shows timing Summaries and Checkpoint information for each script.

With the Summary Report open in Analyze, click a heading in the Test Information area to display detailed information on scripts, errors, and messages. When you enable [data thinning](#), the number of errors and messages is thinned, accordingly.

 Note: There is a limit of 3000 errors processed for each script and 3000 messages processed for each group within a script. When you click # Errors or #Messages for detailed information, any script or group within the script that exceeds the limit does not display. A script or group can fall within the limit when data is thinned but exceed the limit when data is not thinned. This means that more scripts may appear in the Error section and more groups may appear within scripts in the Script Message section when data is thinned.

### Sample Summary Report

For a brief description of each report section, scroll down and click a section heading in the following sample.

Summary - perfect.tim												
Test Information												
<a href="#">Total Scripts</a>	Total Players		<a href="#">Total Virtual Users</a>			<a href="#">#Thinned Errors</a>		<a href="#">#Thinned Messages</a>				
4	1		851			76		1,104				
Test Time												
Start		End		Duration			Pre	User	Post			
11/21/2003 - 12:48:57		11/21/2003 - 12:51:37		2 Minutes and 40 Seconds			00:00:00	00:02:40	00:00:00			
Data Thinning and Time Range												
Thin Data		Conflict Resolution		Percentile	Units	Restrict Time Range			Virtual Users			
1024 datapoint(s), Max		Max		90%	Seconds	No			851			
Script Information												
CP01												
Summary												
		Total			Thinned							
Peak Virtual Users		266			266							
Transaction Pacing		1.00 Second(s)			1.00 Second(s)							
Transaction Rate		43.46 Transactions Per Second			16.01 Transactions Per Second							
# Errors		0			74							
# Messages		6,167			1,024							
Timing Data Thinning		Every 2 transactions			Every 2 transactions							
Include Sleep Time		Yes			Yes							
Checkpoints <a href="#">Hide Thresholds</a>												
ID	Description	#Thinned Trans	#Thinned Recs	Min	Mean	Max	Std Dev.	Median	90%	Threshold	Failure Rate	Total Failures
0	Transaction Duration	2,048	1,024	3.0640	3.1821	3.5050	0.1177	3.1390	3.2440	--	--	--
1	Checkpoint: 1-1s	2,048	1,024	1.0010	1.0027	1.0320	0.0037	1.0020	1.0110	--	--	--
2	Checkpoint: 2-1s	2,048	1,024	1.0010	1.0019	1.0120	0.0022	1.0010	1.0020	--	--	--

### Session Report

Provides summary information about the test session. The information in this report was obtained from the Conductor's configuration settings when the load test was started. To view a summary of test settings that includes changes made while the test was running, see the [Summary report](#).

## Session - mjc\_aa\_1\_03042005\_100438.TIM

Note: The following information was obtained from the Conductor's configuration settings when the load test was started. To view a summary of test settings that includes changes made while the test was running, see the Summary report.

### Test Information

#### Summary

Session ID Name	mjc_aa_1.ID
Conductor Build	05.05.00 Build 234
Session Duration	00:00:00
Configuration file	C:\Program Files\Compuware\QALoad\Session\Default.cfg
Total Scripts	1
Total Players	1
Total Virtual Users	10
Total Running Virtual Users	0

### Script Information

#### mjc\_aa

#### Summary

Path	C:\Program Files\Compuware\QALoad\Middlewares\WWW\Scripts\mjc_aa.cpp
Middleware Type	WWW
Transactions	30
Automatic Timings	Enabled
Include Sleep Times	False
Checkpoint Thinning	Disabled
Counter Data Collection	Store in Timing File and Display in Conductor
Counter Thinning	By Script Every 1 second(s)
Sleep Factor	100%
Transaction Pacing	00:00:01.000
Service Level Threshold	00:00:00
Error Handling	Restart Transaction
Central Datapool	None
Local Datapools	
Binary Files	

### Machine Information

#### Machines In Test

Hostname	OS	RAM	Processor
dtw114910d01	Windows XP Workstation Service Pack 1	1023 MB	Intel Pentium 4

#### Machine Assignments

Script	Expert User	Start VUs	VU Increment	Interval	End VUs	Machine	Mode
mjc_aa		1	1	00:00:10	10	dtw114910d01	Thread

For

Using the Player, Script Development Workbench, and Analyze

descriptions of the information provided in each section, click the sections in the following image.

### Session - perfect.tim

Test Information	
Session	Perfect_Test1.ID
Total Scripts	1
Total Players	1
Total Virtual Users	500
Total Running Virtual Users	0

Script Assignments								
Name	Middleware	Transactions	Auto Timings	Thin Every	Sleep %	Pacing	Threshold	On Error
Perfect	WWW	0	True	1	Random	00:00:01.000	00:00:00	Restart

Machines In Use			
Hostname	OS	RAM	Processor
sprite	Windows 2000 Server Service Pack 2	256 MB	Intel Pentium III

Machine Assignments						
Script	Start VUs	VU Increment	Interval	End VUs	Machine	Mode
Perfect	1	0	00:00:00	500	sprite	Thread

## Concurrent Users Report

Displays the total number of virtual users for the test, concurrent users vs. elapsed time, as well as graphs for individual scripts that were part of the test.

 Note: A totals graph will not display if the test contains only one script.



## Response Time Analysis Report

Provides an indicator of how well a script ran. The report displays a graph of each script's **transaction duration** (response time vs. elapsed time) as well as the following checkpoint summary data:

#Trans: Number of data points used to calculate the statistics.

#Recs: Number of data records. This value, if different from the value of #Trans, reflects the number of checkpoint records that are used for analysis after data thinning has been applied.

