LoadRunner Analysis

Software Version: 12.50

User Guide

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Contents

Welcome to the Analysis User Guide

Welcome to the HP LoadRunner Analysis User Guide. This guide describes how to use the LoadRunner Analysis graphs and reports in order to analyze system performance.

You use Analysis after running a load test scenario in the HP LoadRunner Controller or HP Performance Center.

HP LoadRunner, a tool for performance testing, stresses your entire application to isolate and identify potential client, network, and server bottlenecks.

HP Performance Center implements the capabilities of LoadRunner on an enterprise level.

You can access various additional documentation for LoadRunner from **Start > All Programs > HP Software > HP LoadRunner > Documentation**. In icon-based such as Windows 8, search for the User Guide.

What's New in LoadRunner 12.50

Highlights

- JavaScript as a new scripting language for the Web - HTTP/HTML protocol, empowering scripting capabilities.
- Improvements in LoadRunner integration with HP Network Virtualization:
  - Network Virtualization Analytics report provides advanced network performance breakdown, including optimization suggestions.
  - Network Virtualization emulation provides support for additional protocols.
- TruClient record and replay is now supported in Chromium, enabling cross-browser capabilities such as the ability to record in one browser and replay in another.
- LoadRunner Help Center is accessible both locally and online. To access the online help, click http://lrhelp.saas.hp.com/en/12.50/help/.

For details about these highlights, see the sections below and their associated links.

New supported technologies and platforms

- Google Compute Engine available as a cloud provider in the Controller.
- Support of GWT DFE on Linux.
- Support for the latest versions of Internet Explorer, Google Chrome, and Firefox browsers.
- Support for latest versions of Eclipse and Selenium.

- Updated Linux load generator matrix with extended support for 64-bit systems. For details, see the section Supported Linux distributions in the Readme file.

Improved HP Network Virtualization integration

- Simplified process for creating a test with Network Virtualization Integration:
  - Predefined virtual locations.
  - Simpler access to the Network Virtualization settings from the LoadRunner user interface.
- Ability to define virtual locations for all protocols. For details, see the Product Availability Matrix.
- New Analysis graph comparing transaction response times by location.
- Unified licensing management (LoadRunner and Network Virtualization).
- The default installation of LoadRunner includes a Network Virtualization Community license with two free Vusers capable of running in virtual locations.

HP NV Analytics

- Enhanced replay summary in VuGen, with Network Virtualization statistics for Web-based and TruClient - Web protocols.
- A fully functional version of NV Analytics with a 30-day license.
- Network Virtualization Analytics Standalone and Predictor integrations, providing feedback that enables you to improve your Web application performance. Analytics Standalone and Predictor are separate installations, available in the **DVD/Additional Components/HP NV** folder.

For details, see Network Virtualization (NV) Analytics Report.

Protocol enhancements

- **Web - HTTP/HTML:**
  - Ability to create script code in JavaScript as an alternative to C. For details, see General > Script Recording Options.
  - Usability enhancements in GWT DFE mechanism.
  - Ability to generate WebSocket code directly from pcap files. For details, see Analyzing Traffic.
  - Ability to create Vuser Script from HTTP Archive (HAR) files. For details, see Analyzing Traffic.
  - Support for 64-bit recording in Google Chrome.
  - Ability to set default SSL level in Runtime settings. For details, see Preferences View - Internet Protocol.
  - Initial Authentication for NTLM and Kerberos authentications. For details, see **web_set_sockets_option** in the LoadRunner Function Reference.
  - Correlation settings enhancements, with improvements to the TestPad dialog box and ability to exclude content types through the user interface. For details, see Correlations > Configuration Recording Options.

  - Automatic password hiding within script code. For details, see HTTP Properties > Advanced Recording Options.
  - Recording alerts, issuing warnings to indicate that SSL is not being recorded.
- **TruClient:**
  - New protocol, **TruClient - Web**, allows cross-record and replay between Internet Explorer, Firefox, and Chromium browsers. A script recorded with one browser, can be replayed in another browser. For details, see Record a TruClient Script.
    - Ability to convert TruClient - Firefox or TruClient - IE scripts to TruClient - Web.
    - New toolbox step, **If Browser**, allows you to add browser-specific steps.
  - A global watch panel allows you to view variable values using breakpoints. For details, see Debug a TruClient Script.
  - Support for download filters in TruClient - Web scripts. For details, see the hints in the **Network > Download Filters** view of the Runtime settings (F4).
  - TruClient Event Handlers support for the following dialog boxes: alert, confirm, prompt, and authentication.
  - Ability to mark Generic Browser steps as optional. For details, see Enhance a script with Toolbox functions.
  - Improved reporting, by designating the time spent on object identification for optional steps that were not replayed, as wasted time. For details, see Resolve Object Identification Issues.
  - Enhancements to the user interface:
    - Ability to group multiple steps into an action.
    - Ability to rename a function library.
    - Ability to close dialog boxes using the Esc key.
    - Ability to open context sensitive help using the F1 key from all dialog boxes.
    - Ability to apply a dark theme to the TruClient sidebar.
  - A TruClient standalone setup file allows you to install TruClient independent of VuGen. Access the setup file in the **Standalone Applications** folder under the installation media's root folder.
- **Citrix:**
  - Support for XenApp with App-V.
  - Ability to override recorded synchronization area by specifying exact values for top-left point, width, and height of the synchronization area in the Snapshot Pane.
  - Ability to synchronize when launching the Citrix agent. For details, see **ctrx_wait_for_event** in the LoadRunner Function Reference.
  - Improved Citrix Recording Tips with additional tips and guidelines.
- **.NET:**
  - Support for *Async* and *Await* modifiers for Asynchronous Calls.
  - The filter manager is now a dockable pane, accessible from the **View** menu. For details, see .NET

Recording Filter Pane.

  - You can manage a method's inclusion or exclusion from the VuGen editor's context menu. For details, see Guidelines for Setting .NET Filters.

- **Web Services:** Ability to create Vuser script from Fiddler .saz files. For details, see How to Create a Script by Analyzing Traffic.
- **Flex:**
  - Support for RTMP over SSL (RTMPS).. For details, see RTMP/RTMPT Streaming.
  - Ability to insert a text check from the Floating Recording Toolbar.
- **RDP:** Session management improvements, with ability to resume unclosed sessions and terminate sessions at the end of a replay. For details, see the field descriptions in the **RDP > Advanced** view in the Runtime settings.
- **POP3, SMTP, IMAP:** When recording a login step in which an IP address was specified, the script saves the IP address instead of the host name. For details, see Mailing Service Protocols Overview.
- **RTE:** New explicit disconnect API command. For details, see the **TE_disconnect** in the LoadRunner Function Reference.
- **SAP - Web, Siebel - Web:** Support for remote and local proxy recording. For details, see Recording via a Proxy - Overview.
- **Java over HTTP:** Support for DFE extensions (with the exception of GWT).
- **Windows Sockets:** Support for SSL. For details, see **lrs_start_ssl** in the LoadRunner Function Reference.

VuGen replay summary improvements

- Improved replay statistics details and ability to view results for script actions.
- Export replay statistics to PDF.
- Link to Network Virtualization Analytics reports for Web-based and TruClient protocols.

For details, see Replay Summary Pane.

VuGen general usability improvements

- JavaScript language support for Web - HTTP/HTML protocol. For details, see General > Script Recording Options.
- Proxy recording enhancements: Support of traffic filtering, client-side certificates, and error detection. For details, see Recording via a Proxy - Overview.
- Ability to enable/disable Async rules when recording a script. For details, see Asynchronous Options Dialog Box.
- Correlation support for JSON content type. For details, see **web_reg_save_param_json** in the LoadRunner Function Reference.
- Ability to edit and save all file types in VuGen code Editor Pane.

- Enhanced keyboard support for the Runtime Settings views. For details, see Runtime Settings Overview.

Analysis improvements

- Support for HTML reports in Google Chrome and Firefox browsers. For details, see "HTML Reports" on page 373.
- New "TruClient - Native Mobile Graphs" on page 354 graphs were added showing CPU, memory, and free memory on device.
- Performance and Graphs UI improvements.
- New "Transaction Response Time by Location Graph" on page 143.

Security enhancements

- Updated to OpenSSL version 1.0.2d incorporating all of the latest security fixes.
- FIPS Windows compatibility.

Load generator improvements

- Docker installation for Linux load generators. For details, see the LoadRunner Installation Guide.

Increased documentation accessibility

- LoadRunner Help Center is available on the Web. You can switch between the online and local Help Centers using the button at the top right of the Help Center page.

Integrations with latest HP product versions

- **HP Mobile Center:**
  - TruClient - Native Mobile protocol integration with version 1.50 of HP Mobile Center. For details see the Mobile Center Help.
  - New TruClient - Native Mobile Monitors and "TruClient - Native Mobile Graphs" on page 354 showing CPU, memory, and free memory on mobile device.
- **HP Service Virtualization:**
  - Integration with HP Service Virtualization 3.70.
  - Auto deploy functionality allowing services to be deployed automatically when test run begins. For details, see How to Use Service Virtualization when Designing Scenarios.
  - Improved HP Service Virtualization Setup Dialog Box for configuring services before the test run.
  - Improved HP Service Virtualization Runtime Dialog Box allowing interaction with services during runtime.
- **Jenkins plugin:** HP Application and Automation Tools integration with Jenkins version 1.602.

- Integration with recent versions of the following HP products:
  - HP Diagnostics
  - HP SiteScope
  - HP Unified Functional Testing (UFT)
  - HP Application Lifecycle Management (ALM)
  - HP Performance Center
  - HP Business Process Monitor (BPM)

For more details about the supported integrations for LoadRunner, see the HP Software Integrations Support Matrices.

For details about the supported versions, see the Product Availability Matrix.

Analysis

HP Analysis is a component of LoadRunner, enabling you to create graphs and reports for analyzing system performance after a test run.

To learn more, see "Introducing Analysis" below.

Introducing Analysis

Welcome to LoadRunner Analysis, HP's tool for gathering and presenting load test data. When you execute a load test scenario, Vusers generate result data as they perform their transactions. The Analysis tool provides graphs and reports enabling you to view and understand the data, and analyze system performance after a test run.

What do you want to do?

- Set up Analysis
- Create graphs
- Generate reports
- Define a Service Level Agreement

See also:

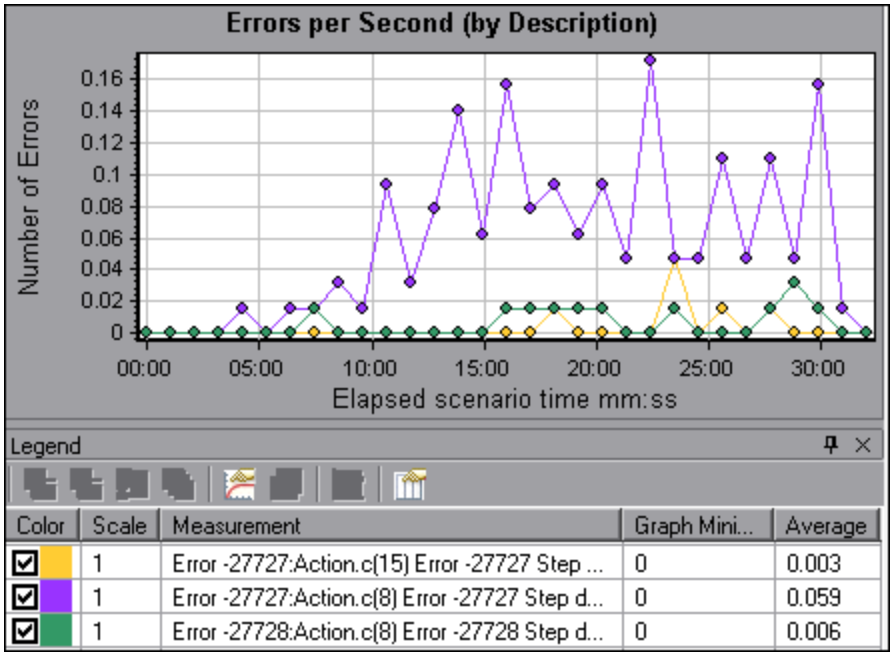
- Results overview
- Analysis API

Results Overview

To view a summary of the results *after* test execution, use one or more of the following tools:

- **Vuser log files.** These files contain a full trace of the load test scenario run for each Vuser. These files are located in the scenario results folder. (When you run a Vuser script in standalone mode, these files are stored in the Vuser script folder.)
- **Controller Output window.** The output window displays information about the load test scenario run. If your scenario run fails, look for debug information in this window.
- **Analysis Graphs.** Standard and protocol-specific graphs help you determine system performance and provide information about transactions and Vusers.
  - You can compare multiple graphs by combining results from several load test scenarios or merging several graphs into one.

- Each graph has a legend which describes the metrics in the graph. You can also filter your data and sort it by a specific field.



- **Analysis Graph Data and Raw Data Views.** These views display the actual data used to generate the graph in a spreadsheet format. You can copy this data into external spreadsheet applications for further processing.
- **Analysis Reports.** This utility enables you to generate a summary of each graph. The report summarizes and displays the test's significant data in graphical and tabular format. You can generate reports based on customizable report templates.

Analysis Toolbars

This section describes the buttons that you access from the main Analysis toolbars.

Common Toolbar

This toolbar is always accessible from the toolbar at top of the page and includes the following buttons:

User interface elements are described below:

UI Element	Description
	Create a new session.
	Open an existing session.

UI Element	Description
	Generate a Cross Result graph.
	Save a session.
	Print item.
	Create an HTML report.
	View runtime settings.
	Set global filter options.
	Configure SLA rules
	Analyze a transaction.
	Undo the most recent action.
	Reapply the last action that was undone.
	Apply filter on summary page
	Export Summary to Excel

Graph Toolbar

This toolbar is accessible from the top of the page when you have a graph open and includes the following buttons

User interface elements are described below:

UI Element	Description
	Set filter settings.
	Clear filter settings.

UI Element	Description
	Set granularity settings.
	Merge graphs.
	Configure auto correlation settings.
	View raw data.
	Add comments to a graph.
	Add arrows to a graph.
	Set display options.

Analysis API

The LoadRunner Analysis API enables you to write programs to perform some of the functions of the Analysis user interface, and to extract data for use in external applications. Among other capabilities, the API allows you to create an analysis session from test results, analyze raw results of an Analysis session, and extract key session measurements for external use. You can also use the API to launch an application from the LoadRunner Controller at the completion of a test.

To view this help from a LoadRunner machine, go to **Start > All Programs > HP Software > HP LoadRunner > Documentation > Analysis API Reference**. In icon-based desktops, such as Windows 8, search for **API** and select **Analysis API Reference** from the results.

> **Note:** The Analysis API is only supported for 32-bit environments. If you use Visual Studio to develop your script, make sure to define the platform as x86 in the project options.

Workflow

Click on one of the images below to learn more about the Analysis workflow.

What do you want to do?

- Configure Analysis
- Define a Service Level Agreement
- Create graphs
- Generate reports

See also:

- Analysis Basics
- Troubleshooting Analysis

Analysis Basics

Creating Analysis Sessions

When you run a load test scenario, LoadRunner stores the runtime data in a result file with an **.lrr** extension. LoadRunner **Analysis** is the utility that processes this data and generates graphs and reports.

When you work with the LoadRunner Analysis, you work within an Analysis *session*. This session contains one or more sets of scenario results (**.lrr** file). Analysis stores the display information and layout settings for the active graphs in a file with an **.lra** extension.

Starting Analysis

You can open Analysis as an independent application or directly from the Controller. To open Analysis as an independent application, choose one of the following:

- **Start** > **All Programs > HP Software > HP LoadRunner > Analysis**
- The Analysis shortcut on the desktop

To open Analysis directly from the Controller, click the **Analysis** button on the toolbar or select **Results > Analyze Result**. This option is only available after running a load test scenario. Analysis takes the latest result file from the current scenario, and opens a new session using these results. You can also instruct the Controller to automatically open Analysis after it completes scenario execution by selecting **Results > Auto Load Analysis**.

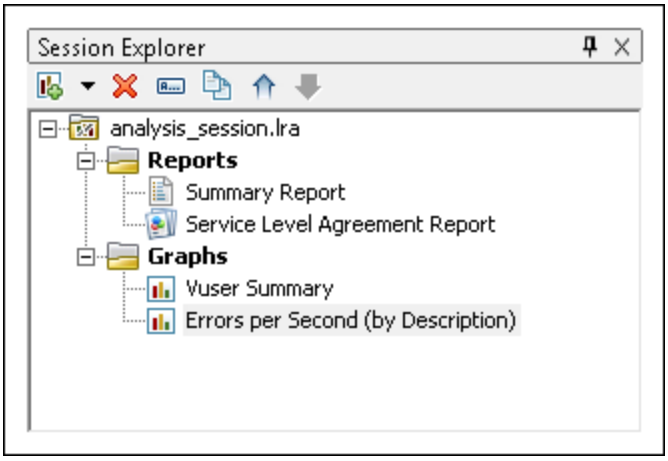
Collating Execution Results

When you run a load test scenario, by default all Vuser information is stored locally on each Vuser host. After scenario execution, the results from all of the hosts are automatically collated or consolidated in the results folder.

You disable automatic collation by choosing **Results** > **Auto Collate Results** from the Controller window, and clearing the check mark adjacent to the option. To manually collate results, choose **Results** > **Collate Results**. If your results have not been collated, Analysis will automatically collate the results before generating the analysis data.

Session Explorer Window

This window displays a tree view of the items (graphs and reports) that are open in the current session. When you click an item in the Session Explorer, it is activated in the main Analysis window.



To access	Use one of the following: • **Session Explorer** • **Session Explorer > Reports > Summary Report** • **Session Explorer > Reports >Service Level Agreement Report** • **Session Explorer >** **> Analyze Transaction** • **Session Explorer > Graphs**

User interface elements are described below:

UI Element	Description
	Add a new graph or report to the current Analysis session. Opens the Open a New Graph dialog box. For details, see "Open a New Graph Dialog Box" on page 125
	Delete the selected graph or report.
	Rename the selected graph or report.

UI Element	Description
	Create a copy of the selected graph.

Analysis Window Layouts

This section describes ways to customize the layout of the windows of the Analysis session.

Open Windows

You can open a window or restore a window that was closed by selecting the name of the relevant window from the **Windows** menu.

Lock/Unlock the Layout of the Screen

Select **Windows > Layout Locked** to lock or unlock the layout of the screen.

Restore the Window Placement to the Default Layout

Select **Windows > Restore Default Layout** to restore the placement of the Analysis windows to their default layout.

> **Note:** This option is available only when no Analysis session is open.

Restore the Window Placement to the Classic Layout

Select **Windows > Restore Classic Layout** to restore the placement of the Analysis windows to their classic layout. The classic layout resembles the layout of earlier versions of Analysis.

> **Note:** This option is available only when no Analysis session is open.

Reposition and Dock Windows

You can reposition any window by dragging it to the desired position on the screen. You can dock a window by dragging the window and using the arrows of the guide diamond to dock the window in the desired position.

> **Note:**
>
> - Only document windows (graphs or reports) can be docked in the center portion of the screen.

- **Windows > Layout Locked** must not be selected when repositioning or docking windows.

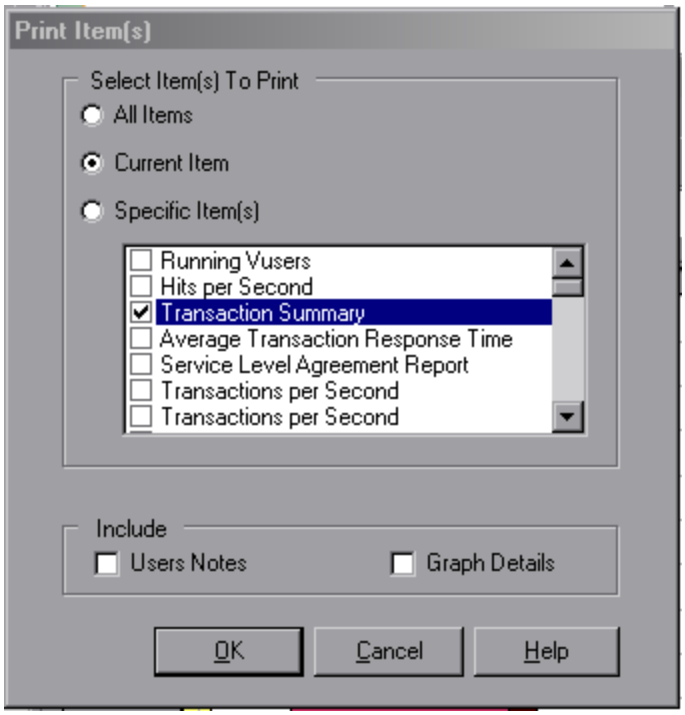
Using Auto Hide

You can use the Auto Hide feature to minimize open windows that are not in use. The window is minimized along the edges of the screen.

Click the **Auto Hide** button on the title bar of the window to enable or disable Auto Hide.

Printing Graphs or Reports

This dialog box enables you to print graphs or reports



To access	Do one of the following: • **File > Print** • **Main toolbar >**

User interface elements are described below:

UI Element	Description
Select Items to Print	• **All Items.** Prints all graphs and reports in the current session. • **Current Item.** Prints the graph or report currently selected in the Session

UI Element	Description
	Explorer. • **Specific Item(s).** Select the graphs or reports to print.
Include	• **User Notes.** Prints the notes in the User Notes window. • **Graph Details.** Prints details such as graph filters and granularity settings.

Configuring Analysis

Summary Data Versus Complete Data

In large load test scenarios, with results exceeding 100 MB, it can take a long time for Analysis to process the data. When you configure how Analysis generates result data from load test scenarios, you can choose to generate complete data or summary data.

Complete data refers to the result data after it has been processed for use within Analysis.

Summary data refers to the raw, unprocessed data. The summary graphs contain general information such as transaction names and times. Some fields are not available for filtering when you work with summary graphs.

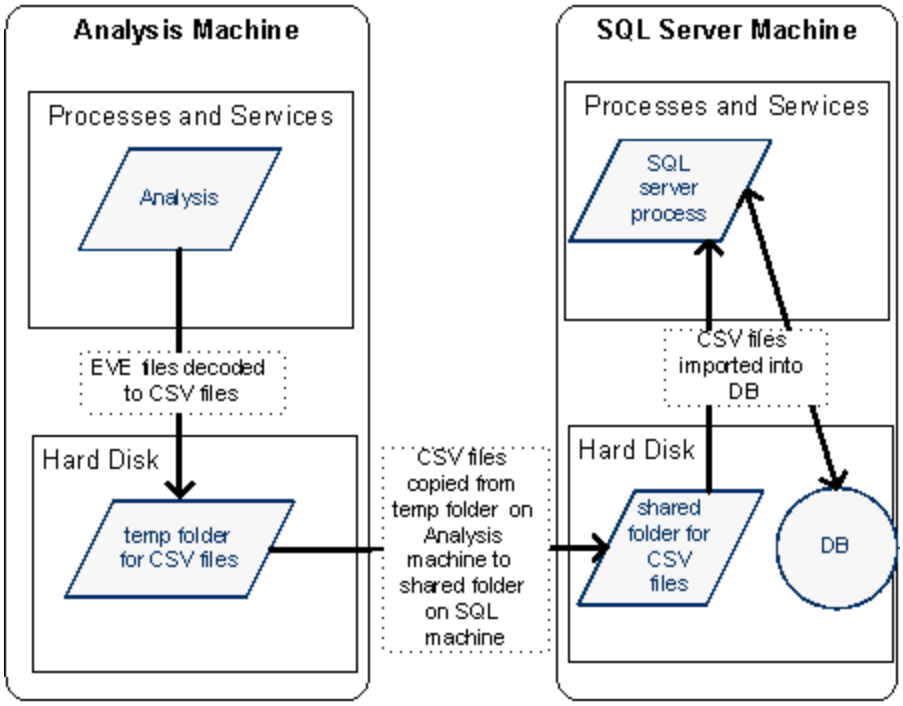
Note that some graphs will not be available when viewing only the summary data.

Importing Data Directly from the Analysis Machine

If you are using an SQL server / MSDE machine to store Analysis result data, you can configure Analysis to import data directly from the Analysis machine.

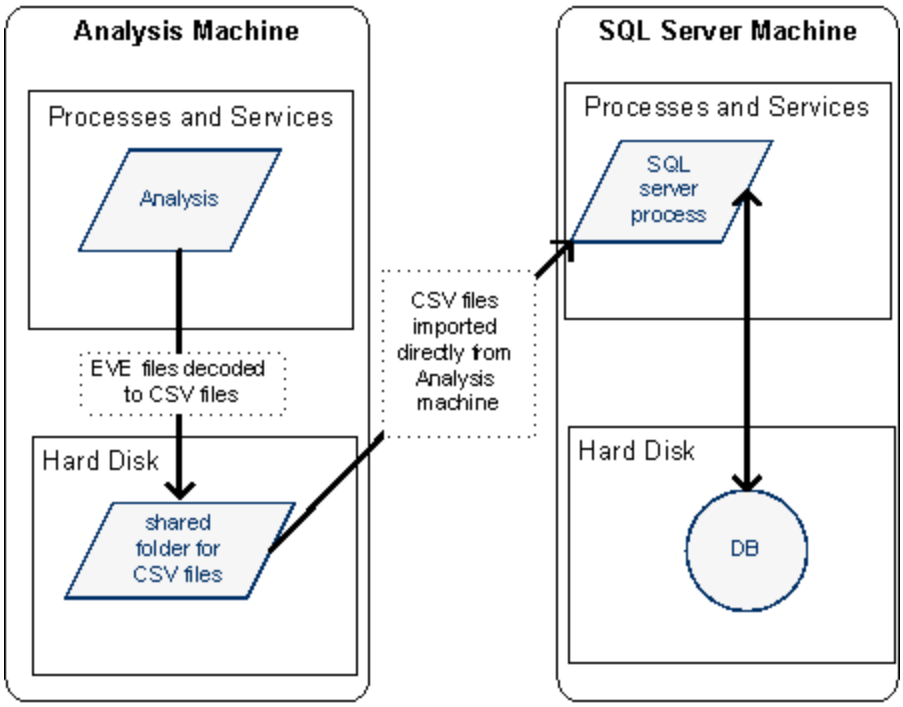
Importing Data from the SQL Server

If you do not select the option to import data directly from the Analysis machine, Analysis creates CSV files in a local temp folder. The CSV files are copied to a shared folder on the SQL Server machine. The SQL server engine then imports the CSV files into the database. The following diagram illustrates the data flow:



Importing Data from the Analysis Machine

If you selected the option to import data directly from the Analysis machine, Analysis creates the CSV files in a shared folder on the Analysis machine and the SQL server imports these CSV files from the Analysis machine directly into the database. The following diagram illustrates the data flow:



How to Configure Settings for Analyzing Load Test Results

The following steps describe how to configure certain Analysis settings that significantly impact the way in which Analysis analyzes load test results.

Configure how Analysis processes result data

You define how Analysis processes result data from load test scenarios in the **Tools > Options > Result Collection** tab. For example, you can configure how Analysis aggregates result data, to what extent the data is processed, and whether output messages are copied from the Controller. For details on the user interface, see "Result Collection Tab (Options Dialog Box)" on page 33.

Configure template settings

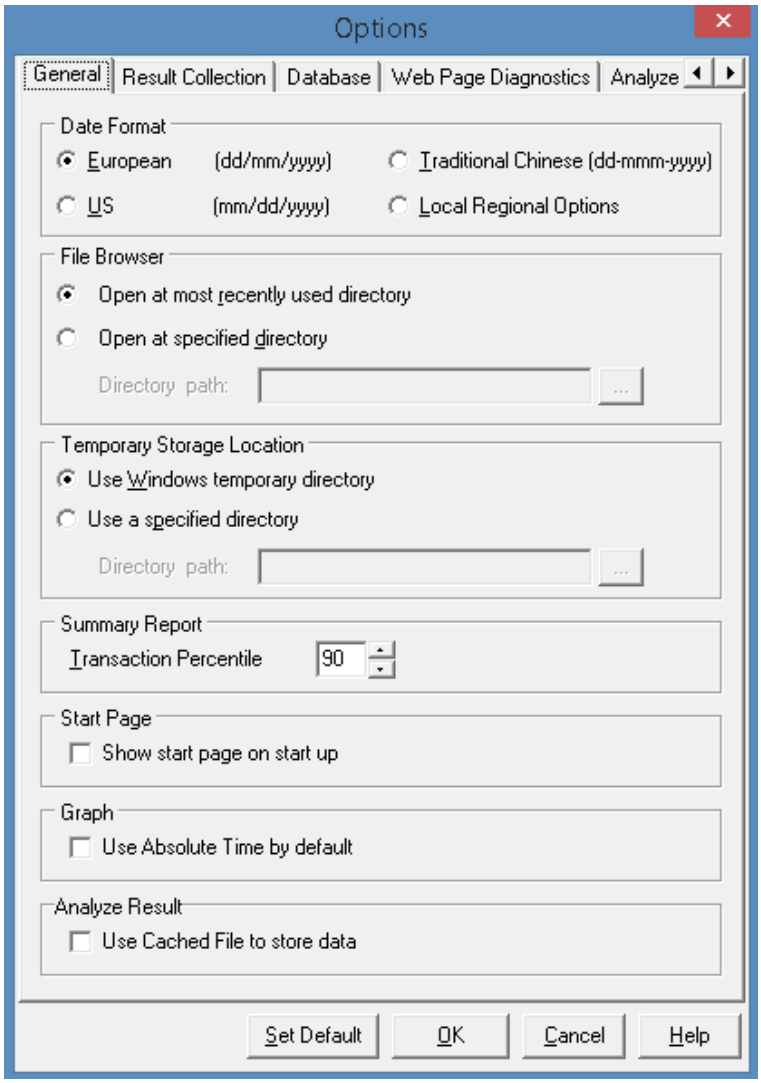
For details on the user interface, see "Apply/Edit Template Dialog Box" on page 84.

Configure analysis of transactions

You configure how transactions are analyzed and displayed in the summary report in the **Summary Report** area of the **Tools > Options > General** tab. For details, see the description of "General Tab (Options Dialog Box)" below.

General Tab (Options Dialog Box)

This tab enables you to configure general Analysis options, such as date formats, temporary storage location, and transaction report settings.



To access	**Tools > Options > General** tab.
See Also	"How to Configure Settings for Analyzing Load Test Results" on the previous page

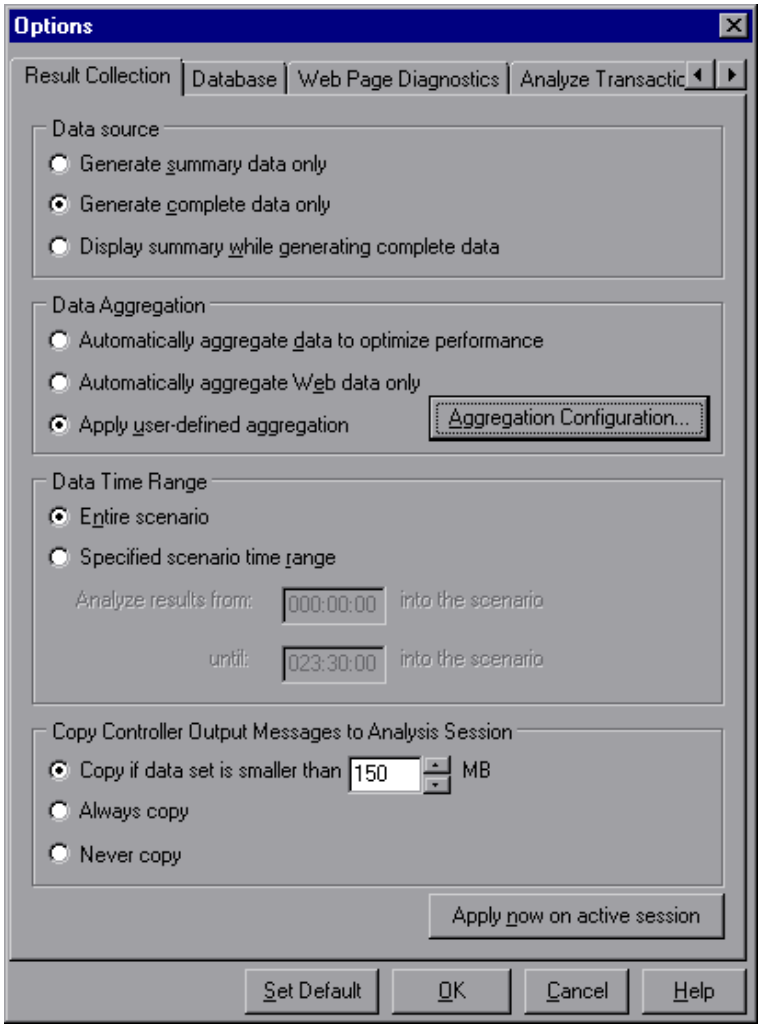
User interface elements are described below:

UI Element	Description
Date Format	Select a date format for storage and display. (For example, the date displayed in the Summary report) • **European.** Displays the European date format. • **US.** Displays the U.S. date format. • **Traditional Chinese.** Displays the Traditional Chinese date format.

UI Element	Description
	• **Local Regional Options.** Displays the date format as defined in the current user's regional settings. **Note:** When you change the date format, it only affects newly created Analysis sessions. The date format of existing sessions is not affected.
File Browser	Select the directory location at which you want the file browser to open. • **Open at most recently used directory.** Opens the file browser at the previously used directory location. • **Open at specified directory.** Opens the file browser at a specified directory. In the **Directory path** box, enter the directory location where you want the file browser to open.
Temporary Storage Location	Select the directory location in which you want to save temporary files. • **Use Windows temporary directory.** Saves temporary files in your Windows temp directory. • **Use a specified directory.** Saves temporary files in a specified directory. In the **Directory path** box, enter the directory location in which you want to save temporary files.
Summary Report	Set the following transaction settings in the Summary Report: • **Transaction Percentile.** The Summary Report contains a percentile column showing the response time of 90% of transactions (90% of transactions that fall within this amount of time). To change the value of the default 90 percentile, enter a new figure in the **Transaction Percentile** box. The Transaction Percentile value is only applied to newly created templates . To create a new template, select **Tools >Templates**. For details, see "Apply/Edit Template Dialog Box" on page 84.
Start Page	Select **Show start page on start up** to display the **Welcome to Analysis** tab every time you open the Analysis application.
Graph	Select the way in which graphs shows the Elapsed Scenario Time on the x-axis. **Use Absolute time by default.** Shows an elapsed time based on the absolute time of the machine's system clock. If not checked, the graphs show the elapsed time relative to the start of the scenario. The default is unchecked.
Analyze Result	**Use cached file to store data.**Uses a cached file to store the analysis data. This option should only be used when analyzing a large result file. Enabling this option may increase the time required to analyze and open the results.

Result Collection Tab (Options Dialog Box)

This tab enables you to configure how Analysis processes result data from load test scenarios.



To access	**Tools > Options > Result Collection** tab.
Important information	The options in this tab are pre-defined with default settings. It is recommended to use these default settings unless there is a specific need to change them. Changing some of the settings, such as default aggregation, can significantly impact the amount of data stored in the Analysis database.
See Also	"How to Configure Settings for Analyzing Load Test Results" on page 30

User interface elements are described below:

UI Element	Description
Data Source	In this area, you configure how Analysis generates result data from load

UI Element	Description
	test scenarios. **Complete data** refers to the result data after it has been processed for use within Analysis. **Summary data** refers to the raw, unprocessed data. The summary graphs contain general information such as transaction names and times. For more details on summary data versus complete data, see "Summary Data Versus Complete Data" on page 28. Select one of the following options: • **Generate summary data only.** If this option is selected, Analysis will not process the data for advanced use with filtering and grouping. • **Generate complete data only.** If this option is selected, the graphs can then be sorted, filtered, and manipulated. • **Display summary data while generating complete data.** Enables you to view summary data while you wait for the complete data to be processed. **Note:** If you selected one of the options to generate complete data, you can define how Analysis aggregates the complete data in the **Data Aggregation** area.
Data Aggregation	If you chose to generate complete data in the **Data Source** area, you use this area to configure how Analysis aggregates the data. Data aggregation is necessary in order to reduce the size of the database and decrease processing time in large scenarios. Select one of the following options: • **Automatically aggregate data to optimize performance.** Aggregates data using built-in data aggregation formulas. • **Automatically aggregate Web data only.** Aggregates Web data only using built-in data aggregation formulas. • **Apply user-defined aggregation.** Aggregates data using settings you define. Click the **Aggregation Configuration** button to open the Data Aggregation Configuration Dialog Box and define your custom aggregation settings. For details on the user interface, see "Data Aggregation Configuration Dialog Box (Result Collection Tab)" on page 36.
Data Time Range	In this area you specify whether to display data for the complete duration of the scenario, or for a specified time range only. Select one of the

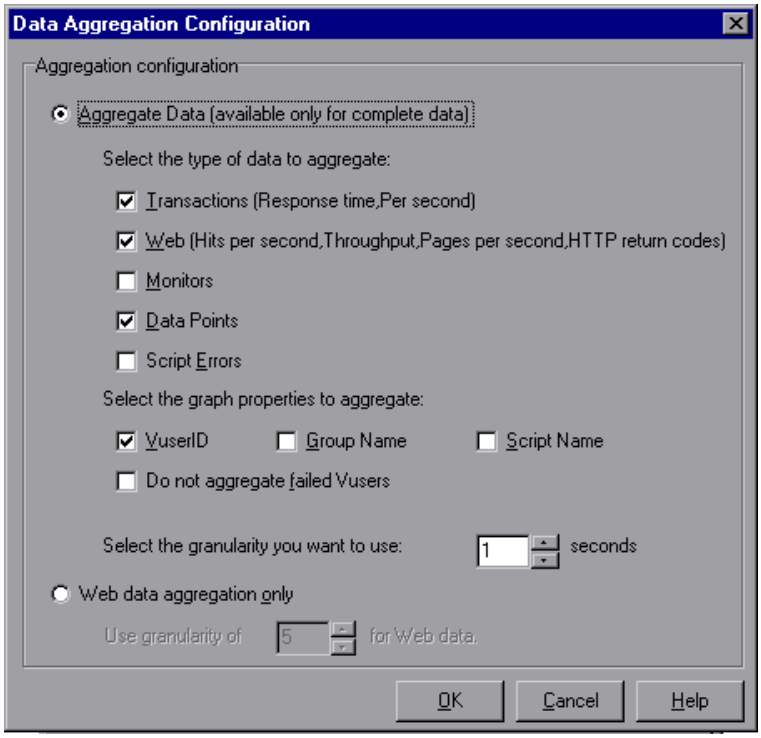
UI Element	Description

	following options:
	• **Entire scenario.** Displays data for the complete duration of the load test scenario
	• **Specified scenario time range.** Specify the time range using the following boxes:
	  • **Analyze results from.** Enter the amount of scenario time you want to elapse (in hh:mm:ss format) before Analysis begins displaying data.
	  • **until.** Enter the point in the scenario (in hh:mm:ss format) at which you want Analysis to stop displaying data.
	Note:
	• It is not recommended to use the **Specified scenario time range** option when analyzing the Oracle - Web and Siebel DB Diagnostics graphs, since the data may be incomplete.
	• The **Specified scenario time range** settings are not applied to the Connections and Running Vusers graphs.

Copy Controller Output Messages to Analysis Session	Controller output messages are displayed in Analysis in the Controller Output Messages window. Select one of the following options for copying output messages generated by the Controller to the Analysis session. • **Copy if data set is smaller than X MB.** Copies the Controller output data to the Analysis session if the data set is smaller than the amount you specify. • **Always Copy.** Always copies the Controller output data to the Analysis session. • **Never Copy.** Never copies the Controller output data to the Analysis session.
Apply now on active session	Click this button to apply the settings in the Result Collection tab to the current session. The Controller output data is copied when the Analysis session is saved.

Data Aggregation Configuration Dialog Box (Result Collection Tab)

If you choose to generate the complete data from the load lest scenario results, Analysis aggregates the data using either built-in data aggregation formulas, or aggregation settings that you define. This dialog box enables you to define custom aggregation settings.



To access	Select **Tools > Options > Result Collection**. Select the **Apply user-defined aggregation** option and click the **Aggregation Configuration** button.
Important information	In this dialog box, you can select granularity settings. To reduce the size of the database, increase the granularity. To focus on more detailed results, decrease the granularity.

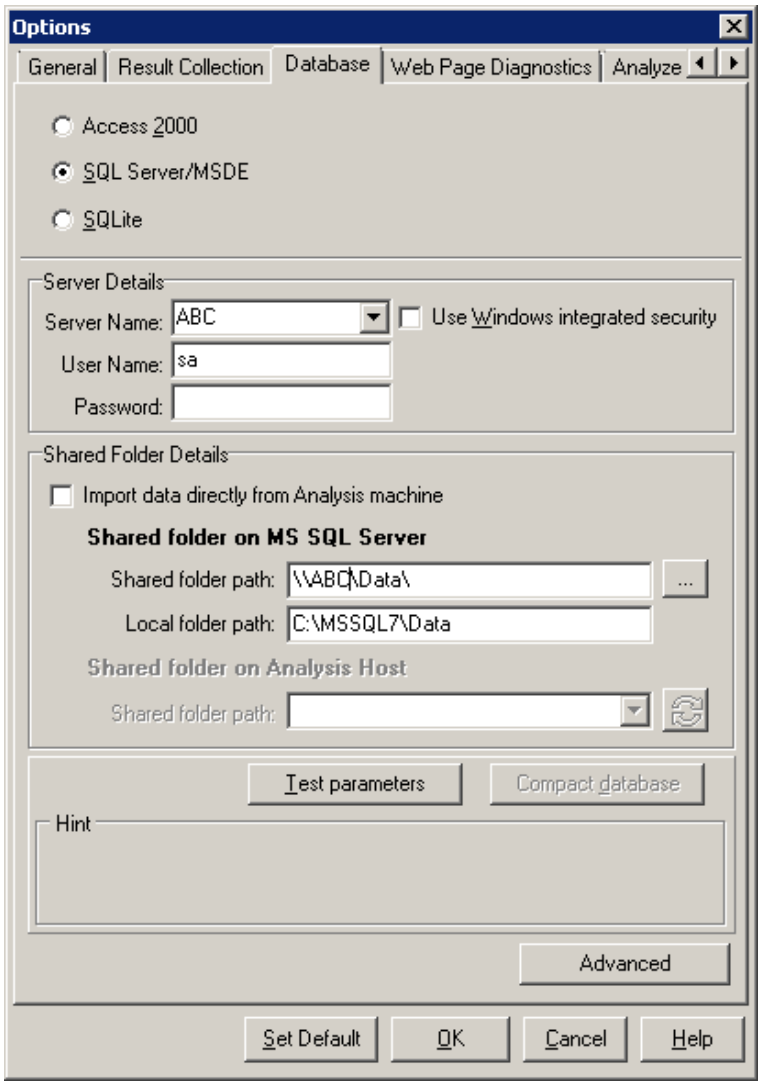
User interface elements are described below:

UI Element	Description
Aggregate Data	Select this option to define your custom aggregation settings using the following criteria: • **Select the type of data to aggregate.** Use the check boxes to select the types of graphs for which you want to aggregate data. • **Select graph properties to aggregate**. Use the check boxes to select the graph properties you want to aggregate.

UI Element	Description
	To exclude data from failed Vusers, select **Do not aggregate failed Vusers**. **Note:** You will not be able to drill down on the graph properties you select in this list. • **Select the granularity you want to use.** Specify a custom granularity for the data. The minimum granularity is 1 second.
Web data aggregation only	Select this option to aggregate Web data only. In the **Use Granularity of X for Web data** box, specify a custom granularity for Web data. The minimum granularity is 1 second. By default, Analysis summarizes Web measurements every 5 seconds.

Database Tab (Options Dialog Box)

This tab enables you to specify the database in which to store Analysis session result data and to configure the way in which CSV files will be imported into the database.



To access	**Analysis > Tools > Options > Database** tab.
Important information	Analysis data can be saved in one of three formats. Select the format based on the size of the analysis session file, as shown in the table below:

Size of the Analysis session file	**Recommended format**
• Less than 2 GB	Access 2000
• 2 GB to 10 GB	SQL Server/MSDE Select SQL Server/MSDE if you need to work in multithread mode.
• More than 10 GB	SQLite

	Note that the SQLite format allows you to store up to 32 terabytes of data.

> **Note:** Both the Access 2000 database format and the SQLite format are embedded databases. The session directory contains both the database and the analysis data.

See also	"Importing Data Directly from the Analysis Machine" on page 28

User interface elements are described below:

UI Element	Description
Access 2000	Instructs LoadRunner to save Analysis result data in an Access 2000 database format. This setting is the default.
SQL Server/MSDE	Instructs LoadRunner to save Analysis result data on an SQL server / MSDE machine. If you select this option, you have to complete the **Server Details** and **Shared Folder Details**, described below.
SQLite	Instructs LoadRunner to save Analysis result data in an SQLite database format. If you choose this format, you will not be able to work in multithread mode.
Server Details area	SQL server / MSDE machine details. See description below.
Shared Folder Details area	SQL server / MSDE machine shared folder details. See description below.
Test parameters	Depending on which database you are using, this button performs the following action: • **For Access.** Checks the connection parameters to the Access database and verifies that the **delimiter** on your machine's regional settings matches the Microsoft JET delimiter on the database machine. • **For SQL server / MSDE.** Checks the connection parameters, the existence of a shared server directory, whether there are write permissions on the shared server directory, and whether the shared and physical server directories are synchronized. • **For SQLite.** This button is disabled.
Compact database	When you configure and set up your Analysis session, the database containing the results may become fragmented. As a result, it will use excessive disk space. For Access databases, the **Compact database** button enables you to repair and compress your results and optimize your database. This button is

UI Element	Description
	disabled if you choose **SQLite**. **Note:** Long load test scenarios (duration of two hours or more) will require more time for compacting.
Advanced	Opens the Advanced Options dialog box, allowing you to increase performance when processing LoadRunner results or importing data from other sources.This button is disabled if you choose **SQLite**. For user interface details see "Advanced Options Dialog Box (Database Tab)" on the next page.