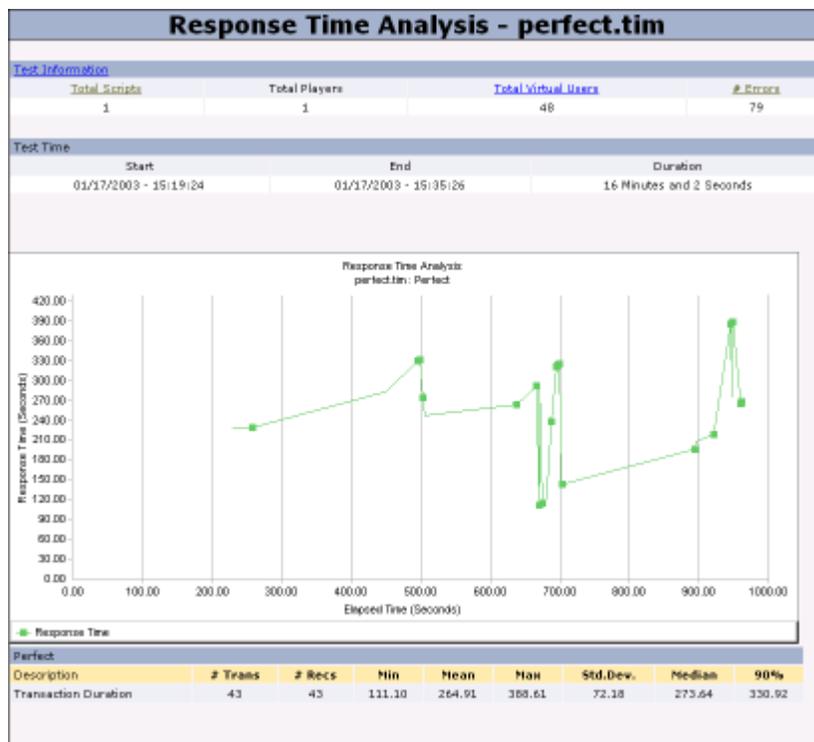
Min: Minimum recorded response time.

Max: Maximum recorded response time.

Std. Dev: Standard deviation of all response times. A large standard deviation indicates a wide variance in response times.

Median: Median response time, in seconds.

nth%: n percent of the responses have a value less than the value shown.



## Output Report

Provides a cumulative list of all errors, sorted by script and occurrence in time, that occurred during the course of a load test.

 Note: Failed messages are included in the errors count that appears in the Test Information section of the report, but are detailed in the Script Messages section.

Using the Player, Script Development Workbench, and Analyze

### Output - perfect.tim

Test Information					
Total Scripts	Total Players	Total Virtual Users	#Thinned Errors	#Thinned Messages	
4	1	851	76	1,104	

Test Time					
Start	End	Duration	Pre	User	Post
11/21/2003 - 12:48:57	11/21/2003 - 12:51:18	2 Minutes and 21 Seconds	00:00:00	00:02:21	00:00:00

Data Thinning and Time Range					
Thin Data	Conflict Resolution	Percentile	Units	Restrict Time Range	Virtual Users
1024 datapoint(s), Max	Max	90%	Seconds	No	851

**Errors**

- ▶ Test Initialization Errors (2)
- ▶ Transfer Errors (4)
- ▶ Failed Messages (74)

**Script Messages**

- ▶ CD01
- ▶ CD02

 QLoad Tracing File Version 05.01.00 Build 142  
 QLoad Analyze Version 05.02.00 Build 106  
 ©Copyright 1994-2004, Compuware Corporation. All Rights Reserved.

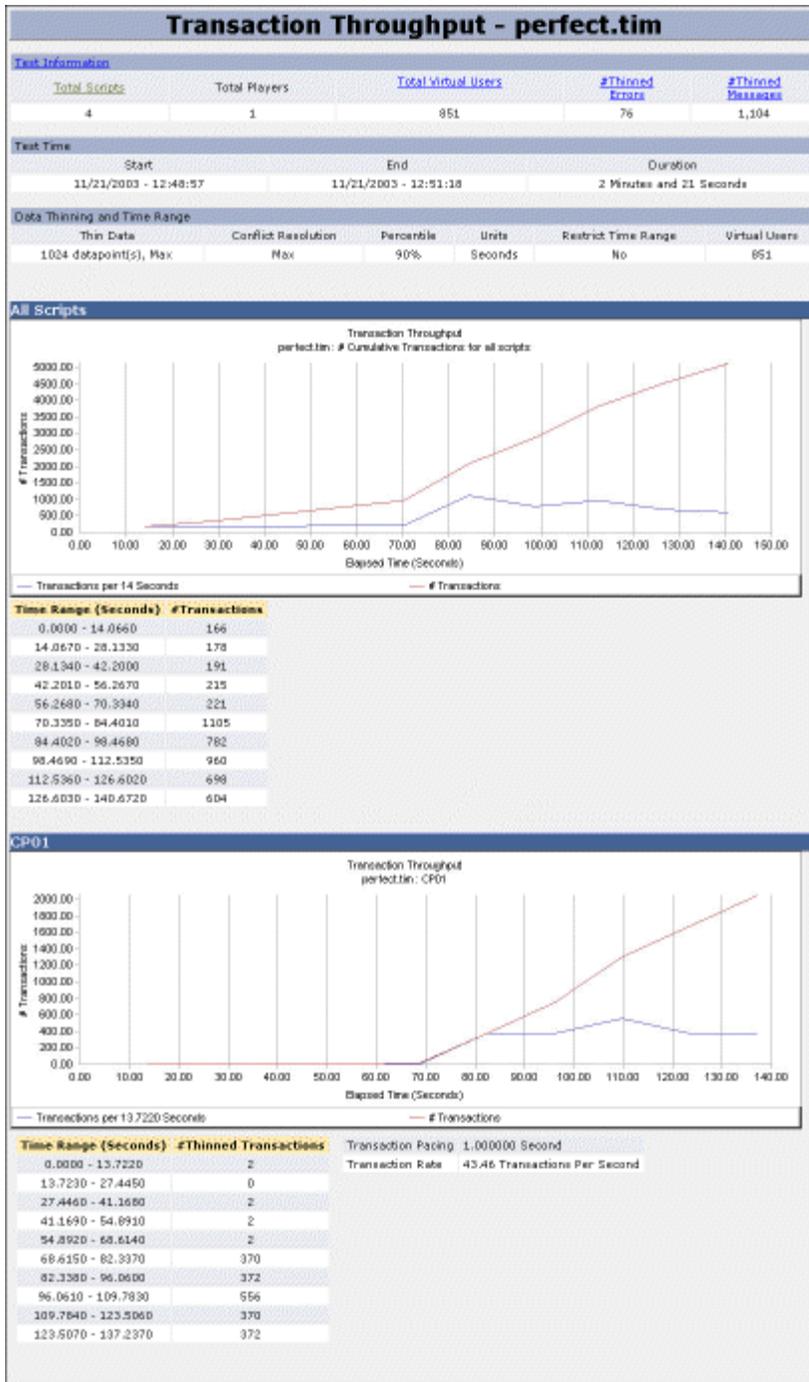
## Client Throughput Report

Provides a graph of HTTP Reply analysis for key HTTP counters, HTTP counter vs. elapsed time.



## Transaction Throughput Report

Provides the cumulative number of transactions over elapsed time for each script and for the total test.



## Top Ten Longest Checkpoint Durations Report

Provides graphs and lists details about checkpoints that had the longest checkpoint duration during the test. Checkpoints with longest durations are those that consumed the most amount of time during the test. This report contains the following sections:

- ! A summary section with overview information about the test.

## Using the Player, Script Development Workbench, and Analyze

- ! A bar graph of the ten longest checkpoint durations in the test, followed by details for each checkpoint in the graph. These checkpoints can originate in any script that was included in the test.
- ! Bar graphs for each script that show up to the ten longest checkpoint durations, followed by details for each checkpoint in the script.

The report is generated by Analyze only if each script has at least one checkpoint other than the duration checkpoint. The data provided in the report can be used as a starting point to identify performance problems.

 Note: Transaction duration checkpoints are not included in the report.

### Top Ten Longest Checkpoint Durations - perfect.tim

Test Information				
Total Scripts	Total Players	Total Virtual Users	#Thinned Errors	#Thinned Messages
4	1	851	76	1,104

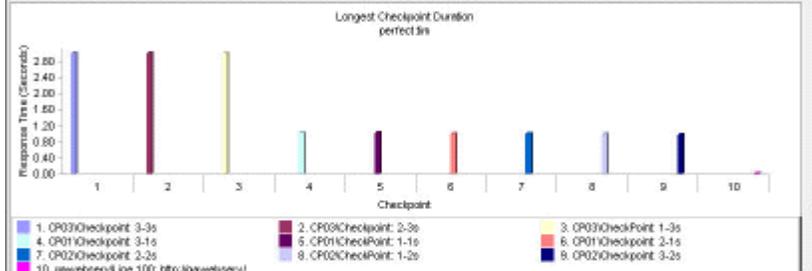
  

Test Time		
Start	End	Duration
11/21/2003 - 12:48:57	11/21/2003 - 12:51:18	2 Minutes and 21 Seconds

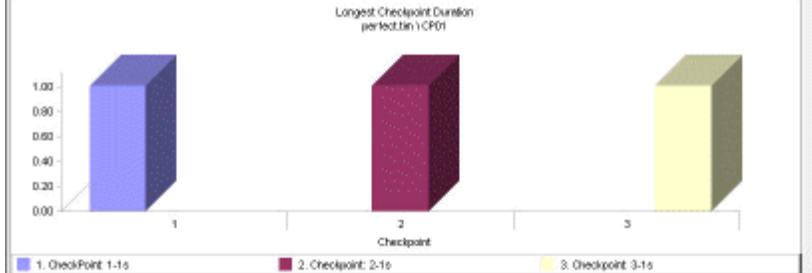
Data Thinning and Time Range					
Thin Data	Conflict Resolution	Percentile	Units	Restrict Time Range	Virtual Users
1024 datapoint(s), Max	Max	90%	Seconds	No	851