Server Details Area

If you choose to store Analysis result data on an SQL server / MSDE machine, you need to complete the server details. User interface elements are described below:

UI Element	Description
Server Name	The name of the machine on which the SQL server / MSDE is running.
Use Windows integrated security	Enables you to use your Windows login, instead of specifying a user name and password. By default, the user name "sa" and no password are used for the SQL server.
User Name	The user name for the master database.
Password	The password for the master database.

Shared Folder Details Area

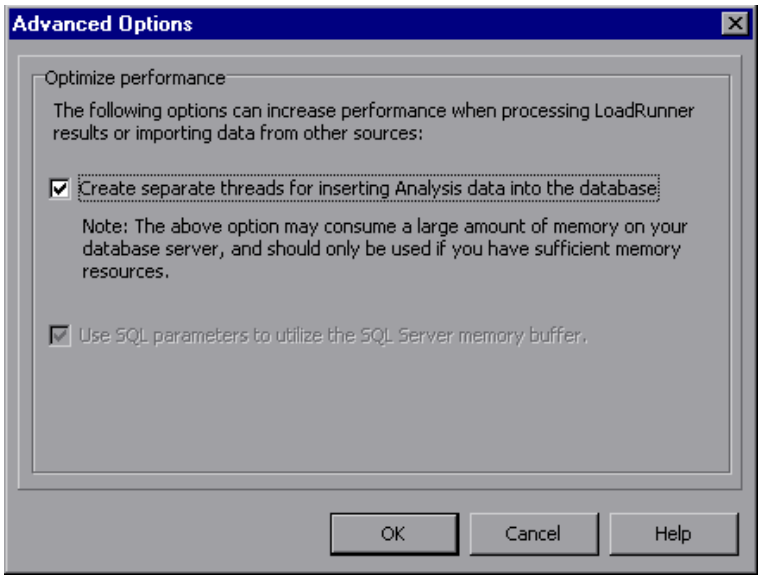
If you store Analysis result data on an SQL server / MSDE machine, you need to provide the shared folder details. User interface elements are described below:

UI Element	Description
Import Data Directly from Analysis machine	Select this option to import data directly from the Analysis machine. For details on this option, see "Importing Data Directly from the Analysis Machine" on page 28.
Shared Folder on MS SQL	• **Shared folder path.** Enter a shared folder on the SQL server / MSDE machine. For example, if your SQL server's name is `fly`, enter `\\fly\<Analysis database folder>\`.

UI Element	Description
Server	This folder has different functions, depending on how you import the Analysis data: • **If you did not select the option to import data directly from the Analysis machine**, this folder stores permanent and temporary database files. Analysis results stored on an SQL server / MSDE machine can only be viewed on the machine's local LAN. • **If you selected the option to import data directly from the Analysis machine**, this folder is used to store an empty database template copied from the Analysis machine. • **Local folder path.** Enter the real drive and folder path on the SQL server / MSDE machine that correspond to the above shared folder path. For example, if the Analysis database is mapped to an SQL server named `fly`, and `fly` is mapped to drive D, enter `D:\<Analysis database folder>`. If the SQL server / MSDE and Analysis are on the same machine, the logical storage location and physical storage location are identical.
Shared Folder on Analysis Host	If you selected the option to import data directly from the Analysis machine, the **Shared folder path** box is enabled. Analysis detects all shared folders on your Analysis machine and displays them in a drop-down list. Select a shared folder from the list. **Note:** • Ensure that the user running the SQL server (by default, SYSTEM) has access rights to this shared folder. • If you add a new shared folder on your machine, you can click the refresh button to display the updated list of shared folders. • Analysis creates the CSV files in this folder and the SQL server imports these CSV files from the Analysis machine directly into the database. This folder stores permanent and temporary database files.

Advanced Options Dialog Box (Database Tab)

This dialog box enables you to increase performance when processing LoadRunner results or importing data from other sources.



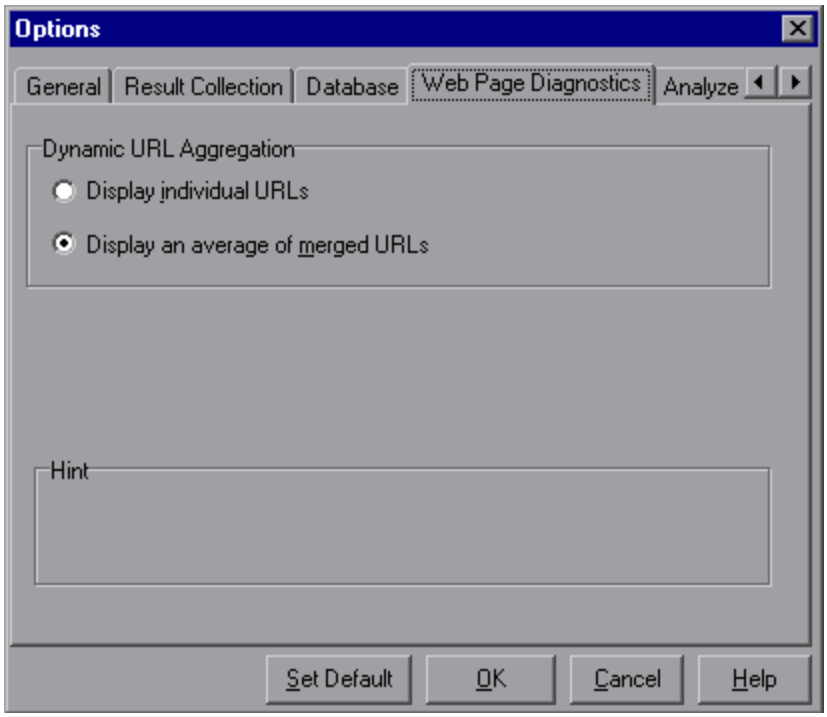
To access	**Analysis** > **Tools** > **Options** > **Database** tab > **Advanced** button
See also	"Database Tab (Options Dialog Box)" on page 37

User interface elements are described below:

UI Element	Description
Create separate threads for inserting Analysis data into the database.	This option may consume a large amount of memory on your database server, and should only be used if you have sufficient memory resources.
Use SQL parameters to utilize the SQL Server memory buffer.	This option is only enabled when you store Analysis result data on an SQL server or MSDE machine.

Web Page Diagnostics Tab (Options Dialog Box)

This tab enables you to set Web page breakdown options. You can choose how to aggregate the display of URLs that include dynamic information, such as a session ID. You can display these URLs individually, or you can unify them and display them as one line with merged data points.



To access	**Tools > Options > Web Page Diagnostics** tab

User interface elements are described below:

UI Element	Description
Display individual URLs	Displays each URL individually
Display an average of merged URLs	Merges URLs from the same script step into one URL, and displays it with merged (average) data points.

Session Information Dialog Box (Options Dialog Box)

This dialog box enables you to view a summary of the configuration properties of the current Analysis session.

To access	File > Session Information

User interface elements are described below:

UI Element	Description
Aggregation Properties...	Displays the type of data aggregated, the criteria according to which it is aggregated, and the time granularity of the aggregated data.
Server Properties...	Displays the properties of the SQL server and MSDE databases.
Aggregation	Indicates whether the session data has been aggregated.
Data Collection Mode	Indicates whether the session displays complete data or summary data.
Data Time Filter	Indicates whether a time filter has been applied to the session.
Database Name	Displays the name and directory path of the database.
Database Type	Displays the type of database used to store the load test scenario data.
Results	Displays the name of the LoadRunner result file.

UI Element	Description
Session Name	Displays the name of the current session.
Web Granularity	Displays the Web granularity used in the session.

Viewing Load Test Scenario Information

Viewing Load Test Scenario Information

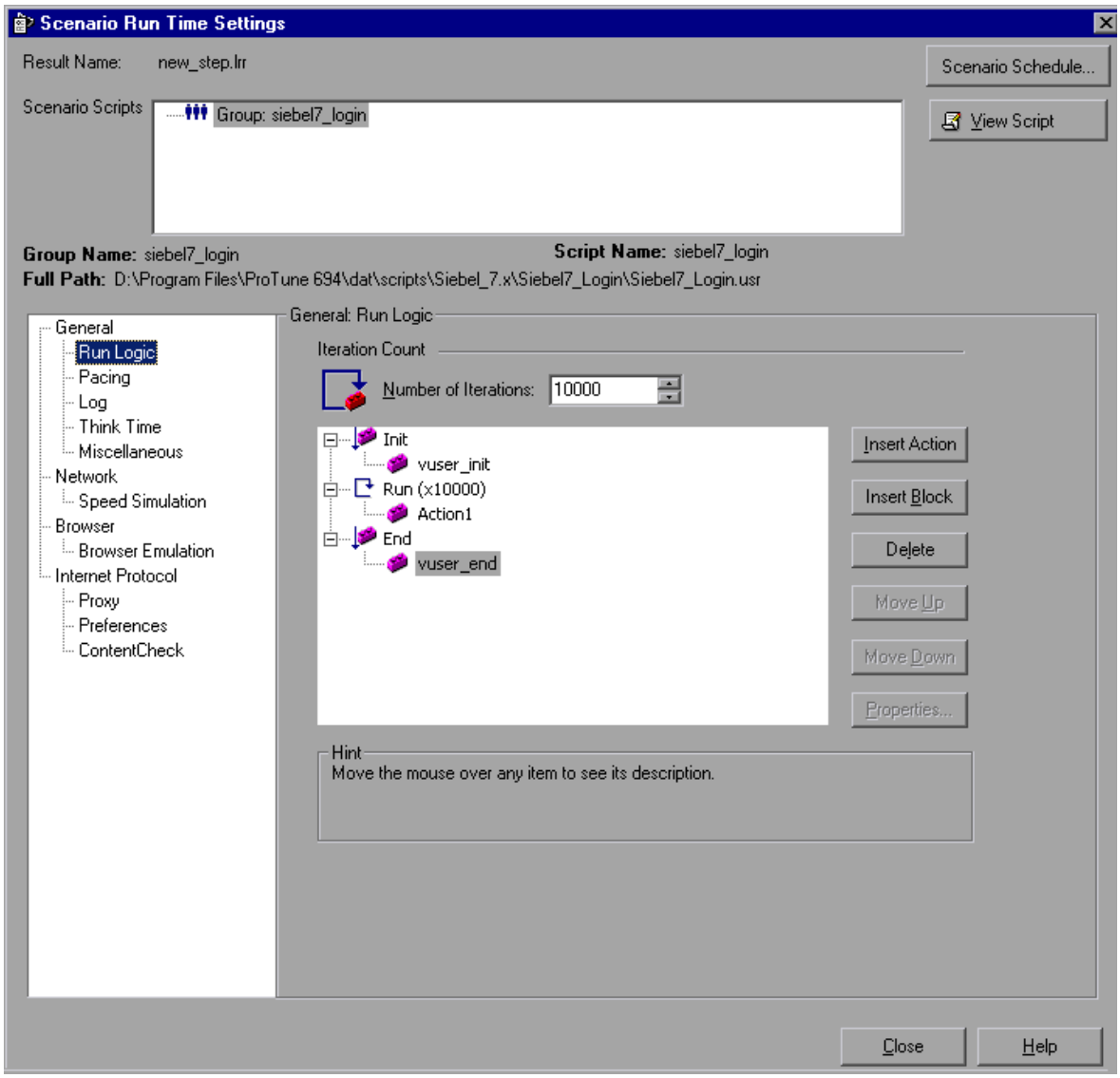
In Analysis, you can view information about the load test scenario which you are analyzing. You can view the scenario runtime settings and output messages that were generated by the Controller during the scenario.

You can view information about the Vuser groups and scripts that were run in each scenario, as well as the runtime settings for each script in a scenario, in the Scenario runtime settings dialog box.

> **Note:** The runtime settings allow you to customize the way a Vuser script is executed. You configure the runtime settings from the Controller or Virtual User Generator (*VuGen*) before running a scenario. For information on configuring the runtime settings, refer to the online help in those products.

Select **File > View Scenario Runtime Settings**, or click the **View runtime settings** button on the toolbar.

The Scenario runtime settings dialog box opens, displaying the Vuser groups, scripts, and scheduling information for each scenario. For each script in a scenario, you can view the runtime settings that were configured in the Controller or VuGen before scenario execution.



How to Configure Controller Output Messages Settings

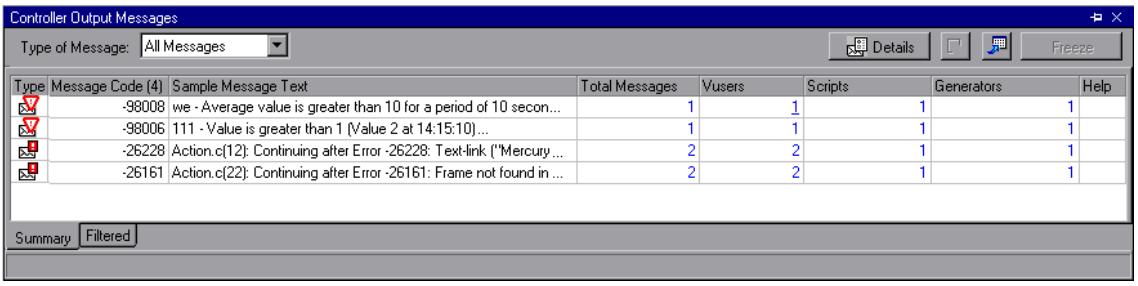
This task describes how to configure settings for output messages.

1. Choose **Tools > Options** and select the **Result Collection** tab.
2. In the **Copy Controller Output Messages to Analysis Session** area, choose one of the following options:
   - **Copy if data set is smaller than X MB.** Copies the Controller output data to the Analysis session if the data set is smaller than the amount you specify.
   - **Always Copy.** Always copies the Controller output data to the Analysis session.
   - **Never Copy.** Never copies the Controller output data to the Analysis session.
3. Apply your settings.

- To apply these settings to the current session, click **Apply now to active session**.
- To apply these settings after the current session is saved, click **OK**.

Controller Output Messages Window

This window displays error, notification, warning, debug, and batch messages that are sent to the Controller by the Vusers and load generators during a scenario run.



To access	**Windows > Controller Output Messages**
Important information	• The Summary tab is displayed by default when you open this window. • Analysis searches for the output data in the current Analysis session. If the data is not found, it searches in the scenario results folder. If Analysis cannot locate the results folder, no messages are displayed.

User interface elements are described below:

UI Element	Description
Summary Tab	See "Summary Tab" below
Filtered Tab	See "Filtered Tab" on page 49

Summary Tab

This tab displays summary information about the messages sent during a scenario run.

To access	**Controller Output Messages** window > **Summary** tab
Important Information	You can drill down further on any information displayed in blue.
Parent topic	"Controller Output Messages Window" above
See also	"Filtered Tab" on page 49

User interface elements are described below:

UI Element	Description
Details	Displays the full text of the selected output message in the Detailed Message Text area at the bottom of the Output window.
	Remove all messages. Clears all log information from the Output window.
	Export the view. Saves the output to a specified file.
Freeze Resume	• **Freeze.** Stops updating the Output window with messages. • **Resume.** Resumes updating the Output window with messages. The newly updated log information is displayed in a red frame.
Detailed Message Text	Displays the full text of the selected output message when you click the **Details** button.
Generators	Displays the number of load generators that generated messages with the specified message code.
Help	Displays an icon if there is a link to troubleshooting for the message.
Message Code	Displays the code assigned to all similar messages. The number in parentheses indicates the number of different codes displayed in the Output window.
Sample Message Text	Displays an example of the text of a message with the specified code.
Scripts	Displays the number of scripts whose execution generated messages with the specified code.
Total Messages	Displays the total number of sent messages with the specified code.
Type	The type of message being displayed. The following icons indicate the various message types. For more information about each type, see **Type of Message** below: • Batch • Debug • Errors • Notifications • Warnings

UI Element	Description
	• Alerts
Type of Message	Filters the output messages to display only certain message types. Select one of the following filters: • **All messages.** Displays all message types. • **Batch.** Sent instead of message boxes appearing in the Controller, if you are using automation. • **Debug.** Sent only if the debugging feature is enabled in the Controller. (Expert mode: **Tools > Options > Debug Information**). For more information, see "Options > Debug Information Tab" on page 242. • **Errors.** Usually indicate that the script failed. • **Notifications.** Provides runtime information, such as message sent using **lr_output_message**. • **Warnings.** Indicates that the Vuser encountered a problem, but the scenario continued to run. • **Alerts**. Indicates a warning.
Vusers	Displays the number of Vusers that generated messages with the specified code.

Filtered Tab

This tab displays a drilled down view by message, Vuser, script, or load generator. For example, if you drill down on the Vuser column, the Filtered tab displays all the messages with the code you selected, grouped by the Vusers that sent the messages.

To access	**Controller Output Messages** window > **Summary** tab. Click the blue link on the column that you wish to view more information about.
Important information	The tab appears when you click on a blue link in the Summary tab.
See also	"Summary Tab" on page 47

User interface elements are described below (unlabeled elements are shown in angle brackets):

UI Element	Description
	Previous/Next View. Enables you to move between the various drill down levels.
Details	Displays the full text of the selected output message in the Detailed Message Text area at the bottom of the Output window.

UI Element	Description
	Export the view. Saves the output to a specified file.
Refresh	Refreshes the Filtered tab with new log information that arrived in the Output window updated in the Summary tab.
<Message icon>	Displays an icon indicating the type of message by which the current Output view is filtered.
Active Filter	Displays the category or categories by which the current Output view is filtered.
Viewed By	Displays the name of the column on which you selected to drill down. The following icons indicate the various message types: • Batch • Debug • Errors • Notifications • Warnings • Alerts
Detailed Message Text	Displays the full text of the selected output message when the **Details** button is selected.
Message	Displays all instances of the sample message text.
Script	The script on which the message was generated. If you click the blue link, VuGen opens displaying the script.
Action	The action in the script where the message was generated. If you click the blue link, VuGen opens the script to the relevant action.
Line #	The line in the script where the message was generated. If you click the blue link, VuGen opens the script and highlights the relevant line.
# Lines	The total number of lines in the script where the Vuser failed.
Time	The time the message was generated.
Iteration	The iteration during which the message was generated.

UI Element	Description
Vuser	The Vuser that generated the message.
Generator	The load generator on which the message was generated. If you click the blue link, the Load Generator dialog box opens.
# Messages	The number of messages generated by a specific Vuser.

Scenario Runtime Settings Dialog Box

This dialog box enables you to view information about executed load test scenarios, as well as the runtime settings for each script in a scenario.

To access	Toolbar >
See also	"Viewing Load Test Scenario Information" on page 45

User interface elements are described below

UI Element	Description
Result Name	The name of the result file.
Scenario Scripts	Displays the result set for each executed scenario, as well as the Vuser groups and scripts that were run in the scenario.
Group Name	Displays the name of the group to which the selected script belongs.
Full Path	Displays the script's full directory path.
Script Name	Displays the name of the selected script.
Scenario Schedule	Displays goal-oriented or manual scenario scheduling information for the selected scenario.
View Script	Opens the Virtual User Generator, so that you can edit the script.

Defining Service Level Agreements

Service Level Agreements Overview

Service level agreements (SLAs) are specific goals that you define for your load test scenario. After a scenario run, HP LoadRunner Analysis compares these goals against performance related data that was gathered and stored during the course of the run, and determines whether the SLA passed or failed.

Depending on the measurements that you are evaluating for your goal, LoadRunner determines the SLA status in one of the following ways:

SLA Type	Description
SLA status determined at time intervals over a timeline	Analysis displays SLA statuses at set time intervals over a timeline within the run. At each time interval in the timeline—for example, every 10 seconds—Analysis checks to see if the measurement's performance deviated from the threshold defined in the SLA. Measurements that can be evaluated in this way: • **Transaction Response Time (Average) per time interval** • **Errors per Second per time interval**
SLA status determined over the whole run	Analysis displays a single SLA status for the whole scenario run. Measurements that can be evaluated in this way: • **Transaction Response Time (Percentile) per run** • **Total Hits per run** • **Average Hits (hits/second) per run** • **Total Throughput (bytes) per run** • **Average Throughput (bytes/second) per run**

You can define and edit SLAs in the Controller or in Analysis.

Tracking Period

When you define service level agreements (SLAs)an SLA for measurements that are evaluated over a timeline, Analysis determines SLA statuses at specified time intervals within that timeline. The frequency of the time intervals is called the **tracking period**.

An internally-calculated tracking period is defined by default. You can change the tracking period by entering a value in the Advanced Options dialog box which Analysis plugs into a built-in algorithm to calculate the tracking period. For details, see "Advanced Options Dialog Box (Service Level Agreement Pane)" on page 57.

How to Define Service Level Agreements

This task describes how to define service level agreements (SLAs).

You can define service level agreements (SLAs) which measure scenario goals over time intervals, or over a whole scenario run. For details, see "Service Level Agreements Overview" on page 51.

> **Tip:** For a use-case scenario related to this task, see "How to Define Service Level Agreements - Use-Case Scenario" on the next page.

1. ## Prerequisites

   If you are defining an SLA for Average Transaction Response Time, your scenario must include a script that contains at least one transaction.

2. ## Run through the SLA wizard

   In the Service Level Agreement pane, click **New** to open the Service Level Agreement wizard. For user interface details, see "Service Level Agreement Wizard" on page 58.

   a. Select a measurement for the SLA.

   b. If you are defining an SLA for Average Transaction Response Time or Transaction Response Time (Percentile), select the transactions to include in your goal.

   c. (Optional) When evaluating SLA statuses over a timeline, select load criteria to take into account and define appropriate load value ranges for the load criteria. For an example, see "How to Define Service Level Agreements - Use-Case Scenario" on the next page.

   d. Set thresholds for the measurements.

      - If the **Average Transaction Response Time** or **Errors per Second** exceed the defined thresholds, Analysis will produce a **Failed** SLA status.
      - If **Transaction Response Time(Percentile)**, **Total Hits per run**, **Average Hits (hits/second) per run**, **Total Throughput (bytes) per run**, or **Average Throughput (bytes/second) per run** are lower than the defined threshold, Analysis will produce a **Failed** SLA status.

3. ## Define a tracking period - optional

   For measurements whose SLA statuses are determined over time intervals, you need to define the frequency of the time intervals, that is, the **tracking period**. For details, see "Tracking Period" on the previous page.

   For user interface details, see "Advanced Options Dialog Box (Service Level Agreement Pane)" on page 57.

4. ## Results

   When analyzing your scenario run, HP LoadRunner Analysis compares the data collected from the scenario run against the SLA settings, and determines SLA statuses which are included in the default Summary Report.

How to Define Service Level Agreements - Use-Case Scenario

This use-case scenario describes how to define a service level agreement (SLA) for Average Transaction Response Time.

1. ## Background

   The administrator of HP Web Tours would like to know when the average transaction response time for booking a flight and searching for a flight exceeds a certain value. Assume that your scenario includes a script that includes the following transactions: **book_flight** and **search_flight**.

2. ## Start the SLA wizard

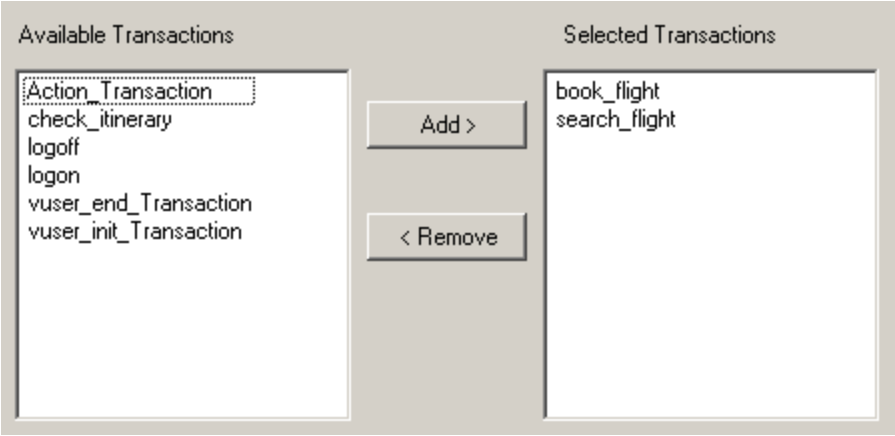
   In the Service Level Agreement pane, click **New** to open the Service Level Agreement wizard.

3. ## Select the measurement for the SLA

   On the Select a Measurement page, under **Select a Measurement for Your Goal,** in the **Transaction Response Time** box, select **Average**.

4. ## Select the transactions to evaluate in your goal

   On the Select a Transaction page, select the transactions to be evaluated: **book_flight** and **search_flight**.

5. ## Select a load criterion and define appropriate ranges of load - optional

   On the Select Load Criteria page, select the load criterion to take into account when evaluating the average transaction response time.

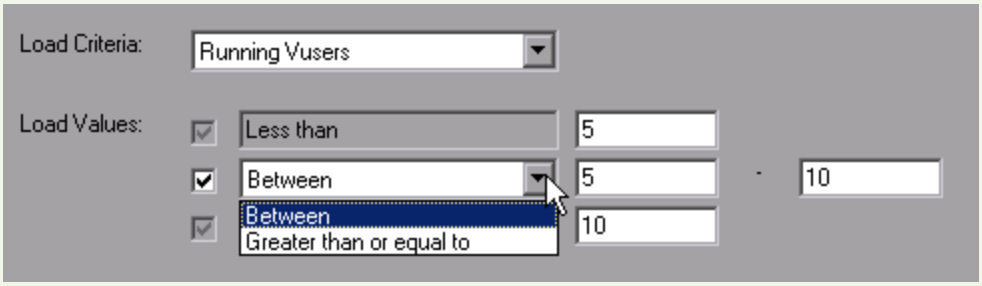
   In this case, to see the effect that various quantities of Vusers running on the system has on the average transaction response time of each transaction, in the **Load Criteria** box, select **Running Vusers**.

   Then set the value ranges for the running Vusers:

Consider less than 20 Vusers to be a light load, 20 – 50 Vusers an average load, and 50 Vusers or more a heavy load. Enter these values in the Load Values boxes.

Note:

- You can set up to three in-between ranges.
- Valid load value ranges are consecutive—there are no gaps in the range—and span all values from zero to infinity.



6. ## Set thresholds

On the Set Threshold Values page, you define the acceptable average transaction response times for the transactions, taking into account the defined load criteria.

In this case, define the same threshold values for both transactions as follows: for a light load, a reasonable average response time can be up to 5 seconds, for an average load, up to 10 seconds, and for a heavy load, up to 15 seconds.

	Running Vusers		
Transaction Name	<20	≥20 and <50	≥50
book_flight	5	10	15
search_flight	5	10	15

Tip: To define the same thresholds for all the transactions, you can type the values in the table nearer the bottom of the Set Threshold Values page, and click **Apply to all transactions**.

7. ## Define a tracking period - optional

When SLA statuses for a measurement are determined at time intervals over a timeline, the frequency of the time intervals is determined by the **tracking period**.

This step is optional because an internally-calculated tracking period of at least 5 seconds is defined by default. You can change the tracking period in the Advanced Options dialog box:

a. In the Service Level Agreement pane, click the **Advanced** button.

b. Select **Tracking period of at least X seconds**, and select a tracking period. The time intervals are calculated by Analysis according to a built-in algorithm and as a function of the value you enter here.

Example:

If you select a tracking period of 10, and the aggregation granularity for the scenario (defined in Analysis) is 6, then the tracking period is set to the nearest multiple of 6 that is greater than or equal to 10, that is, Tracking Period = 12.

For details, see "Tracking Period" on page 52.

For user interface details, see "Advanced Options Dialog Box (Service Level Agreement Pane)" on the next page.

8. **Results**

When analyzing your scenario run, Analysis applies your SLA settings to the default Summary Report and the report is updated to include all the relevant SLA information.

For example, it displays the worst performing transactions in terms of defined SLAs, how specific transactions performed over set time intervals, and overall SLA statuses.

Service Level Agreement Pane

This pane lists all the service level agreements (SLAs) defined for the scenario.

To access	**Tools** menu > **Configure SLA Rules** > **Service Level Agreement** pane
Relevant Tasks	• How to Design a Goal-Oriented Scenario • How to Design a Manual Scenario • "How to Define Service Level Agreements" on page 52 • "How to Define Service Level Agreements - Use-Case Scenario" on page 54
See also	"Service Level Agreements Overview" on page 51

User interface elements are described below:

UI Element	Description
New	Starts the Service Level Agreement wizard where you can define new goals for the load test scenario.
Details	Opens the Goal Details dialog box which displays a summary of the details of the selected SLA.
Edit	Opens the Service Level Agreement wizard where you can modify the goals defined in the SLA.

UI Element	Description
Delete	Deletes the selected SLA.
Advanced	Opens the Advanced Options dialog box where you can adjust the tracking period for measurements that are evaluated per time interval over a timeline. For more information, see "Tracking Period" on page 52. For user interface details, see "Advanced Options Dialog Box (Service Level Agreement Pane)" below.
Service Level Agreement list	Lists the SLAs defined for the scenario.

Advanced Options Dialog Box (Service Level Agreement Pane)

This dialog box enables you to define a tracking period for load test scenario.

To access	**Tools** menu > **Configure SLA Rules** > **Service Level Agreement** pane > Advanced
Important information	The tracking period is calculated by Analysis according to a built-in algorithm and as a function of the value entered here.
Relevant tasks	• "How to Define Service Level Agreements" on page 52 • "How to Define Service Level Agreements - Use-Case Scenario" on page 54
See also	"Service Level Agreements Overview" on page 51

User interface elements are described below:

UI Element	Description
Internally calculated tracking period	Analysis sets the tracking period to the minimum value possible, taking into account the aggregation granularity defined for the scenario. This value is at least 5 seconds. It uses the following formula: `Tracking Period = Max (5 seconds, aggregation granularity)`
Tracking period of at least X seconds	Determines the minimum amount of time for the tracking period. This value can never be less than 5 seconds. Analysis sets the tracking period to the nearest multiple of the scenario's aggregation granularity that is greater than or equal to the value (X) that you selected. For this option, Analysis uses the following formula: `Tracking Period =`

UI Element	Description
	`Max(5 seconds, m(Aggregation Granularity))` where **m** is a multiple of the scenario's aggregation granularity such that **m (Aggregation Granularity)** is greater than or equal to **X.** **Example:** If you select a tracking period of X=10, and the aggregation granularity for the scenario is 6, then the tracking period is set to the nearest multiple of 6 that is greater than or equal to 10, that is, Tracking Period = 12.

Goal Details Dialog Box (Service Level Agreement Pane)

This dialog box displays the thresholds that were set for the selected SLA.

To access	**Tools** menu > **Configure SLA Rules** > **Service Level Agreement** pane > Details
Important information	If you defined load criteria as part of your SLA, the threshold values are displayed per the defined load value ranges.
See also	"Service Level Agreements Overview" on page 51

Service Level Agreement Wizard

This wizard enables you to define goals or **service level agreements** (SLAs) for your load test scenario.

To access	**Tools** menu > **Configure SLA Rules** > **Service Level Agreement** pane > New
Important information	There are two modes for the Service Level Agreement wizard. The pages included in the wizard depend on the measurement that is selected. See the wizard maps below.
Relevant tasks	• "How to Define Service Level Agreements" on page 52 • "How to Define Service Level Agreements - Use-Case Scenario" on page 54
Wizard map - Goal measured per time interval	The Service Level Agreement Wizard contains: **Welcome** > "Select a Measurement Page" on the next page > ("Select Transactions Page" on page 60) > "Set Load Criteria Page" on page 60 > "Set Threshold Values Page (Goal Per Time Interval)" on page 62
Wizard map - Goal measured over whole scenario run	The Service Level Agreement Wizard contains: **Welcome** > "Select a Measurement Page" on the next page > ("Select Transactions Page" on page 60) > "Set Threshold Values Page (Goal Per Whole

	Run)" on page 63
See also	"Service Level Agreements Overview" on page 51

Select a Measurement Page

This wizard page enables you to select a measurement for your goal.

Important information	• General information about this wizard is available here: "Service Level Agreement Wizard" on the previous page. • There are two modes for the Service Level Agreement wizard. The wizard pages that follow depend on the measurement that you select on this page. See the wizard maps below.
Wizard map - Goal measured per time interval	The "Service Level Agreement Wizard" on the previous page contains: **Welcome** > Select a Measurement Page > ("Select Transactions Page" on the next page) > "Set Load Criteria Page" on the next page > "Set Threshold Values Page (Goal Per Time Interval)" on page 62
Wizard map - Goal measured over whole scenario run	The "Service Level Agreement Wizard" on the previous page contains: **Welcome** > Select a Measurement Page > ("Select Transactions Page" on the next page) > "Set Threshold Values Page (Goal Per Whole Run)" on page 63
See also	"Service Level Agreements Overview" on page 51

User interface elements are described below:

UI Element	Description
SLA status determined over the whole run	Evaluates a single SLA status for the whole scenario run. Select one of the following measurements: • **Transaction Response Time (Percentile)** • **Total Hits per run** • **Average Hits (hits/second) per run** • **Total Throughput (bytes) per run** • **Average Throughput (bytes/second) per run**
SLA status determined per time intervals over a timeline	Evaluates SLA statuses at set time intervals within the run. Select one of the following measurements: • **Average Transaction Response Time** • **Errors per Second** The time intervals at which the SLA statuses are evaluated are known as the **tracking period**. For details, see "Tracking Period" on page 52.

Select Transactions Page

This wizard page enables you to select transactions to evaluate as part of your goal.

Important information	• General information about this wizard is available here: "Service Level Agreement Wizard" on page 58. • This page is displayed when creating an SLA for Transaction Response Time by Average or by Percentile. • In order to define an SLA for Transaction Response Time by Average or by Percentile, at least one of the Vuser scripts participating in the scenario must include a transaction. • You can select multiple transactions using the CTRL key.
Wizard map - Goal measured per time interval	The "Service Level Agreement Wizard" on page 58 contains: **Welcome** > "Select a Measurement Page" on the previous page > (**Select Transactions Page**) > "Set Load Criteria Page" below > "Set Threshold Values Page (Goal Per Time Interval)" on page 62
See also	"Service Level Agreements Overview" on page 51

User interface elements are described below:

UI Element	Description
Available Transactions	Lists the transactions in the Vuser scripts participating in the scenario. To move a script to the **Selected Transaction** list, select it and click **Add**.
Selected Transactions	Lists the transactions in the Vuser scripts participating in the scenario that have been selected for the SLA. To remove a script from this list, select it and click **Remove**.

Set Load Criteria Page

This wizard page enables you to select load criteria to take into account when testing your goal.

Important information	• General information about this wizard is available here: "Service Level Agreement Wizard" on page 58. • This page is displayed only when defining an SLA that determines SLA statuses per time interval over a timeline. • In the next wizard step (Set Threshold Values page), you will set different thresholds per each of the load ranges that you select here.

Wizard map - Goal measured per time interval	The "Service Level Agreement Wizard" on page 58 contains: **Welcome** > "Select a Measurement Page" on page 59 > ("Select Transactions Page" on the previous page) > **Set Load Criteria Page** > "Set Threshold Values Page (Goal Per Time Interval)" on the next page
See also	"Service Level Agreements Overview" on page 51

User interface elements are described below:

UI Element	Description
Load Criteria	The relevant load criteria that you want to use **Example:** If you want to see the impact of running Vusers on the measurement, select **Running Vusers**. To define an SLA without load criteria, select **None**.
Load Values	Valid load value ranges are consecutive—there are no gaps in the range—and span all values from zero to infinity. • **Less than.** Enter the upper value for the lower range of values for the load criteria. The lower range is between 0 and the value you entered. It does not include the upper value. **Example:** If you enter 5, the lower range of values for the load criteria is between 0 and 5, but does not include 5. • **Between.** The in-between range of values for the load criteria. Enter lower and upper values for this range. The lower range is included in this range; it does not include the upper value. **Example:** If you enter 5 and 10, the in-between range of values for the load criteria is from 5 and up to, but not including, 10. **Note:** You can set up to three in-between ranges. • **Greater than.** Enter the lower value for the upper range of values for the load criteria. The upper range includes values from the value you entered and on. **Example:** If you enter 10, the upper range of values for the load criteria is from 10 and on.
Selected Measurement	The measurement selected for the goal.

Set Percentile Threshold Values Page

This wizard page enables you to select load criteria to take into account when testing your goal.

Important information	• General information about this wizard is available here: "Service Level Agreement Wizard" on page 58. • The Percentile SLA enables you to measure whether the percentage of transaction samples meets the defined threshold criteria. • You can enter a threshold value to 3 decimal places.
Wizard map - Goal measured over whole scenario run	The "Service Level Agreement Wizard" on page 58 contains: **Welcome** > "Select a Measurement Page" on page 59 > ("Select Transactions Page" on page 60) > **Set Percentile Threshold Values Page**
See also	"Service Level Agreements Overview" on page 51

User interface elements are described below:

UI Element	Description
Selected Measurement	The measurement selected for the goal.
Percentile	Percentage of transactions to measure against the configured threshold.
Provide threshold value for all transactions	To apply one set of threshold values to all transactions selected for the goal, enter the threshold value and click **Apply to all**. These values are applied to all the transactions in the Thresholds table at the bottom of the page.
Transaction name	The transaction from the scenario run.
Threshold	The threshold value for the selected transaction.

Set Threshold Values Page (Goal Per Time Interval)

This wizard page enables you to set thresholds for the measurements you are evaluating in your goal.

Important information	• General information about this wizard is available here: "Service Level Agreement Wizard" on page 58. • If you defined load criteria in the "Set Load Criteria Page" on page 60, you must set thresholds per each of the defined load ranges. If you did not define load criteria, you set one threshold value. For Average Transaction response time, you set threshold values for each transaction. • You can enter a threshold value to 3 decimal places.

Wizard map - Goal measured per time interval	The "Service Level Agreement Wizard" on page 58 contains: **Welcome** > "Select a Measurement Page" on page 59 > ("Select Transactions Page" on page 60) > "Set Load Criteria Page" on page 60 > **Set Threshold Values Page (Goal Per Time Interval)**
See also	"Service Level Agreements Overview" on page 51

User interface elements are described below (unlabeled elements are shown in angle brackets):

UI Element	Description
<Thresholds table>	The thresholds for your goal. If you defined load criteria, enter thresholds for each range of values. **Note:** If the maximum threshold value is exceeded during a particular time interval during the run, Analysis displays an SLA status of **Failed** for that time interval.
Apply to all (Average Transaction Response Time goal only)	To apply one set of threshold values to all transactions selected for the goal, enter the threshold values in this table and click **Apply to all transactions**. These values are applied to all the transactions in the Thresholds table at the top of the page. **Note:** Threshold values for selected transactions do not have to be the same. You can assign different values for each transaction.
Selected Measurement	The measurement selected for the goal.

Set Threshold Values Page (Goal Per Whole Run)

This wizard page enables you to set minimum thresholds for the measurements you are evaluating in your goal.

Important information	General information about this wizard is available here: "Service Level Agreement Wizard" on page 58.
Wizard map - Goal measured over whole scenario run	The "Service Level Agreement Wizard" on page 58 contains: **Welcome** > "Select a Measurement Page" on page 59 > **Set Threshold Values Page (Goal Per Whole Run)**
See also	"Service Level Agreements Overview" on page 51

User interface elements are described below:

UI Element	Description
Selected measurement	The measurement selected for the goal.
Threshold	The minimum threshold value for the selected measurement. **Note:** If the value of the measurement is lower than this threshold during the run, Analysis displays an SLA status of **Failed** for the entire run.

Working with Application Lifecycle Management

Managing Results Using ALM - Overview

Analysis works together with HP Application Lifecycle Management (ALM). ALM provides an efficient method for storing and retrieving scenario and analysis results. You can store results in an ALM project and organize them into unique groups.

In order for the Analysis to access an ALM project, you must connect it to the Web server on which ALM is installed. You can connect to either a local or remote Web server.

When working against an ALM server with Performance Center, the ALM integration has several additional capabilities, such as the ability to save the Analysis session to a new location, and upload a report from the file system to ALM. For details, see "How to Work with Results in ALM - With Performance Center" on page 66.

For more information on working with ALM, see the *Application Lifecycle Management User Guide*.

How to Connect to ALM from Analysis

To store and retrieve Analysis results from ALM, you need to connect to an ALM project. You can connect or disconnect from an ALM project at any time during the testing process.

You can connect to one version of HP ALM from Analysis and a different version from your browser. For more information, see the **Important Information** section in "HP ALM Connection Dialog Box" on page 69.

Connect to ALM

1. Select **Tools** > **HP ALM Connection**. The HP ALM Connection dialog box opens.
2. Enter the required information in the HP ALM Connection dialog box, as described in "HP ALM Connection Dialog Box" on page 69.
3. To disconnect from ALM, click **Disconnect**.

> **Note:** There is no explicit option in the Analysis user interface for enabling CAC mode (as in VuGen). Analysis automatically enables CAC mode if the ALM server machine supports it. .

How to Work with Results in ALM - Without Performance Center

The following steps describe the workflow for working with results saved in an ALM project, whose server does not have a Performance Center installation.

When working against an ALM server with HP Performance Center, there are several differences. For more information, see "How to Work with Results in ALM - With Performance Center" on the next page.

1. ## Connect to ALM

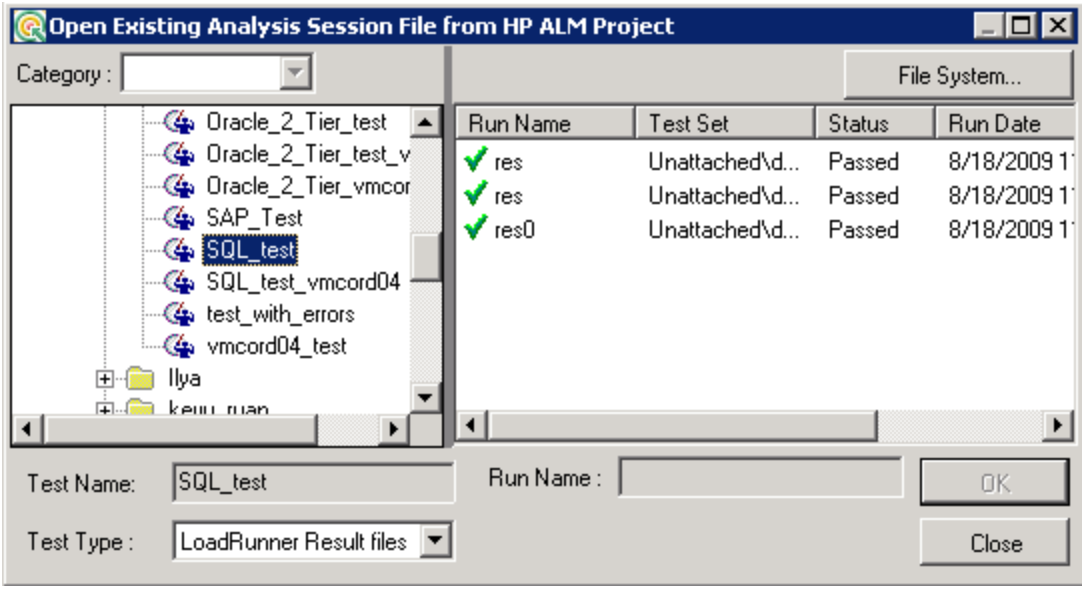
   Open a connection to the ALM server and project that contains the LoadRunner result or Analysis session files. For task details, see "How to Connect to ALM from Analysis" on the previous page.

2. ## Open an existing Analysis session file - optional

   a. Select **File > Open**.

   b. In the left pane select a script.

   c. In the right pane, select the results for which the Analysis session file was created.



   d. Click **OK**.

3. ## Create a new Analysis session file from the raw data - optional

   This procedure describes how to create a new Analysis session file on the ALM server, from the raw results file. If an Analysis session file already exists for the raw data, you can choose to overwrite the existing file.

a. Select **File > New**.

b. In the left pane select a script.

c. In the right pane, select the results you want to analyze.

d. Click **OK**.

4. ### Save the LoadRunner results file

When you are finished analyzing your results and creating reports or graphs, save the changes. Select **File > Save**. The Analysis session file is in the ALM project.

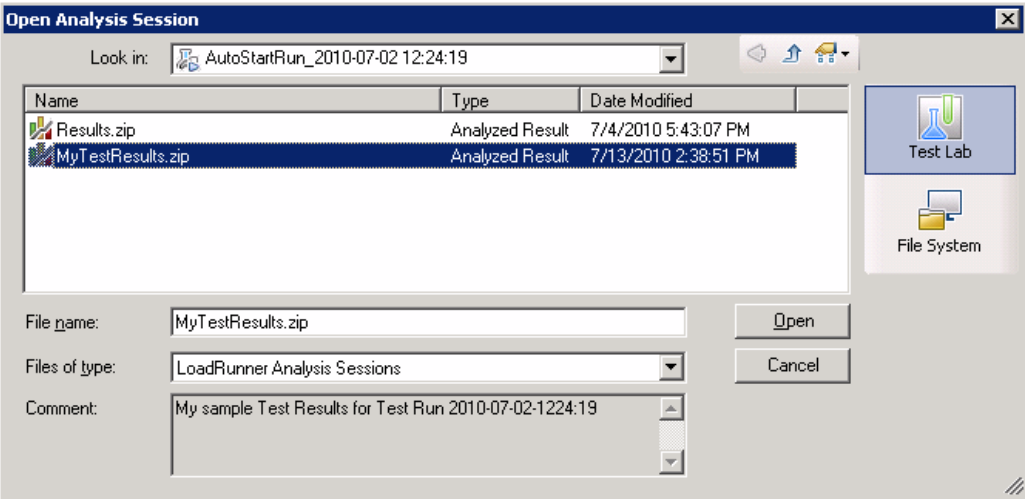
> **Note:** When working with ALM without Performance Center, **Save As** is not supported—you cannot save the Analysis session file to another location.

How to Work with Results in ALM - With Performance Center

ALM servers with Performance Center, allow you to perform the following operations:

Open an existing Analysis Session file

1. Select **Tools > HP ALM Connection** and make sure your connection to ALM is open.
2. Select **File > Open**.
3. Drill down to the Run level within the Test Plan module, and select an individual run.
4. Select a zip file containing the Analysis session file.

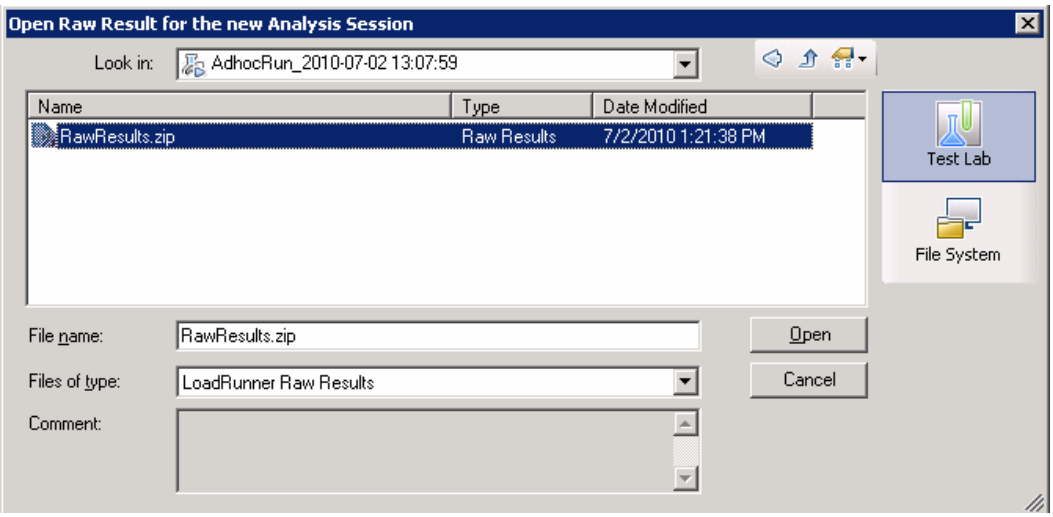


5. Click **Open**.

Open raw data and create a new Analysis session

1. Select **Tools > HP ALM Connection** and make sure your connection to ALM is open.

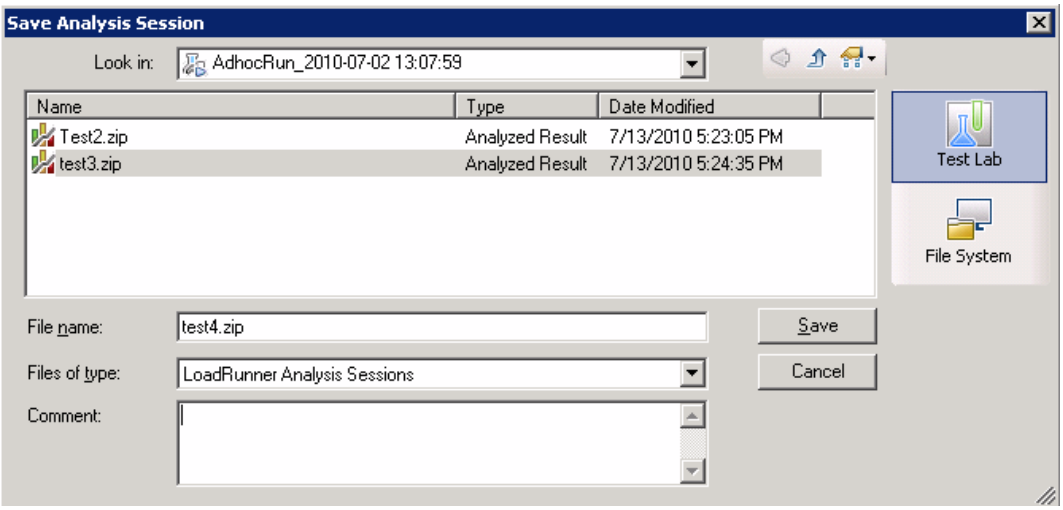
2. To create a new Analysis session file from the raw data, select **File > New**.
3. Drill down to the Run level within the Test Plan module, and select an individual run.
4. Select a zip file containing the run's raw data.



5. Click **Open**.

Save the changes to the Analysis session file

1. Complete your changes to the Analysis results.
2. Select **Tools > HP ALM Connection** and make sure your connection to ALM is open.
3. Select **File > Save**.
4. To save an Analysis session that was opened from the file system, click the **Test Lab** module button.
5. Drill down to the Run level within the Test Plan module, and specify a name for the zip file.

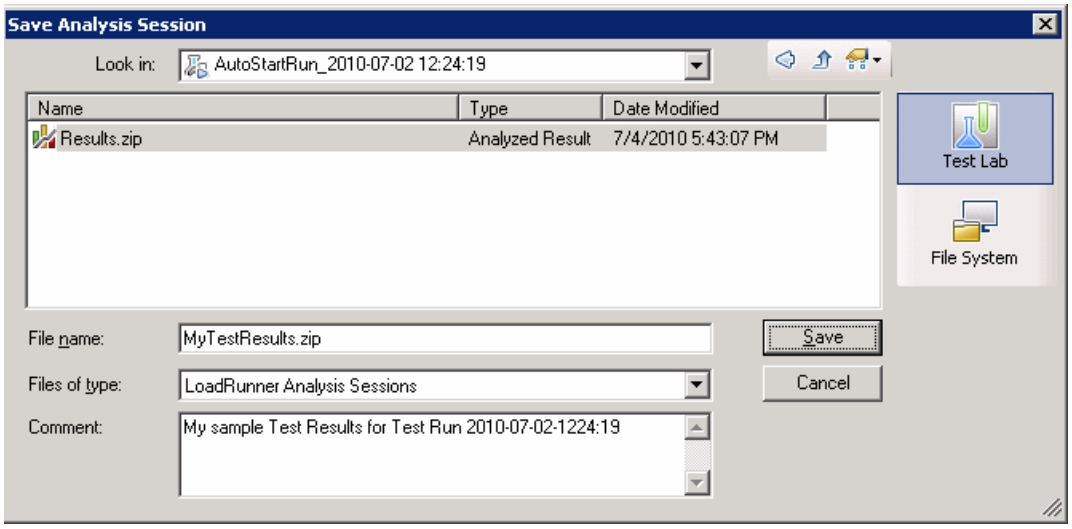


6. Provide a comment about the Analysis session (optional).

7. Click **Save**.

Save the Analysis session file to a new ALM location

1. Select **Tools > HP ALM Connection** and make sure your connection to ALM is open.
2. Open an Analysis session file from the file system, or from ALM as described above.
3. Select **File > Save as**.
4. Drill down to the Run level within the Test Plan module, and select an individual run.
5. Specify a name for the Analysis session zip file. The name *Results* is reserved.



6. Provide a comment about the Analysis session (optional).
7. Click **Save**.

Integration Methods - TestPlan or TestLab

Analysis uses different integration methods for ALM projects with Performance Center extensions, depending on how it was invoked:

- Through the Web-interface or from the Controller—**TestPlan** integration is used.
- Through a manual launch, connected to a project through the HP ALM Connection dialog box—**TestLab** integration is used.

How to Upload a Report to ALM

The following steps describe how to upload a report from the file system to an ALM's Test Lab module. This capability is only available for ALM installation with Performance Center.

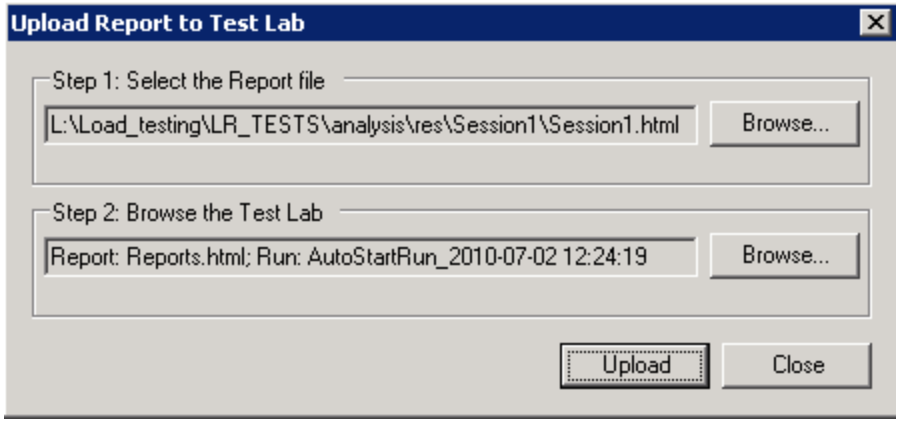
When working against an ALM server with HP Performance Center, there are several differences. For more information, see "How to Work with Results in ALM - With Performance Center" on page 66.

1. ### Connect to ALM

   Open a connection to the ALM server and project that contains the LoadRunner result or Analysis session files. For task details, see "How to Connect to ALM from Analysis" on page 64.

2. ### Open the Upload dialog box

   Select **Tools > Upload Report to Test Lab**.



3. ### Select a report

   Click **Browse** in the **Step 1** section**.** The **Select the Report file** dialog box opens. Select an HTML or XML file from the file system. Click **Open**.

4. ### Select a location on ALM

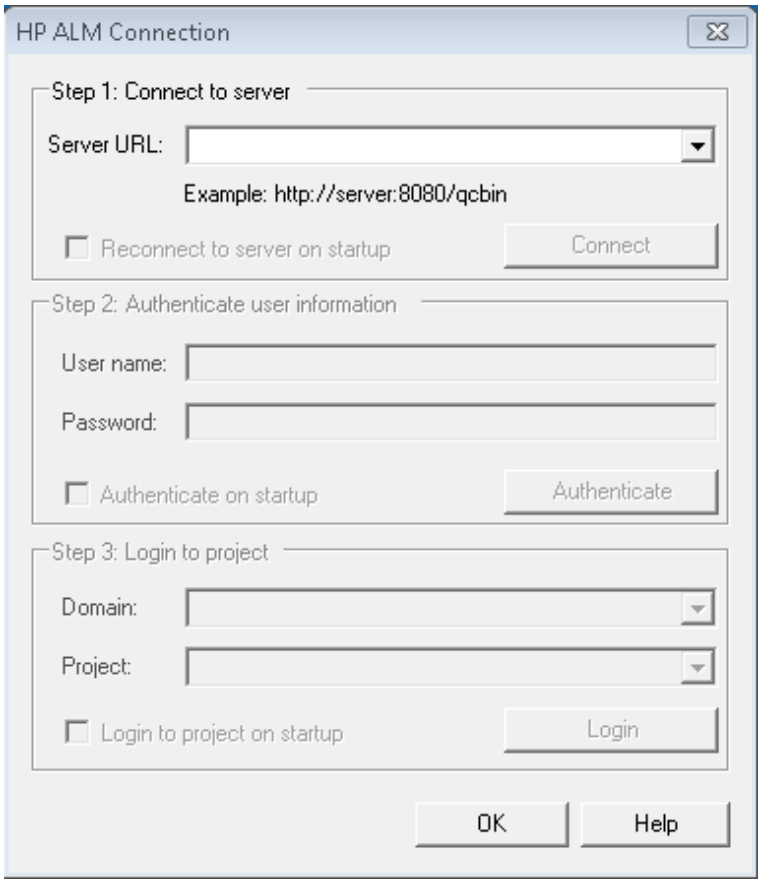
   Click **Browse** in the **Step 2** section**.** The **Select Location for the Report** dialog box opens. Navigate to a Run level in the Test Lab module. Specify a name for the report and include any relevant comments. Click **OK**.

5. ### Begin the upload

   Click **Upload**. The upload begins.

HP ALM Connection Dialog Box

This dialog box enables you to connect to an ALM project.



To access	**Tools > HP ALM Connection**
Important information	You can connect to one version of HP ALM from LoadRunner and a different version of HP ALM from your browser. You can only connect to different versions of HP ALM if one of the versions is HP ALM 11.00 or higher. **Note:** Before you connect to ALM through the LoadRunner interface, it is recommended that you first connect to the HP ALM server through your browser.This automatically downloads the ALM client files to your computer.
Relevant tasks	"How to Connect to ALM from Analysis" on page 64

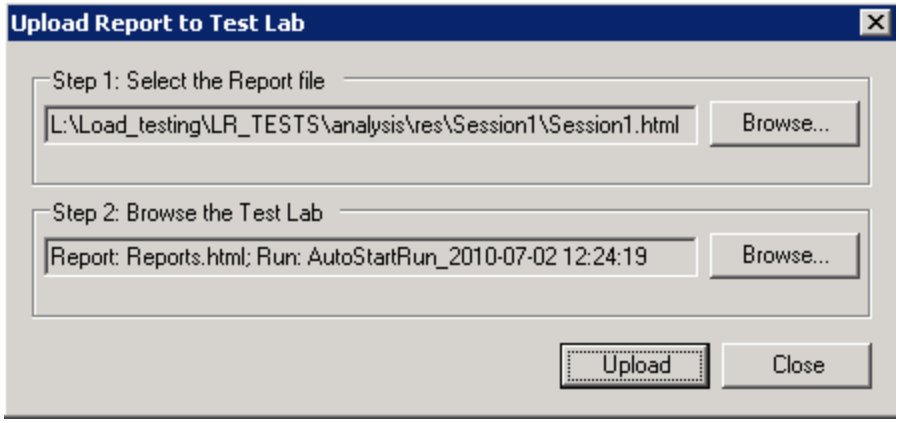
User interface elements are described below:

UI Element	Description
Step 1: Connect to	• **Server URL.** The URL of the server on which ALM is installed. The URL must be in the following form **http://<server_name:port>/qcbin**.

UI Element	Description
Server	• **Reconnect to server on startup.** Automatically reconnect to the server every time you start LoadRunner. • Connect / Disconnect. Connects to the server specified in the **Server URL** box. Only one button is visible at a time, depending on your connection status.
Step 2: Authenticate User Information	• **User Name.** Your ALM project user name. • **Password.** Your ALM project password. • **Authenticate on startup.** Authenticates your user information automatically, the next time you open the application. This option is available only if you selected **Reconnect to server on startup** above. • Authenticate. Authenticates your user information against the ALM server. After your user information has been authenticated, the fields in the Authenticate user information area are displayed in read-only format. The Authenticate button changes to Change User. You can log in to the same ALM server using a different user name by clicking **Change User**, entering a new user name and password, and then clicking **Authenticate** again.
Step 3: Login to Project	• **Domain.** The domain that contains the ALM project. Only those domains containing projects to which you have permission to connect to are displayed. • **Project.** Enter the ALM project name or select a project from the list. Only those projects that you have permission to connect to are displayed. • **Login to project on startup.** This option is only enabled when the **Authenticate on startup** check box is selected. • Login / Logout. Logs into and out of the ALM project.

Upload Report to Test Lab Dialog Box

This dialog box enables you to upload an Analysis report to an ALM project's Test Lab module.



To access	Reports > Upload Report to Test Lab

User interface elements are described below:

UI Element	Description
Step 1: Select the report file	Allows you to select an Analysis report from the file system. You can select an HTML report, or Rich report in XML format.
Step 2: Browse the test lab	Allows you to select an location within the Test Lab module, for the report. **Note:** You must drill down to the level of a Run within the Test Lab module.
Upload	Begins the uploading of the report. If the uploading succeeds, the Analysis issues a message.

Setup

Configuring Graph Display

Analysis allows you to customize the display of the graphs and measurements in your session so that you can view the data displayed in the most effective way possible.

How to Customize the Analysis Display

The following steps describes how to customize the display of analysis. You can customize the display of the graphs and measurements in your session so that you can view the data displayed in the most effective way possible.

Enlarging a section of the graph

To zoom in or enlarge a section of the graph, move and hold down the left mouse button over the section of the graph you want to enlarge.

Using comments in a graph

To add a comment to a graph, click  and then click the mouse over the section of the graph where you would like to add a comment. Type your comment in the Add Comment dialog box.

To edit, format or delete a comment from the graph, click the comment and apply your change in the Edit Comments dialog box. In the left pane, verify the relevant comment is selected before you edit, format or delete.

Using arrows in a graph

To add an arrow to a graph, click  and then click the mouse button within the graph to position the base of the arrow.

To delete an arrow from a graph, select the arrow and press Delete.

Using the User Notes Window

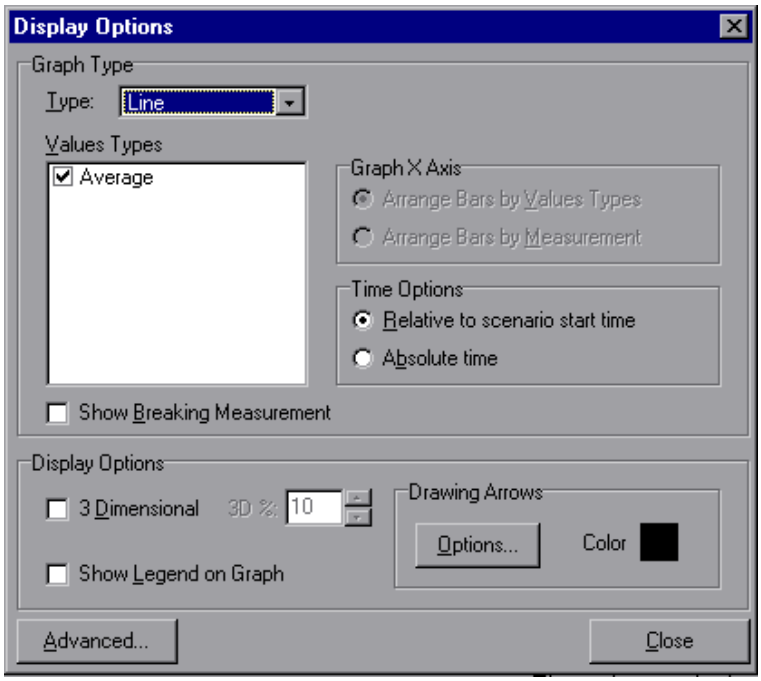
In the User Notes window (**Windows > User Notes**), you can enter text about the graph or report that is currently open. The text in the User Notes window is saved with the session.

To view the text that you entered for a specific graph or report, select the relevant graph or report and open the User Notes window (**Windows > User Notes**).

Display Options Dialog Box

This dialog box enables you to select the graph type and configure the display of the graph.

> **Note:** This option is not available for all graph types.



To access	**View > Display Options**
See also	• "Editing Main Chart Dialog Box (Display Options Dialog Box)" on the next page • "Chart Tab (Editing MainChart Dialog Box)" on page 76 • "Series Tab (Editing MainChart Dialog Box)" on page 77

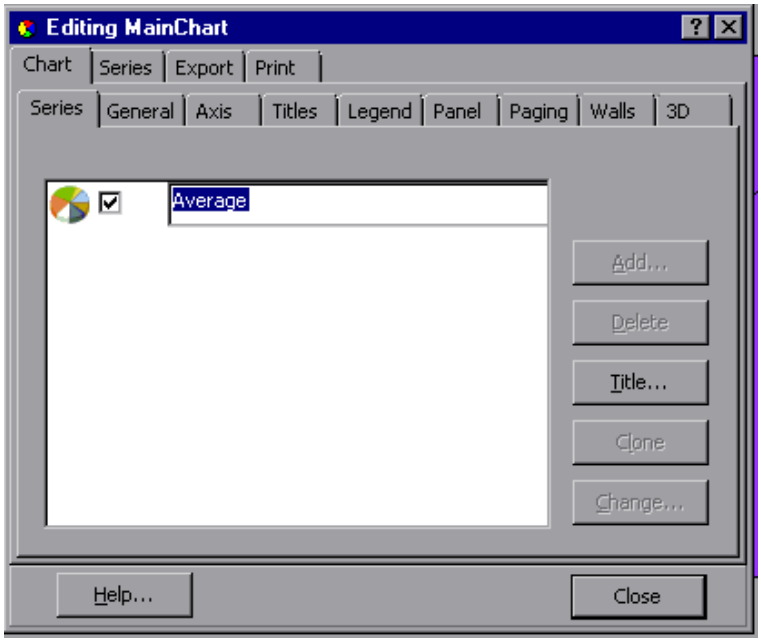
User interface elements are described below:

UI Elements	Description
Type	Select the type of graph to display from the drop-down list.
Values Types	Select the type of display information from the list of available values. For example, a bar graph displaying Average Transaction Response Time can be configured to display minimum, maximum, average, STD, count, and sum averages.
Graph X Axis (Bar graphs only)	Select the bar arrangement along the x-axis. You can arrange the bars by value types or measurement.
Time Options	Select the way in which the graph shows the Elapsed Scenario Time on the x-axis. You can choose an elapsed time relative to the beginning of the scenario or an elapsed time from the absolute time of the machine's system clock.
Show Breaking Measurement	Select this check box to display the name and properties of the breaking measurement at the top of the graph (disabled by default).

UI Elements	Description
3 Dimensional	Select this check box to enable a 3-dimensional display of the graph.
3D %	Specify a percentage for the 3-dimensional aspect of lines in the graph. This percentage indicates the thickness if the bar, grid, or pie chart.
Show Legend on Graph	Select this check box to display a legend at the bottom of the graph.
Drawing Arrows	Allows you to configure the style, color, and width of arrows you draw to highlight graph information.
Advanced...	Opens the **Editing MainChart** dialog box. For more information, see "Editing Main Chart Dialog Box (Display Options Dialog Box)" below.

Editing Main Chart Dialog Box (Display Options Dialog Box)

This dialog box enables you to configure the look and feel of your graph as well as its title and the format of the data.



To access	**View > Display Options > Advanced** button
See also	• "Display Options Dialog Box" on page 73 • "Chart Tab (Editing MainChart Dialog Box)" on the next page • "Series Tab (Editing MainChart Dialog Box)" on page 77

User interface elements are described below:

UI Element	Description
Chart tab	Enables you to configure the look and feel of your entire graph. You set Chart preferences using the following tabs: For details, see "Chart Tab (Editing MainChart Dialog Box)" below.
Series tab	Enables you to control the appearance of the individual points plotted in the graph. You set Series preferences using the following tabs. For details, see "Series Tab (Editing MainChart Dialog Box)" on the next page.
Export tab	Enables you to store the current graph to an image file in the format of your choice—BMP, JPG, or EMF. You can also export the graph's data to HTML, Excel, or XML
Print tab	Enables you to print only the graph itself without the legend and other data such as the User Notes.

Chart Tab (Editing MainChart Dialog Box)

This tab enables you to configure the look and feel of your entire graph.

To access	**View > Display Options > Advanced button > Chart** tab
See also	• "Display Options Dialog Box" on page 73 • "Editing Main Chart Dialog Box (Display Options Dialog Box)" on the previous page • "Series Tab (Editing MainChart Dialog Box)" on the next page

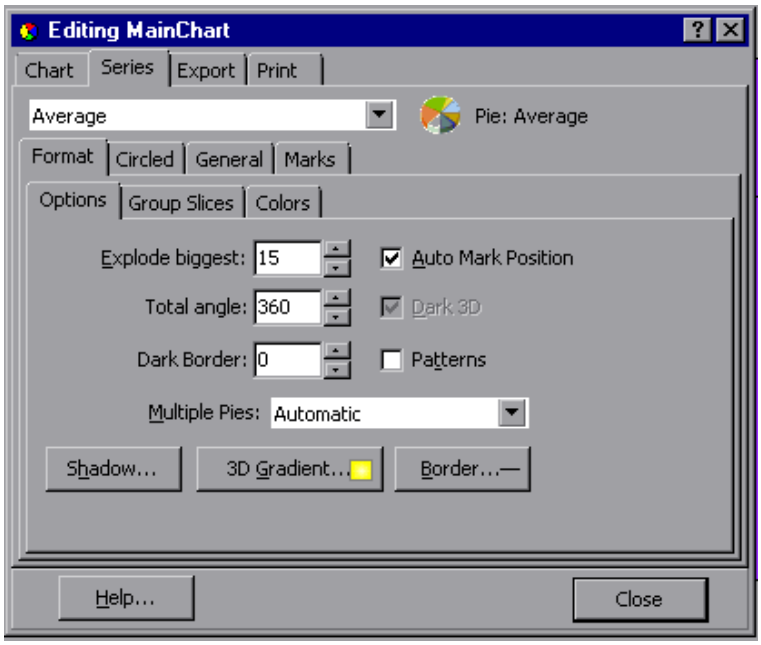
User interface elements are described below:

UI Element	Description
Series tab	Select the graph style (for example, bar or line), the hide/show settings, line and fill color, and the title of the series.
General tab	Select options for print preview, export, margins, scrolling, and magnification.
Axis tab	Select which axes to show, as well as their scales, titles, ticks, and position.
Titles tab	Set the title of the graph, its font, background color, border, and alignment.
Legend tab	Set all legend related settings, such as position, fonts, and divider lines.

UI Element	Description
Panel tab	Show the background panel layout of the graph. You can modify its color, set a gradient option, or specify a background image.
Paging tab	Set all page related settings, such as amount of data per page, scale, and page numbering. These settings are relevant when the graph data exceeds a single page.
Walls tab	Set colors for the walls of 3-dimensional graphs.
3D	Select the 3-dimensional settings, offset, magnification, and rotation angle for the active graph.

Series Tab (Editing MainChart Dialog Box)

This page enables you to control the appearance of the individual points plotted in the graph.



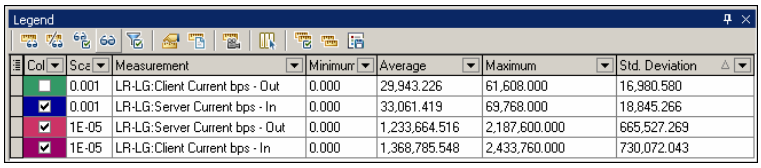
To access	**View > Display Options > Advanced button > Series** tab
See also	• "Display Options Dialog Box" on page 73 • "Editing Main Chart Dialog Box (Display Options Dialog Box)" on page 75 • "Chart Tab (Editing MainChart Dialog Box)" on the previous page

User interface elements are described below:

UI Element	Description
Format tab	Set the border color, line color, pattern, and invert property for the lines or bars in your graph.
Point tab	Set the size, color, and shape of the points that appear within your line graph.
General tab	Select the type of cursor, the format of the axis values, and show/hide settings for the horizontal and vertical axes.
Marks tab	Configure the format for each point in the graph.

Legend Window

This window enables you to configure the color, scale, minimum, maximum, average, median, and standard deviation of each measurement appearing in the graph.



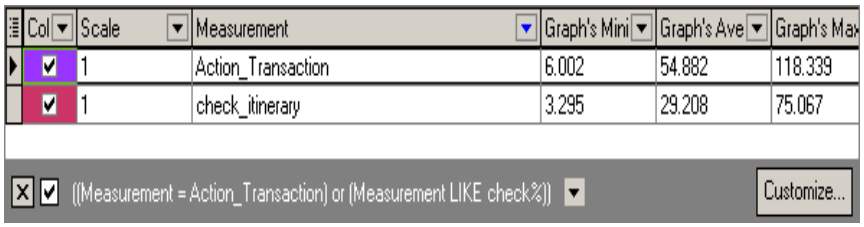
Col	Sca	Measurement	Minimum	Average	Maximum	Std. Deviation
	0.001	LR-LG:Client Current bps - Out	0.000	29,943.226	61,608.000	16,980.580
✓	0.001	LR-LG:Server Current bps - In	0.000	33,061.419	69,768.000	18,845.266
✓	1E-05	LR-LG:Server Current bps - Out	0.000	1,233,664.516	2,187,600.000	665,527.269
✓	1E-05	LR-LG:Client Current bps - In	0.000	1,368,785.548	2,433,760.000	730,072.043

To access	**Analysis Window > Legend** window
Tip	**Filtering:** To show only certain values, click the down arrow in the selected column and click **Custom**. The Custom Filter dialog box opens. For details, see "Custom Filter Dialog Box" on page 113. **Sorting:** To sort the measurements by a specific metrics, select a column header once to display the measurements in ascending order. Click it again to display them in descending order.
See also	• "Measurement Description Dialog Box" on page 81 • "Measurement Options Dialog Box" on page 82

Legend Toolbar

User interface elements are described below:

UI Element	Description
	Show. Displays the selected measurements in the graph.
	Hide. Hides the selected measurements in the graph.
	Show only Selected. Displays the highlighted measurement only.
	Show All. Displays all the available measurements in the graph.
	Filter. Filters the graph by the measurements selected in the Legend window. You can select multiple measurements. To clear the filter, select **View > Clear Filter/Group By**.
	Configure. Opens the Measurement Options dialog box that enables you to configure measurement options (for example, set color and measurement scale). For more information, see "Measurement Options Dialog Box" on page 82.
	Show Description. Opens the Measurement Description dialog box that displays the name, monitor type, and description of the selected measurement. For more information, see "Measurement Description Dialog Box" on page 81.
	Animate. Displays the selected measurement as a flashing line.
	Configure Columns. Opens the Legend Columns Options dialog box that enables you to select the columns to display in the Legend window.
	Copy Selection. Copies the selected rows to the clipboard. You can paste the data in a text file or a spreadsheet.
	Copy All. Copies all of the legend data to the clipboard, regardless of what is selected. You can paste the data in a text file or a spreadsheet.
	Export. Saves the legend data to a CSV file.
<Custom filter>	After adding a custom filter (by expanding the down arrow in the column headers), the window shows them at the bottom of the legend. Click the **x** button to remove the filter, or clear the check box to disable it temporarily. For details, see "Custom Filter Dialog Box" on page 113.

UI Element	Description
	
Customize	Opens the Filter Builder and allows you to save your filter settings to a file.

Legend grid shortcut menu

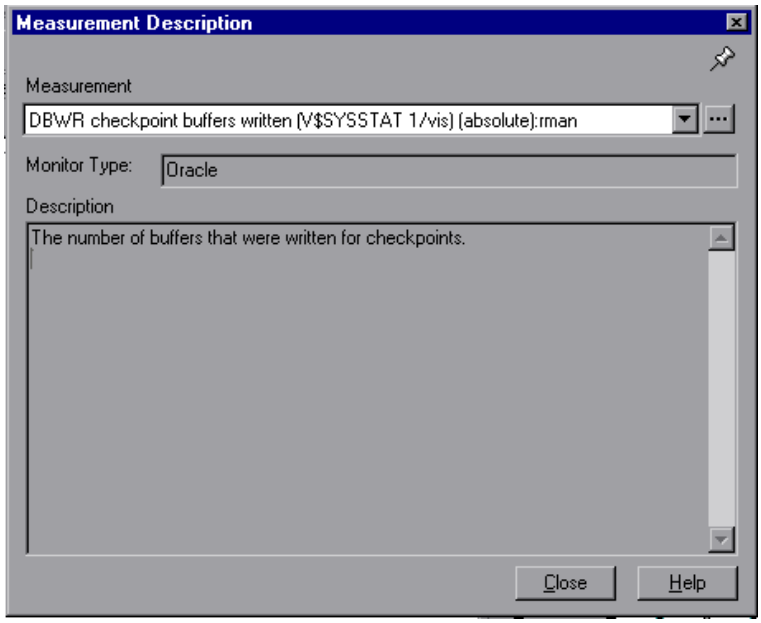
User interface elements are described below:

UI Element	Description
Show	Displays the selected measurements in the graph.
Hide	Hides the selected measurements in the graph.
Show only Selected	Displays the highlighted measurement only.
Show All	Displays all the available measurements in the graph.
Filter	Filters the graph by the measurements selected in the Legend window. You can select multiple measurements. To clear the filter, select **View > Clear Filter/Group By**.
Configure	Opens the Measurement Options dialog box that enables you to configure measurement options (for example, set color and measurement scale). For more information, see "Measurement Options Dialog Box" on page 82.
Show Description	Opens the Measurement Description dialog box that displays the name, monitor type, and description of the selected measurement. For more information, see "Measurement Description Dialog Box" on the next page.
Animate	Displays the selected measurement as a flashing line.
Auto Correlate	Opens the Auto Correlate dialog box that enables you to correlate the selected measurement with other monitor measurements in the load test scenario. For more information on auto correlation, see "Auto Correlating Measurements" on page 93.
Configure Columns	Opens the Legend Columns Options dialog box that enables you to select the columns to display in the Legend window.

UI Element	Description
Web Page Diagnostics for <selected measurement>	Displays a Web Page Diagnostics graph for the selected transaction measurement (only available for the Average Transaction Response Time and Transaction Performance Summary graphs).
Break down	Displays a graph with a breakdown of the selected page (only available for the Web Page Diagnostics graphs).

Measurement Description Dialog Box

This dialog box shows you additional information about the selected measurement.



To access	**Legend Toolbar >**
See also	• "Legend Window" on page 78 • "Measurement Options Dialog Box" on the next page

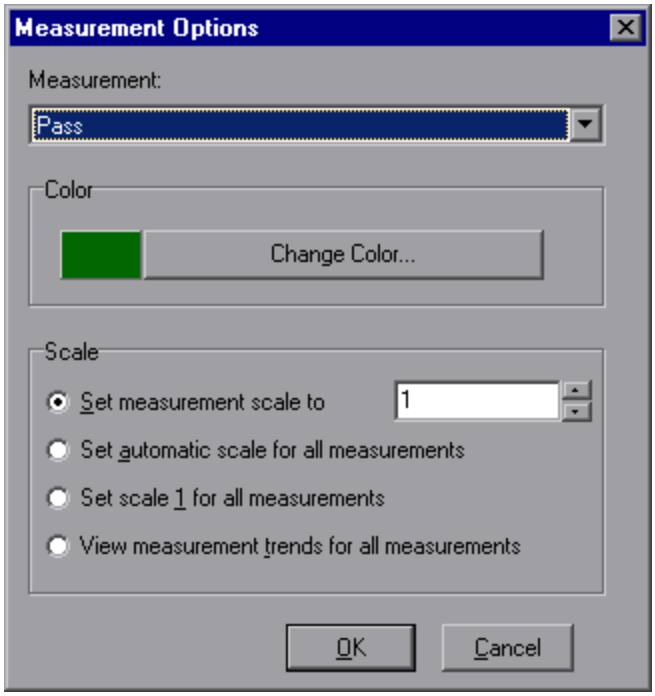
User interface elements are described below:

UI Element	Description
Measurement	Displays the name of the selected measurement. Click the drop-down arrow to select a different measurement.
Monitor Type	Displays the type of monitor used to obtain the selected measurement.

UI Element	Description
Description	Displays a description of the selected monitored measurement.
SQL	If an SQL logical name is in use, displays the full SQL statement.

Measurement Options Dialog Box

This dialog box enables you to set the color and the scale for any measurement of the graph you selected.



To access	**Legend Toolbar >**
See also	• "Legend Window" on page 78 • "Measurement Description Dialog Box" on the previous page

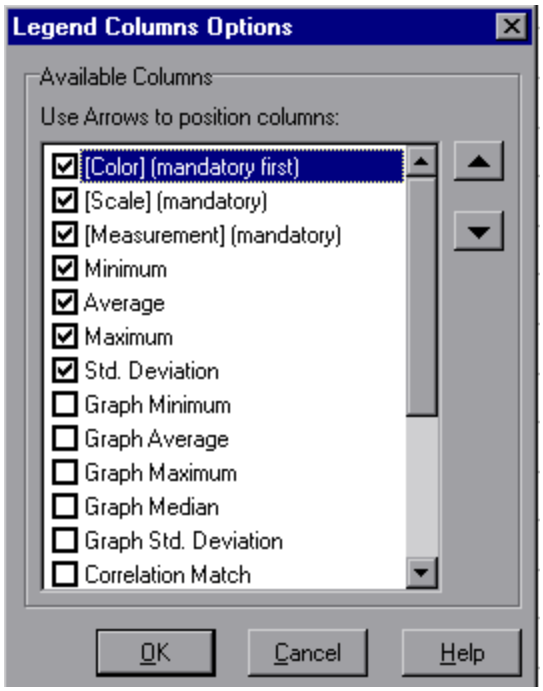
User interface elements are described below:

UI Element	Description
Measurement	Select a measurement to configure.
Change Color	Select a new color for the selected measurement.
Scale	Select the desired scale option: • Set measurement scale to x. Select the scale with which you want to view the

UI Element	Description
	• Set automatic scale for all measurements. Uses an automatic scale optimized to display each measurement in the graph. • Set scale 1 for all measurements. Sets the scale to one for all measurements in the graph. • View measurement trends for all measurements. Standardizes the y-axis values in the graph, according to the following formula: New Y value = (Previous Y Value - Average of previous values) / STD of previous values.

Legend Columns Options Dialog Box

This dialog box enables you to select the columns to be displayed.



To access	**View > Legend Columns**
See also	"Legend Window" on page 78

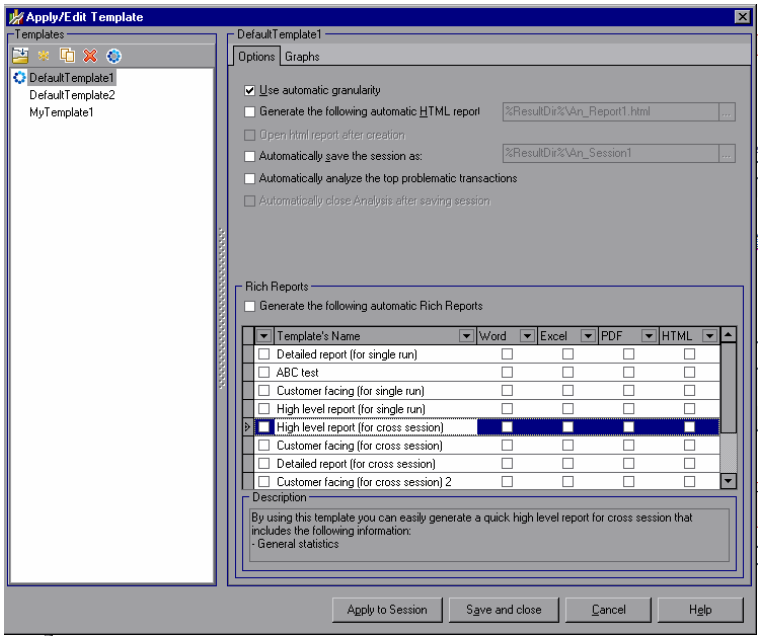
User interface elements are described below:

UI Element	Description
Available Columns	Select or deselect the check boxes to the left of the column names to show or hide the columns respectively.

UI Element	Description
	Notes: • The Color, Scale, and Measurement columns are mandatory and cannot be deselected. • To rearrange the order in which the columns appear (from left to right), you use the vertical arrows to the right of the Available Columns list to place the columns in the desired order.

Apply/Edit Template Dialog Box

This dialog box enables you to configure template settings and select report template options. Using this dialog box, you can create new templates, open existing ones, and set the default template for your sessions.



To access	Tools > Templates

User interface elements are described below (unlabeled elements are shown in angle brackets):

UI Element	Description
Templates	Select one of the following buttons: • Browse for a template. • Add a new template. Enter the title of the new template in the **Add new template** dialog box.

UI Element	Description
	• Duplicate the selected template. • Delete the selected template. • Set the selected template as the default.
Use automatic granularity	Applies the default Analysis granularity (one second) to the template. For information about setting Analysis granularity, see "Changing the Granularity of the Data" on page 91.
Generate the following automatic HTML report	Generates an HTML report using the template. Specify or select a report name. For information about generating HTML reports, see "HTML Reports" on page 373.
Open html report after creation	If you selected the option of generating an automatic HTML report, select this option to automatically open the HTML report after it is created.
Automatically save the session as	Automatically saves the session using the template you specify. Specify or select a file name.
Automatically analyze the top problematic transactions	Automatically generates Transaction Analysis reports for the transactions with the worst SLA violations. Reports are generated for a maximum of five transactions. For more information about Transaction Analysis reports, see "Analyze Transactions Dialog Box" on page 358.
Automatically close Analysis after saving session	Automatically closes Analysis after a session is automatically saved (using the previous option). This prevents the running of multiple instances of Analysis.
Generate the following automatic Rich Reports	The selected reports are added to the template.
<check box on left of Template's Name>	Select to add report template to selected template. The reports are added to the session.
Word	Generates a report using the selected report template to MS Word.

UI Element	Description
	Note: Take into account that the content load may affect the table format within the MS Word document.
Excel	Generates a report using the selected report template to Excel.
PDF	Generates a report using the selected report template to PDF.
HTML	Generates a report using the selected report template to HTML.
Graphs tab	Displays the list of graphs that are included in the template. When the template is applied to a session, the graphs are displayed under Graphs in Session Explorer. If there is no data in the session, the graphs are not created.
Apply to Session	Applies your changes to the current analysis session without closing the dialog box.

Color Palettes

Color Palettes allow you to define the colors that will be used in Analysis graphs and to allocate those colors to specific series. There is a general, default palette and you can also define a Color Palette for a specific session. You can add new colors to a palette and delete existing colors from a palette, but a palette must contain at least thirty two colors.

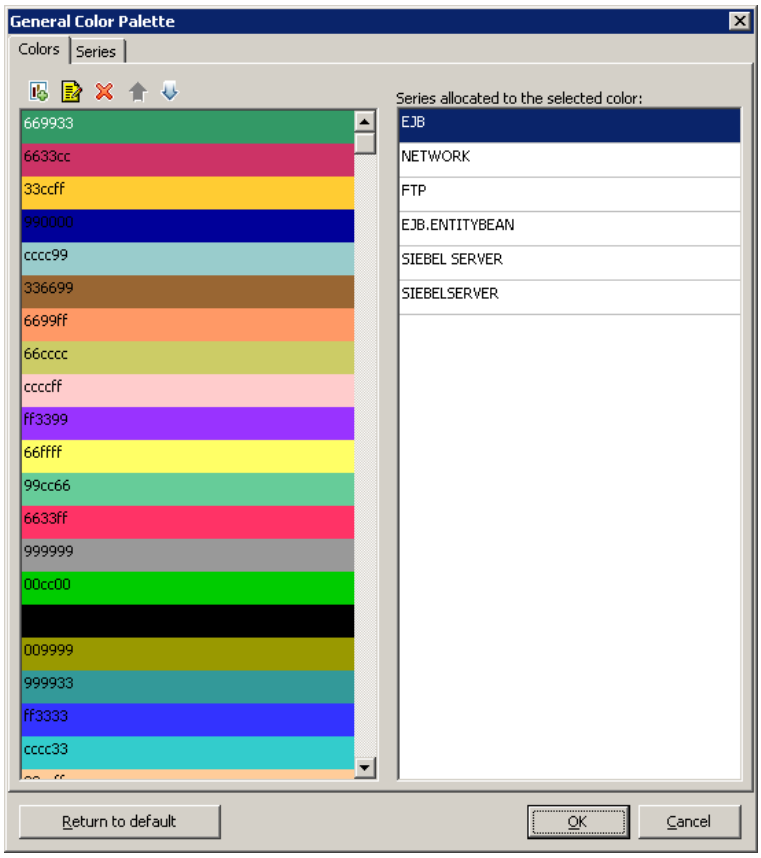
When a new session is created, or when you open an existing session that does not have a Graph Colors file, Analysis uses the general color palette. When you open an existing session that has a Graph Colors file, Analysis uses the file from the session folder.

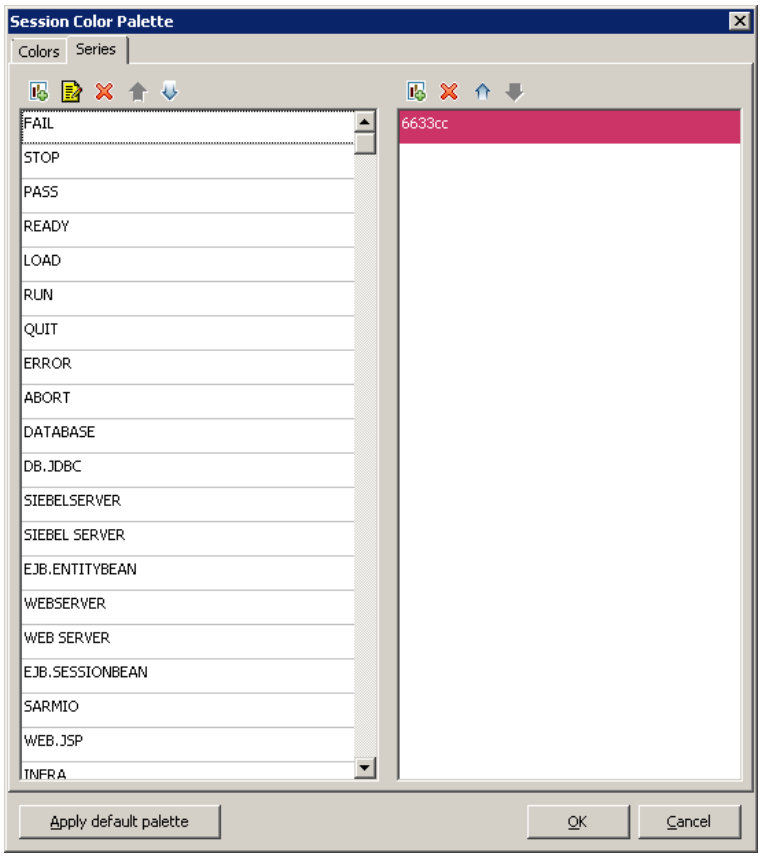
The colors are allocated to the graph in the order they appear in the palette. Colors allocated to a series, are used to represent graph elements for the series in the order the colors were allocated. To change the colors in the graph, update the palette, close and re-open the graph.

For more information, see "Color Palette Dialog Box" below.

Color Palette Dialog Box

This dialog box enables you to configure the colors that will be used in graphs. You use the General Color Palette to define a default set of colors for all graphs and the Session Color Palette to define the set of colors for a specific session.