#### Longest Checkpoint Duration Summary



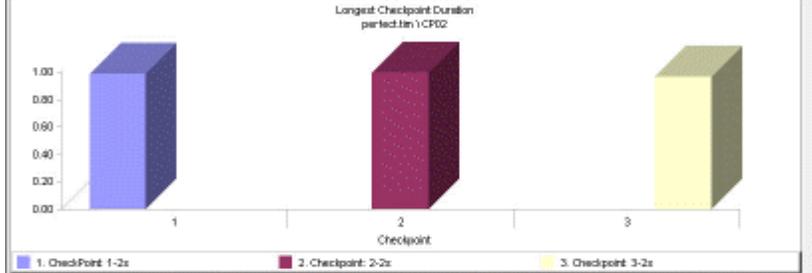
Description	#Thinned Trans	#Thinned Recs	Min	Mean	Max	Std Dev.	Median	90%
1 CP03/Checkpoint: 3-3s	1,024	75	3.0040	3.0054	3.0240	0.0035	3.0040	3.0050
2 CP03/Checkpoint: 2-3s	1,024	74	3.0040	3.0048	3.0240	0.0026	3.0040	3.0050
3 CP03/Checkpoint: 1-3s	1,024	82	3.0040	3.0046	3.0150	0.0020	3.0040	3.0050
4 CP01/Checkpoint: 3-1s	2,048	62	1.0010	1.0062	1.0310	0.0070	1.0020	1.0120
5 CP01/Checkpoint: 1-1s	2,048	62	1.0010	1.0046	1.0320	0.0060	1.0020	1.0120
6 CP01/Checkpoint: 2-1s	2,048	68	1.0010	1.0032	1.0120	0.0039	1.0020	1.0110
7 CP02/Checkpoint: 2-2s	1,024	819	0.0100	0.9924	2.0030	0.5679	1.0020	1.7650
8 CP02/Checkpoint: 1-2s	1,024	839	0.0000	0.9883	2.0030	0.5760	0.9810	1.7830
9 CP02/Checkpoint: 3-2s	1,024	832	0.0100	0.9662	2.0030	0.5956	0.9220	1.8130
10 qawebserver/Line 100: http://qawebserver/	1,024	1,024	0.0000	0.0027	0.0300	0.0045	0.0000	0.0100

#### CP01



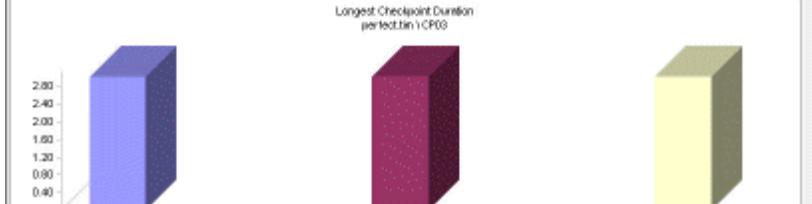
Description	#Thinned Trans	#Thinned Recs	Min	Mean	Max	Std Dev.	Median	90%
1 CheckPoint: 1-1s	2,048	62	1.0010	1.0046	1.0320	0.0060	1.0020	1.0120
2 Checkpoint: 2-1s	2,048	68	1.0010	1.0032	1.0120	0.0039	1.0020	1.0110
3 Checkpoint: 3-1s	2,048	82	1.0010	1.0062	1.0310	0.0070	1.0020	1.0120

#### CP02



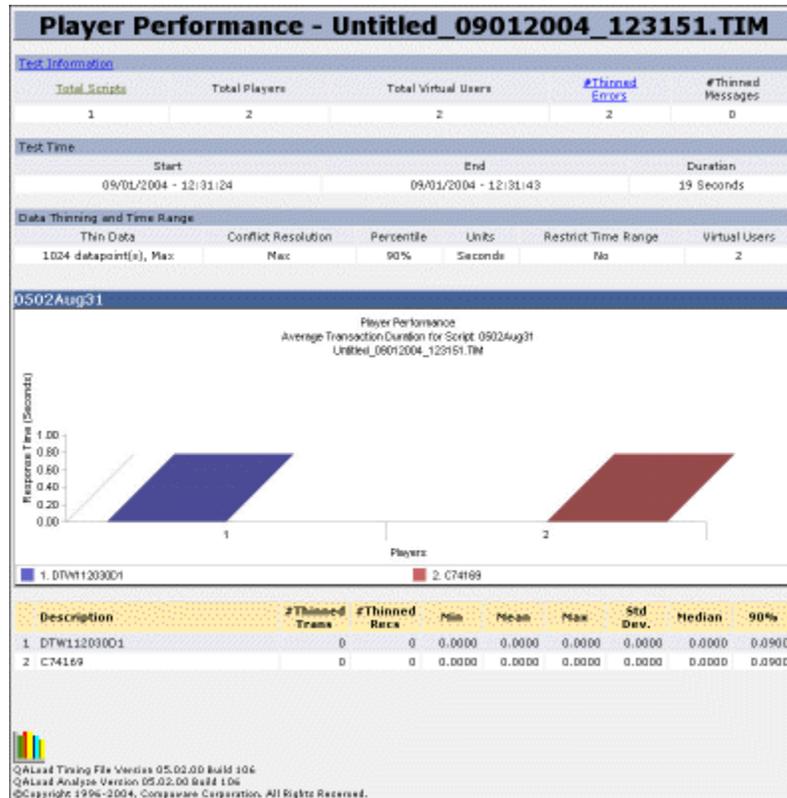
Description	#Thinned Trans	#Thinned Recs	Min	Mean	Max	Std Dev.	Median	90%
1 CheckPoint: 1-2s	1,024	839	0.0000	0.9883	2.0030	0.5760	0.9810	1.7830
2 Checkpoint: 2-2s	1,024	819	0.0100	0.9924	2.0030	0.5679	1.0020	1.7650
3 Checkpoint: 3-2s	1,024	832	0.0100	0.9662	2.0030	0.5956	0.9220	1.8130

#### CP03



## Player Performance Report

Displays transaction durations in a graph format by player machine. This report helps identify individual player machines that have poor test results. In addition to the bar graph that plots the average transaction duration for each player machine, the report also includes summary data for the overall test, and details for each player machine. This report is generated by Analyze only if two or more player machines were used in the test.



## Worst Performing Checkpoints and Counters Report

This report provides graphs and lists details about checkpoints and counters that had the worst performance during the test. Performance is based on the thresholds you define.

Checkpoints with the worst performance are calculated using the average response time for each checkpoint. Counters with the worst performance are those that consume the most amount of time during the test. Checkpoints with the most errors and counters with the highest failure rates are listed first. The data provided is a starting point for identifying performance problems.

### Notes:

- ! The report is generated by Analyze only if a threshold is defined and if the threshold is violated by the data. Thresholds that are not violated do not appear in the report.
- ! Failure numbers may differ between this report and the Summary report and detail reports. QALoad Analyze performs internal data thinning when creating the Worst Performing Checkpoints and Counters report, so that VU data points with the same elapsed time are combined and displayed as one record.

Since the [Summary](#) report and the [detail report](#) for checkpoints and counters display every data record in the timing file, these reports may show a larger number of failures.

The bar graphs for each script show up to ten of the longest checkpoint durations and are followed by details for each checkpoint in the graph. The checkpoints can originate in any script that was included in the test. The report contains the following sections:

- ! A summary section with overview information about the test.
- ! Bar graphs for checkpoints and bar graphs for counters showing the following:
  - ! Summary by percentage of violations - Shows the number of points that exceeded the threshold divided by the total number of data points. For example, in the report for counters below, the total failure of 8 divided by the total records of 60, yields a failure rate of 13.3 percent.
  - ! Summary by severity - Shows the percent of time during the test that the data is in violation of the threshold. This calculation uses a weighted average to determine the percentage. For example, in the report for counters below, when the weighted average is used to calculate the severity, the failure rate is 7.6 percent and 6.5 percent.

Since the first method measures the failure rate by percentage of violations, and the second method measures failures by the amount of time the data is in violation, the numbers can differ greatly between the two methods. It is possible for a data set to have a 5 percent failure rate when calculated by percentage of failures, and an 80 percent failure rate when calculated by severity. This can indicate that an error deviating significantly from the norm may be a more notable failure than a greater number of failures.

In the example below, the counter summary by percent of violations for Server Analysis shows a total of 8 failures out of 60 records, for a failure rate of 13.3 percent. The percentage of violations for Remote Monitoring has a total of 3 failures in 41 records, for a failure rate of 4.2 percent.

When measured by severity, however, the failure rate for Remote Monitoring is more serious than for Server Analysis. Here, the failure rate for Remote Monitoring is 7.6 percent compared to the rate 6.5 percent for Server Analysis.

 Note: Transaction duration checkpoints are not included in the report.

## Worst Performing Checkpoints and Counters - perfect.tim

### Test Information

<a href="#">Total Scripts</a>	Total Players	<a href="#">Total Virtual Users</a>	<a href="#">#Thinned Errors</a>	<a href="#">#Thinned Messages</a>
4	1	851	76	1,104

### Test Time

Start	End	Duration
11/21/2003 - 12:48:57	11/21/2003 - 12:51:37	2 Minutes and 40 Seconds

### Data Thinning and Time Range

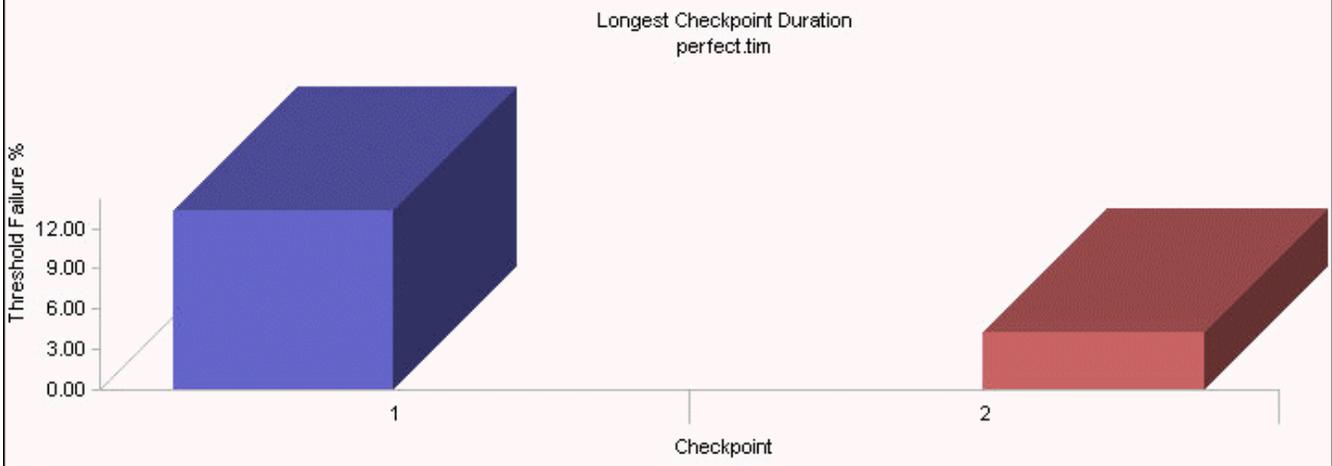
Thin Data	Conflict Resolution	Percentile	Units	Restrict Time Range	Virtual Users
1024 datapoint(s), Max	Max	90%	Seconds	No	851

## Checkpoints

**Worst Performing Checkpoints have not been found. There are no checkpoints that violate their respective thresholds.**

## Counters

### Worst Performing Counter Summary (by % violations)



1. Server Analysis\ARCHIE\Processor\% Processor Time\\_Total      2. Remote Monitoring\farva\Processor\% Processor Time\\_Total

	Description	#Thinned Trans	#Thinned Recs	Max	Threshold	Failure Rate	Total Failures
1	Server Analysis\ARCHIE\Processor\% Processor Time\_Total	0	60	57.7889	> 18.0	13.3%	8
2	Remote Monitoring\farva\Processor\% Processor Time\_Total	0	71	100.0000	> 34.0	4.2%	3

### Worst Performing Counter Summary (by severity)



## Expert User Report

Displays information on the scripts that ran on each player machine with the Expert User option enabled. It provides a timing breakdown of the individual components, such as HTML, images, and objects, of the web pages that were requested during a test. The Expert User report shows how much time it took to download a particular component of a web page from the server. It also shows the percentage of network and server time for the request.