General Color Palette
Colors
Series
Series allocated to the selected color:
669933
6633cc
33ccff
990000
cccc99
336699
6699ff
66cccc
ccccff
ff3399
66ffff
99cc66
6633ff
999999
00cc00
009999
999933
ff3333
cccc33
EJB
NETWORK
FTP
EJB.ENTITYBEAN
SIEBEL SERVER
SIEBELSERVER
Return to default
OK
Cancel



To access	• **Tools > General Color Palette** • **Tools > Session Color Palette**
See also	"Color Palettes" on page 86

User interface elements are described below:

UI Elements>	Description
Return to default	Restores the palette to the currently saved General Palette. This button appears on the General Color Palette, not on the Session Color Palette.
Apply default palette	Applies the default palette as the session palette. This button appears on the Session Color Palette, not on the General Color Palette.
Colors tab	Allows you to configure the colors on the palette.
	Add a new color to the palette.

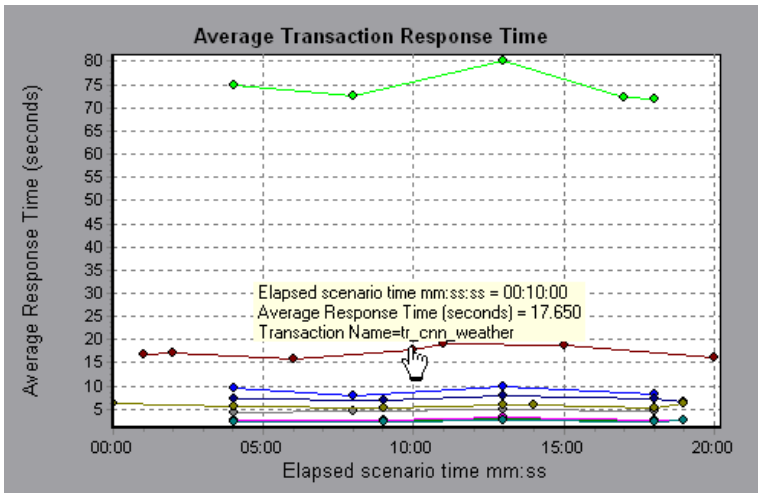
UI Elements>	Description
	Replace an existing color with a new color.
	Delete a color from the palette.
	Move the color upwards.
	Move the color downwards.
Series tab - left pane	Allows you to configure the series on the palette.
	Add a new series to the palette.
	Edit a series.
	Delete a series from the palette.
	Move the series upwards.
	Move the series downwards.
Series tab - right pane	Allows you to define colors for the selected series.
	Add a color to the series.
	Delete a color from the series.
	Move the color upwards.
	Move the color downwards.

Working with Analysis Graph Data

Analysis contains several utilities that enable you to manage graph data to most effectively view the displayed data.

Determining a Point's Coordinates

You can determine the coordinates and values at any point in a graph. Place the cursor over the point you want to evaluate and Analysis displays the axis values and other grouping information.

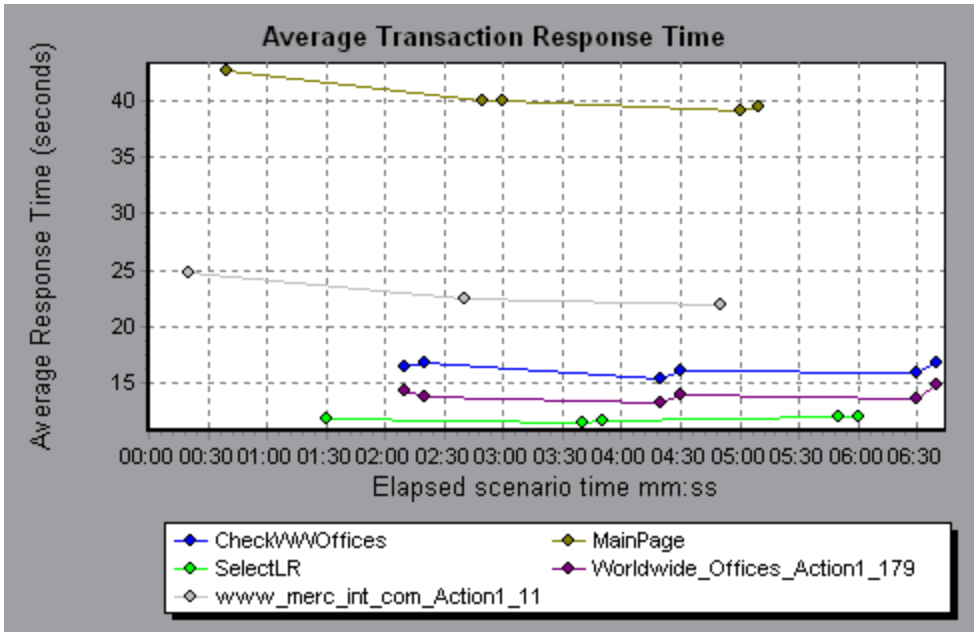


Drilling Down in a Graph

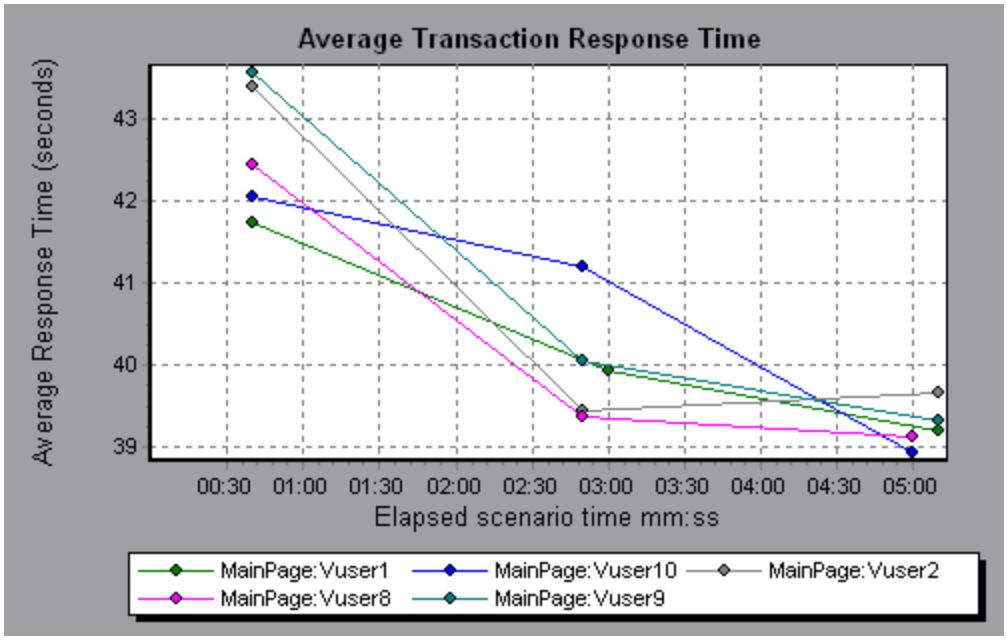
Drill down enables you to focus on a specific measurement within your graph and display it according to a desired grouping. The available groupings depend on the graph. For example, the Average Transaction Response Time graph shows one line per transaction. To determine the response time for each Vuser, you drill down on one transaction and sort it according to Vuser ID. The graph displays a separate line for each Vuser's transaction response time.

> **Note:** The drill down feature is not available for the Web Page Diagnostics graph.

The following graph shows a line for each of five transactions.



When you drill down on the MainPage transaction, grouped by Vuser ID, the graph displays the response time only for the MainPage transaction, one line per Vuser.



You can see from the graph that the response time was longer for some Vusers than for others.

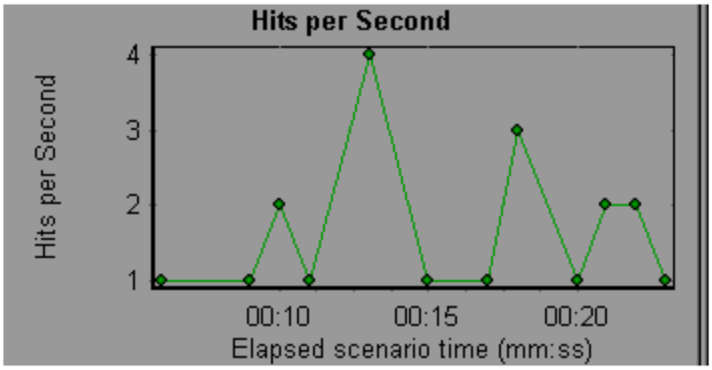
To determine the response time for each host, you drill down on one transaction and sort it according to host. The graph displays a separate line for the transaction response time on each host. For more information on drilling down in a graph, see "How to Manage Graph Data" on page 94.

Changing the Granularity of the Data

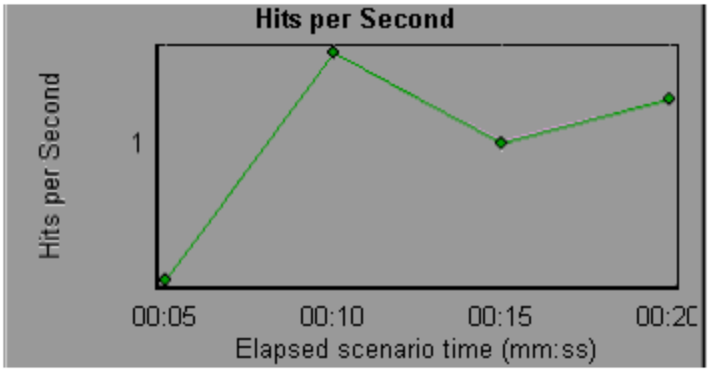
You can make the graphs easier to read and analyze by changing the granularity (scale) of the *x-axis*. The maximum granularity is half of the graph's time range. To ensure readability and clarity, Analysis automatically adjusts the minimum granularity of graphs with ranges of 500 seconds or more.

In the following example, the Hits per Second graph is displayed using different granularities. The y-axis represents the number of hits per second within the granularity interval. For a granularity of 1, the y-axis shows the number of hits per second for each one second period of the load test scenario.

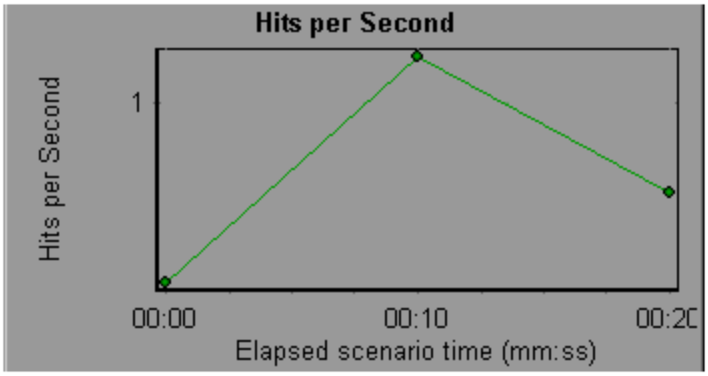
For a granularity of 5, the y-axis shows the number of hits per second for every five-second period of the scenario.



GRANULARITY=1



GRANULARITY=5



GRANULARITY=10

In the above graphs, the same load test scenario results are displayed in a granularity of 1, 5, and 10. The lower the granularity, the more detailed the results. For example, using a low granularity as in the upper graph, you see the intervals in which no hits occurred. It is useful to use a higher granularity to study the overall Vuser behavior throughout the scenario.

By viewing the same graph with a higher granularity, you can see that overall, there was an average of approximately 1 hit per second.

Viewing Measurement Trends

You can view the pattern of a line graph more effectively by standardizing the graph's y-axis values. Standardizing a graph causes the graph's y-axis values to converge around zero. This cancels the

measurements' actual values and allows you to focus on the behavior pattern of the graph during the course of the load test scenario.

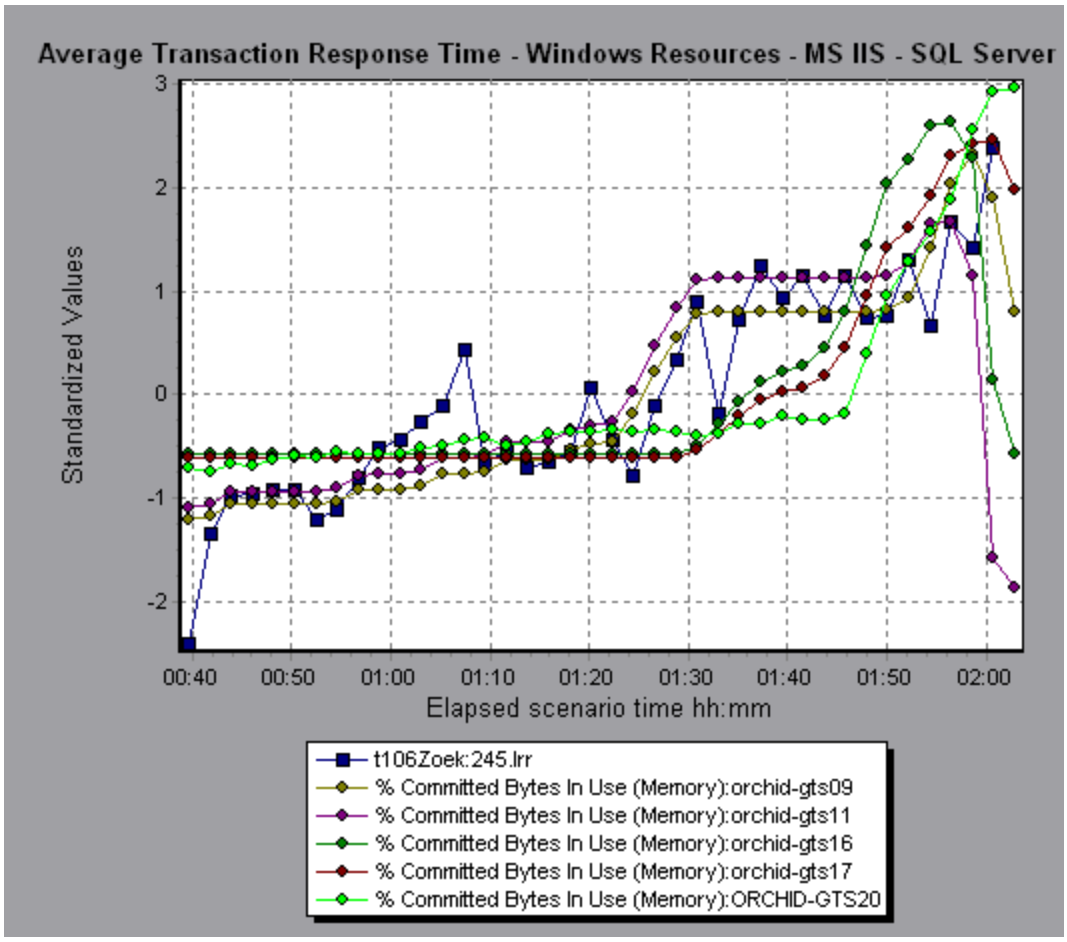
Analysis standardizes the y-axis values in a graph according to the following formula:

```
New Y value = (Previous Y Value - Average of previous values) / STD of previous values
```

Auto Correlating Measurements

You can detect similar trends among measurements by correlating a measurement in one graph with measurements in other graphs. Correlation cancels the measurements' actual values and allows you to focus on the behavior pattern of the measurements during a specified time range of the load test scenario.

In the following example, the **t106Zoek:245.lrr** measurement in the Average Transaction Response Time graph is correlated with the measurements in the Windows Resources, Microsoft IIS, and SQL Server graphs. The five measurements most closely correlated with **t106Zoek:245.lrr** are displayed in the graph below.



> **Note:** This feature can be applied to all line graphs except the Web Page Diagnostics graph.

Viewing Raw Data

You can view the actual raw data collected during test execution for the active graph. The Raw Data view is not available for all graphs.

Viewing the raw data can be especially useful in the following cases:

- To determine specific details about a peak—for example, which Vuser was running the transaction that caused the peak value(s).
- To perform a complete export of unprocessed data for your own spreadsheet application.

For user interface details, click "Graph/Raw Data View Table" on page 100.

How to Manage Graph Data

The following list includes the utilities you can use in Analysis to enable you to manage graph data to most effectively view the displayed data.

Determine a point's coordinates

To determine the coordinates and values at any point in a graph, place the cursor over the point you want to evaluate. Analysis displays the axis values and other grouping information.

Drill down in a graph

Drill down enables you to focus on a specific measurement within your graph and display it according to the desired grouping.

1. Right-click on a line, bar, or segment within the graph, and select **Drill Down**. The **Drill Down Options** dialog box opens, listing all of the measurements in the graph.
2. Select a measurement for drill down.
3. From the **Group By** box, select a group by which to sort.
4. Click **OK**. Analysis drills down and displays the new graph.

   To undo the last drill down settings, choose **Undo Set Filter/Group By** from the right-click menu.

   - To perform additional drill-downs, repeat steps 1 to 4.
   - To clear all filter and drill down settings, choose **Clear Filter/Group By** from the right-click menu.

Filter the data

This task describes how to filter the data and create custom filters.

1. In the Legend window, click the column header of the measurement you want to use as a base for the filter.
2. To show a single entry, expand the drop-down list and select that entry.
3. To create a custom filter, select **Custom** in the drop-down list. The Custom Filter dialog box opens.
4. Select an evaluation expression and provide a value. To use wildcards, use an underscore, **_**, to represent a single character and **%** for multiple characters. For details, see "Custom Filter Dialog Box" on page 113.
5. To provide additional criteria, select a logical operator, **AND** or **OR** and set up the second expression.

Change the granularity of the data

This task describes how to change the granularity of a graph.

1. Click inside a graph.
2. Select **View** > **Set Granularity**, or click the**Set Granularity** button  . The Granularity dialog box opens.
3. Enter the granularity of the x-axis and select a time measurement. The maximum granularity is half of the graph's time range.
4. To ensure readability and clarity, LoadRunner automatically adjusts the minimum granularity of graphs with ranges of 500 seconds or more.
5. Click **OK**.

View measurement trends

This task describes how to activate the View Measurements Trends option from a line graph.

1. Select **View > View Measurement Trends**, or right-click the graph and choose **View Measurement Trends**. Alternatively, you can select **View > Configure Measurements** and check the View measurement trends for all measurements box.

   > **Note:** The standardization feature can be applied to all line graphs except the Web Page Diagnostics graph.

2. View the standardized values for the line graph you selected. The values in the Minimum, Average, Maximum, and Std. Deviation legend columns are real values.

   To undo the standardization of a graph, repeat step 1.

   > **Note:** If you standardize two line graphs, the two y-axes merge into one y-axis.

Auto correlate measurements

You can detect similar trends among measurements by correlating a measurement in one graph with measurements in other graphs. Correlation cancels the measurements' actual values and allows you to focus on the behavior pattern of the measurements during a specified time range of the load test scenario.

1. From a graph or legend, right-click the measurement you want to correlate and choose **Auto Correlate**. The Auto Correlate dialog box opens with the selected measurement displayed in the graph.
2. Select a suggested time range method and time range.
3. If you applied a time filter to your graph, you can correlate values for the complete scenario time range by clicking the **Display** button in the upper right-hand corner of the dialog box.
4. To specify the graphs you want to correlate with a selected measurement and the type of graph output to be displayed, perform the following:
   - Select the **Correlation Options** tab.
   - Select the graphs to correlate, the data interval, and output options, as described in "Drill Down Options Dialog Box" below.
   - On the **Time Range** tab, click **OK**. Analysis generates the correlated graph you specified. Note the two new columns—**Correlation Match** and **Correlation**—that appear in the Legend window below the graph.

   To specify another measurement to correlate, select the measurement from the Measurement to Correlate box at the top of the Auto Correlate dialog box.

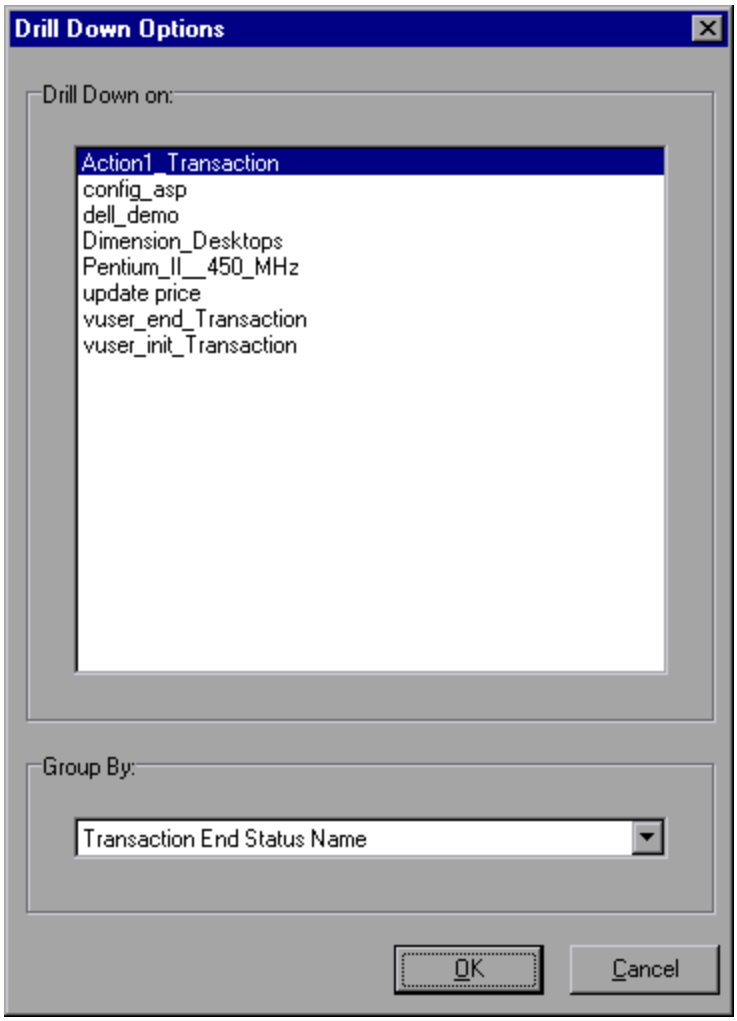
   The minimum time range should be more than 5% of the total time range of the measurement. Trends which are smaller than 5% of the whole measurement will be contained in other larger segments.

   Sometimes, very strong changes in a measurement can hide smaller changes. In cases like these, only the strong change is suggested, and the **Next** button will be disabled.

   > **Note:** This feature can be applied to all line graphs except the Web Page Diagnostics graph.

Drill Down Options Dialog Box

This dialog box lists all the measurements in the graph.



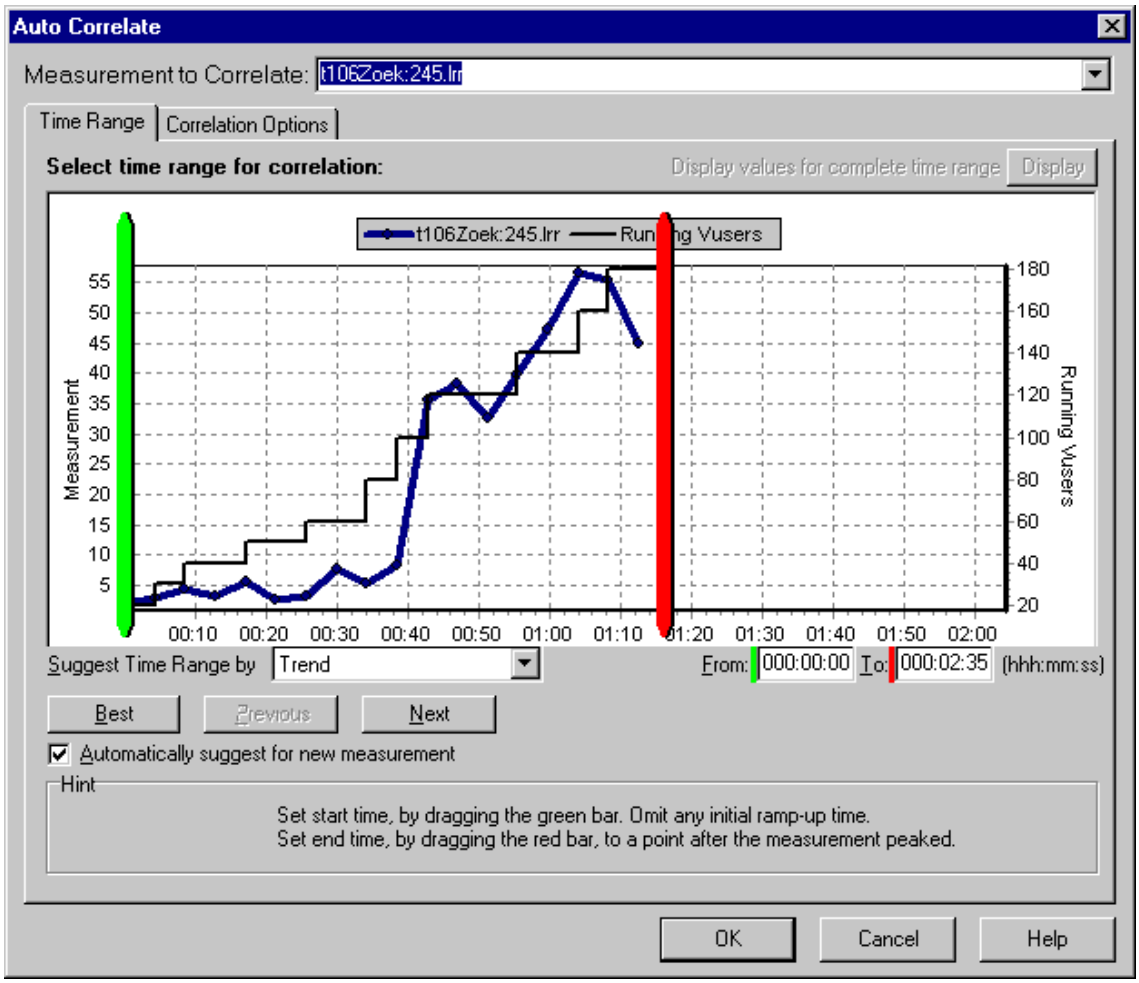
To access	<Right-click> graph line/bar/segment > **Drill Down**
See also	"Drilling Down in a Graph" on page 90

User interface elements are described below:

UI Element	Description
Drill Down on	Filter graph by selected transaction.
Group By	The selected transaction is sorted by selected criteria.

Auto Correlate Dialog Box

This dialog box enables you to configure settings used to correlate measurements from the selected graph with measurements in other graphs.



To access	Click on a graph and select **> Auto Correlate** from the right-click menu
Important information	You can also use the green and red vertical drag bars to specify the start and end values for the scenario time range.
Note	The granularity of the correlated measurements graph may differ from that of the original graph, depending on the scenario time range defined.
See also	"Auto Correlating Measurements" on page 93

Time Range Tab

The **Time Range** tab of the Auto Correlate dialog box enables you to specify a load test scenario time range for the correlated measurement graph.

User interface elements are described below:

UI Element	Description
Measurement to Correlate	Select the measurement you want to correlate.
Display values for complete time range	Click **Display** to correlate values for the complete scenario time range. This option is available only if you applied a time filter to your graph.
Suggest Time Range By	Analysis automatically demarcates the most significant time period for the measurement in the scenario. • **Trend.** Demarcated an extended time segment which contains the most significant changes. • **Feature.** Demarcates a smaller dimension segment which forms the trend.
Best	Choose the time segment most dissimilar to its adjacent segments.
Next	Suggest the next time segment for auto correlation. Each suggestion is successively less dissimilar.
Previous	Return to the previous suggestion of a time segment.
Automatically suggest for new measurement	Generates new suggestions each time that the Measurement to Correlate item changes.
From	Specify a start value (in hh:mm:ss format) for the desired scenario time range.
To	Specify an end value (in hh:mm:ss format) for the desired scenario time range.

Correlation Options tab

You use the **Correlation Options** tab to set the graphs to correlate, the data interval, and the output options.

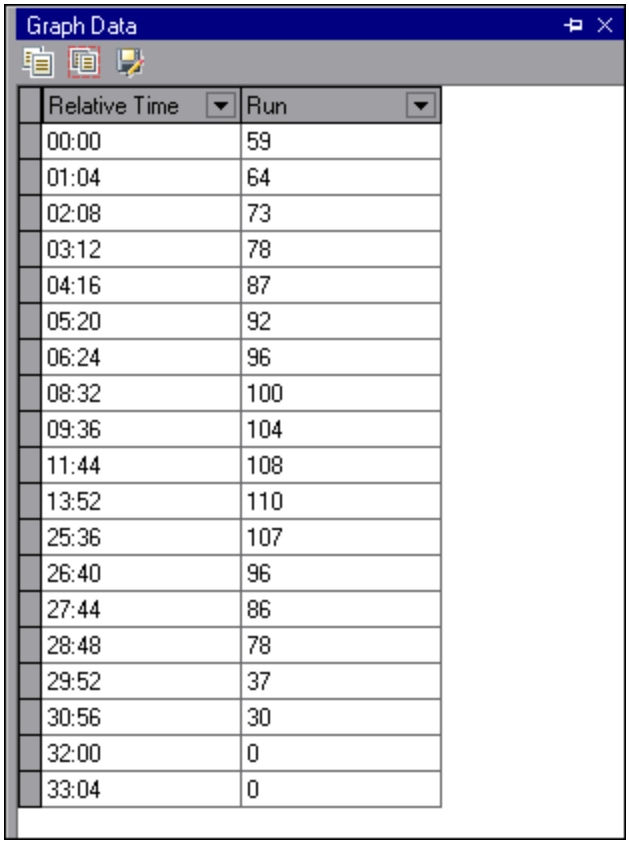
User interface elements are described below:

UI Element	Description
Select Graphs for Correlation	Select the graphs whose measurements you want to correlate with your selected measurement.
Data Interval	Calculate the interval between correlation measurement polls. • **Automatic**. Uses an automatic value, determined by the time range.

UI Element	Description
	• **Correlate data based on X second intervals**. Enter a fixed value.
Output	Choose the level of output displayed. • **Show the X most closely correlated measurements.** Displays only the specified number of measurements most closely related to the selected measurement. The default value is 5. • **Show measurements with an influence factor of at least X%.** Displays only those measurements that converge to the specified percent with the selected measurement. The default value is 50%.

Graph/Raw Data View Table

You can view graph data in spreadsheet view or raw data view. The data is instantly displayed on request.

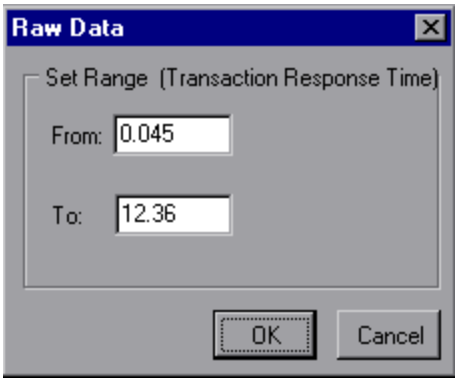


Relative Time	Run
00:00	59
01:04	64
02:08	73
03:12	78
04:16	87
05:20	92
06:24	96
08:32	100
09:36	104
11:44	108
13:52	110
25:36	107
26:40	96
27:44	86
28:48	78
29:52	37
30:56	30
32:00	0
33:04	0

To access	Click the appropriate tab on the right border of the Analysis window or do one of the following: • **Windows > Graph Data**

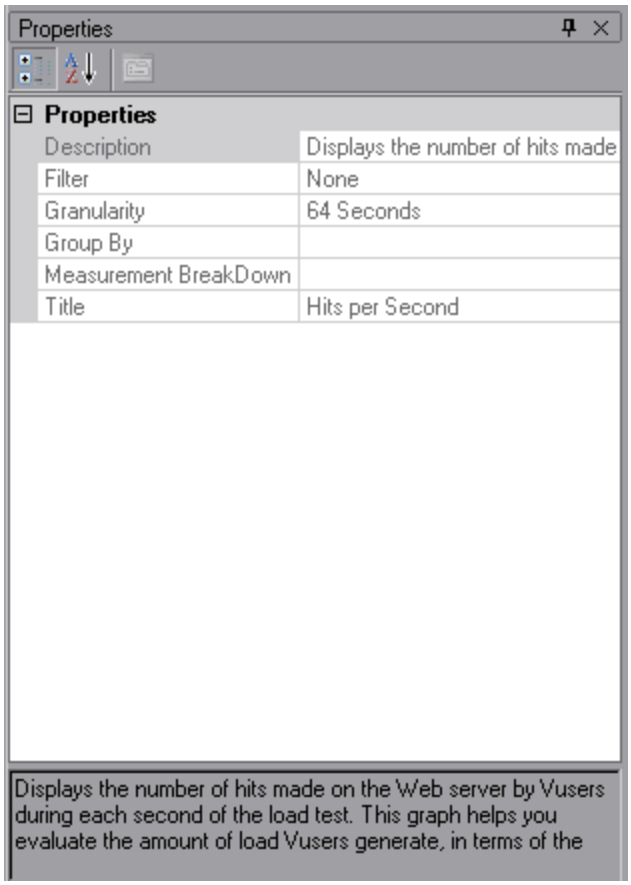
	• **Windows > Raw Data**
Note	Raw Data is not available for all graphs.

User interface elements are described below:

UI Element	Description
	Copies the data that you have selected.
	Copies the spreadsheet to the clipboard. You can paste to a spreadsheet.
	Saves the spreadsheet data to an Excel or CSV file. In Excel, you can generate your own customized graphs.
	Use the buttons on the toolbar to navigate through the table, and mark any records for future reference.
Relative Time	The first column in the Graph Data window. displays the elapsed scenario time (the x-axis values). The following columns displays the relative y-axis values for each measurement represented on the graph.
Raw Data dialog box	In **Set Range**, set a time range. 

Graph Properties Pane

This pane displays the details of the graph or report selected in the Session Explorer. Fields that appear in black are editable. When you select an editable field, an edit button is displayed next to the selected field value.



To access	One of the following: • **Windows > Properties** • Select a graph in the Session Explorer, and select **Properties** from the right-click menu.

User interface elements are described below:

UI Element	Description
...	Enables you to edit the value for the selected field.
Graph fields	• **Filter**. Shows configured filter. • **Granularity.** Shows configured granularity. • **Group By**. Shows the filter for selected group. • **Measurement Breakdown**. Shows the measurements of the graph. • **Title**. Shows the name of the graph in the graph display window.
Summary Report fields	• **Description**. A short summary of what is included in the summary report. • **Filter**. Shows configured filter for the summary report.

UI Element	Description
	• **Percentile.** The Summary Report contains a percentile column showing the response time of 90% of transactions (90% of transactions that fall within this amount of time). To change the value of the default 90 percentile, enter a new figure in the **Transaction Percentile** box. • **Title**. The name of the summary report.
Transaction Analysis Report fields	When clicking the edit button for some of the fields, the Analyze Transaction Settings dialog box opens, enabling you to edit some of the Analyze Transaction settings.

Filtering and Sorting Graph Data

Filtering Graph Data Overview

You can filter graph data to show fewer transactions for a specific segment of the load test scenario. More specifically, you can display four transactions beginning from five minutes into the scenario and ending three minutes before the end of the scenario.

You can filter for a single graph, in all graphs in a load test scenario, or in the summary graph.

The available filter conditions differ for each type of graph. The filter conditions also depend on your scenario. For example, if you only had one group or one load generator machine in your scenario, the Group Name and Load Generator Name filter conditions do not apply.

> **Note:** You can also filter merged graphs. The filter conditions for each graph are displayed on separate tabs.

Sorting Graph Data Overview

You can sort graph data to show the data in more relevant ways. For example, Transaction graphs can be grouped by the Transaction End Status, and Vuser graphs can be grouped by Scenario Elapsed Time, Vuser End Status, Vuser Status, and Vuser ID.

You can sort by one or several groups—for example by Vuser ID and then Vuser status. The results are displayed in the order in which the groups are listed. You can change the grouping order by rearranging the list.

Filter Conditions

Common Filter Condition Options

The following filter conditions are common to many graphs:

Filter Condition	Filters the graph according to...
Host Name	The name of the Host machine. Select one or more hosts from the drop-down list.
Transaction End Status	The end status of a transaction: *pass, fail, stop*.
Scenario Elapsed Time	The time that elapsed from the beginning to the end of the load test scenario. For more information about setting the time range, see "Scenario Elapsed Time Dialog Box" on page 117.
Vuser ID	The Vuser ID. For more information, see "Vuser ID Dialog Box" on page 119.
Script Name	The name of the script.
Group Name	The name of the group to filter by.
Think Time	The Think Time option in the graph filter for complete mode is turned off by default. The transaction time displayed shows pure time.

Vuser Graphs

You can apply the following filter conditions to Vuser graphs:

Filter Condition	Filters the graph according to...
Vuser Status	The Vuser status: *load, pause, quit, ready, run*
Vuser End Status	The status of the Vuser at the end of the transaction: *error, failed, passed, stopped.*
Number of Released Vusers	The number of Vusers that were released.
Rendezvous Name	The name of the rendezvous point.

Error Graphs

You can apply the following filter conditions to Error graphs:

Filter Condition	Filters the graph according to...
Error Type	The type of error (per error number).
Parent Transaction	The parent transaction.
Line Number in Script	The line number in the script.

Transaction Graphs

You can apply the following filter conditions to Transaction graphs:

Filter Condition	Filters the graph according to...
Transaction Name	The name of the transaction.
Transaction Response Time	The response time of the transaction.
Transaction Hierarchical Path	The hierarchical path of the transaction. For more information on setting this condition, see "Hierarchical Path Dialog Box" on page 117.

Web Resource Graphs

You can apply the following filter conditions to Web Resources graphs:

Filter Condition	Filters the graph according to...
Web Resource Name	The name of the Web resource.
Web Resource Value	The value of the Web resource.
Web Server Resource Name	The name of the Web Server resource.
Web Server Resource Value	The value of the Web Server resource.

Web Page Diagnostics Graphs

You can apply the following filter conditions to Web Page Diagnostics graphs:

Filter Condition	Filters the graph according to...
Component Name	The name of the component.
Component Response Time	The response time of the component.

Filter Condition	Filters the graph according to...
Component DNS Resolution Time	The amount of time the component needs to resolve the DNS name to an IP address, using the closest DNS server.
Component Connection Time	The time taken for the component to establish an initial connection with the Web server hosting the specified URL.
Component First Buffer Time	The time that passes from the component's initial HTTP request (usually GET) until the first buffer is successfully received back from the Web server.
Component Receive Time	The time that passes until the component's last byte arrives from the server and the downloading is complete.
Component SSL Handshaking Time	The time take for the component to establish an SSL connection. (Applicable to HTTPS communication only.)
Component FTP Authentication Time	The time taken for the component to authenticate the client. (Applicable to FTP protocol communication only).
Component Error Time	The average amount of time that passes from the moment a component's HTTP request is sent until the moment an error message (HTTP errors only) is returned.
Component Size (KB)	The size of the component (in kilobytes).
Component Type	The type of component: *Application; Image; Page; Text*
Component Hierarchical Path	The hierarchical path of the component. For more information on setting this condition, see "Hierarchical Path Dialog Box" on page 117.
Component Network Time	The amount of time from the component's first HTTP request, until receipt of ACK.
Component Server Time	The amount of time from when the component receives of ACK, until the first buffer is successfully received back from the Web server.
Component Client Time	The average amount of time that passes while a component request is delayed on the client machine due to browser think time or other client-related delays.

User Defined Data Point Graphs

You can apply the following filter conditions to User-Defined Data Point graphs:

Filter Condition	Filters the graph according to...
Datapoint Name	The name of the data point.
Datapoint Value	The value of the data point.

System Resources Graphs

You can apply the following filter conditions to System Resource graphs:

Filter Condition	Filters the graph according to...
System Resource Name	The name of the system resource.
System Resource Value	The value of the system resource. See "Set Dimension Information Dialog Box" on page 118.

Network Monitor Graphs

You can apply the following filter conditions to Network Monitor graphs:

Filter Condition	Filters the graph according to...
Network Path Name	The name of the network path.
Network Path Delay	The delay of the network path.
Network Path Father	The father of the network path.
Network SubPath Name	The name of the network subpath.
Network SubPath Delay	The delay of the network subpath.
Network Full Path	The full network path.
Network Segment Name	The name of the network segment.
Network Segment Delay	The delay of the network segment.
Network Segment Full Path	The full network segment path.

Firewall Graphs

You can apply the following filter conditions to Firewall graphs:

Filter Condition	Filters the graph according to...
Firewall Resource	The name of the Firewall resource.

Filter Condition	Filters the graph according to...
Name	
Firewall Resource Value	The value of the firewall resource. See "Set Dimension Information Dialog Box" on page 118.

Web Server Resource Graphs

You can apply the following filter conditions to Web Server Resource graphs:

Filter Condition	Filters the graph according to...
Measurement Name	The name of the measurement.
Measurement Value	The measurement value. See "Set Dimension Information Dialog Box" on page 118.

Web Application Server Resource Graphs

You can apply the following filter conditions to Web Application Server Resource graphs:

Filter Condition	Filters the graph according to...
Resource Name	The name of the resource.
Resource Value	The value of the resource. See "Set Dimension Information Dialog Box" on page 118.

Database Server Resource Graphs

You can apply the following filter conditions to Database Server Resource graphs:

Filter Condition	Filters the graph according to...
Database Resource Name	The name of the database resource.
Database Resource Value	The value of the database resource. See "Set Dimension Information Dialog Box" on page 118.

Streaming Media Graphs

You can apply the following filter conditions to Streaming Media graphs:

Filter Condition	Filters the graph according to...
Streaming Media Name	The name of the streaming media.
Streaming Media Value	The value of the streaming media. See "Set Dimension Information Dialog Box" on page 118.

ERP/CRM Server Resource Graphs

You can apply the following filter conditions to ERP/CRM Server Resource graphs:

Filter Condition	Filters the graph according to...
ERP/CRM Server Resource Name	The name of the ERP/CRM server resource.
ERP/CRM Server Resource Value	The value of the ERP/CRM Server resource. See "Set Dimension Information Dialog Box" on page 118.
ERP Server Resource Name	The name of the ERP server resource.
ERP Server Resource Value	The value of the ERP server resource. See "Set Dimension Information Dialog Box" on page 118.

Siebel Diagnostics Graphs

You can apply the following filter conditions to Siebel Diagnostics graphs:

Filter Condition	Filters the graph according to...
Siebel Transaction Name	The name of the Siebel transaction.
Siebel Request Name	The name of the Siebel request.
Siebel Layer Name	The name of the Siebel layer.
Siebel Area Name	The name of the Siebel area.
Siebel Sub-Area Name	The name of the Siebel sub-area.
Siebel Server Name	The name of the Siebel server.
Siebel Script Name	The name of the Siebel script.
Response Time	The response time of the Siebel transaction.
Siebel Chain of Calls	The chain of calls for the Siebel transaction.

Siebel DB Diagnostics Graphs

You can apply the following filter conditions to Siebel DB Diagnostics graphs:

Filter Condition	Filters the graph according to...
Transaction Name - SIEBEL	The name of the Siebel DB transaction.
SQL Chain of Calls	The SQL chain of calls for the Siebel DB transaction.
SQL Alias Name	The SQL alias name for the Siebel DB transaction.
SQL Response Time	The SQL response time of the Siebel DB transaction.

Oracle - Web Diagnostics Graphs

You can apply the following filter conditions to Oracle - Web Diagnostics graphs:

Filter Condition	Filters the graph according to...
Transaction Name - ORACLE	The name of the Oracle transaction.
SQL Chain of Calls	The SQL chain of calls for the Oracle transaction.
SQL Alias Name - Oracle	The SQL alias name for the Oracle transaction.
SQL Response Time	The SQL response time of the Oracle transaction.
Oracle SQL Parse Time	The SQL parse time of the Oracle transaction.
Oracle SQL Execute Time	The SQL execute time of the Oracle transaction.
Oracle SQL Fetch Time	The SQL fetch time of the Oracle transaction.
Oracle SQL Other Time	Other SQL time for the Oracle transaction.

Java Performance Graphs

You can apply the following filter conditions to Java Performance graphs:

Filter Condition	Filters the graph according to...
Java Performance Resource Name	The name of the Java performance resource.
Java Performance Resource Value	The value of the Java performance resource.

J2EE & .NET Diagnostics Graphs

You can apply the following filter conditions to J2EE & .NET Diagnostics graphs:

Filter Condition	Filters the graph according to...
Transaction Name	The name of the Java transaction.
Method Chain of Calls	The chain of calls for the Java method.
Layer Name	The name of the layer.
Class Name	The name of the class.
Method Name	The name of the method.
SQL Logical Name	The SQL logical name for the Java transaction.
Response Time	The response time of the Java transaction.
Host Name - J2EE/.NET	The name of the host for the J2EE & .NET transaction.
Application Host Name - (VM)	The name of the application host for the VM.
Transaction Request	The request for the transaction.
Transaction Hierarchical Path	The hierarchical path of the transaction. For more information on setting this condition, see "Hierarchical Path Dialog Box" on page 117.

Application Component Graphs

You can apply the following filter conditions to Application Component graphs:

Filter Condition	Filters the graph according to...
Component Resource Name	The resource name of the component.
Component Resource Value	The value of the component resource. See "Set Dimension Information Dialog Box" on page 118.
COM+ Interface	The interface of the COM+ component.
COM+ Response Time	The response time of the COM+ component.
COM+ Call Count	The call count of the COM+ component.

Filter Condition	Filters the graph according to...
COM+ Method	The method of the COM+ component.
.NET Resource Name	The resource name of the .NET component.
.NET Value	The .NET resource value. See "Set Dimension Information Dialog Box" on page 118.
.NET Class	The class of the .NET component.
.NET Response Time	The response time of the .NET component.
.NET Call Count	The call count of the .NET component.
.NET Method	The method of the .NET component.

Application Deployment Graphs

You can apply the following filter conditions to Application Deployment graphs:

Filter Condition	Filters the graph according to...
Citrix Resource Name	The name of the Citrix resource.
Citrix Resource Value	The value of the Citrix resource. See "Set Dimension Information Dialog Box" on page 118.

Middleware Performance Graphs

You can apply the following filter conditions to Middleware Performance graphs:

Filter Condition	Filters the graph according to...
Message Queue Resource Name	The name of the message queue resource.
Message Queue Resource Value	The value of the Message Queue resource. See "Set Dimension Information Dialog Box" on page 118.

Infrastructure Resource Graphs

You can apply the following filter conditions to Infrastructure Resource graphs:

Filter Condition	Filters the graph according to...
Network Client	The name of the network client.

Filter Condition	Filters the graph according to...
Network Client Value	The value of the network client. See "Set Dimension Information Dialog Box" on page 118.

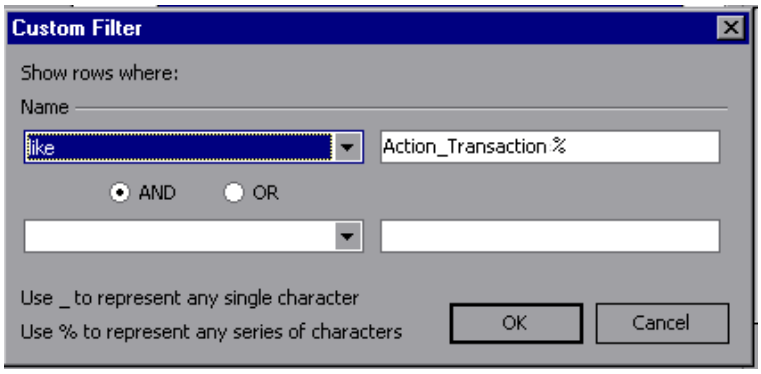
External Monitor Graphs

You can apply the following filter conditions to External Monitor graphs:

Filter Condition	Filters the graph according to...
External Monitor Resource Name	The name of the external monitor resource.
External Monitor Resource Value	The value of the external monitor resource. See "Set Dimension Information Dialog Box" on page 118.

Custom Filter Dialog Box

This dialog box enables you to customize your filter criteria.



To access	Do the following: 1. In a **Legend** window, click a column header. 2. Expand the down arrow and choose **(Custom)**.
Tip	You can use wildcards: • Use **_** to represent a single character. • Use **%** to represent a series of characters.
See also	"Legend Window" on page 78

User interface elements are described below:

UI Element	Description
<First Evaluator Expression>	A drop-down list of evaluation expressions such as **equals**, **is greater than**, **like**, and so forth, followed by a value.
Operator	The logical operator by which to add a second expression: **AND** or **OR**.
<Second Evaluator Expression>	A drop-down list of evaluation expressions such as **equals**, **is greater than**, **like**, and so forth, followed by a value.

For example, the above image shows how to filter the data for transactions that begin with the phrase "Action_Transaction", using **Like** and **Action_Transaction%**.

After you save a customization for one of the metrics, the Analysis displays it in the lower section of the Legend window.

Filter Dialog Boxes

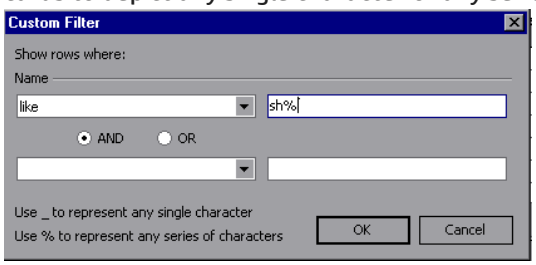
The filter dialog boxes (Graph Settings, Global Filter, and Analysis Summary Filter) enable you to filter the data that is displayed in the graph or report.

When adding a graph, the filter and sort button is displayed which enables you to filter and sort data before the graph is displayed.

To access	**Use one of the following:** • **View > Set Filter/Group By** or click  • **File > Set Global Filter** or click  • **View > Summary Filter** or click 
Note	Some of the following fields are not displayed in all of the filter boxes.

User interface elements are described below:

UI Element	Description
Filter Condition	Select criteria and values for each filter condition that you want to employ. The applicable filter conditions are displayed for each graph. For details on each graphs filter conditions, see the chapter on the relevant graph.
Criteria	Select "=" (equals) or "<>" (does not equal).
Values	The filter conditions are grouped into three value types (discrete, continuous, and time-based). A discrete value is a distinct integer (whole number) or string value such as Transaction Name or Vuser ID. Select the check box(es) of the value(s) that you

UI Element	Description
	want to include in your filter. You can also customize your filter by entering wild cards to depict any single character or any series of characters.  • A continuous value is a variable dimension that can take any value within the minimum and maximum range limits, such as Transaction Response Time. You set the dimension information for each measurement in the "Set Dimension Information Dialog Box" on page 118. • A time-based value is a value that is based on time relative to the start of the load test scenario. Scenario Elapsed Time is the only condition that uses time-based values. You specify time-based values in the "Scenario Elapsed Time Dialog Box" on page 117. For some filter conditions, one of the following dialog boxes opens to enable you to specify additional filtering details: • "Set Dimension Information Dialog Box" on page 118 • "Vuser ID Dialog Box" on page 119 • "Scenario Elapsed Time Dialog Box" on page 117 • "Hierarchical Path Dialog Box" on page 117: Enables you to display the hierarchical path of a transaction or component, or a method chain of calls.
Transaction Percentile	The Summary Report contains a percentile column showing the response time of 90% of transactions (90% of transactions that fall within this amount of time). To change the value of the default 90 percentile, enter a new figure in the **Transaction Percentile** box.
Set Default	Displays the default criteria and values for each filter condition.
Clear All	Deletes all of the information you entered in the dialog box.
Group By settings	Use these settings to sort the graph display by grouping the data. You can group the data by: • **Available groups**. Select the group by which you want to the sort the results, and click the right arrow. • **Selected groups**. Displays a list of all the selected groups by which the results will be sorted. To remove a value, select it and click the left arrow.

UI Element	Description
Reset all graphs to their defaults prior to applying the Global Filter	All graphs filter settings are reverted to their default.

Filter Builder Dialog Box

The Filter Builder dialog box enable you to design, add, and edit filters for your graph.

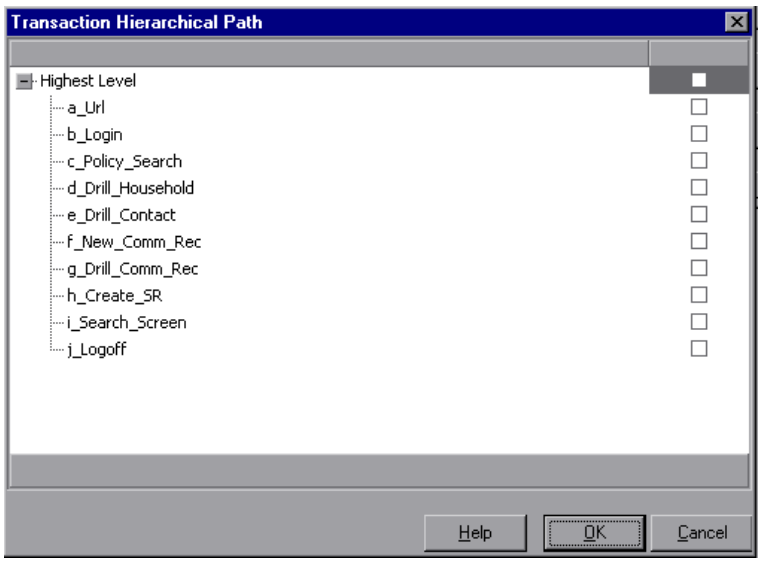
To access	**Use one of the following:** 1. In the Legend pane, expand the down arrow in a column header. 2. Select **Custom** to open the Custom Filter dialog box. Provide filter details and click OK. 3. Click **Customize** in the filter entry in the lower part of the **Legend** pane.
See also	"Custom Filter Dialog Box" on page 113

User interface elements are described below:

UI Element	Description
Filter button	Opens a menu with the following options: • **Add Condition.** Add another condition for the current filter. • **Add Group.** Adds a second condition, joined by a logical operator AND or OR, to the last condition in the list. • **Clear All.** Removes all of the conditions in the window.
...	Opens a menu with the following options: • **Add Condition.** Add another condition for the current filter. • **Add Group.** Adds a second condition, joined by a logical operator AND or OR, to the selected condition in the list. • **Remove Row.** Removes the selected condition.
Open	Opens an **.flt** file saved from a previous session.
Save as	Saves all of the conditions to an **.flt** file.

Hierarchical Path Dialog Box

This dialog box enables you to display the hierarchical path of a transaction or component, or a method chain of calls.



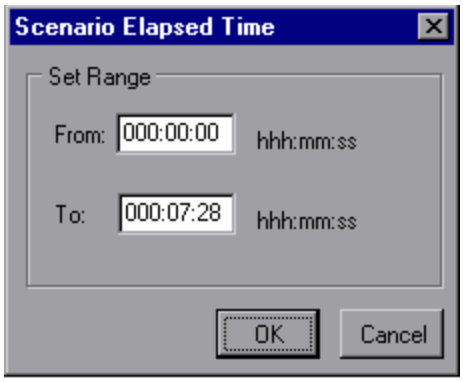
To access	**View** menu > **Set Filter/Group by** > **Filter condition** pane > **Transaction, Component Hierarchical Path or a method chain of calls**

User interface elements are described below:

UI Element	Description
Transaction, Component Hierarchical Path or a method chain of calls	Select the box for the path where you want to start to see results. Only the selected path and its immediate sub-nodes will be displayed.

Scenario Elapsed Time Dialog Box

This dialog box enables you to specify the start and end time range for the graph's x-axis.



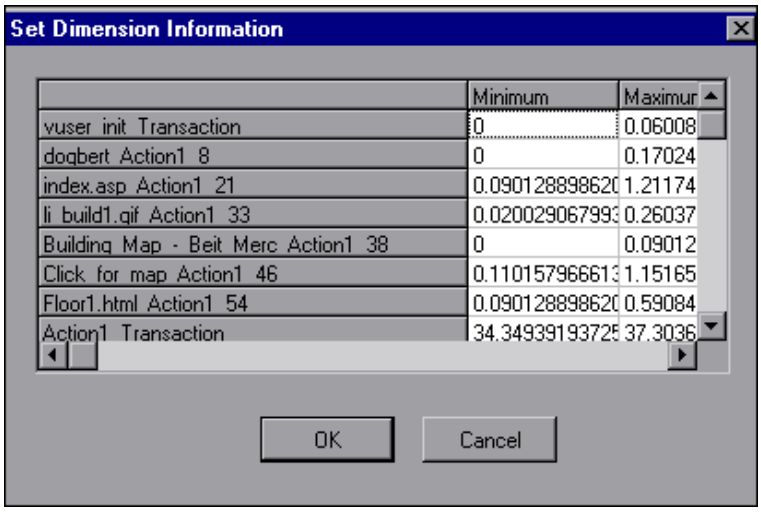
To access	**View** menu **> Set Filter/Group by** > **Filter condition** pane > **Scenario Elapsed Time**
Note	The time is relative to the start of the scenario.

User interface elements are described below:

UI Element	Description
From	Specify a start value for the desired range.
To	Specify an end value for the desired range.

Set Dimension Information Dialog Box

This dialog box enables you to set the dimension information for each measurement (transaction, number of released Vusers, resource) in the result set. You specify the minimum and maximum values for each measurement you want in the analysis. By default, the full range of values for each measurement is displayed.



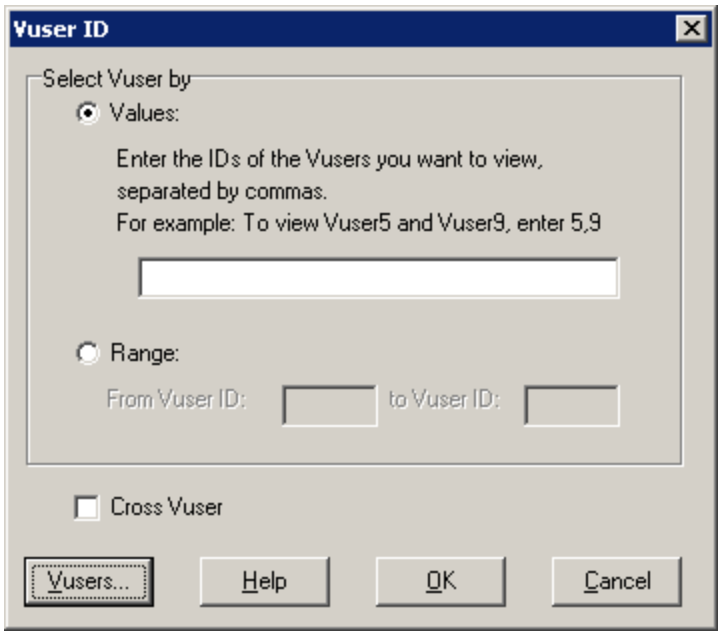
To access	You can open this dialog box from the following locations: • **Transaction** graphs **> View** menu **> Set Filter/Group by** > **Filter condition** pane > **Transaction Response Time** • **Vusers** graph > **Rendezvous** graph > **View** menu **> Set Filter/Group by** > **Filter condition** pane > **Number of Released Vusers** • All graphs that measure resources (**Web Server**, **Database Server**, and so on) > **View** menu **> Set Filter/Group by** > **Filter condition** pane > **Resource Value**
Note	If you are specifying the start and end time for a transaction (in minutes:seconds format), the time is relative to the beginning of the load test scenario.

User interface elements are described below:

UI Element	Description
Minimum	Specify a minimum value for the measurement.
Maximum	Specify a maximum value for the measurement.

Vuser ID Dialog Box

This dialog box opens to enable the entering of additional filter information for the Vuser ID filter condition.



To access	View menu > Set Filter/Group by > Filter condition pane > Vuser ID

User interface elements are described below:

UI Element	Description
Value	Enter the Vuser IDs of the Vusers you want the graph(s) to display, separated by commas.
Range	Specify the beginning and end of the desired range of Vusers you want the graph(s) to display.
Cross Vuser	Cross Vuser transactions are transactions that start with one Vuser and end with a different Vuser, such as sending an email. Selecting this check box places the value "CrossVuser" in the Vuser ID filter. By default, the check box is not selected.

UI Element	Description
	Note: Only transaction graphs have Cross Vuser data.
Vusers	Displays the existing Vuser IDs from which you can choose.

Cross Result and Merged Graphs

Comparing results is essential for determining bottlenecks and problems. You use Cross Result graphs to compare the results of multiple load test scenario runs. You create Merged graphs to compare results from different graphs within the same scenario run.

Cross Result and Merged Graphs Overview

Comparing results is essential for determining bottlenecks and problems. You use Cross Result graphs to compare the results of multiple load test scenario runs. You create Merged graphs to compare results from different graphs within the same scenario run.

Cross Result Graphs Overview

Cross Result graphs are useful for:

- Benchmarking hardware
- Testing software versions
- Determining system capacity

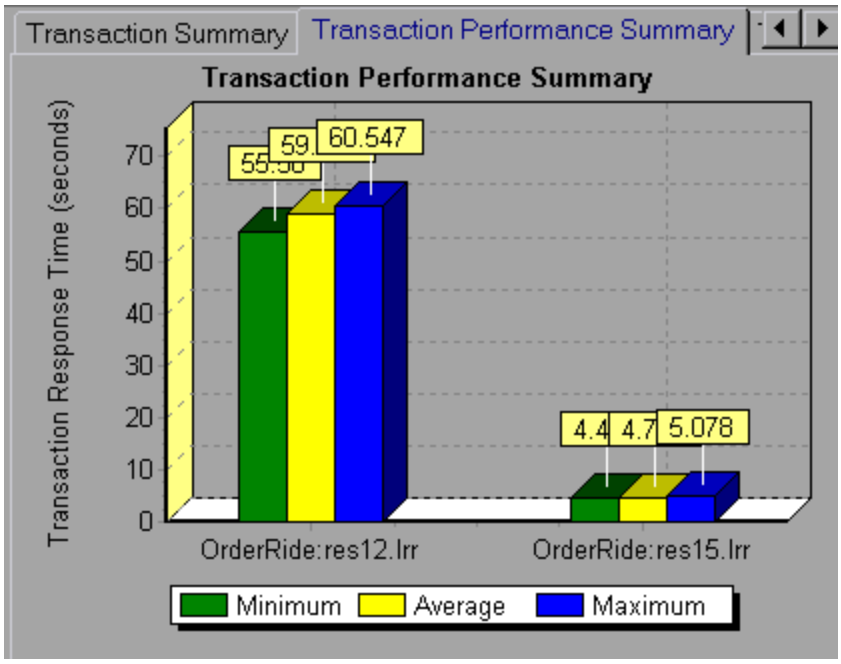
If you want to benchmark two hardware configurations, you run the same load test scenario with both configurations and compare the transaction response times using a single Cross Result graph.

Suppose that your vendor claims that a new software version is optimized to run quicker than a previous version. You can verify this claim by running the same scenario on both versions of the software, and comparing the scenario results.

You can also use Cross Result graphs to determine your system's capacity. You run scenarios using different numbers of Vusers running the same script. By analyzing Cross Result graphs, you can determine the number of users that cause unacceptable response times.

In the following example, two scenario runs are compared by crossing their results, **res12**, and **res15**. The same script was executed twice—first with 100 Vusers and then with 50 Vusers.

In the first run, the average transaction time was approximately 59 seconds. In the second run, the average time was 4.7 seconds. It is apparent that the system works much slower with a greater load.



The Cross Result graphs have an additional filter and group by category: **Result Name**. The above graph is filtered to the **OrderRide** transaction for results **res12**, and **res15**, grouped by **Result Name**.

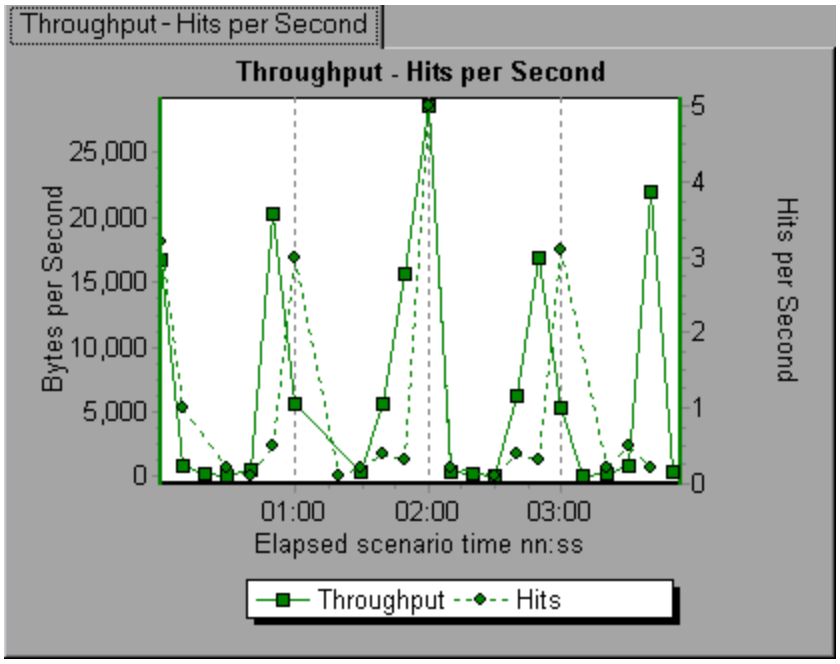
Merging Types Overview

Analysis provides three types of merging:

Overlay

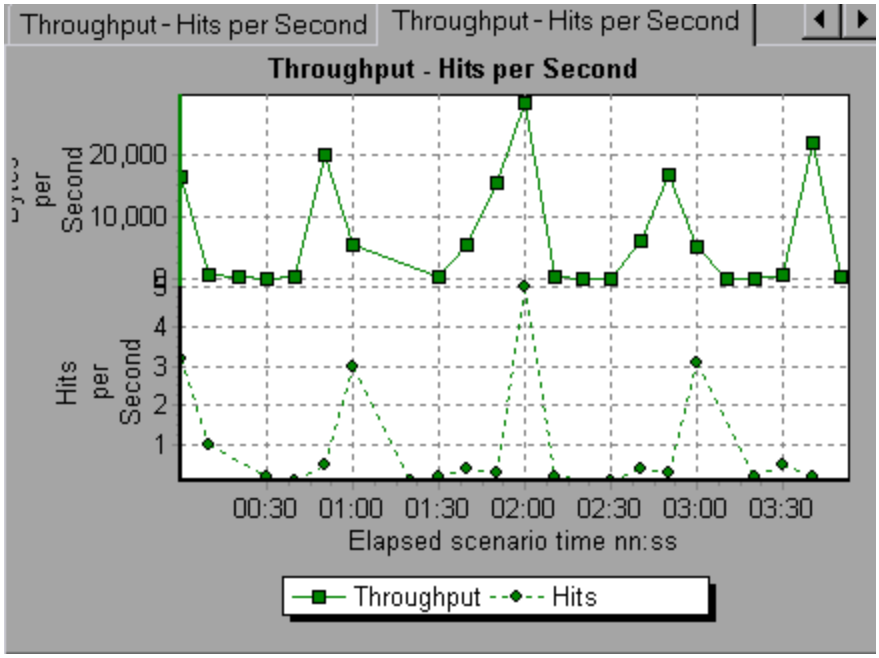
Superimpose the contents of two graphs that share a common x- axis. The left y-axis on the merged graph shows the current graph's values. The right y-axis shows the values of the graph that was merged. There is no limit to the number of graphs that you can overlay. When you overlay two graphs, the y-axis for each graph is displayed separately to the right and left of the graph. When you overlay more than two graphs, Analysis displays a single y-axis, scaling the different measurements accordingly.

In the following example, the Throughput and Hits per Second graph are overlaid with one another.



Tile

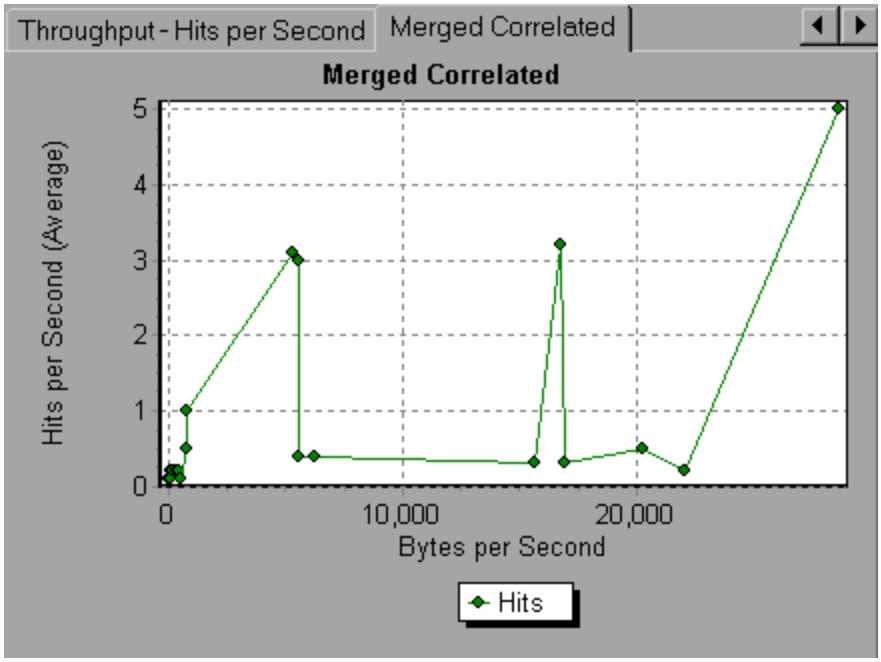
View contents of two graphs that share a common x-axis in a tiled layout, one above the other. In the following example the Throughput and Hits per Second graph are tiled one above the other.



Correlate

Plot the y-axis of two graphs against each other. The active graph's y-axis becomes the x-axis of the merged graph. The y-axis of the graph that was merged, becomes the merged graph's y-axis.

In the following example, the Throughput and Hits per Second graph are correlated with one another. The x-axis displays the bytes per second (the Throughput measurement) and the y-axis shows the average hits per second.



How to Generate Cross Results Graphs

This task describes how to create a Cross Result graph for two or more result sets. The Cross Result dialog box enables you to compare the results of multiple load test scenario runs.

1. Choose **File** > **Cross With Result**. The Cross Results dialog box opens.
2. Click **Add** to add an additional result set to the **Result List**. The Select Result Files for Cross Results dialog box opens.
3. Locate a results folder and select its result file (**.lrr**). Click **OK**. The scenario is added to the Result List.
4. Repeat steps 2 and 3 until all the results you want to compare are in the Result List.
5. When you generate a Cross Result graph, by default it is saved as a new Analysis session. To save it in an existing session, clear the **Create New Analysis Session for Cross Result** box.
6. Click **OK**. Analysis processes the result data and asks for a confirmation to open the default graphs.

> **Note:** When generating a Cross Results Session, verify that the transaction names do not contain a <_> or <@> symbol. This will cause errors to occur when attempting to open the Cross Results graphs.

After you generate a Cross Result graph, you can filter it to display specific scenarios and transactions. You can also manipulate the graph by changing the granularity, zoom, and scale.

You can view a summary report for the Cross Result graph.

How to Generate Merged Graphs

This task describes how to merge the results of two graphs from the same load test scenario into a single graph. The merging allows you to compare several different measurements at once. For example, you can make a merged graph to display the network delay and number of running Vusers, as a function of the elapsed time.

You can merge all graphs with a common x-axis.

1. Select a graph in the Session Explorer or select its tab to make it active.
2. Choose **View > Merge Graphs** or click **Merge Graphs**. The Merge Graphs dialog box opens and displays the name of the active graph.
3. Select a graph with which you want to merge your active graph. Only the graphs with a common x-axis to the active graph are available.
4. Select the merge type and a title for the merged graph. By default, Analysis combines the titles of the two graphs being merged. For more information, see "Merge Graphs Dialog Box" below.
5. Click **OK**.
6. Filter the graph just as you would filter any ordinary graph.

Merge Graphs Dialog Box

This dialog box enables you to merge two graphs into a single graph.

To access	**View > Merge Graphs**
Important information	In order to merge graphs, the graphs' x-axes must be the same measurement. For example, you can merge Web Throughput and Hits per Second graphs, because their x-axes are Scenario Elapsed Time.
See also	"Merging Types Overview" on page 121

User interface elements are described below:

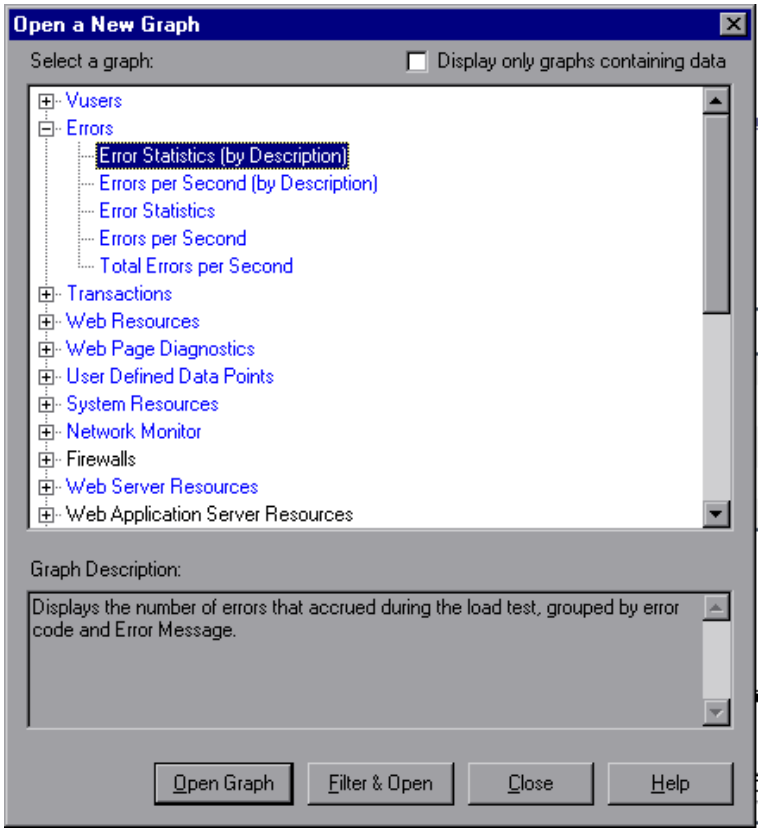
UI Element	Description
Select Graph to merge with	The drop-down list shows all of the open graphs that share a common x-axis measurement with the current graph. Select one of the graphs in the list.

UI Element	Description
Select type of merge	• **Overlay**. View contents of two graphs that share a common x-axis. The left y-axis on the merged graph shows the current graph's values. The right y-axis shows the values of the graph that was merged with the current graph. • **Tile**. View contents of two graphs that share a common x-axis in a tiled layout, one above the other. • **Correlate**. Plot the y-axes of two graphs against each other. The active graph's y-axis becomes the x-axis of the merged graph. The y-axis of the graph that was merged, becomes the merged graph's y-axis.
Title of Merged Graph	Enter a title for the merged graph. This title will appear in the Session Explorer (**Windows > Session Explorer**).

Analysis Graphs

Open a New Graph Dialog Box

The Open a New Graph dialog box enables you to select the graph type to activate in the main Analysis window.



To access	**Session Explorer > Graphs >**

User interface elements are described below:

UI Element	Description
Select a graph	Displays list of graph types.
Display only graphs containing data	If checked, only graphs that contain data are listed (in blue) in the Select a graph area.
Graph Description	Displays detailed information about the selected graph.
Open Graph	Analysis generates the selected graph and adds it to the Session Explorer.
Filter & Open	Opens the graphs Graph Settings dialog box. For details, see "Filter Dialog Boxes" on

UI Element	Description
	page 114. This option enables you to apply filter conditions on the selected graph before the graph is displayed.

Vuser Graphs

During load test scenario execution, Vusers generate data as they perform transactions. The Vuser graphs let you determine the overall behavior of Vusers during the scenario. They display the Vuser states, the number of Vusers that completed the script, and rendezvous statistics. Use these graphs in conjunction with Transaction graphs to determine the effect of the number of Vusers on transaction response time. For more information about Transaction graphs, see "Transaction Graphs" on page 135.

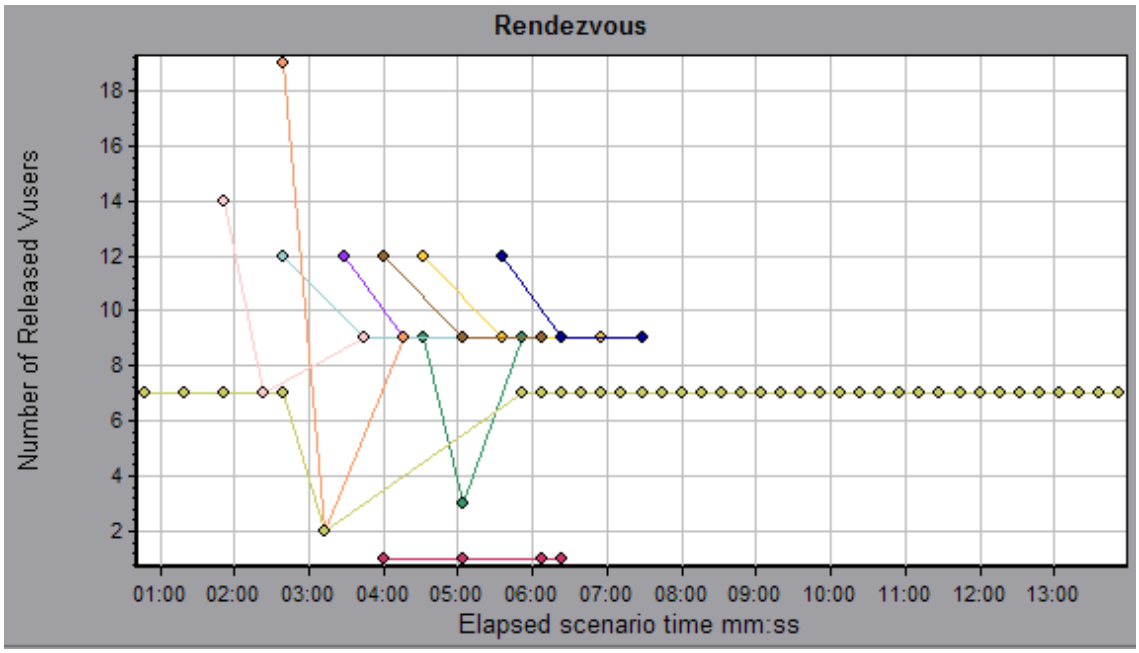
Rendezvous Graph (Vuser Graphs)

During a scenario run, you can instruct multiple Vusers to perform tasks simultaneously by using **rendezvous points**. A rendezvous point creates intense user load on the server and enables LoadRunner to measure server performance under load. For more information about using rendezvous points, see the *HP Virtual User Generator User Guide*.

This graph indicates when Vusers were released from rendezvous points, and how many Vusers were released at each point.

Purpose	Helps you understand transaction performance times.
X-axis	Elapsed time since the start of the run.
Y-axis	Number of Vusers that were released from the rendezvous.
Tips	Compare this to the **Average Transaction Response Time** graph. When you so this, you can see how the load peak created by a rendezvous influences transaction times.
See also	"Vuser Graphs" above

Example

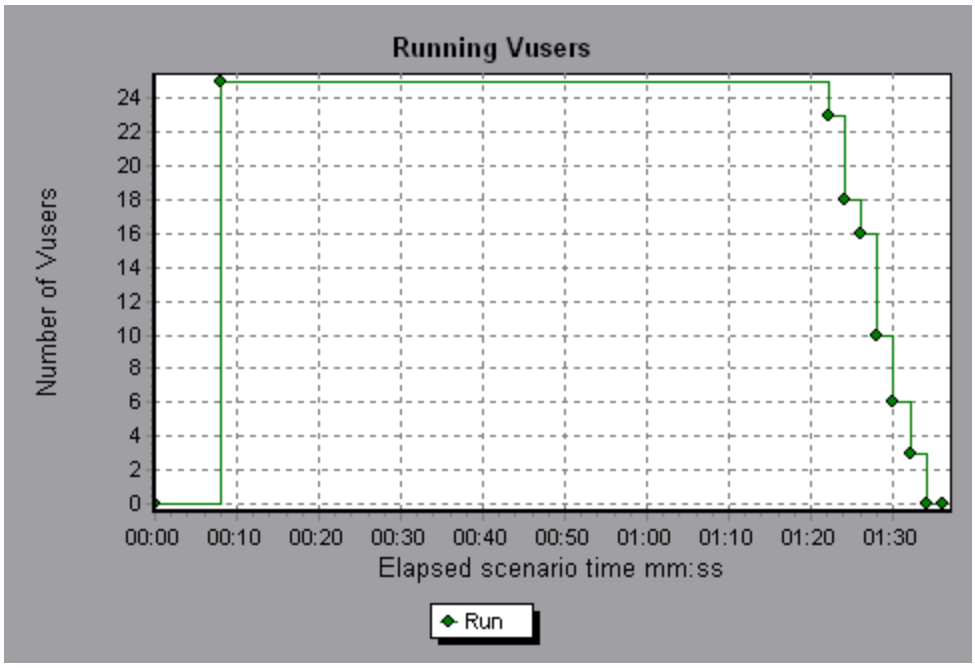


Running Vusers Graph

This graph displays the number of Vusers that executed Vuser scripts and their status during each second of the test.

Purpose	Helps you determine the Vuser load on your server at any given moment.
X-axis	Elapsed time since the start of the run.
Y-axis	Number of Vusers in the scenario.
Note	By default, this graph only shows the Vusers with a **Run** status. To view another Vuser status, set the filter conditions to the desired status. For more information, see "Filtering and Sorting Graph Data" on page 103.
See also	"Vuser Graphs" on the previous page

Example

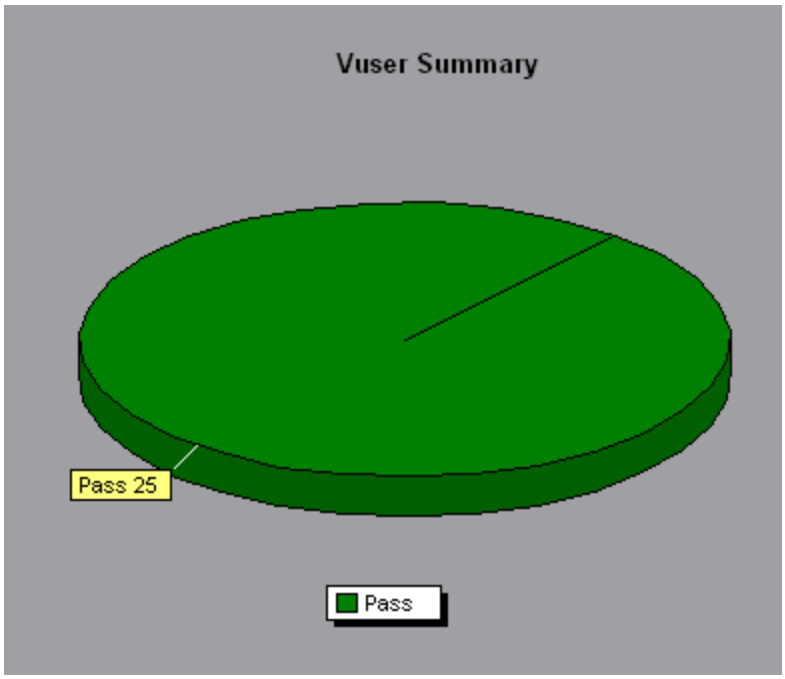


Vuser Summary Graph

This graph displays a summary of Vuser performance.

Purpose	Lets you view the number of Vusers that successfully completed the load test scenario run relative to those that did not.
Note	This graph may only be viewed as a pie.
See also	"Vuser Graphs" on page 127

Example



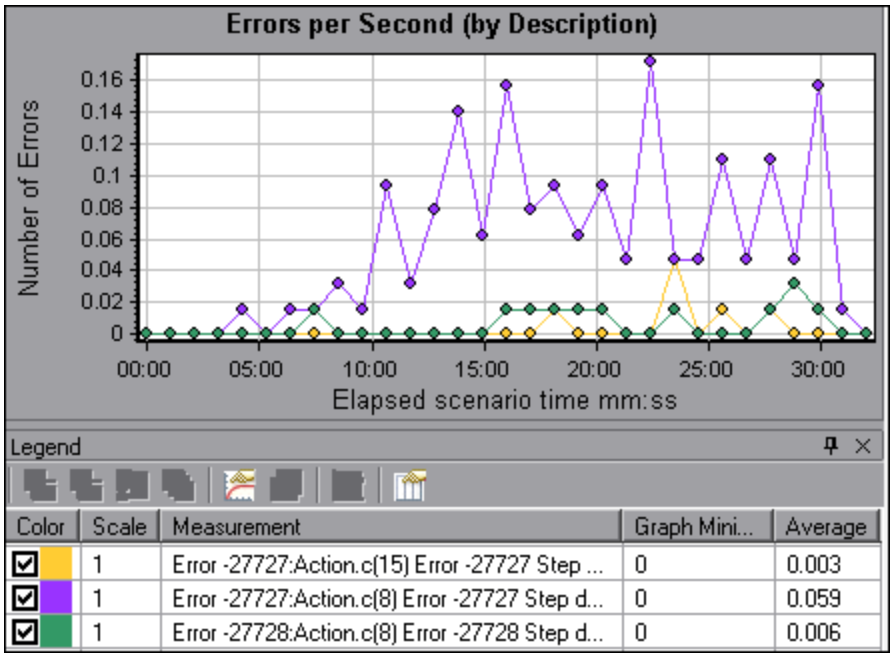
Error Graphs

Errors per Second (by Description) Graph

This graph displays the average number of errors that occurred during each second of the load test scenario run, grouped by error description. The error description is displayed in the legend.

X-axis	Elapsed time since the start of the run.
Y-axis	Number of errors.
See also	"Error Graphs" above

Example

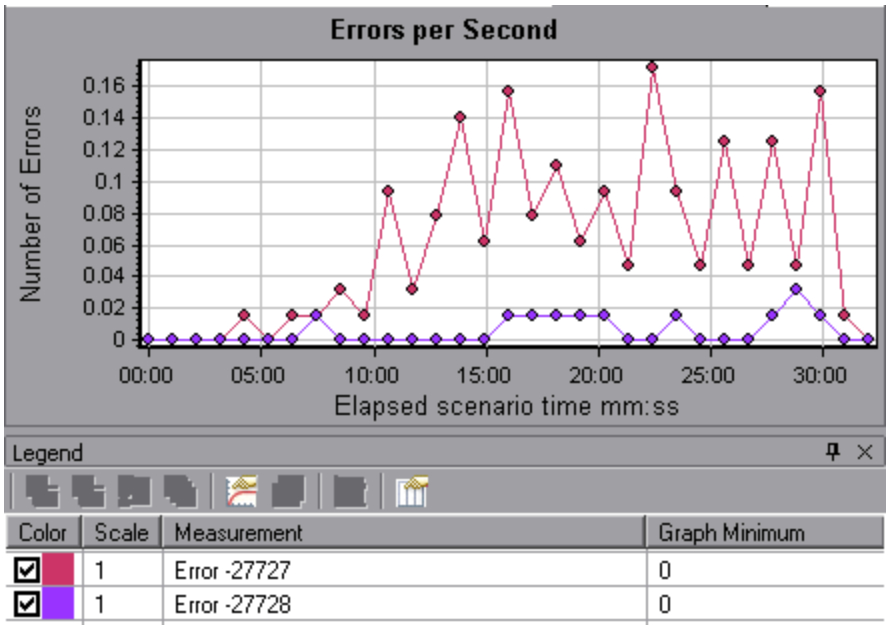


Errors per Second Graph

This graph displays the average number of errors that occurred during each second of the load test scenario run, grouped by error code.

X-axis	Elapsed time since the start of the run.
Y-axis	Number of errors.
See also	"Error Graphs" on the previous page

Example

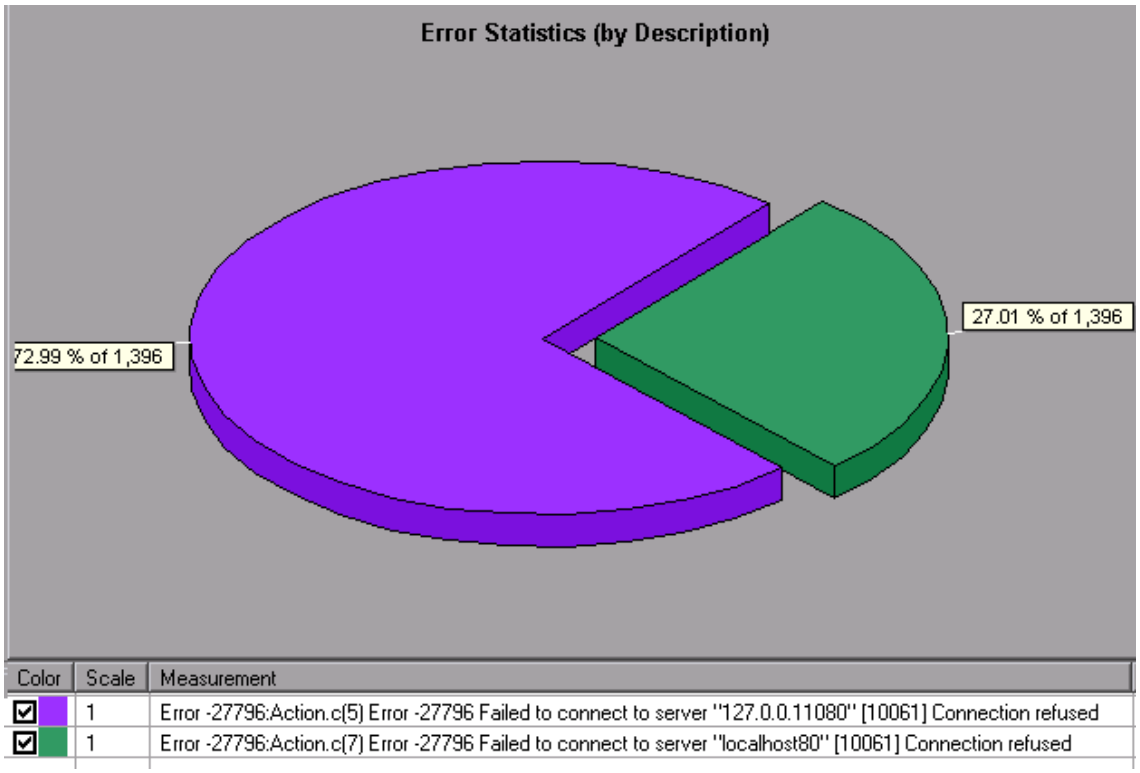


Error Statistics (by Description) Graph

This graph displays the number of errors that accrued during load test scenario execution, grouped by error description. The error description is displayed in the legend.