The Expert User report contains a summary section and a detail section. The Summary section at the top of the report displays overview information about the test for each QALoad Player instance.

The detail section displays the main requests and each subrequest made when the script executes. Main requests are made when `Navigate_to()`, `Click_On()`, `Post_to()`, `DO_http()`, or `DO_https()` are executed in a WWW script. The subrequests, or Web components, that make up the main page can include html, css, js pages, and so forth.

The percentage of server and network time displays in the Average Server and Average Network fields, with a graphic representation in the Server/Network field. This information can help you determine whether web pages with a high response time are having server- or network-related performance problems. If an exceptional amount of time is being spent on the server, you can monitor the server that is under test using a server monitoring tool such as ServerVantage or QALoad's Remote Monitoring options. If too much time is being spent on the network, you can monitor the network under test using a tool such as ApplicationVantage.

### Expert User - Untitled\_10142005\_145740.TIM

Test Information					
<a href="#">Total Scripts</a>	Total Players	<a href="#">Maximum Virtual Users</a>	#Thinned Errors	#Thinned Messages	
4	3	9	16		

Test Time					
Start	End	Duration	Pre	User	Post
10/14/2005 - 14:52:04	10/14/2005 - 14:57:03	4 Minutes and 59 Seconds	00:00:00	00:04:59	00:00:00

Data Thinning and Time Range					
Thin Data	Conflict Resolution	Percentile	Units	Restrict Time Range	Virtual Users
1024 datapoint(s), Max	Max	90%	Seconds	No	9

#### Expert User Data

- ▼ [DTW105766N01](#)
  - ▼ [qaload](#)
    - ▶ [Line 116: Page 1 - QALoad Support Web Server](#)
    - ▼ [Line 132: Page 2 - DevGuru Intro to Hypertext Mar](#)

▼ Name	Response Code	Total # Requests	Average Response (s)	Average Server	Average Network	Server / Network
1 http://qaloadsupport/HTML Reference/html_intro.html	200	4	0.0055	95.45 %	4.55 %	<div style="width: 100%; height: 10px; background-color: #4F81BD;"></div>
2 http://qaloadsupport/HTML Reference/include/STYLER	200	4	0.0040	100.00 %	0.00 %	<div style="width: 100%; height: 10px; background-color: #4F81BD;"></div>

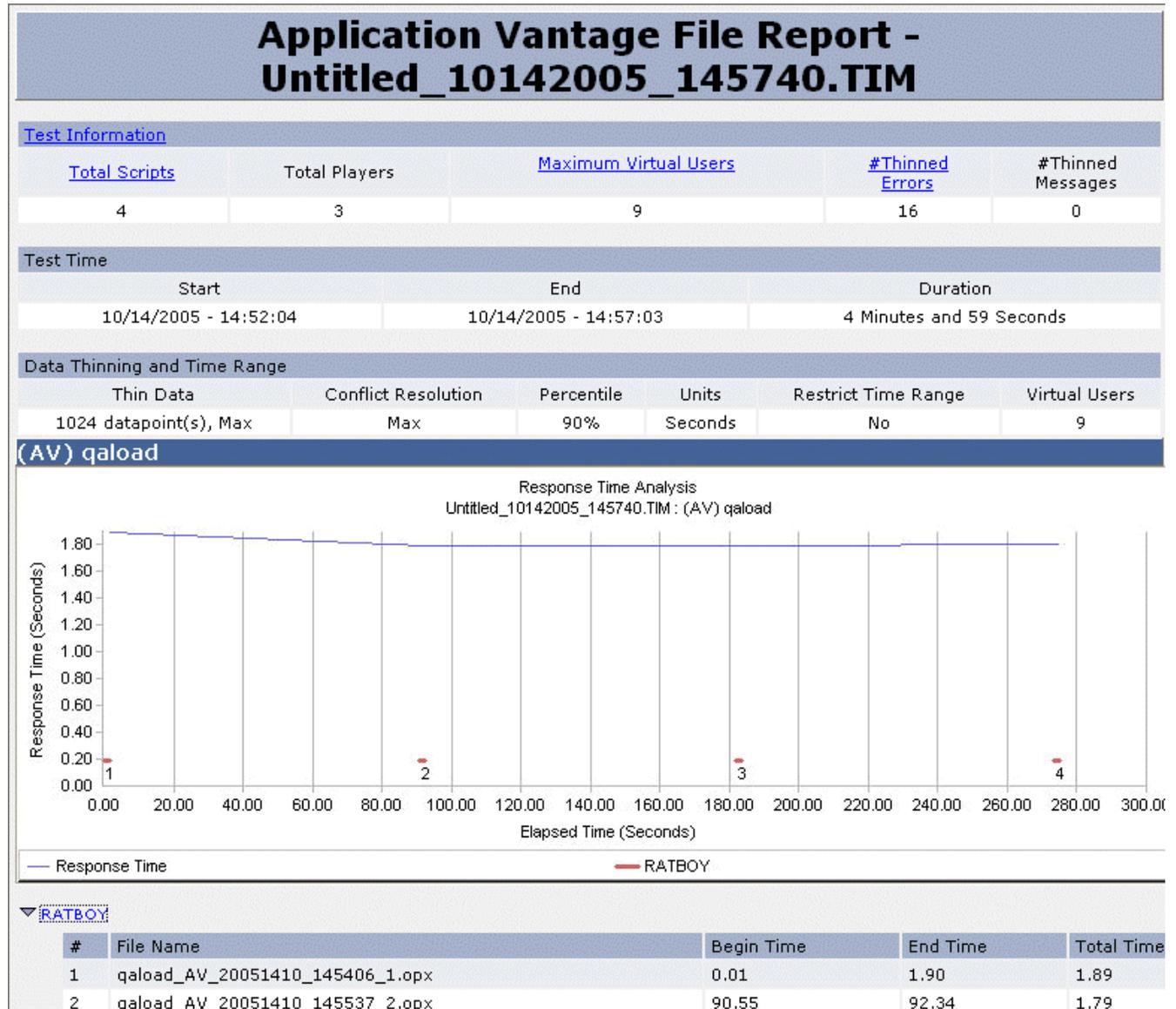
Using the Player, Script Development Workbench, and Analyze

## ApplicationVantage Report

Displays information on the scripts that ran on each player machine. It contains a summary section with overview information about the test, and a graph of the transaction response time of the script in seconds.

 Note: If Expert User data was collected (WWW only), the Network and Server percentage data also is included.

A detail section displays the beginning and ending time for the trace files produced by the scripts running on the ApplicationVantage player machines. A separate section appears for each ApplicationVantage Player machine that ran during the test period, .



## Vantage Analyzer Report

In QALoad Analyze, Vantage Analyzer reports are displayed in a dialog box with tabbed windows that display each type of report you selected to generated on the Retrieve Vantage Analyzer Data dialog box.

Vantage Analyzer reports display performance data collected over a specified collection time period. The following reports are available.

- ! **Top N Methods**—A graph that shows the throughput and response time for each of the top *N* methods.
- ! **Top N SQL**—A graph and table that shows the throughput and response time for each of the top *N* SQL statements.
- ! **Top N Servlets**—A graph that shows the throughput and response time for each of the top *N* servlets.
- ! **Top N JSPs**—A graph that shows the throughput and response time for each of the top *N* JSPs.
- ! **Top N Entity EJBs**—A graph that shows the throughput and response time for each of the top *N* entity EJBs.
- ! **Top N Session EJBs**—A graph that shows the throughput and response time for each of the top *N* session EJBs.
- ! **Top N Message Driven EJBs**—A graph that shows the throughput and response time for each of the top *N* message-driven EJBs in a J2EE application.
- ! **Top N .NET ASPs**—A graph that shows the throughput and response time for each of the top *N* ASPs in a .NET application.
- ! **Top N .NET Web Services**—A graph that shows the throughput and response time for each of the top *N* Web services in a .NET application.
- ! **Top N .NET Methods**—A graph that shows the throughput and response time for each of the top *N* methods in a .NET application.
- ! **Top N Stalled Thread**—A graph that shows the throughput and response time for each of the top *N* stalled threads.

Refer to the online documentation for Vantage Analyzer for more information on Vantage Analyzer reports.

## Viewing Test Results in a Web Browser

An important part of the load testing process is viewing and studying the results of a test. You can view the results of a load test not only on a machine where QALoad is installed, but also on any machine with a Web browser. QALoad Analyze provides pre-defined reports as well as .xml and .xsl files which can be customized to meet desired specifications.

When you open a timing file, QALoad Analyze generates a working folder containing all supporting files, reports, and images generated from that timing file. This folder is located in the directory `\Program Files\Compuware\QALoad\TimingFiles\<xxx>.source` where `<xxx>` is the name of the timing file.

The following files are found in the working folder:

File Name	Description
<code>&lt;timingfile&gt;.xml.source</code>	Working folder generated in the Reports folder when opening a timing file. The working folder name is always the <code>&lt;name of the timing file&gt;</code> with a <code>.xml.source</code> extension.
<code>&lt;timingfile&gt;.xml</code>	Original timing file with just enough information to create the QALoad Analyze pre-defined reports. It is a representation of the timing file, <code>&lt;timingfile&gt;.tim</code> .
<code>&lt;timingfile&gt;.complete.xml</code>	Original timing file containing all data collected during a load test. It can be an extremely large file. Use this file if creating a report using <a href="#">XSL</a> that required this data.
<code>summary.htm</code>	Use this <a href="#">HTML</a> file to view the Summary report (or any other available pre-defined report) in any Web browser.

summary.xml	Generated XML file for the Summary report (or any other available pre-defined report.)
summary.xsl	Generated XSL file for the Summary report (or any other available pre-defined report.) Translates the .xml file specifying HTML as its output and generates the HTML report. Use this file to customize the reports by writing in .xsl.
default.htm	Report which provides a main screen to launch any other pre-defined reports. Uses nav.htm for the navigation frame.

When closing a timing file, either keep all of the reports generated from the timing file in the working folder, or delete them. To set this option, see the [Workspace tab on the Options dialog box](#).

To view load test results in a Web browser, click: [How to View Reports](#).

## Publishing or Sharing Test Results

### Exporting Test Data

Convert test data into three convenient formats for viewing or exporting:

HTML — Export data in a detail view or graph to HTML files for convenient viewing in a default Web browser or for sending as attachments in an email message. See [Exporting Data to HTML](#) for instructions.

Word Document — Export data in a detail view, graph, and predefined sections to Microsoft Word for convenient report documentation. See [Exporting to Word](#) for instructions.

RIP — Any time a user fails during load testing, QALoad Analyze generates a RIP File containing user errors. If a timing file has RIP file data, you can export the RIP file to the working folder and view it in QALoad Analyze or the QALoad Script Development Workbench. See [Exporting RIP File Data](#) for instructions.