Note	This graph may only be viewed as a pie.
See also	"Error Graphs" on page 130

Example



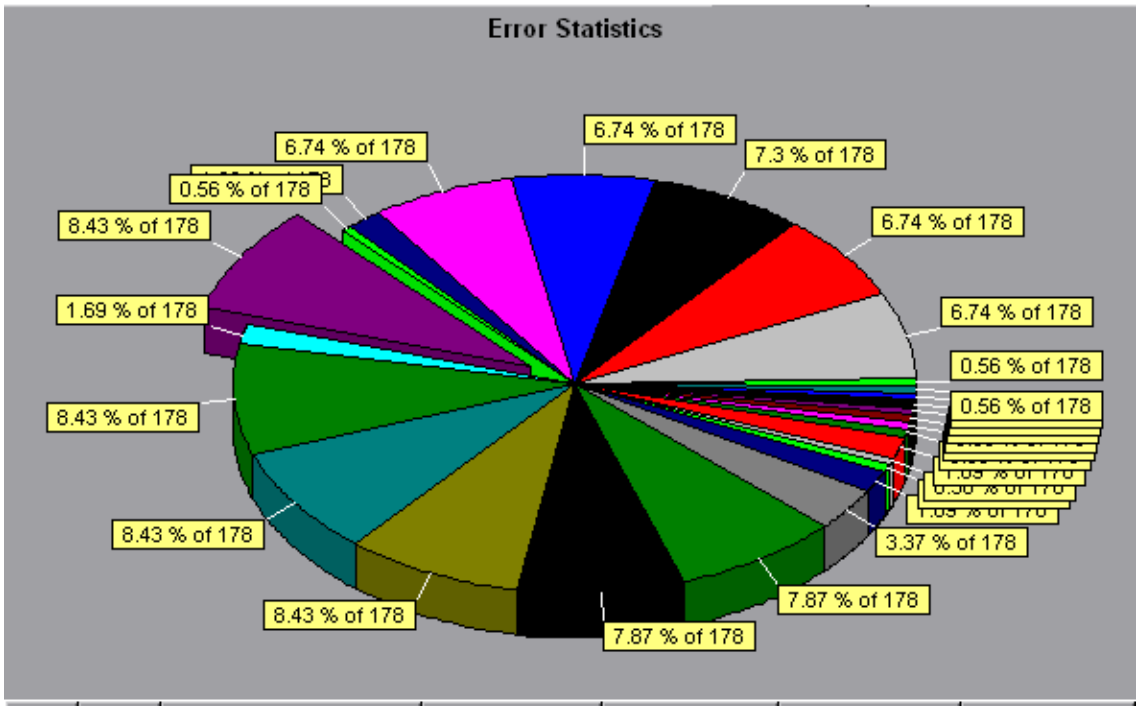
Error Statistics Graph

This graph displays the number of errors that accrued during load test scenario execution, grouped by error code.

Note	This graph may only be viewed as a pie.
See also	"Error Graphs" on page 130

Example

In the following example, out of a total of 178 errors that occurred during the scenario run, the second error code displayed in the legend occurred twelve times, comprising 6.74% of the errors.



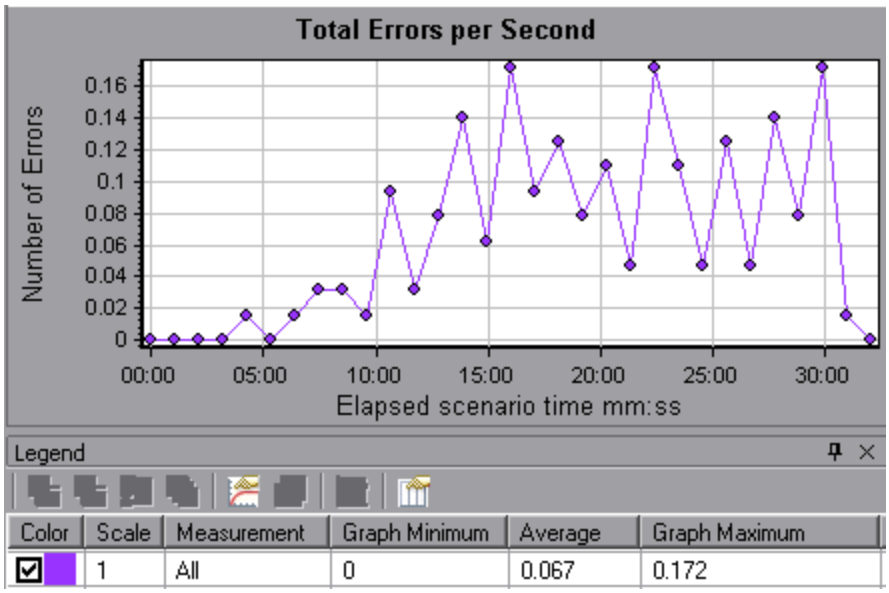
Color	Scale	Measurement	Graph's Minimum	Graph's Average	Graph's Maximum	Graph's Median
	1	Error -26627:-26627 Ac...	13	13	13	13
	1	Error -26627:-26627 Ac...	12	12	12	12
	1	Error -26627:-26627 Ac...	12	12	12	12
	1	Error -26627:-26627 Ac...	3	3	3	3
	1	Error -26627:-26627 Ac...	1	1	1	1

Total Errors per Second Graph

This graph displays the average number of errors that occurred during each second of the load test scenario run. (complete: add sentence about being sum of all errors)

X-axis	Elapsed time since the start of the run.
Y-axis	Number of errors.
See also	"Error Graphs" on page 130

Example



Transaction Graphs

During load test scenario execution, Vusers generate data as they perform transactions. Analysis enables you to generate graphs that show the transaction performance and status throughout script execution.

In addition, when working with HP Network Virtualization, you can view the transaction response times per virtual location.

You can use additional Analysis tools such as merging and crossing results to understand your transaction performance graphs. You can also sort the graph information by transactions and the locations in which they were performed.

For more information, see the transaction graphs below.

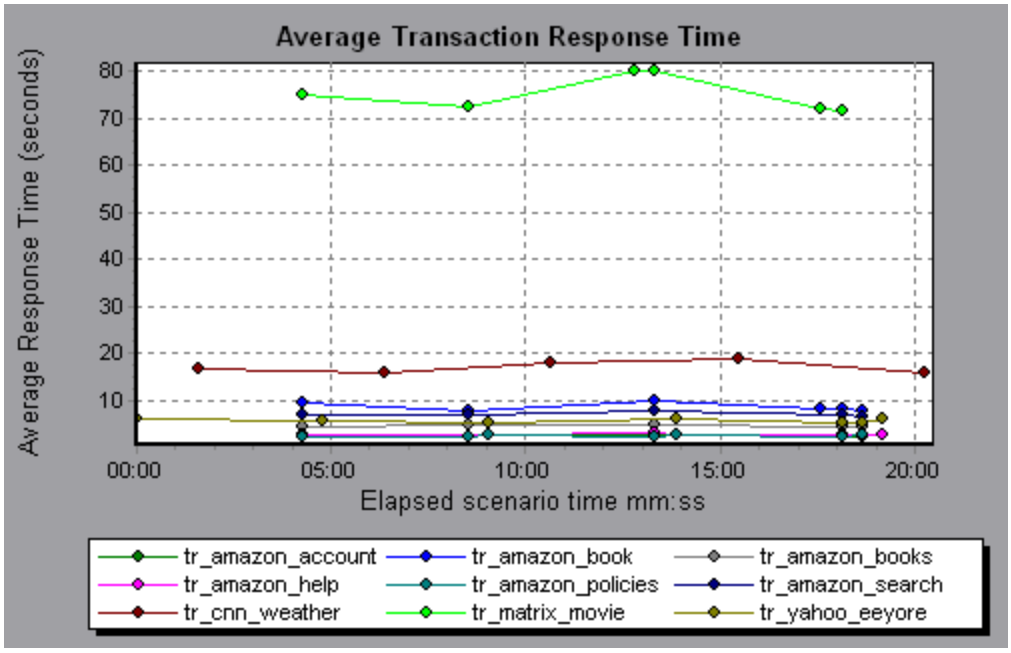
Average Transaction Response Time Graph

This graph displays the average time taken to perform transactions during each second of the load test scenario run.

Purpose	If you have defined acceptable minimum and maximum transaction performance times, you can use this graph to determine whether the performance of the server is within the acceptable range.
X-axis	Elapsed time since the start of the run.
Y-axis	Average response time (in seconds) of each transaction
Breakdown	**Transaction Breakdown**

options	You can view a breakdown of a transaction by right-clicking the transaction in the graph and selecting **Show Transaction Breakdown Tree**. In the Transaction Breakdown Tree, right-click the transaction you want to break down, and select **Break Down <transaction name>**. The Average Transaction Response Time graph displays data for the sub-transactions. For more details, see "Transaction Breakdown Tree" on page 138. **Web Page Breakdown** To view a breakdown of the Web page(s) included in a transaction or sub-transaction, right-click it and select **Web Page Diagnostics for <transaction name>**. For more information on the Web Page Diagnostics graphs, see "Web Page Diagnostics Graphs" on page 157.
Tips	**Granularity** This graph is displayed differently for each granularity. The lower the granularity, the more detailed the results. However, it may be useful to view the results with a higher granularity to study the overall Vuser behavior throughout the scenario. For example, using a low granularity, you may see intervals when no transactions were performed. However, by viewing the same graph with a higher granularity, you will see the graph for the overall transaction response time. For more information on setting the granularity, see "How to Manage Graph Data" on page 94. **Compare with Running Vusers** You can compare the Average Transaction Response Time graph to the Running Vusers graph to see how the number of running Vusers affects the transaction performance time. For example, if the Average Transaction Response Time graph shows that performance time gradually improved, you can compare it to the Running Vusers graph to see whether the performance time improved due to a decrease in the Vuser load.
Note	By default, only transactions that passed are displayed.
See also	"Transaction Graphs" on the previous page

Example

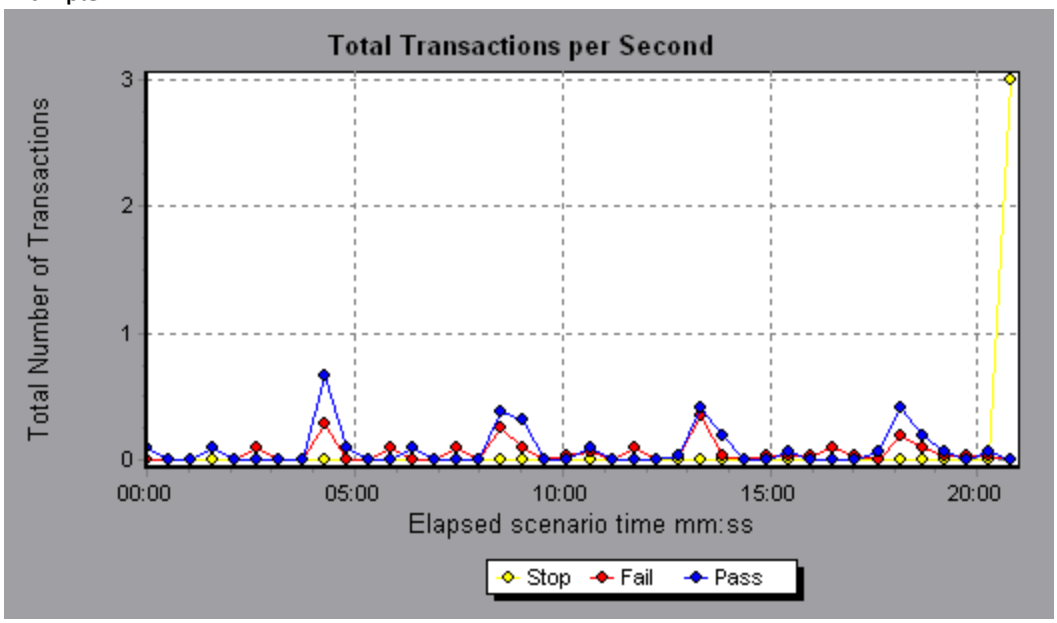


Total Transactions per Second Graph

This graph displays the total number of transactions that passed, the total number of transactions that failed, and the total number of transactions that were stopped, during each second of a load test scenario run.

Purpose	Helps you determine the actual transaction load on your system at any given moment.
X-axis	Elapsed time since the start of the run.
Y-axis	Total number of transactions performed during the scenario run.
See also	"Transaction Graphs" on page 135

Example



Transaction Breakdown Tree

The Transaction Breakdown Tree displays a tree view of the transactions and sub-transactions in the current session. From the tree, you can breakdown transactions and view the results of the breakdown in either the Average Transaction Response Time or Transaction Performance Summary graph.

To access	In either the Average Transaction Response Time or Transaction Performance Summary graph, right-click in the graph and select **Show Transaction Breakdown Tree.**
Important information	After you breakdown a transaction, you can return to the original transaction graph by reapplying the global filter (**File > Set Global Filter**) or by undoing your breakdown actions using **Edit > Undo Last Action**.

User interface elements are described below (unlabeled elements are shown in angle brackets):

UI Element	Description
<Right-click menu>	• **Break Down From Highest Level.** Displays data for the highest level hierarchical path of a transaction. • **Break Down <transaction name>.** Displays data for the sub-transactions in the Average Transaction Response Time or Transaction Performance Summary graph. • **Show Only <transaction name>.** Displays data only for the selected transaction/sub-transaction.

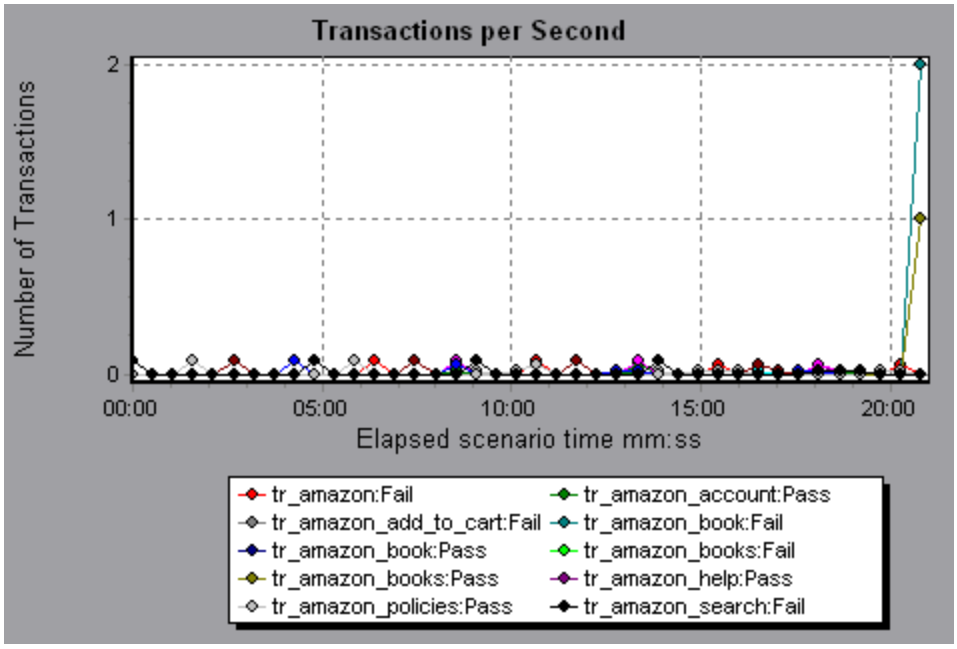
UI Element	Description
	• **Web Page Diagnostics for <page name>.** Displays a breakdown of the Web page(s) included in a transaction or sub-transaction in the Web Page Diagnostics graphs. For details, see "Web Page Diagnostics Graphs" on page 157.

Transactions per Second Graph

This graph displays, for each transaction, the number of times it passed, failed, and stopped during each second of a load test scenario run.

Purpose	Helps you determine the actual transaction load on your system at any given moment.
X-axis	Elapsed time since the start of the run.
Y-axis	Number of transactions performed during the scenario run.
Tips	Compare with the **Average Transaction Response Time** Graph. Doing this helps you analyze the effect of the amount of transactions upon the performance time.
See also	"Transaction Graphs" on page 135

Example

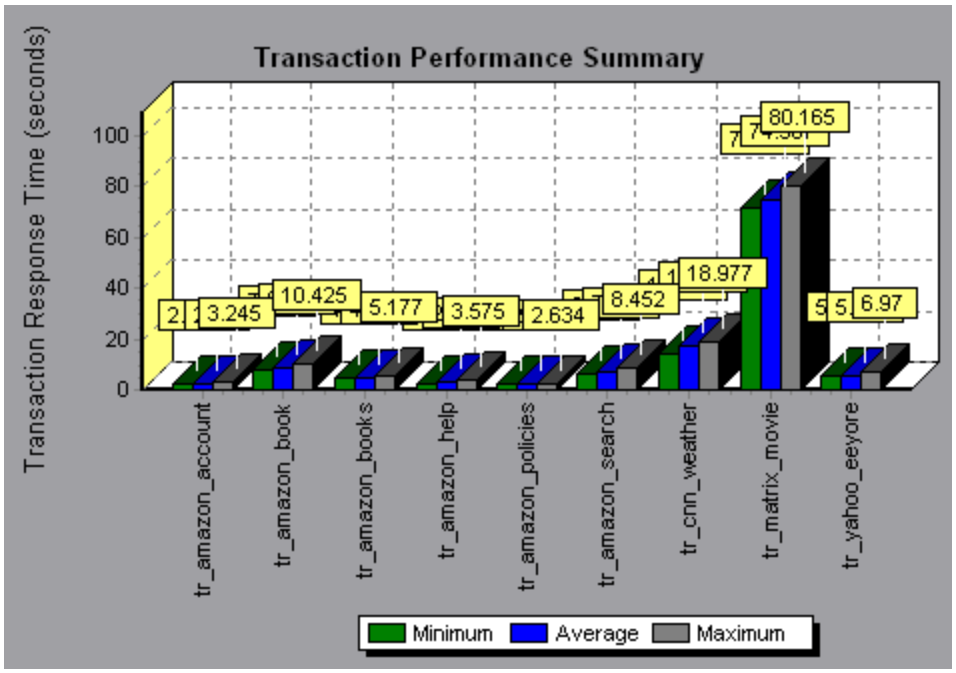


Transaction Performance Summary Graph

This graph displays the minimum, maximum and average performance time for all the transactions in the load test scenario.

X-axis	Name of the transaction.
Y-axis	Response time—rounded off to the nearest second—of each transaction.
Breakdown options	**Transaction Breakdown** You can view breakdown of a transaction in the Transaction Performance Summary graph by right-clicking the transaction in the graph and selecting **Show Transaction Breakdown Tree**. In the Transaction Breakdown Tree, right-click the transaction you want to break down, and select **Break Down <transaction name>**. The Transaction Performance Summary graph displays data for the sub-transactions. For more details, see "Transaction Breakdown Tree" on page 138. **Web Page Breakdown** To view a breakdown of the Web page(s) included in a transaction or sub-transaction, right-click it and select **Web Page Diagnostics for <transaction name>**. For more, see "Web Page Diagnostics Graphs" on page 157.
See also	"Transaction Graphs" on page 135

Example



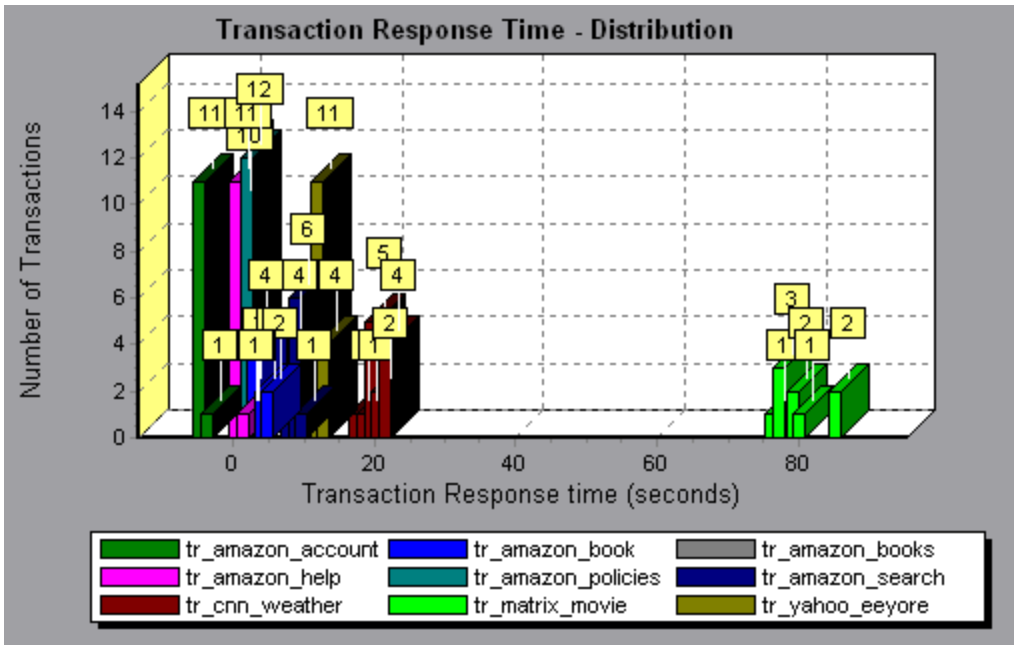
Transaction Response Time (Distribution) Graph

This graph displays the distribution of the time taken to perform transactions in a load test scenario.

Purpose	If you have defined acceptable minimum and maximum transaction performance times, you can use this graph to determine whether the performance of the server is within the acceptable range.
X-axis	Transaction response time (rounded down to the nearest second).
Y-axis	Number of transactions executed during the scenario.
Tips	Compare with **Transaction Performance Summary** Graph to see how the average performance was calculated.
Note	This graph can only be displayed as a bar graph.
See also	"Transaction Graphs" on page 135

Example

In the following example, most of the transactions had a response time of less than 20 seconds.



Transaction Response Time (Percentile) Graph

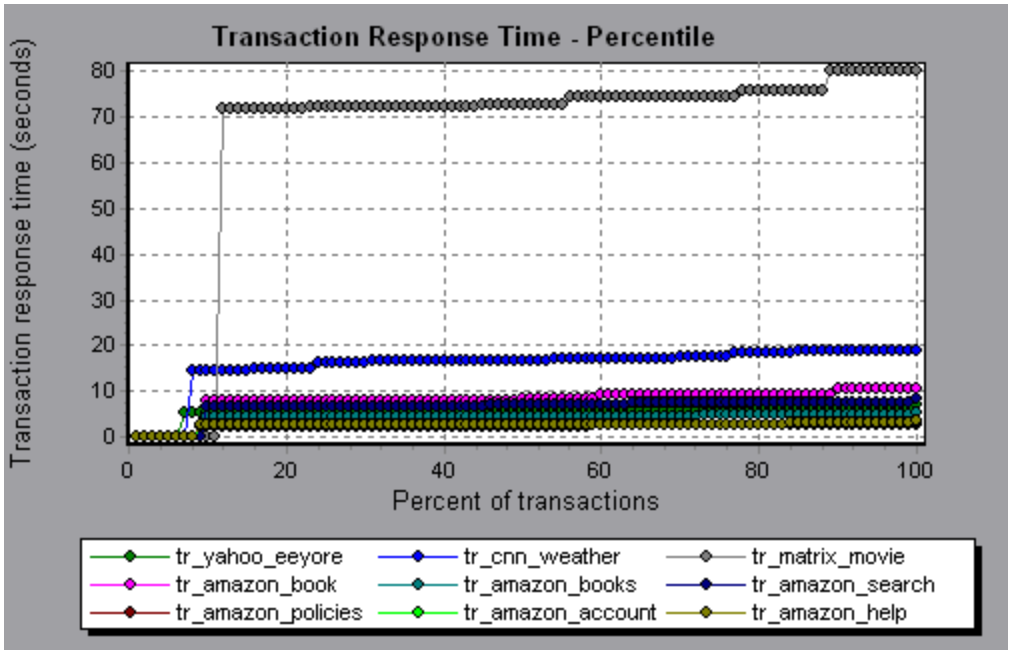
This graph analyzes the percentage of transactions that were performed within a given time range.

Purpose	Helps you determine the percentage of transactions that met the performance criteria

	defined for your system. In many instances, you need to determine the percent of transactions with an acceptable response time. The maximum response time may be exceptionally long, but if most transactions have acceptable response times, the overall system is suitable for your needs.
X-axis	Percentage of the total number of transactions measured during the load test scenario run.
Y-axis	Maximum transaction response time (in seconds). **Note:** Analysis approximates the transaction response time for each available percentage of transactions. The y-axis values, therefore, may not be exact.
Tips	Compare with the **Average Response Time** Graph. A high response time for several transactions may raise the overall average. However, if the transactions with a high response time occurred less than five percent of the time, that factor may be insignificant.
See also	"Transaction Graphs" on page 135

Example

In the following example, fewer than 20 percent of the tr_matrix_movie transactions had a response time less than 70 seconds.

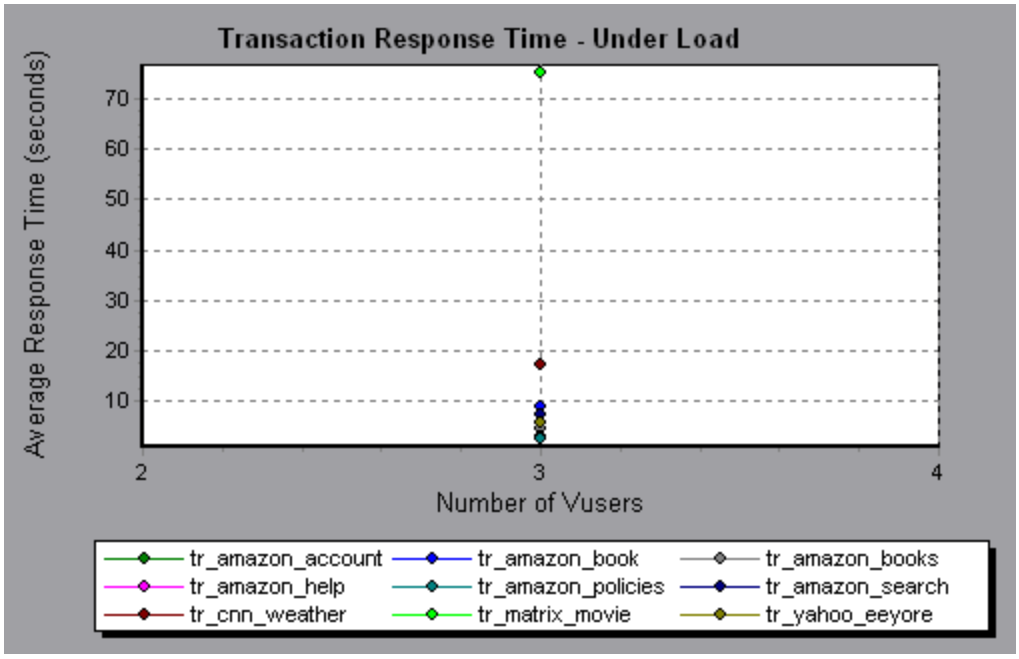


Transaction Response Time (Under Load) Graph

This graph is a combination of the Running Vusers and Average Transaction Response Time graphs and indicates transaction times relative to the number of Vusers running at any given point during the load test scenario.

Purpose	Helps you view the general impact of Vuser load on performance time and is most useful when analyzing a scenario with a gradual load.
X-axis	Number of running Vusers
Y-axis	Average response time (in seconds) of each transaction.
See also	"Transaction Graphs" on page 135

Example



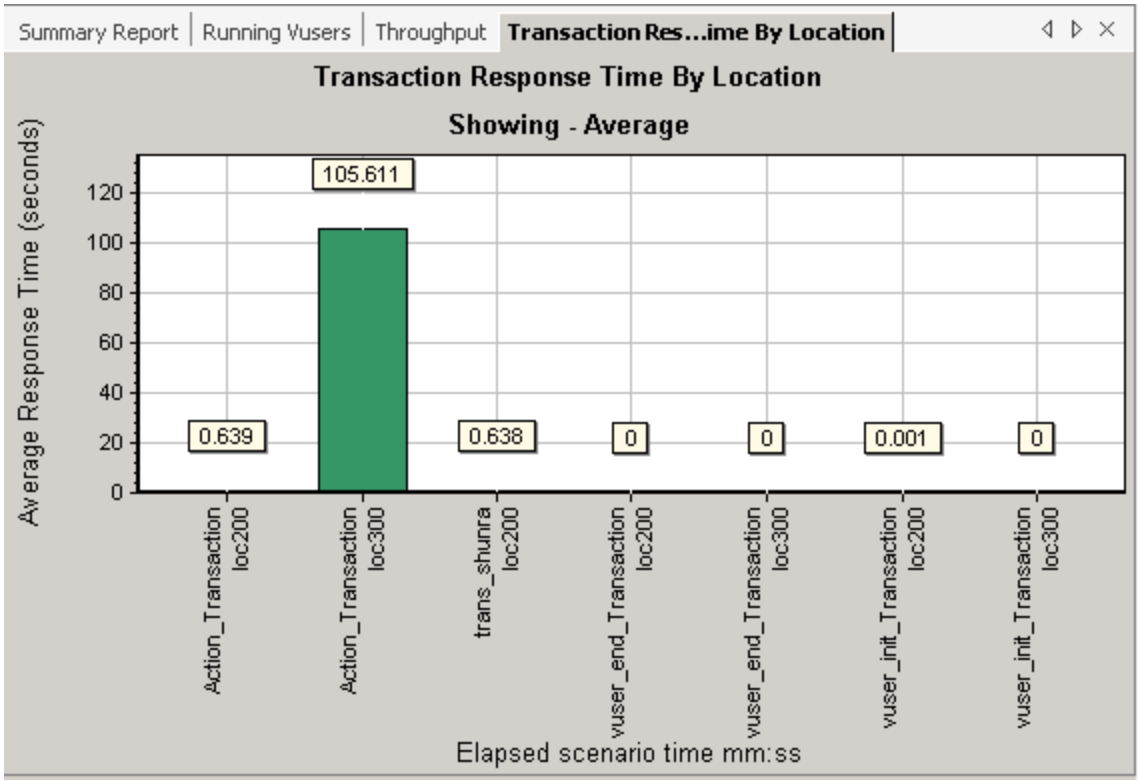
Transaction Response Time by Location Graph

This graph indicates the transaction response times relative to the virtual locations in which they were performed.

This graph is used in conjunction with Network Virtualization. Using HP Network Virtualization, you set up a scenario that runs Vusers on several virtual locations. This graph lets you compare the transaction response times of the various locations. For details, see Network Virtualization Integration.

Purpose	Helps you view the general impact of Vuser load on performance time per virtual location.
X-axis	Elapsed scenario time in mm:ss
Y-axis	Average response time (in seconds) of each transaction, per virtual location. A bar chart and annotation, show the average response times.
See also	"Transaction Graphs" on page 135

The following example shows the transaction response time for several locations. It is evident that the response time was excessive in location **loc300**.

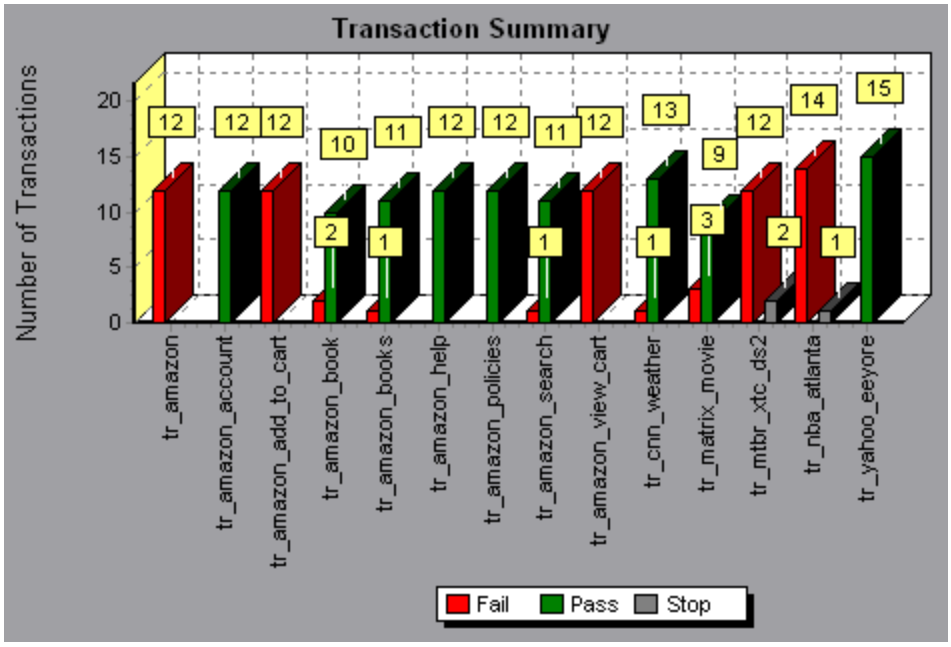


Transaction Summary Graph

This graph summarizes the number of transactions in the load test scenario that failed, passed, stopped, and ended in error.

X-axis	Name of the transaction
Y-axis	Number of transactions performed during the scenario run.
See also	"Transaction Graphs" on page 135

Example



Web Resources Graphs

Web Resources Graphs Overview

Web Resource graphs provide you with information about the performance of your Web server. You use the Web Resource graphs to analyze the following data:

- Throughput on the Web server
- The number of hits per second
- The number of HTTP responses per second
- The HTTP status codes returned from the Web server
- The number of downloaded pages per second
- The number of server retries per second
- A summary of the server retries during the load test scenario
- The number of open TCP/IP connections
- The number of TCP/IP connections per second
- The number of new and reused SSL connections opened per second

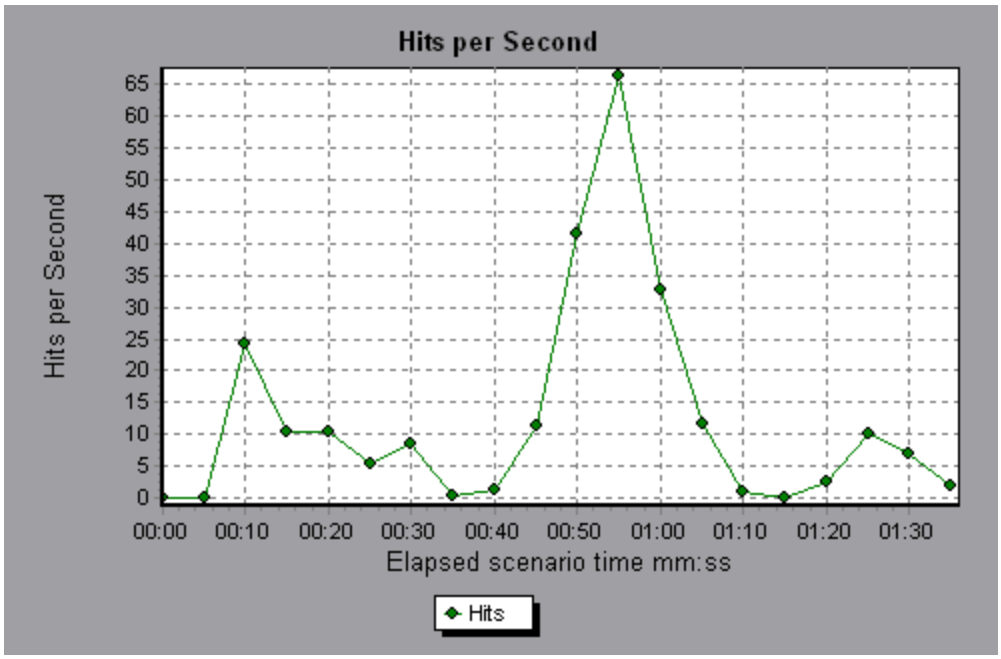
Hits per Second Graph

This graph shows the number of HTTP requests made by Vusers to the Web server during each second of the load test scenario run.

Purpose	Helps you evaluate the amount of load Vusers generate, in terms of the number of hits.
X-axis	Elapsed time since the start of the run.
Y-axis	Number of hits on the server.
Tips	Compare to the **Average Transaction Response Time** graph to see how the number of hits affects transaction performance.
Note	You cannot change the granularity of the x-axis to a value that is less than the Web granularity you defined in the General tab of the Options dialog box.
See also	"Web Resources Graphs Overview" on the previous page

Example

In the following example, the most hits per second took place during the fifty-fifth second of the scenario.



Throughput Graph

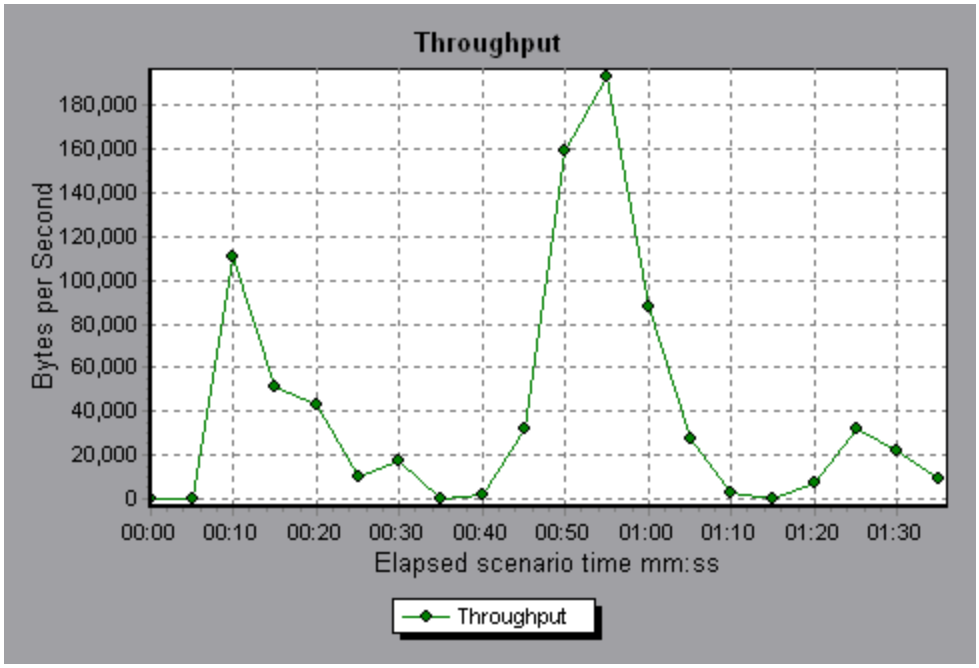
This graph shows the amount of throughput on the server during each second of the load test scenario run. Throughput is measured in bytes or megabytes and represents the amount of data that the Vusers

received from the server at any given second. To view throughput in megabytes, use the **Throughput (MB)** graph.

Purpose	Helps you evaluate the amount of load that Vusers generate, in terms of server throughput.
X-axis	Elapsed time since the start of the scenario run.
Y-axis	Throughput of the server, in bytes or megabytes.
Tips	Compare to the **Average Transaction Response Time** graph to see how the throughput affects transaction performance.
Note	You cannot change the granularity of the x-axis to a value that is less than the Web granularity you defined in the General tab of the Options dialog box.
See also	"Web Resources Graphs Overview" on page 145

Example

In the following example, the highest throughput is 193,242 bytes during the fifty-fifth second of the scenario.



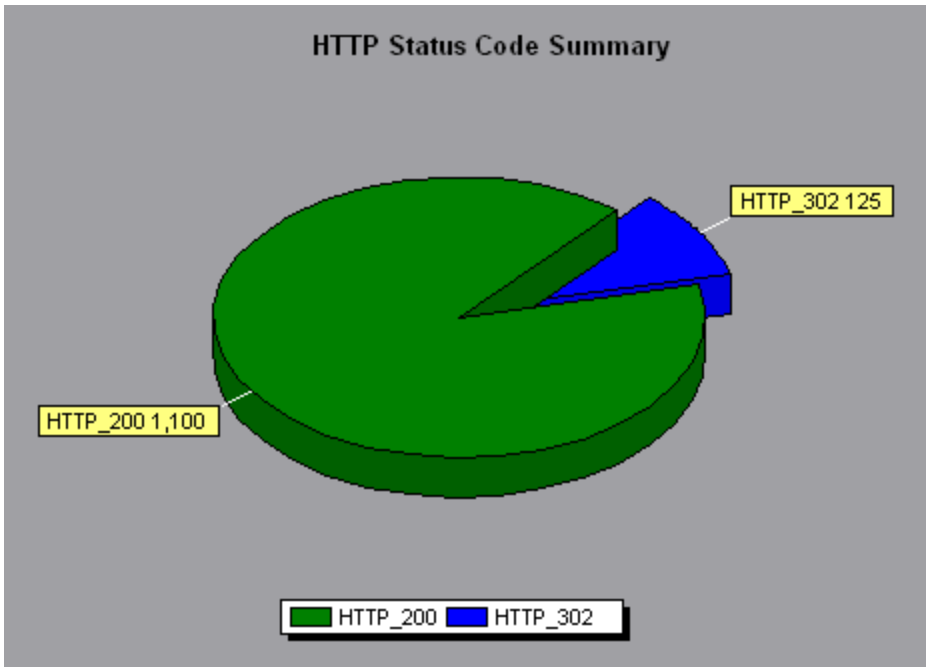
HTTP Status Code Summary Graph

This graph shows the number of HTTP status codes returned from the Web server during the load test scenario run, grouped by status code. HTTP status codes indicate the status of HTTP requests, for example, "the request was successful","the page was not found".

Tips	**Locate scripts which generated error codes** Use this graph together with the HTTP Responses per Second graph to locate those scripts which generated error codes.
Note	This graph can only be viewed as a pie.
See also	• "Web Resources Graphs Overview" on page 145 • "HTTP Status Codes" below

Example

In the following example, the graph shows that only the HTTP status codes 200 and 302 were generated. Status code 200 was generated 1,100 times, and status code 302 was generated 125 times.



HTTP Status Codes

The following table displays a list of HTTP status codes:

Code	Description
200	OK
201	Created
202	Accepted
203	Non-Authoritative Information

Code	Description
204	No Content
205	Reset Content
206	Partial Content
300	Multiple Choices
301	Moved Permanently
302	Found
303	See Other
304	Not Modified
305	Use Proxy
307	Temporary Redirect
400	Bad Request
401	Unauthorized
402	Payment Required
403	Forbidden
404	Not Found
405	Method Not Allowed
406	Not Acceptable
407	Proxy Authentication Required
408	Request Timeout
409	Conflict
410	Gone
411	Length Required
412	Precondition Failed
413	Request Entity Too Large
414	Request - URI Too Large
415	Unsupported Media Type

Code	Description
416	Requested range not satisfiable
417	Expectation Failed
500	Internal Server Error
501	Not Implemented
502	Bad Gateway
503	Service Unavailable
504	Gateway Timeout
505	HTTP Version not supported

For more information on the above status codes and their descriptions, see http://www.w3.org.

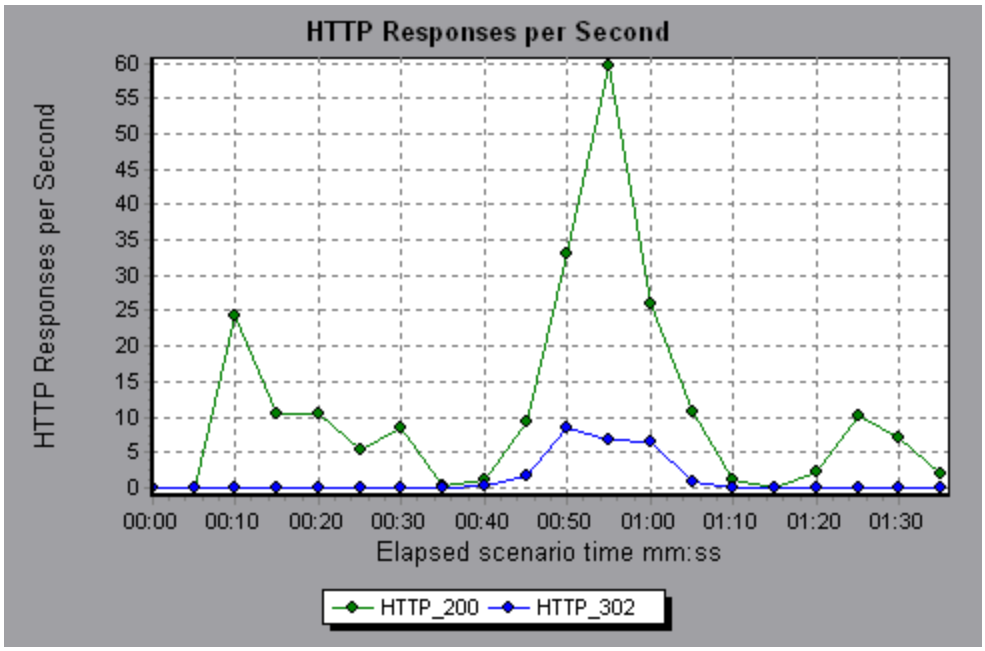
HTTP Responses per Second Graph

This graph shows the number of HTTP status codes returned from the Web server during each second of the load test scenario run, grouped by status code. HTTP status codes indicate the status of HTTP requests, for example, "the request was successful", "the page was not found".

X-axis	Elapsed time since the start of the run.
Y-axis	Number of HTTP responses per second.
Tips	**Locate scripts which generated error codes** You can group the results shown in this graph by script (using the "Group By" function) to locate scripts which generated error codes. For more information on the "Group By" function, see "Filtering and Sorting Graph Data" on page 103.
See also	• "Web Resources Graphs Overview" on page 145 • "HTTP Status Codes" on page 148

Example

In the following example, the greatest number of **200** status codes, 60, was generated in the fifty-fifth second of the scenario run. The greatest number of **302** codes, 8.5, was generated in the fiftieth second of the scenario run.



Pages Downloaded per Second Graph

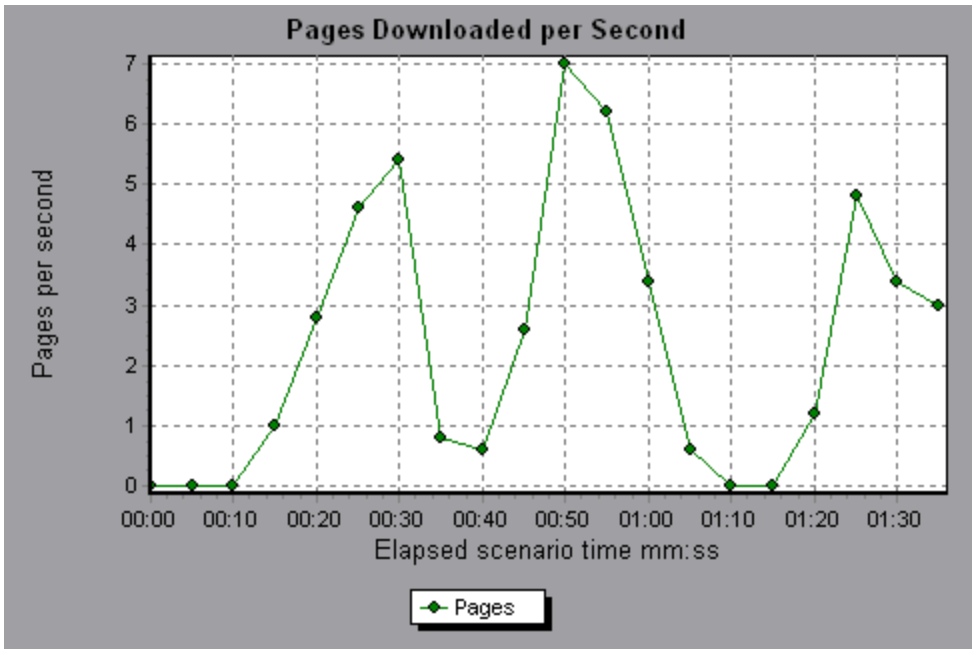
This graph shows the number of Web pages downloaded from the server during each second of the load test scenario run.

Like the Throughput graph, the Pages Downloaded per Second graph represents the amount of data that the Vusers received from the server at any given second. However, the Throughput graph takes into account each resource and its size (for example, the size of each **.gif** file, the size of each Web page). The Pages Downloaded per Second graph takes into account only the number of pages.

Purpose	Helps you evaluate the amount of load Vusers generate, in terms of the number of pages downloaded.
X-axis	Elapsed time since the start of the run.
Y-axis	Number of Web pages downloaded from the server.
Note	To view the Pages Downloaded per Second graph, you must select **Pages per second (HTML Mode only)** from the runtime settings Preferences tab before running your scenario.
See also	"Web Resources Graphs Overview" on page 145

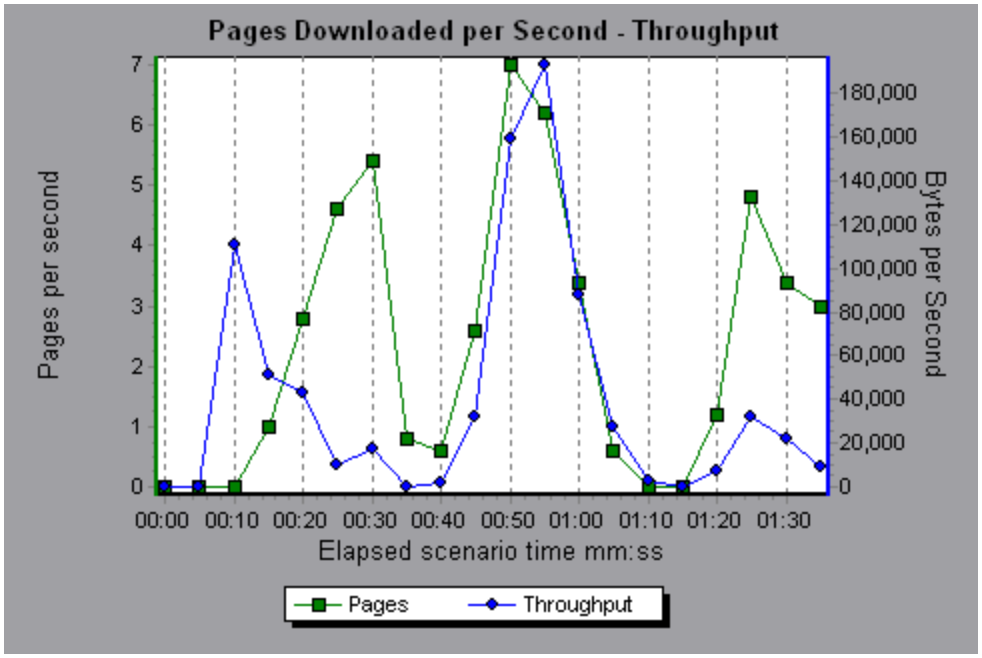
Example 1

In the following example, the greatest number of pages downloaded per second, about 7, occurred in the fiftieth second of the scenario run.



Example 2

In the following example, the Throughput graph is merged with the Pages Downloaded per Second graph. It is apparent from the graph that throughput is not completely proportional to the number of pages downloaded per second. For example, between 10 and 25 seconds into the scenario run, the number of pages downloaded per second increased while the throughput decreased.



Retries per Second Graph

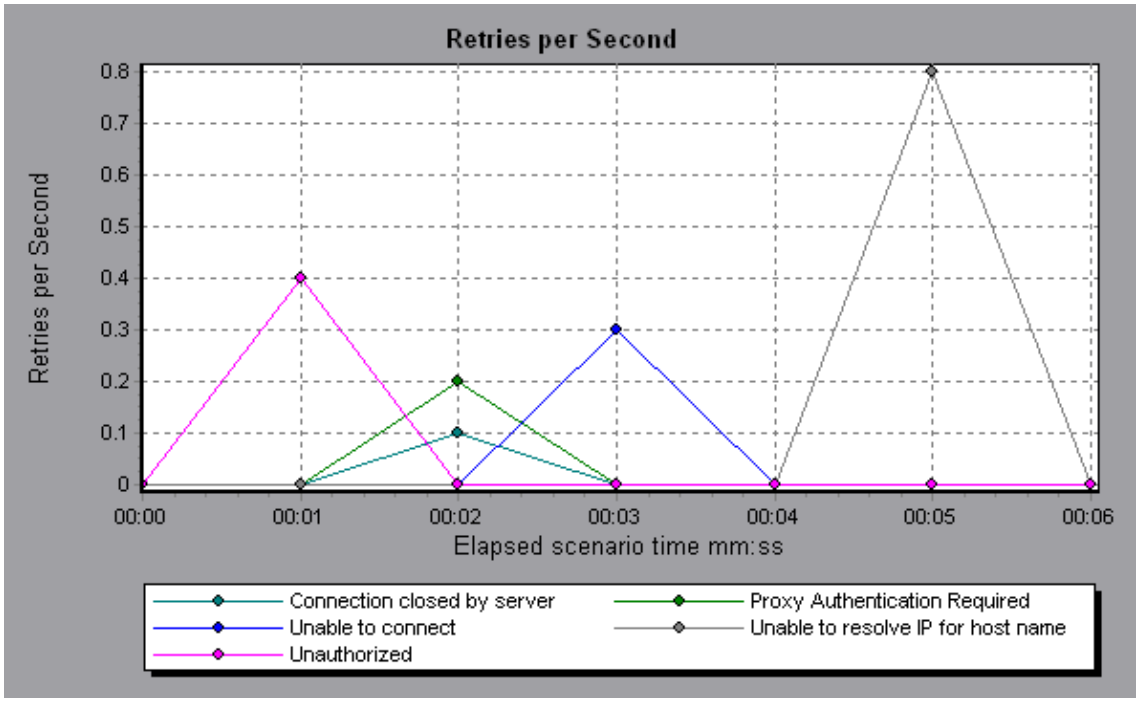
This graph displays the number of attempted server connections during each second of the load test scenario run. A server connection is retried when:

- the initial connection was unauthorized
- proxy authentication is required
- the initial connection was closed by the server
- the initial connection to the server could not be made
- when the server was initially unable to resolve the load generator's IP address

X-axis	Elapsed time since the start of the run.
Y-axis	Number of server retries per second.
See also	"Web Resources Graphs Overview" on page 145

Example

In the following example, the graph shows that during the first second of the scenario, the number of retries was 0.4, whereas in the fifth second of the scenario, the number of retries per second rose to 0.8.



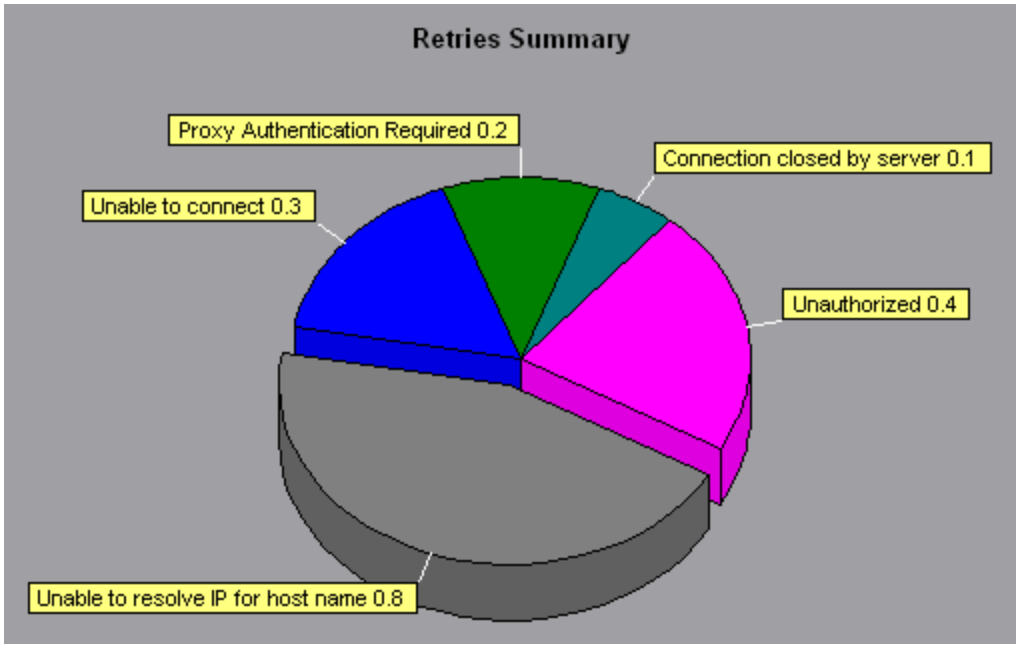
Retries Summary Graph

This graph shows the number of attempted server connections during the load test scenario run, grouped by the cause of the retry.

Tips	**Determine when server retries were attempted** Use this graph together with the Retries per Second graph to determine at what point during the scenario the server retries were attempted.
Note	This graph may only be viewed as a pie.
See also	"Web Resources Graphs Overview" on page 145

Example

In the following example, the graph shows that the server's inability to resolve the load generator's IP address was the leading cause of server retries during the scenario run.

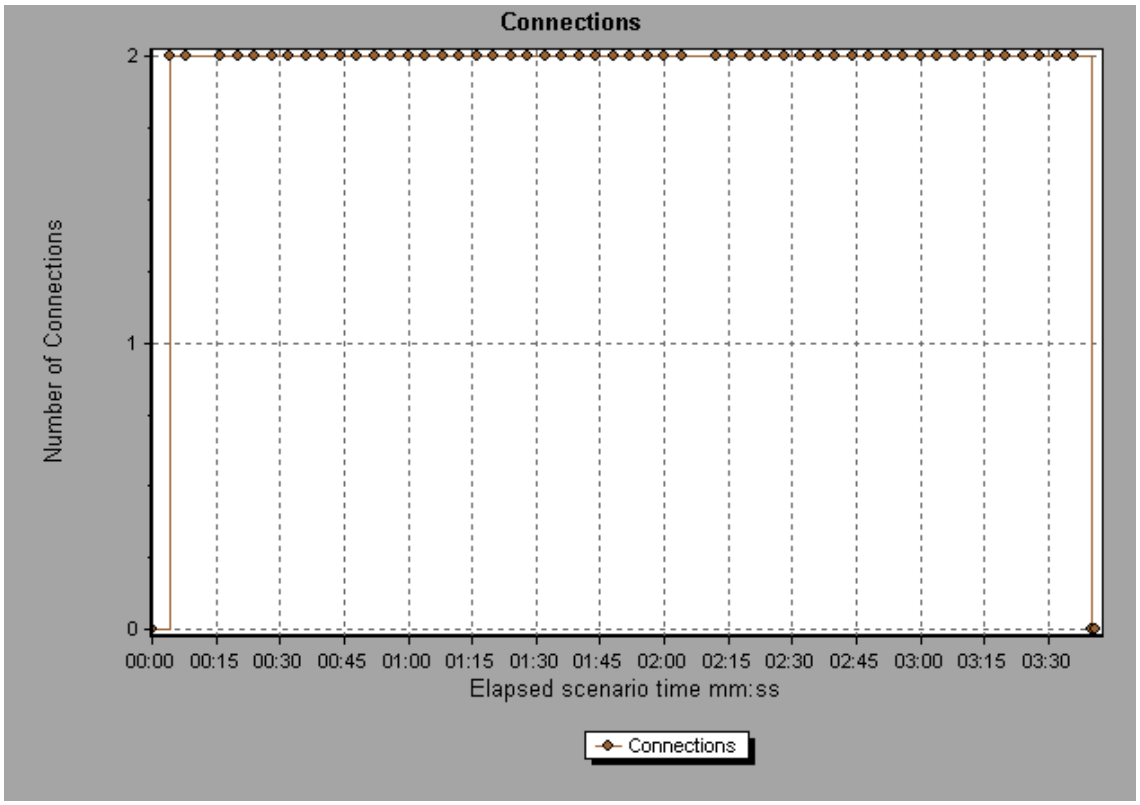


Connections Graph

This graph shows the number of open TCP/IP connections (y-axis) at each point in time of the load test scenario (x-axis). Depending on the emulated browser type, each Vuser may open several simultaneous connections per Web server.

Purpose	This graph is useful in indicating when additional connections are needed. For example, if the number of connections reaches a plateau, and the transaction response time

	increases sharply, adding connections would probably cause a dramatic improvement in performance (reduction in the transaction response time).
X-axis	Elapsed time since the start of the run.
Y-axis	Open TCP/IP connections.
See also	"Web Resources Graphs Overview" on page 145

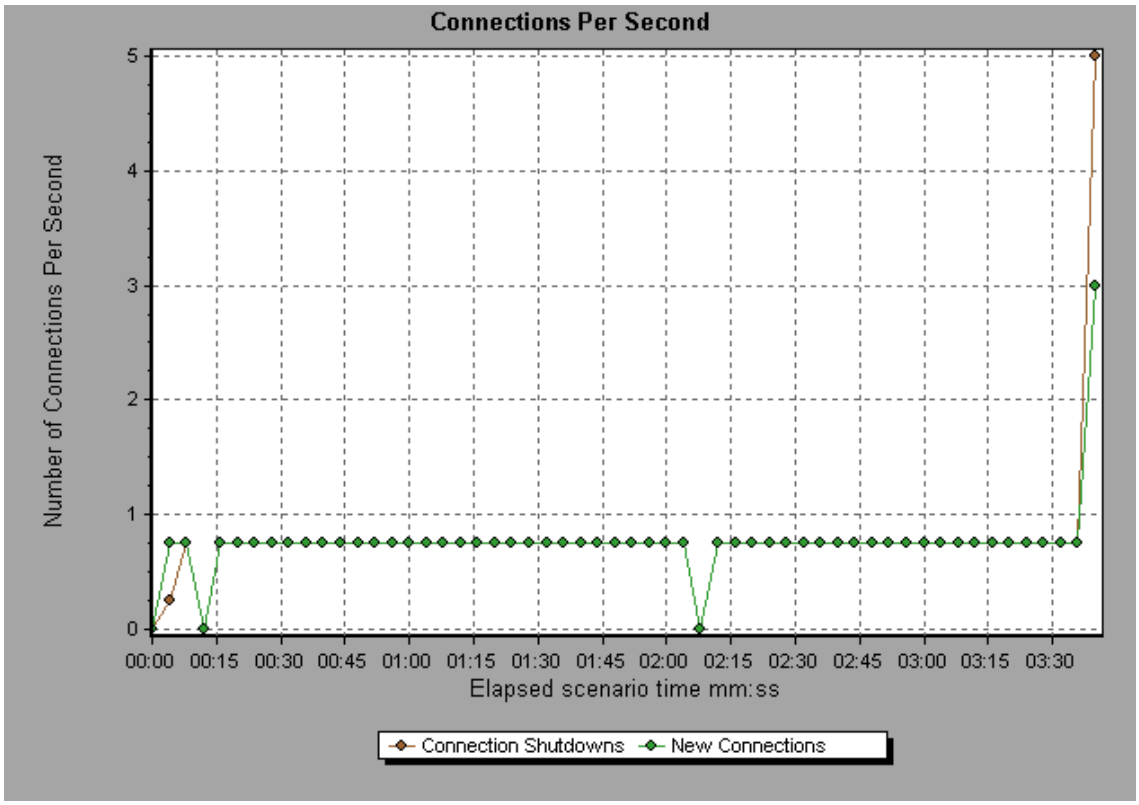


Connections per Second Graph

This graph shows the number of new TCP/IP connections (y-axis) opened and the number of connections that are shut down for each second of the load test scenario (x-axis).

X-axis	Elapsed time since the start of the run.
Y-axis	TCP/IP connections per second.
Tips	**New connections versus hits per second:** The number of new connections should be a small fraction of the number of hits per second, because new TCP/IP connections are very expensive in terms of server, router and network resource consumption. Ideally, many HTTP

	requests should use the same connection, instead of opening a new connection for each request.
See also	"Web Resources Graphs Overview" on page 145



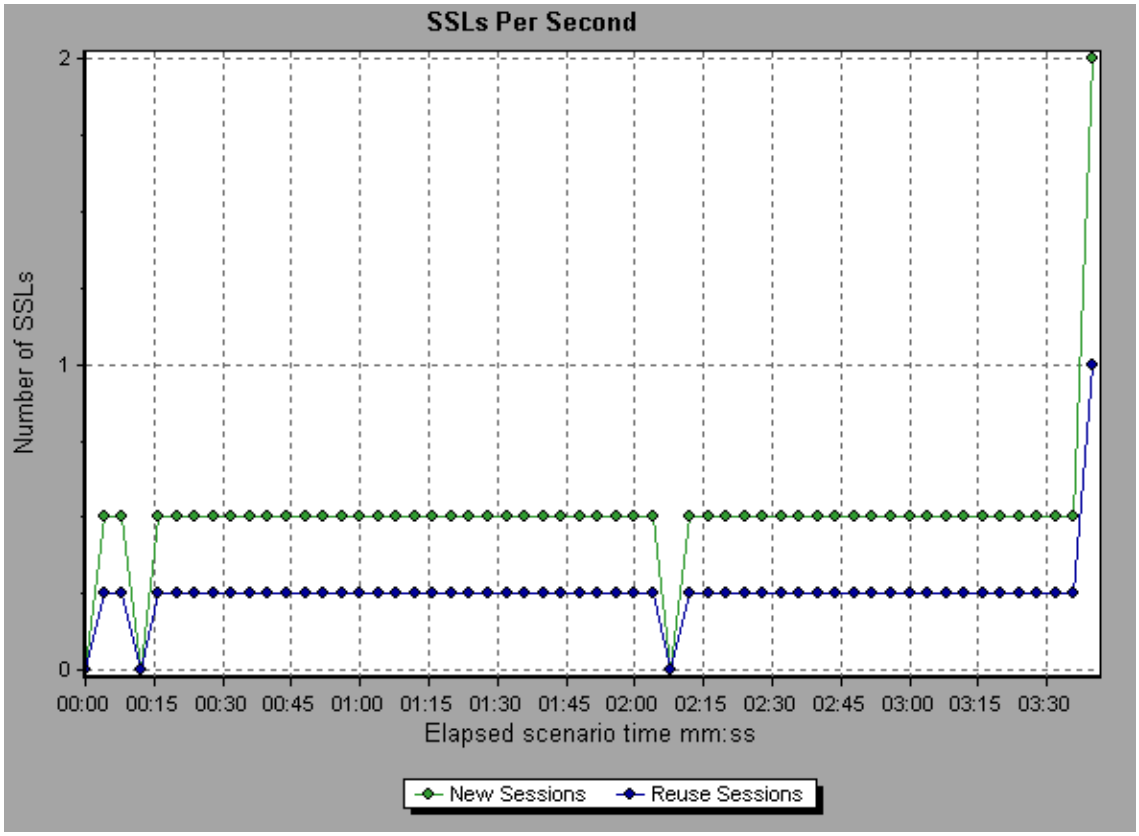
SSLs per Second Graph

This graph shows the number of new and reused SSL Connections (y-axis) opened in each second of the load test scenario (x-axis). An SSL connection is opened by the browser after a TCP/IP connection has been opened to a secure server.

X-axis	Elapsed time since the start of the run.
Y-axis	Number of SSL Connections
Tips	**Reduce SSL connections** Creating a new SSL connection entails heavy resource consumption. Therefore, you should try to open as few new SSL connections as possible. Once you've established an SSL connection, you should reuse it. There should be no more than one new SSL connection per Vuser.

	In cases where you reset TCP connections between iterations (**VuGen Runtime Settings > Browser Emulation node > Simulate a new user on each iteration**), you should have no more than one new SSL connection per iteration.
See also	"Web Resources Graphs Overview" on page 145

Example



Web Page Diagnostics Graphs

Web Page Diagnostics Tree View Overview

The Web Page Diagnostics tree view displays a tree view of the transactions, sub-transactions, and Web pages for which you can view Web Page Diagnostics graphs. For more information about Web Page Diagnostics graphs, see "Web Page Diagnostics Graph" on page 161.

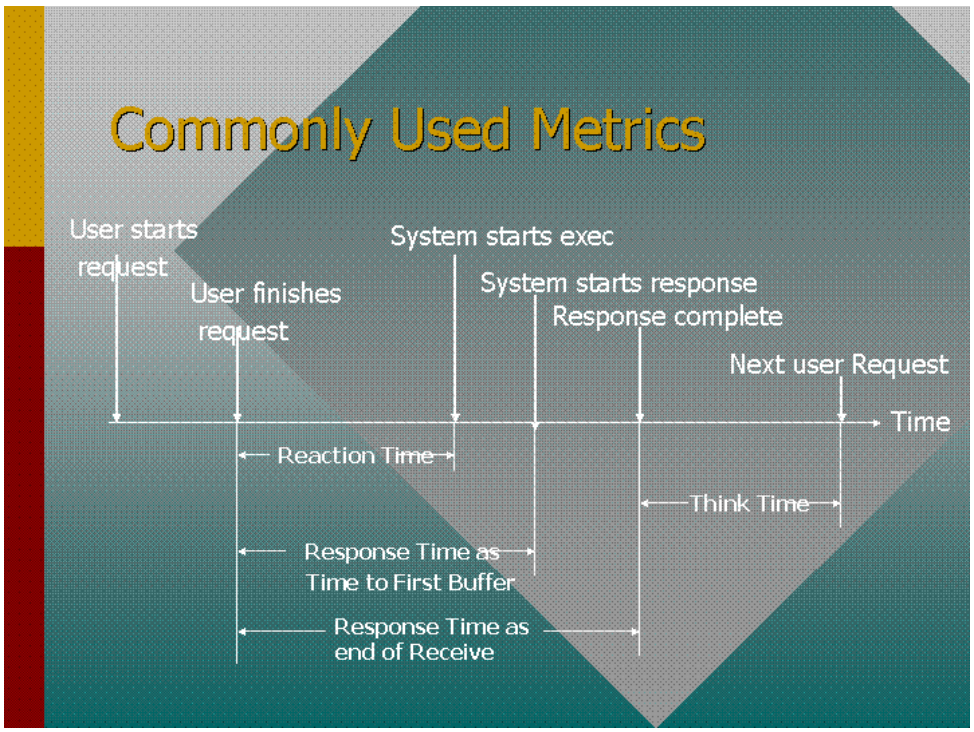
The Web Page Diagnostics graphs enable you to assess whether transaction response times were affected by page content. Using the Web Page Diagnostics graphs, you can analyze problematic elements—for example, images that download slowly, or broken links—of a Web site.

Web Page Diagnostics Graphs Overview

Web Page Diagnostics graphs provide you with performance information for each monitored Web page in your script. You can view the download time of each page in the script and its components, and identify at what point during download time problems occurred. In addition, you can view the relative download time and size of each page and its components. Analysis displays both average download time and download time over time data.

You correlate the data in the Web Page Diagnostics graphs with data in the Transaction Performance Summary and Average Transaction Response Time graphs in order to analyze why and where problems are occurring, and whether the problems are network- or server-related.

The following diagram illustrates the sequence of events from the time an HTTP request is sent:



> **Note:** Because server time is being measured from the client, network time may influence this measurement if there is a change in network performance from the time the initial HTTP request is sent until the time the first buffer is sent. The server time displayed, therefore, is estimated server time and may be slightly inaccurate.

You begin analyzing the Transaction Performance Summary and Average Transaction Response Time graphs with the Web Page Diagnostics graph, which displays the average download time (in seconds) for each monitored Web page during each second of the load test scenario run. The x-axis represents the elapsed time from the beginning of the scenario run. The y-axis represents the average download time (in seconds) for each Web page.

These graphs can also be used for analyzing mobile applications using the Mobile Application - HTTP/HTML protocol.

In order for Analysis to generate Web Page Diagnostics graphs, you must enable the Web Page Diagnostics feature in the Controller before running your scenario.

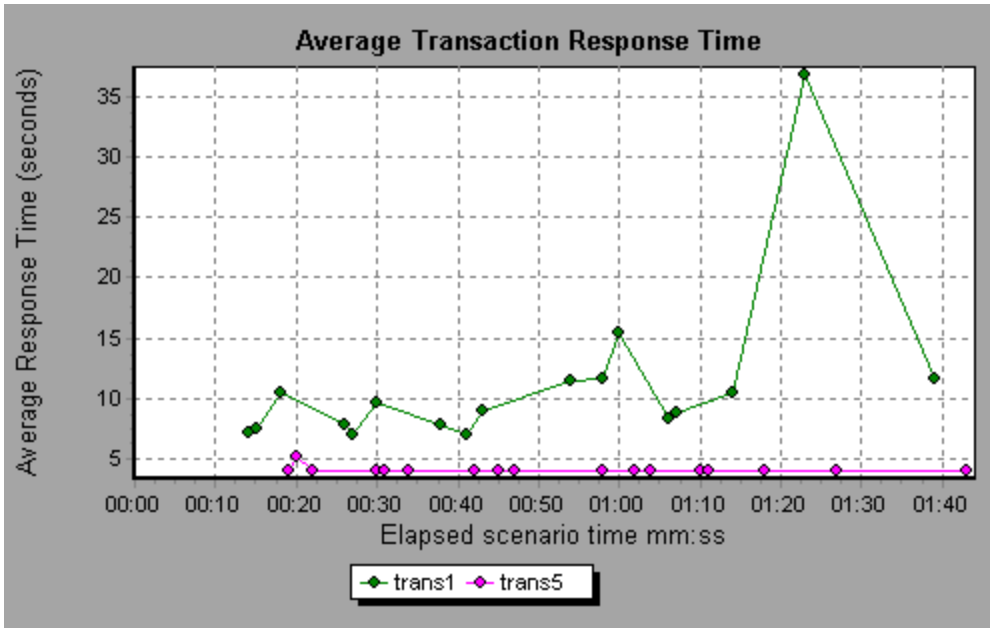
1. From the Controller menu, choose **Diagnostics > Configuration** and select the **Enable the following diagnostics** check box.
2. In the **Offline Diagnostics** section, if the button to the right of **Web Page Diagnostics (Max. Vuser Sampling: 10%)** says **Enable**, click it.

> **Note:** When preparing a Web HTTP/HTML Vuser script for which you want to perform Web diagnostics, it is recommended that you create an **HTML-based script** (using the **Recording** tab in the Recording Options).

For more information on recording scripts, refer to the VuGen section in the *LoadRunner User Guide*.

How to View the Breakdown of a Transaction

The Web Page Diagnostics graphs are most commonly used to analyze a problem detected in the Transaction Performance Summary or Average Transaction Response Time graphs. For example, the Average Transaction Response Time graph below demonstrates that the average transaction response time for the trans1 transaction was high.



Using the Web Page Diagnostics graphs, you can pinpoint the cause of the delay in response time for the trans1 transaction.

This task describes how to breakdown a transaction.

1. Right-click **trans1** and select **Web Page Diagnostics for trans1**. The Web Page Diagnostics graph opens and the Web Page Diagnostics tree appear. An icon appears next to the page name indicating the page content. See "Web Page Diagnostics Content Icons" below.
2. In the Web Page Diagnostics tree, right-click the problematic page you want to break down, and select **Break Down <component name>**. Alternatively, select a page in the **Select Page to Break Down** box that appears under the Web Page Diagnostics graph. The Web Page Diagnostics graph for that page appears.

> **Note:** You can open a browser displaying the problematic page by right-clicking the page in the Web Page Diagnostics tree and selecting **View page in browser**.

3. Select one of the following available breakdown options:
   - **Download Time.** Displays a table with a breakdown of the selected page's download time. The size of each page component (including the component's header) is displayed. See the "Page Download Time Breakdown Graph" on page 165 for more information about this display.
   - **Component (Over Time).** Displays the "Page Component Breakdown (Over Time) Graph" on page 164 for the selected Web page.
   - **Download Time (Over Time).** Displays the "Page Download Time Breakdown (Over Time) Graph" on page 167 for the selected Web page.
   - **Time to First Buffer (Over Time).** Displays the "Time to First Buffer Breakdown (Over Time) Graph" on page 172 for the selected Web page.

   To display the graphs in full view, click the  button. You can also access these graphs, as well as additional Web Page Diagnostics graphs, from the Open a New Graph dialog box.

Web Page Diagnostics Content Icons

The following icons appear in the Web Page Diagnostics tree. They indicate the HTTP content of the page.

Name	Description
	**Transaction**. Specifies that the ensuing content is part of the transaction.
	**Page Content**. Specifies that the ensuing content, which may include text, images, and so on, is all part of one logical page.
	**Text content.** Textual information. Plain text is intended to be displayed as-is. Includes HTML text and style sheets.
	**Multipart content.** Data consisting of multiple entities of independent data types.
	**Message content.** An encapsulated message. Common subtypes are news, or external-body

Name	Description
	which specifies large bodies by reference to an external data source.
	Application content. Some other kind of data, typically either uninterpreted binary data or information to be processed by an application. An example subtype is Postscript data.
	Image content. Image data. Two common subtypes are the jpeg and gif format.
	Resource content. Other resources not listed above. Also, content that is defined as "not available" is likewise included.

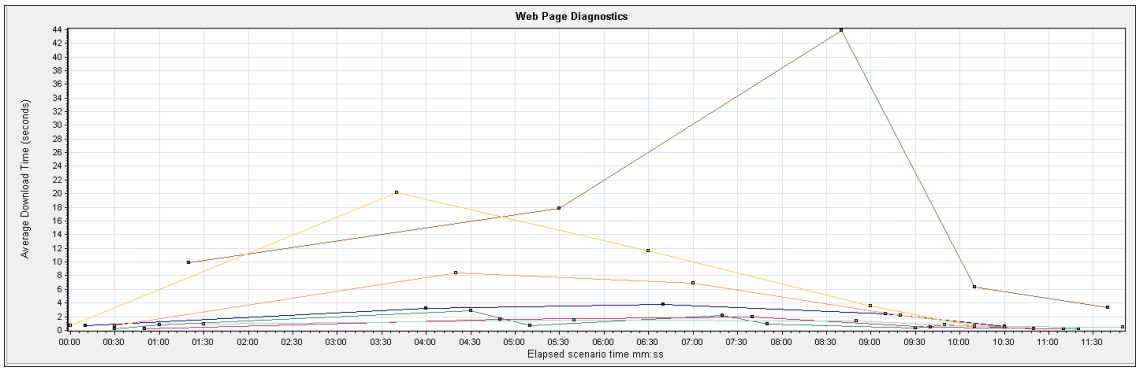
Web Page Diagnostics Graph

The Web Page Diagnostics graph provides you with performance information for each monitored Web page in your script. You can view the download time of each page in the script and its components, and identify at what point during download time problems occurred. In addition, you can view the average download time of each page and its components.

Purpose	This graph enables you to determine at what point during scenario execution a network or server problem occurred, that may have affected access to the Web page.
X-axis	Elapsed time from the beginning of the scenario run.
Y-axis	The download time (in seconds) for each Web page in the download process.
Tips	• Choose a page in the **Select Page to Break Down** drop-down box. • To isolate the most problematic components, you can sort the legend window according to the average number of seconds taken to download a component. To sort the legend by average, double-click the **Average** column heading.
Diagnostic Options	You can choose one of the following options to drill down on the results. For sample graphs, see below. • **Download Time** - as a bar graph • **Component (Over Time)** - as a line graph • **Download Time (Over Time)** - as an area graph • **Time to First Buffer (Over Time)** - as an area graph
See also	"Web Page Diagnostics Tree View Overview" on page 157

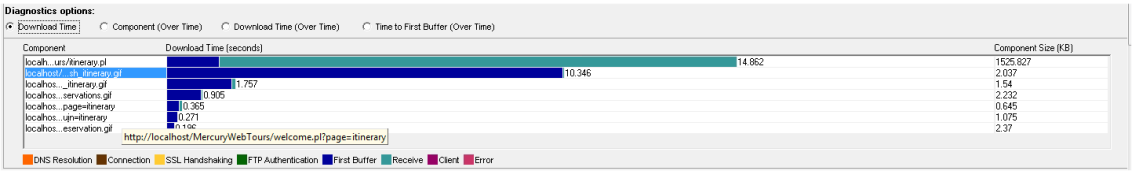
Example

This graph enables you to monitor the download time during the scenario execution, to determine at what point network or server problems occurred.



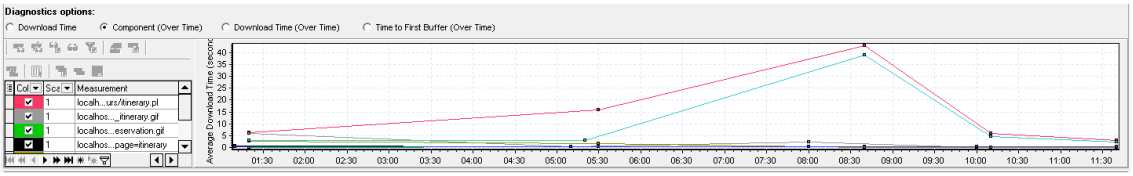
Download Time

In the following example, the download time for the **itinerary.pl** page was the greatest during the **Receive** stage.



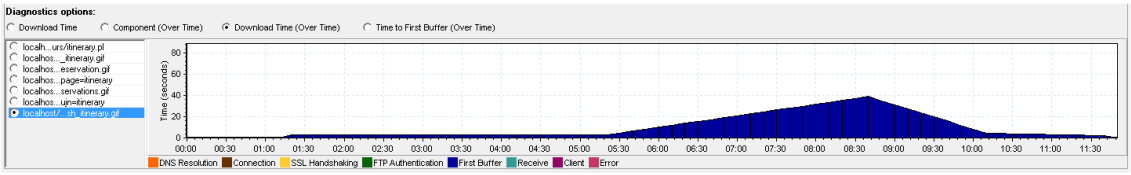
Component(Over Time)

In the following example, the download time for the **itinerary.pl** component was the greatest at approximately 8:40 into the scenario.



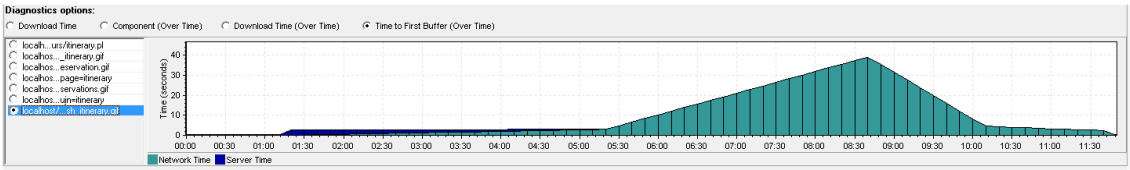
Download Time (Over Time)

The following graph shows the download time for the **itinerary.pl** page as an area graph.



Time to First Buffer (Over Time)

In the following example, the download time for the **splash_itinerary.gif** file was the greatest approximately 8:40 into the scenario.



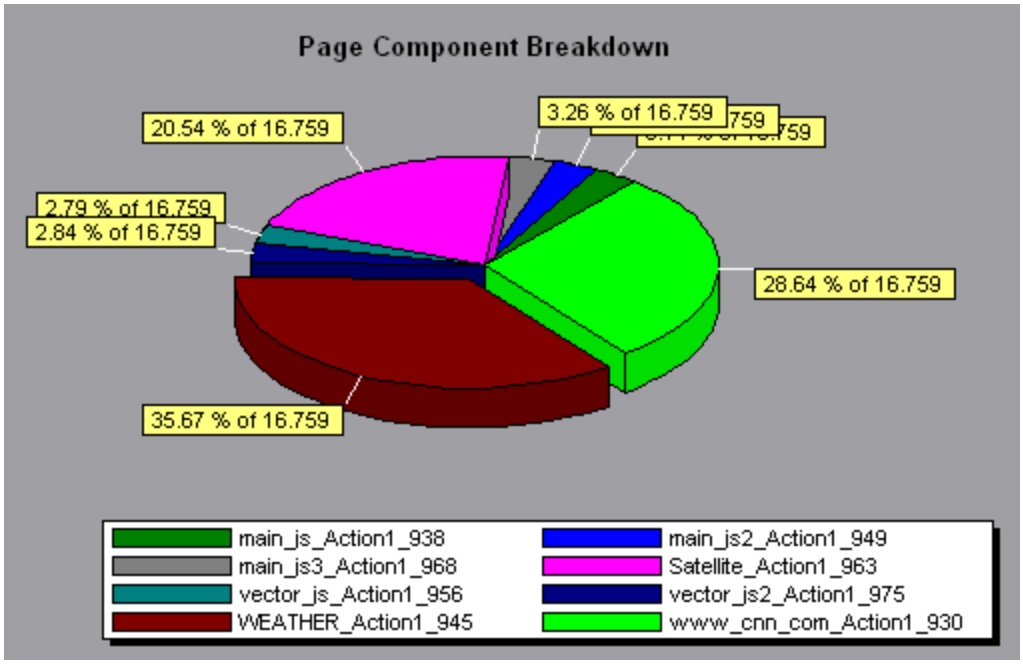
Page Component Breakdown Graph

This graph displays the average download time (in seconds) for each Web page and its components.

Breakdown options	To ascertain which components caused the delay in download time, you can break down the problematic URL by double-clicking it in the Web Page Diagnostics tree.
Tips	To isolate problematic components, it may be helpful to sort the legend according to the average number of seconds taken to download a component. To sort the legend by average, click the **Graph's Average** column.
Note	The graph can only be viewed as a pie.
See also	"Web Page Diagnostics Graphs Overview" on page 158

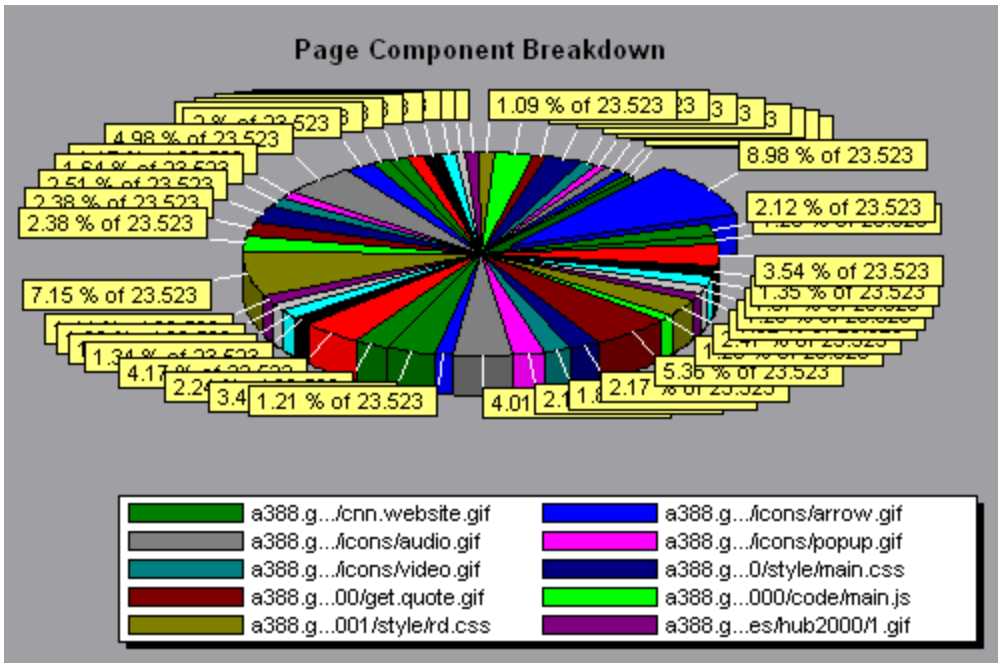
Example

The following graph demonstrates that the main cnn.com URL took 28.64% of the total download time, compared to 35.67% for the www.cnn.com/WEATHER component.



Example

The graph shows that the main cnn.com/WEATHER component took the longest time to download (8.98% of the total download time).



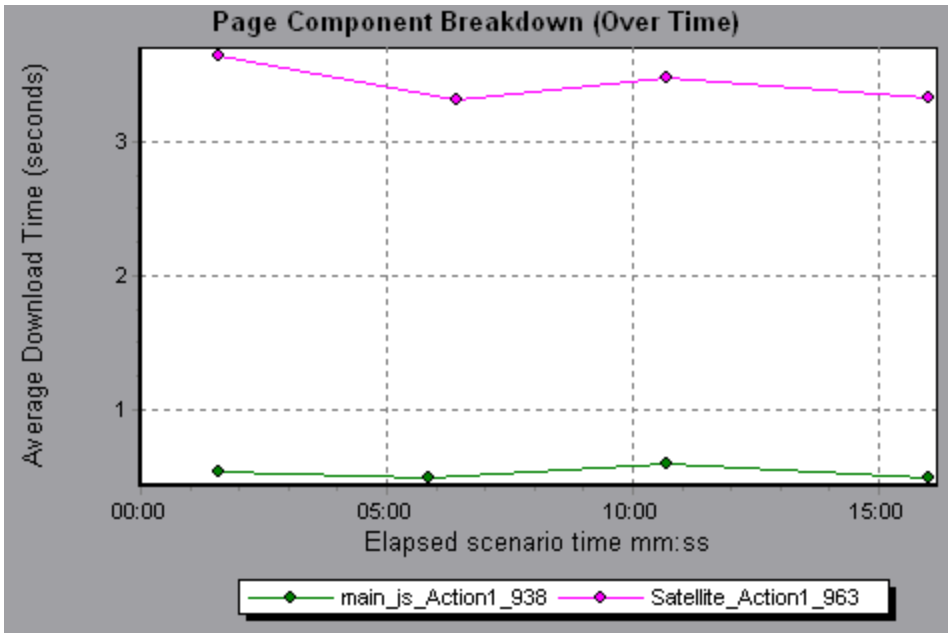
Page Component Breakdown (Over Time) Graph

This graph displays the average response time (in seconds) for each Web page and its components during each second of the load test scenario run.

X-axis	The elapsed time from the beginning of the scenario run.
Y-axis	The average response time (in seconds) for each component.
Tips	• To isolate the most problematic components, it may be helpful to sort the legend window according to the average number of seconds taken to download a component. To sort the legend by average, double-click the **Average** column heading. • To identify a component in the graph, you can select it. The corresponding line in the legend window is selected.
See also	"Web Page Diagnostics Graphs Overview" on page 158

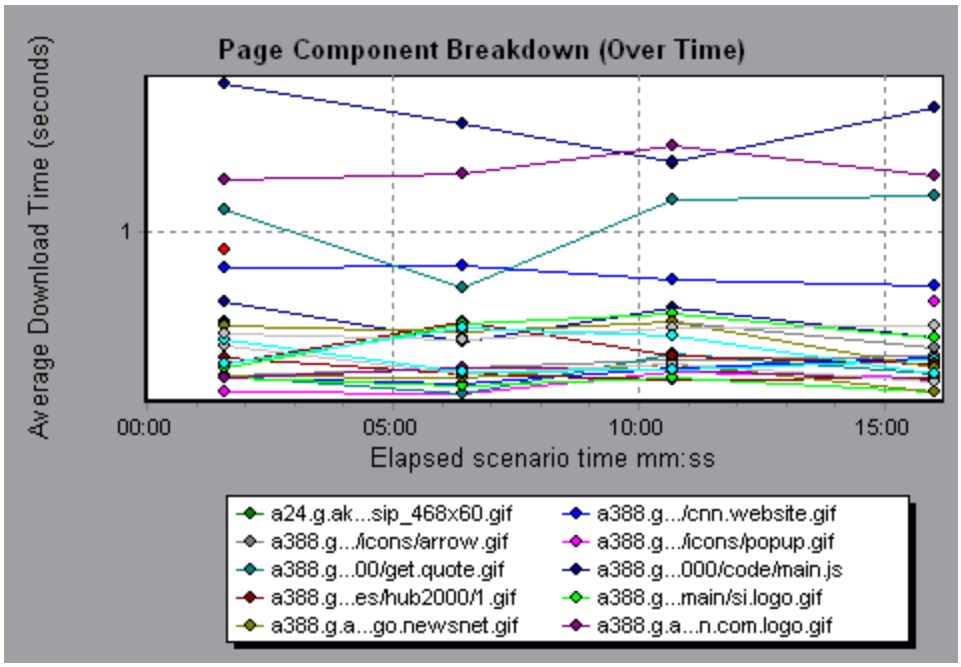
Example

The following graph demonstrates that the response time for Satellite_Action1_963 was significantly greater, throughout the scenario, than the response time for main_js_Action1_938.



Example

Using the graph, you can track which components of the main component were most problematic, and at which point(s) during the scenario the problem(s) occurred.