ApplicationVantage (AV) trace files - When a timing file has ApplicationVantage data, you can export the ApplicationVantage trace files to a working directory and view them within ApplicationVantage. See [Exporting ApplicationVantage Trace Files](#) for instructions.

### Exporting Data to HTML

To export data from a detail view to HTML:

---

1. Open one or several timing files.
2. From the **File** menu, choose **Export Results Setup>To HTML**. The Export Results Setup dialog box appears.
3. Select the reports, views, and timing files to include.
4. Choose **File** or **Email Recipient** from the **Export To** drop down list.
5. Optionally, select **Zip to File** and type a file name.
6. If exporting to file, type the path or click browse to browse to a location for the exported file and click **Export**.
7. If sending to an email recipient, Analyze creates a new Outlook email message that contains all of the pre-defined reports, .xml, .xsl, and files associated with the timing file.

## Exporting to Word

To export data from a detail view to Word

---

1. Open one or several timing files.
2. From the **File** menu, choose **Export Results Setup>To Word**. The Export Results Setup dialog box appears.
3. Select the reports, views, timing files, and predefined sections to include.
4. Type the path or click browse to browse to a location for the exported file and click **Export**.

## Exporting RIP File Data

 **Note:** If a timing file does not contain any RIP data, then a RIP Files group will not exist in the Workspace.

To export the RIP file data to the working folder:

---

1. Open a timing file.
2. In the Workspace, click the RIP Files group.
3. In the tree view, select the appropriate RIP files check box.
4. Right-click on the selected files and choose **Export**. The Browse For Folder dialog box appears.
5. Select the folder you wish to export the RIP file data to. The default is the [working folder](#).
6. Click **OK**. Analyze exports the RIP file to the working folder.

## Exporting ApplicationVantage Trace Files

You can export ApplicationVantage trace files to a working folder or to ApplicationVantage.

 **Note:** If a timing file does not contain any ApplicationVantage data, then the ApplicationVantage group does not exist in the Workspace.

To export the ApplicationVantage data to a working folder:

---

1. Open a timing file.
2. In the Workspace, click the ApplicationVantage group.
3. In the tree view, select the appropriate ApplicationVantage files check box.
4. Right-click on the selected files and choose **Export to File**. The Browse For Folder dialog box appears.
5. Select the folder you wish to export the ApplicationVantage file data to. The default is the [working folder](#).
6. Click **OK**. Analyze exports the ApplicationVantage file to the working folder.

To export the ApplicationVantage data to ApplicationVantage:

---

1. Open a timing file.
2. In the Workspace, click the ApplicationVantage group.

## Using the Player, Script Development Workbench, and Analyze

3. In the tree view, select the appropriate ApplicationVantage files check boxes.
4. Do one of the following:
  - ! Right-click on the selected files and choose Export to ApplicationVantage.
  - ! Double-click the file to export.

The trace files are loaded into the ApplicationVantage database and then opened in ApplicationVantage.

## Exporting Vantage Analyzer Reports to Word

To export Vanatage Analyzer reports to Word:

---

1. Open QALoad Analyze.
2. Generate a [Vantage Analyzer](#) report.
3. Choose **Tools>Export Results>To Word**. The [Export Results Setup](#) dialog box appears.
4. Check **Vantage Analyzer Reports** in the **Reports** tree.
5. Type the path or click browse to browse to a location for the exported file.
6. Click **Export**.

## Sending Email Messages with Test Data

If you are using a Microsoft mail program, QALoad Analyze can send an email message with a timing file or pre-defined report attached. The recipient(s) of the message will be able to open the files in a Web browser.

To email pre-defined reports:

---

1. Choose **File>Export Results>To HTML** or choose **File>Export Results>To Word**.
2. In the **Export Results Setup** dialog box, select reports, views, and timing files that you want to send.
3. In the **Send To** field, choose **Email Recipient**.
4. (optional) Click the **Zip to file** check box to send the files in the compressed .zip format. Type a name for the .zip file in the adjacent field.
5. Click **Export**. If sending HTML, Analyze creates a new Outlook email message that contains all of the pre-defined reports, .xml, .xsl, and files associated with the timing file as attachments, or a single .zip file that contains those files as an attachment. If sending Word, Analyze creates a zip file containing the Word document and places it in a new Outlook email message. Address the email, add message text, and send the message.

## Creating a Zip File of Rest Results

You can create a .zip file of the HTML export to conveniently package all test data into one file for sending to others or storing locally. Analyze creates a file in .zip format, which you can either save to a location on your computer or send as an attachment to an email.

### To create a .zip file:

---

1. Open one or several timing files.
2. Choose **File>Export Results>To HTML**.
3. In the **Export Results Setup** dialog box, select reports, views, and timing files that you want to include in the .zip file.
4. In the **Export To** field, choose **Email Recipient** to email the zip file or choose **File** to save the file on your computer.
5. Click the **Zip to file** check box to send the files in the compressed .zip format. Type a name for the .zip file in the adjacent field.
6. If you chose **File** in step 3, type the path of the location for the .zip file or click the browse button [...] to select a location.
7. Click **Export**. Depending on which option you chose in step 3, Analyze performs one of the following actions:
  - ! If you chose **Email Recipient**, Analyze creates a new Outlook email message that contains all of the pre-defined reports, .xml, .xsl, and files associated with the timing file as a single, compressed .zip file attachment.
  - ! If you chose **File**, Analyze creates a single, compressed .zip file in the location you specified in step 5 that contains all of the pre-defined reports, .xml, .xsl, and files associated with the timing file.



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