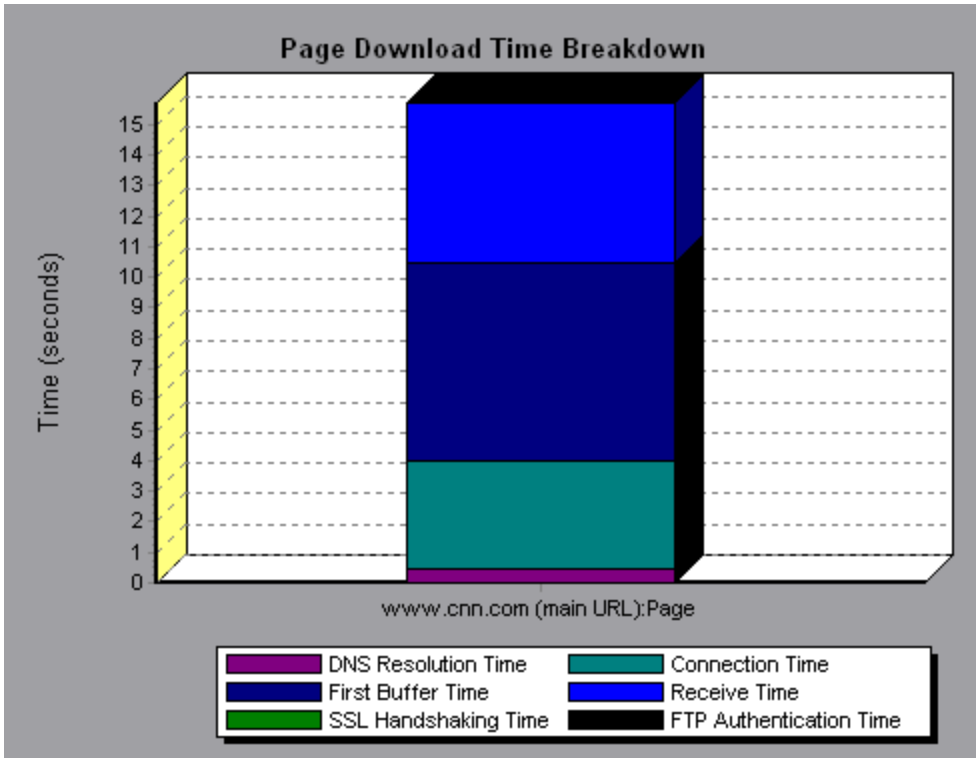
Page Download Time Breakdown Graph

This graph displays a breakdown of each page component's download time.

Purpose	Enables you to determine whether slow response times are being caused by network or server errors during Web page download.
Breakdown options	For breakdown options, see "Page Download Time Breakdown Graph Breakdown Options" on page 169. **Note:** Each measurement displayed on the page level is the sum of that measurement recorded for each page component. For example, the Connection Time for www.cnn.com is the sum of the Connection Time for each of the page's components.
See also	"Web Page Diagnostics Graphs Overview" on page 158

Example

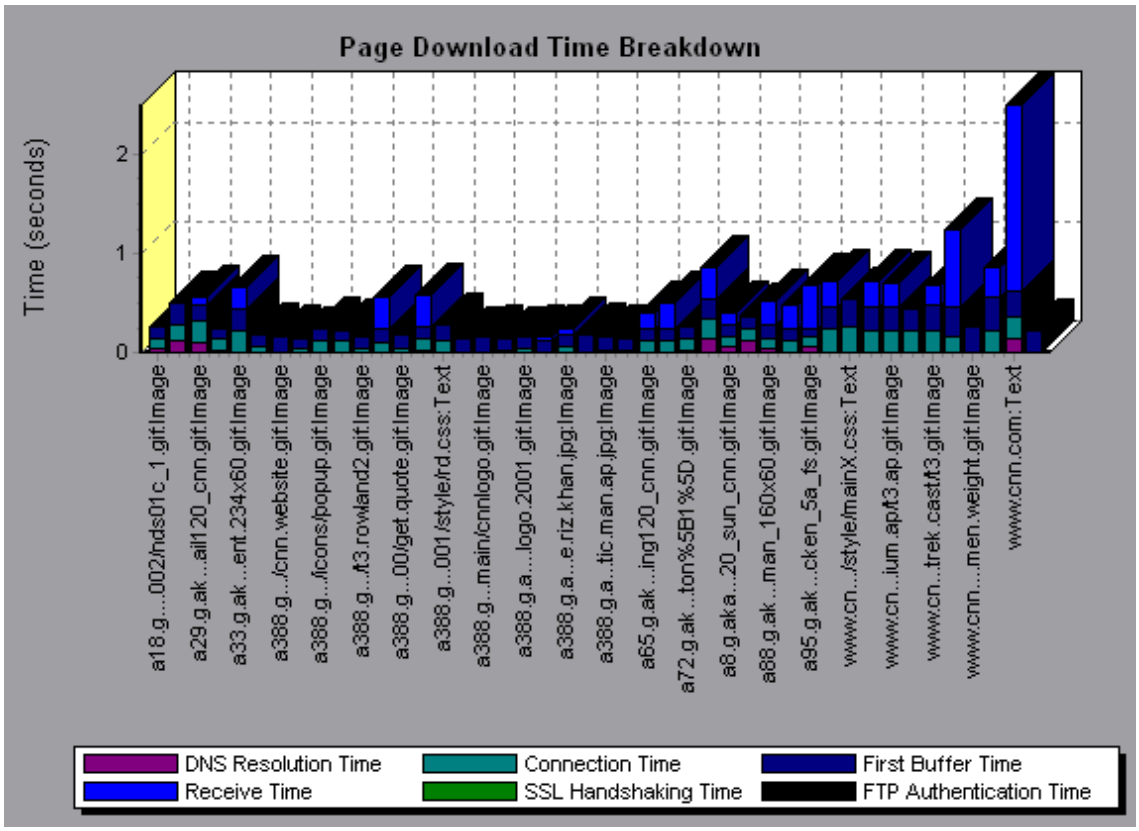
The Page Download Time Breakdown graph demonstrates that receive time, connection time, and first buffer time accounted for a large portion of the time taken to download the main cnn.com URL.



Example

If you break the cnn.com URL down further, you can isolate the components with the longest download time, and analyze the network or server problems that contributed to the delay in response time.

Breaking down the cnn.com URL demonstrates that for the component with the longest download time (the www.cnn.com component), the receive time accounted for a large portion of the download time.



Page Download Time Breakdown (Over Time) Graph

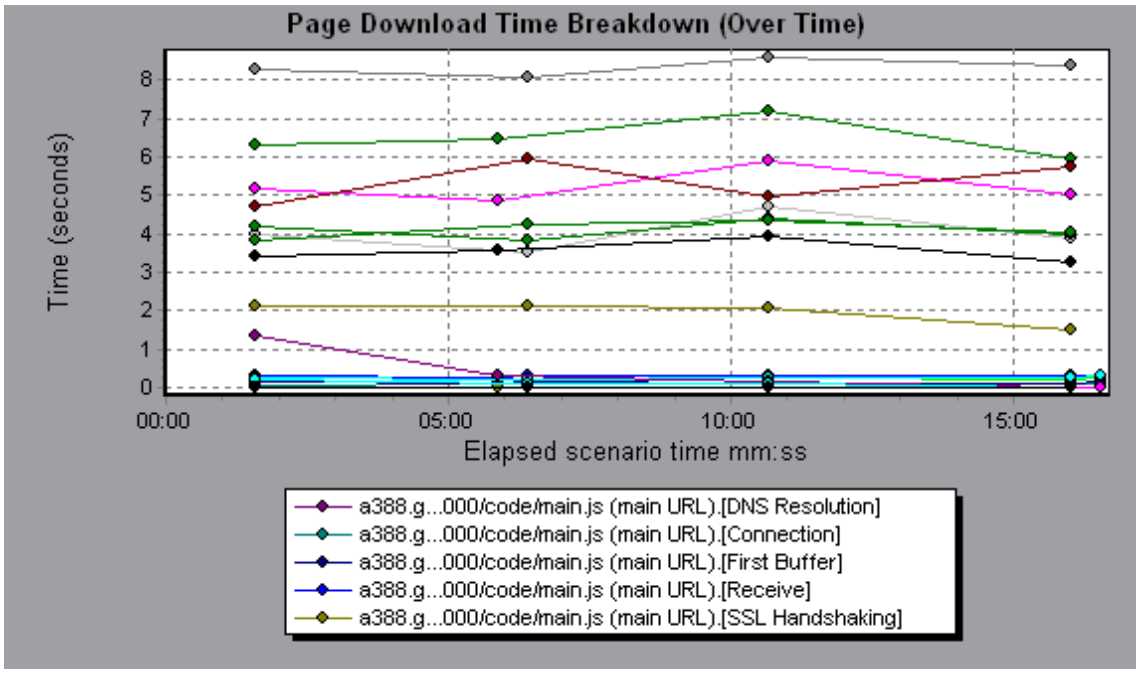
The graph displays a breakdown of each page component's download time during each second of the load test scenario run.

Purpose	This graph enables you to determine at what point during scenario execution network or server problems occurred.
X-axis	Elapsed time from the beginning of the scenario run.
Y-axis	Time (in seconds) taken for each step in the download process.
Tips	To isolate the most problematic components, you can sort the legend window according to the average number of seconds taken to download a component. To sort the legend by average, double-click the **Average** column heading.
Notes	• Each measurement displayed on the page level is the sum of that measurement recorded for each page component. For example, the Connection Time for www.cnn.com is the sum of the Connection Time for each of the page's components. • When the Page Download Time Breakdown (Over Time) graph is selected from the Web Page Diagnostics graph, it appears as an area graph.

See also	"Web Page Diagnostics Graphs Overview" on page 158

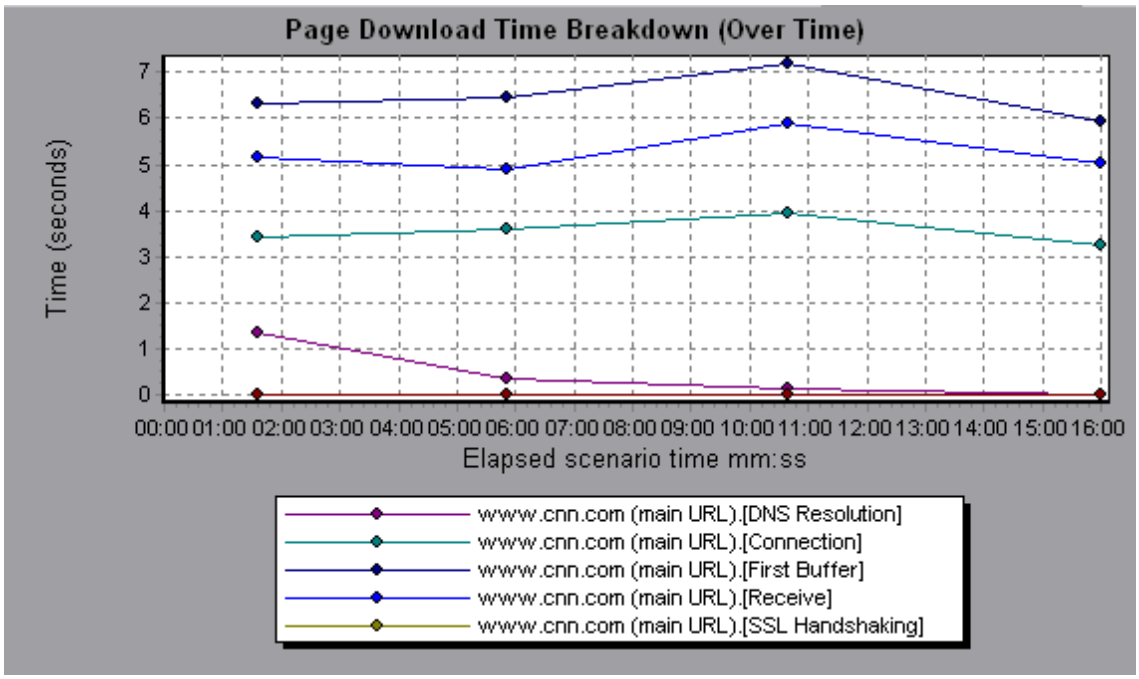
Example

This graph enables you to determine at what point during scenario execution network or server problems occurred.



Example

In the example in the previous section, it is apparent that cnn.com was the most problematic component. If you examine the cnn.com component, the Page Download Time Breakdown (Over Time) graph demonstrates that **First Buffer** and **Receive** time remained high throughout the scenario, and that **DNS Resolution** time decreased during the scenario.



Page Download Time Breakdown Graph Breakdown Options

The Page Download Time Breakdown graph breaks down each component by DNS resolution time, connection time, time to first buffer, SSL handshaking time, receive time, FTP authentication time, client time, and error time.

These breakdowns are described below:

Name	Description
DNS Resolution	Displays the amount of time needed to resolve the DNS name to an IP address, using the closest DNS server. The DNS Lookup measurement is a good indicator of problems in DNS resolution, or problems with the DNS server.
Connection	Displays the amount of time needed to establish an initial connection with the Web server hosting the specified URL. The connection measurement is a good indicator of problems along the network. It also indicates whether the server is responsive to requests.
First Buffer	Displays the amount of time that passes from the initial HTTP request (usually GET) until the first buffer is successfully received back from the Web server. The first buffer measurement is a good indicator of Web server delay as well as network latency. **Note:** Since the buffer size may be up to 8K, the first buffer might also be the time it takes to completely download the element.

Name	Description
SSL Handshaking	Displays the amount of time taken to establish an SSL connection (includes the client hello, server hello, client public key transfer, server certificate transfer, and other—partially optional—stages). After this point, all the communication between the client and server is encrypted. The SSL Handshaking measurement is only applicable for HTTPS communications.
Receive	Displays the amount of time that passes until the last byte arrives from the server and the downloading is complete. The Receive measurement is a good indicator of network quality (look at the time/size ratio to calculate receive rate).
FTP Authentication	Displays the time taken to authenticate the client. With FTP, a server must authenticate a client before it starts processing the client's commands. The FTP Authentication measurement is only applicable for FTP protocol communications.
Client Time	Displays the average amount of time that passes while a request is delayed on the client machine due to browser think time or other client-related delays.
Error Time	Displays the average amount of time that passes from the moment an HTTP request is sent until the moment an error message (HTTP errors only) is returned.

Time to First Buffer Breakdown Graph

This graph displays each Web page component's relative server/network time (in seconds) for the period of time until the first buffer is successfully received back from the Web server.

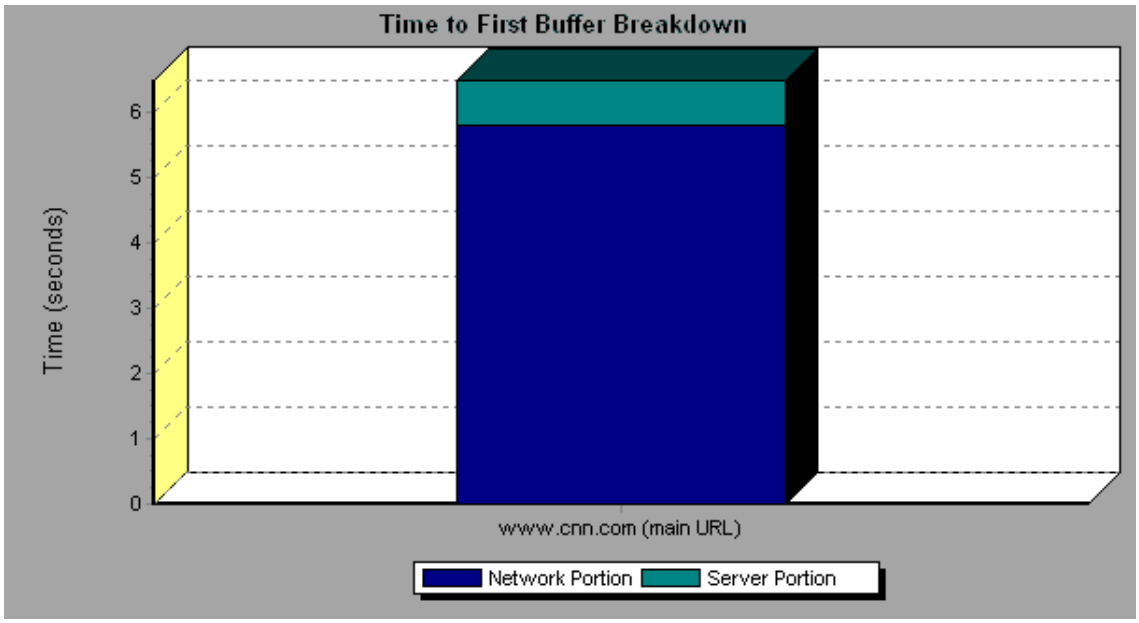
> **Note:** This graph is only relevant when the load generator does not use a proxy to connect to the application under test. If the load generator is connected through a proxy, this graph will only show the proxy latency—not the AUT latency.

Purpose	If the download time for a component is high, you can use this graph to determine whether the problem is server- or network-related.
X-axis	Specifies the name of the component.
Y-axis	Shows the average network/server time (in seconds) for each component.
Measurements	• Network time is defined as the average amount of time that passes from the moment the first HTTP request is sent until receipt of ACK. • Server time is defined as the average amount of time that passes from the

	receipt of ACK of the initial HTTP request (usually GET) until the first buffer is successfully received back from the Web server.
Note	• Each measurement displayed on the page level is the sum of that measurement recorded for each page component. For example, the network time for www.cnn.com is the sum of the network time for each of the page's components. • Because server time is being measured from the client, network time may influence this measurement if there is a change in network performance from the time the initial HTTP request is sent until the time the first buffer is sent. The server time displayed, therefore, is estimated server time and may be slightly inaccurate. • The graph can only be viewed as a bar graph.
See also	"Web Page Diagnostics Graphs Overview" on page 158

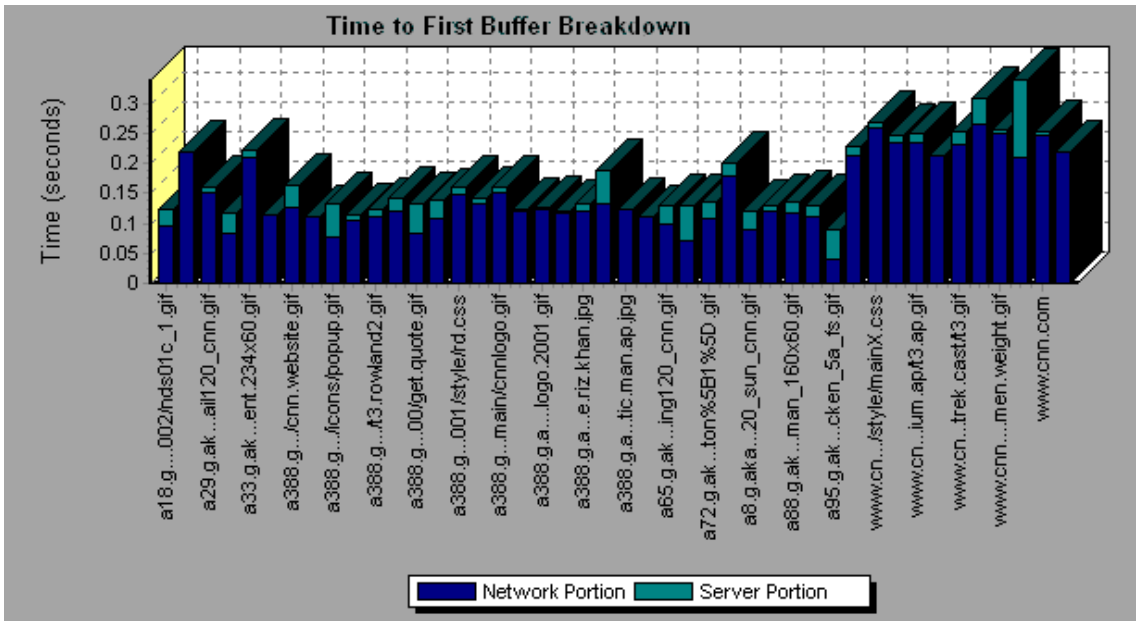
Example

In the following example it is apparent that network time is greater than server time.



Example

In the following example shows that you can break the main cnn.com URL down further to view the time to first buffer breakdown for each of its components. It is apparent that for the main cnn.com component (the first component on the right), the time to first buffer breakdown is almost all network time.



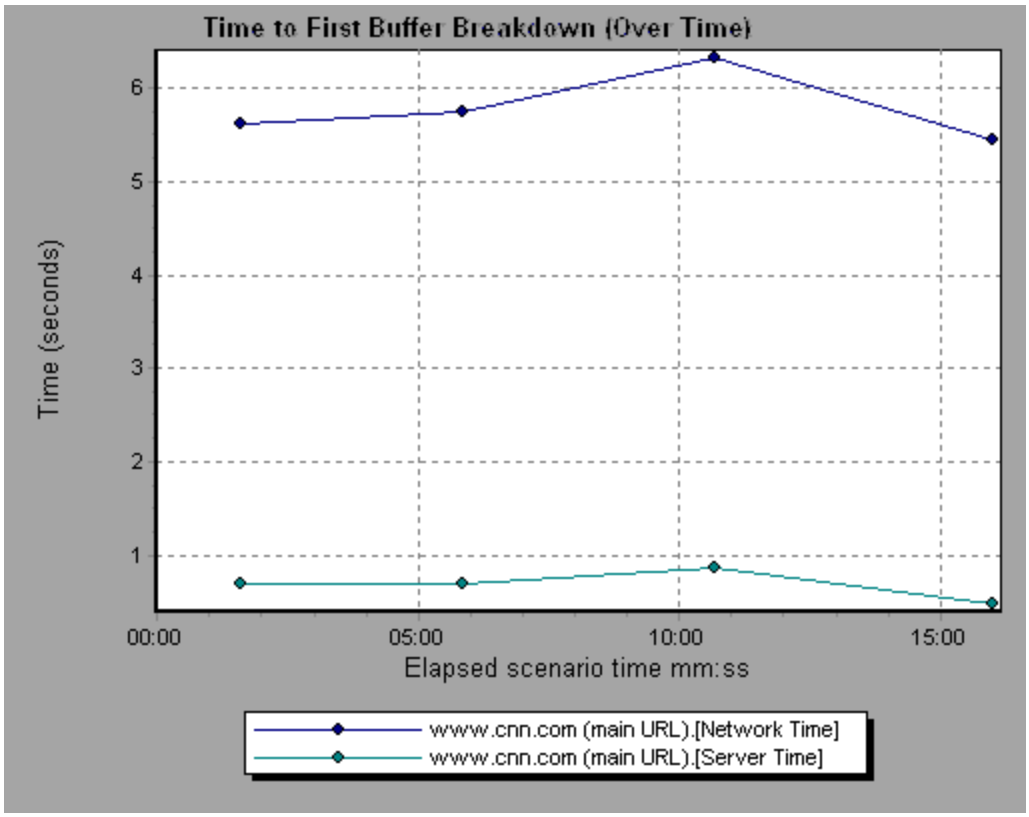
Time to First Buffer Breakdown (Over Time) Graph

This graph displays each Web page component's server and network time (in seconds) during each second of the load test scenario run, for the period of time until the first buffer is successfully received back from the Web server.

> **Note:** This graph is only relevant when the load generator does not use a proxy to connect to the application under test. If the load generator is connected through a proxy, this graph will only show the proxy latency—not the AUT latency.

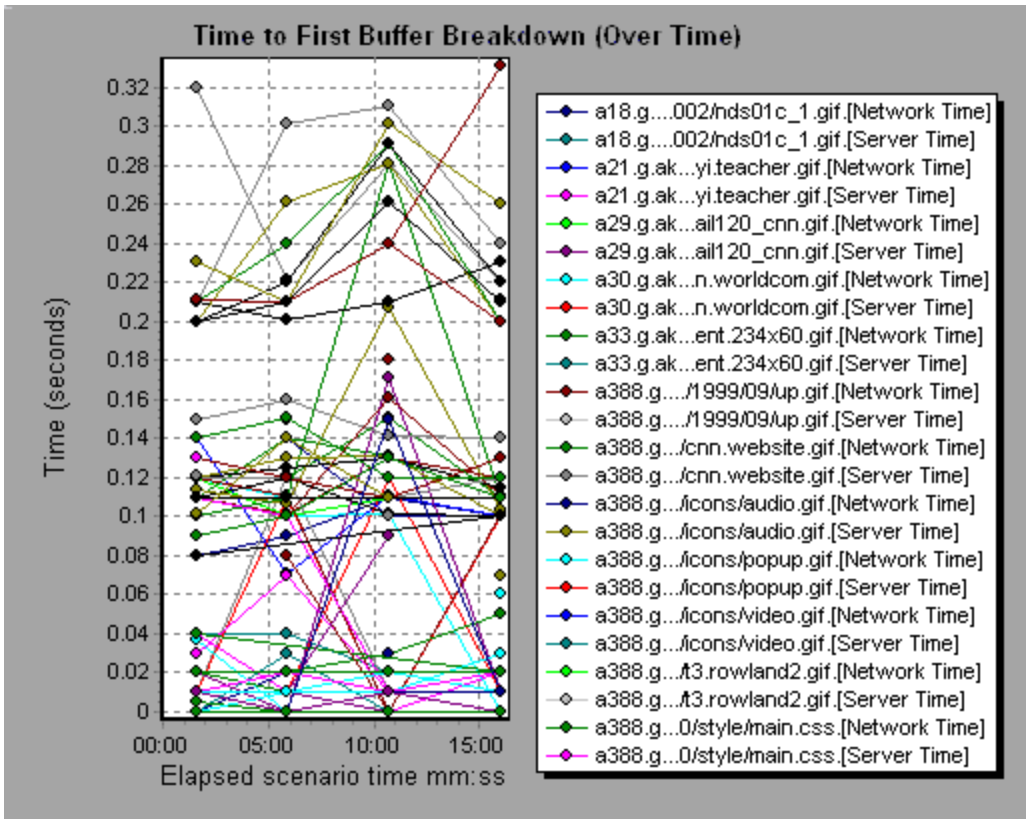
Purpose	You can use this graph to determine when during the scenario run a server- or network-related problem occurred.
X-axis	Elapsed time from the beginning of the scenario run.
Y-axis	Average network or server time (in seconds) for each component.
Measurements	• Network time is defined as the average amount of time that passes from the moment the first HTTP request is sent until receipt of ACK. • Server time is defined as the average amount of time that passes from the receipt of ACK of the initial HTTP request (usually GET) until the first buffer is successfully received back from the Web server. **Note:** Because server time is being measured from the client, network time may influence this measurement if there is a change in network performance from the time the initial HTTP request is sent until the time the first buffer is sent. The server time displayed, therefore, is estimated server time and may be slightly

	inaccurate.
Note	• Each measurement displayed on the page level is the sum of that measurement recorded for each page component. For example, the network time for www.hp.com is the sum of the network time for each of the page's components. • When the Time to First Buffer Breakdown (Over Time) graph is selected from the Web Page Diagnostics graph, it appears as an area graph.
See also	"Web Page Diagnostics Graphs Overview" on page 158



Example

In the following example you can break the main cnn.com URL down further to view the time to first buffer breakdown for each of its components.



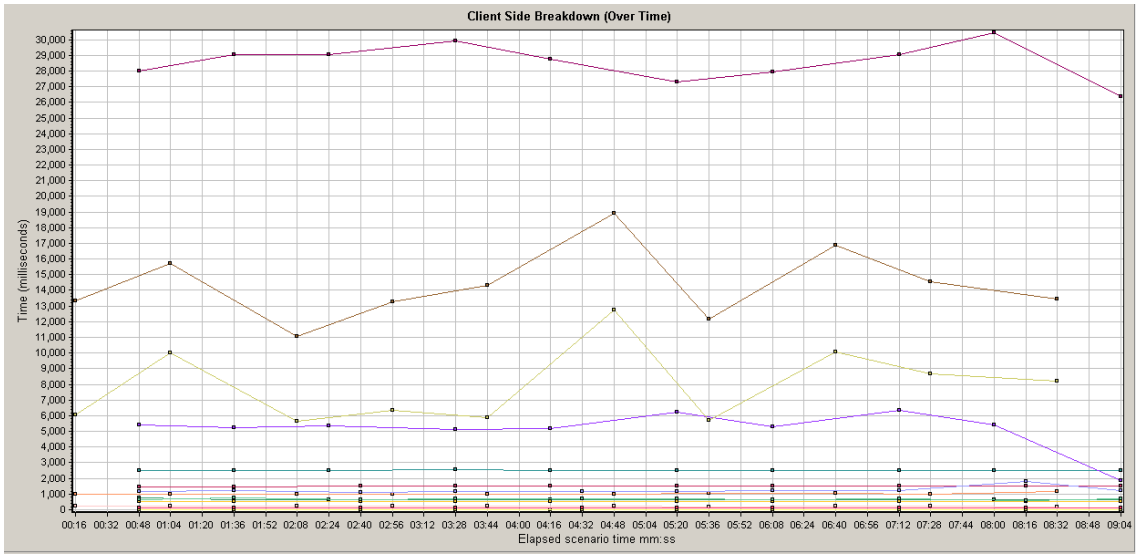
Client Side Breakdown (Over Time) Graph

This graph displays the client side breakdown of each transaction during each second of the load test scenario run.

X-axis	The elapsed time from the beginning of the scenario run.
Y-axis	The average response time (in seconds) for each transaction.
Tips	• To isolate the most problematic transactions, it may be helpful to sort the legend window according to the average number of seconds taken for the transaction to run. To sort the legend by average, double-click the **Average** column heading. • To identify a transaction in the graph, you can select it. The corresponding line in the legend window is selected.
See also	"Web Page Diagnostics Graph" on page 161

Example

Using the graph, you can track which transactions on the client side were most problematic, and at which point(s) during the scenario the problem(s) occurred.



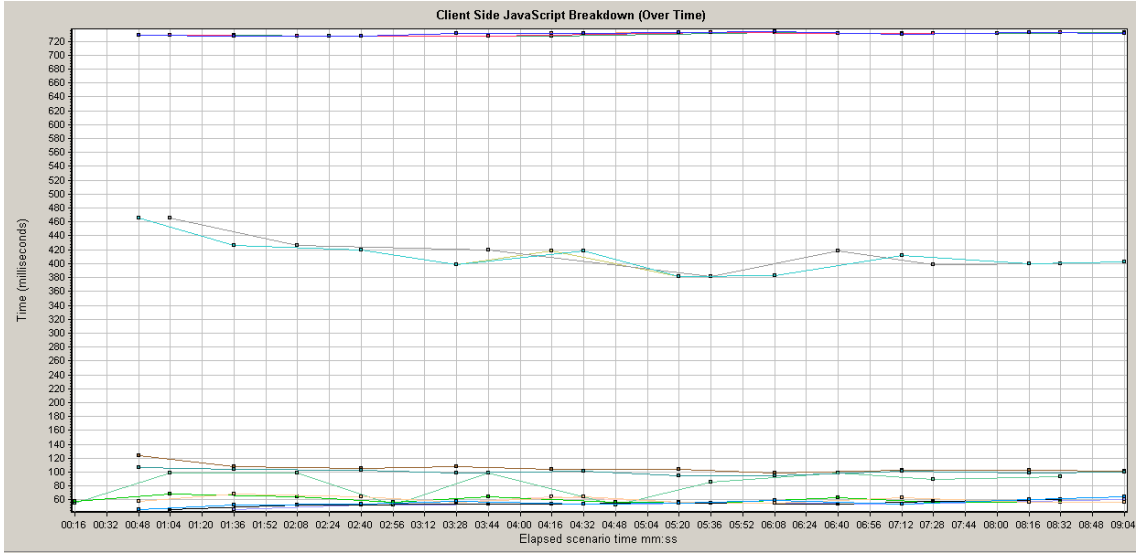
Client Side Java Script Breakdown (Over Time) Graph

This graph displays the client side breakdown of each JavaScript transaction during each second of the load test scenario run.

X-axis	The elapsed time from the beginning of the scenario run.
Y-axis	The average response time (in seconds) for each transaction.
Tips	• To isolate the most problematic transactions, it may be helpful to sort the legend window according to the average number of seconds taken for the transaction to run. To sort the legend by average, double-click the **Average** column heading. • To identify a transaction in the graph, you can select it. The corresponding line in the legend window is selected.
See also	"Web Page Diagnostics Graph" on page 161

Example

Using the graph, you can track which transactions on the client side were most problematic, and at which point(s) during the scenario the problem(s) occurred.



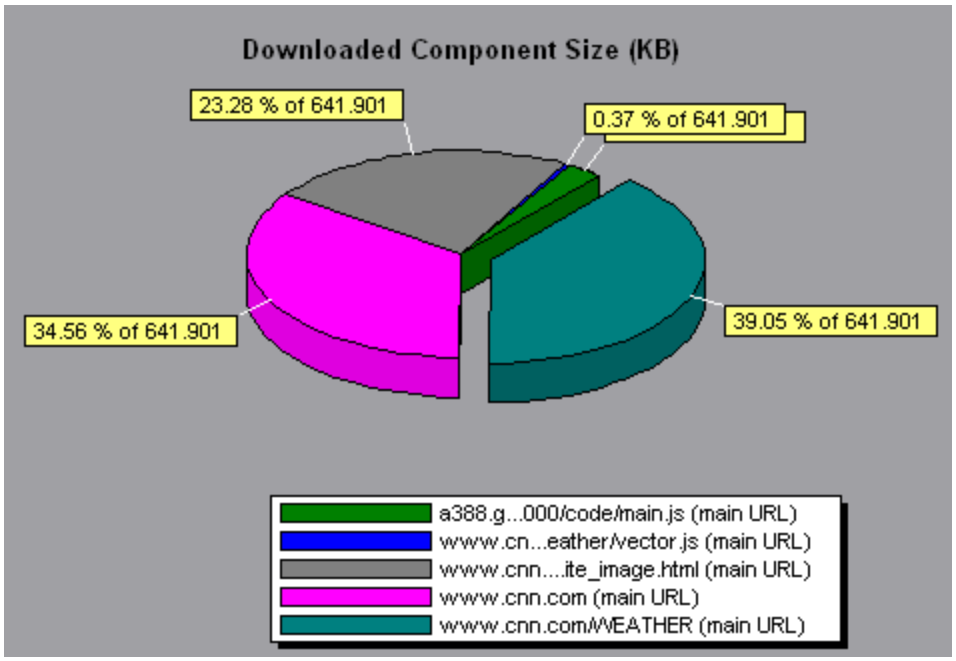
Downloaded Component Size Graph

This graph displays the size of each Web page component.

Note	• The Web page size is a sum of the sizes of each of its components. • The Downloaded Component Size graph can only be viewed as a pie graph.
See also	"Web Page Diagnostics Graphs Overview" on page 158

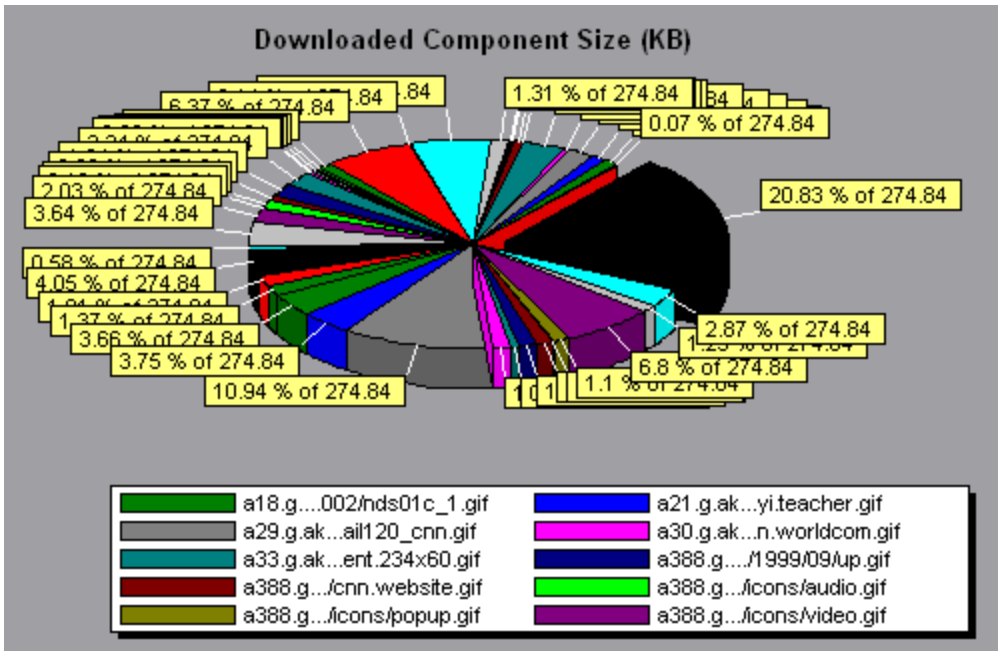
Example

In the following example the www.cnn.com/WEATHER component is 39.05% of the total size, whereas the main cnn.com component is 34.56% of the total size.



Example

In the following example the cnn.com component's size (20.83% of the total size) may have contributed to the delay in its downloading. To reduce download time, it may help to reduce the size of this component.



User-Defined Data Point Graphs

User-Defined Data Point Graphs Overview

The User-Defined Data Point graphs display the values of user-defined data points. You define a data point in your Vuser script by inserting an **lr_user_data_point** function at the appropriate place (**user_data_point** for GUI Vusers and **lr.user_data_point** for Java Vusers).

```
Action1()
{
    lr_think_time(1);
    lr_user_data_point ("data_point_1",1);
    lr_user_data_point ("data_point_2",2);
    return 0;
}
```

For Vuser protocols that support the graphical script representations such as Web and Oracle NCA, you insert a data point as a User Defined step. Data point information is gathered each time the script executes the function or step. For more information about data points, refer to the Function Reference.

Data points, like other Analysis data, are aggregated every few seconds, resulting in less data points shown on the graph than actually recorded. For more information, see "Changing the Granularity of the Data" on page 91.

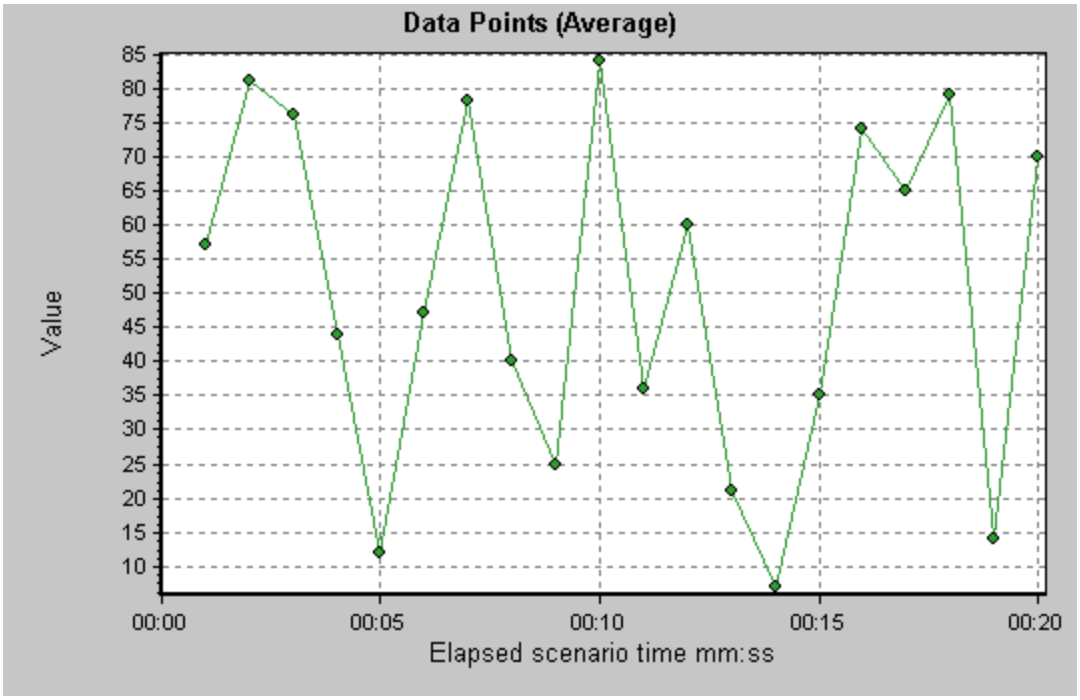
Data Points (Average) Graph

This graph shows the average values that were recorded for user-defined data points during the load test scenario run.

Purpose	This graph is typically used in cases where the actual value of the measurement is required. Suppose that each Vuser monitors CPU utilization on its machine and records it as a data point. In this case, the actual recorded value of CPU utilization is required. The Average graph displays the average value recorded throughout the scenario.
X-axis	Elapsed time since the start of the run.
Y-axis	The average values of the recorded data point statements.
See also	"User-Defined Data Point Graphs Overview" above

Example

In the following example, the CPU utilization is recorded as the data point **user_data_point_val_1**. It is shown as a function of the elapsed scenario time.



Data Points (Sum) Graph

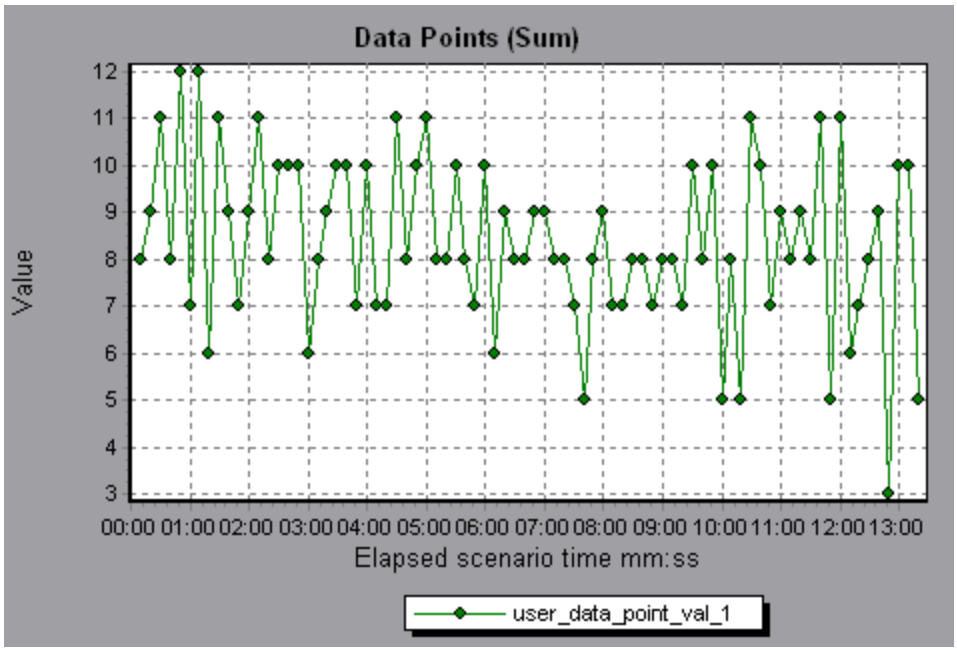
This graph shows the sum of the values for user-defined data points throughout the load test scenario run.

This graph typically indicates the total amount of measurements which all Vusers are able to generate. For example, suppose only a certain set of circumstances allow a Vuser to call a server. Each time it does, a data point is recorded. In this case, the Sum graph displays the total number of times that Vusers call the function.

X-axis	Elapsed time since the start of the run.
Y-axis	The sum of the recorded data point values.
See also	"User-Defined Data Point Graphs Overview" on the previous page

Example

In the following example, the call to the server is recorded as the data point user_data_point_val_1. It is shown as a function of the elapsed scenario time.



System Resource Graphs

System Resource graphs display the system resource usage measured by the online monitors during the load test scenario run. These graphs require that you specify the resources you want to measure *before* running the scenario. For more information, see the section on online monitors in the LoadRunner Controller documentation.

Server Resources Performance Counters

The following table describes the available counters:

Monitor	Measurements	Description
CPU Monitor	Utilization	Measures CPU utilization.
Disk Space Monitor	Disk space	Measures the amount (in MB) free disk space and the percentage of disk space used.
Memory Monitor	MB free	Measures the amount of free memory (in MB).
	Pages/sec	Measures the number of virtual memory pages that are moved between main memory and disk storage.
	Percent used	Measures the percentage of memory and paging file space used.
Services		Monitors processes locally or on remote systems. Can be used to

Monitor	Measurements	Description
Monitor		verify that specific processes are running.

Linux Resources Default Measurements

The following default measurements are available for Linux machines:

Measurement	Description
Average load	Average number of processes simultaneously in `Ready' state during the last minute.
Collision rate	Collisions per second detected on the Ethernet.
Context switches rate	Number of switches between processes or threads, per second.
CPU utilization	Percent of time that the CPU is utilized.
Disk rate	Rate of disk transfers.
Incoming packets error rate	Errors per second while receiving Ethernet packets.
Incoming packets rate	Incoming Ethernet packets per second.
Interrupt rate	Number of device interrupts per second.
Outgoing packets errors rate	Errors per second while sending Ethernet packets.
Outgoing packets rate	Outgoing Ethernet packets per second.
Page-in rate	Number of pages read to physical memory, per second.
Page-out rate	Number of pages written to pagefile(s) and removed from physical memory, per second.
Paging rate	Number of pages read to physical memory or written to pagefile(s), per second.
Swap-in rate	The rate by which disk content is swapped into the machine's memory in Kbps.
Swap-out rate	The rate by which the machine's memory is being swapped out to disk in Kbps.
System mode CPU	Percent of time that the CPU is utilized in system mode.

Measurement	Description
utilization	
User mode CPU utilization	Percent of time that the CPU is utilized in user mode.

Windows Resources Default Measurements

The following default measurements are available for Windows Resources:

Object	Measurement	Description
System	**% Total Processor Time**	The average percentage of time that all the processors on the system are busy executing non-idle threads. On a multi-processor system, if all processors are always busy, this is 100%, if all processors are 50% busy this is 50% and if 1/4 of the processors are 100% busy this is 25%. It can be viewed as the fraction of the time spent doing useful work. Each processor is assigned an Idle thread in the Idle process which consumes those unproductive processor cycles not used by any other threads.
Processor	**% Processor Time**	The percentage of time that the processor is executing a non-idle thread. This counter was designed as a primary indicator of processor activity. It is calculated by measuring the time that the processor spends executing the thread of the idle process in each sample interval, and subtracting that value from 100%. (Each processor has an idle thread which consumes cycles when no other threads are ready to run.) It can be viewed as the percentage of the sample interval spent doing useful work. This counter displays the average percentage of busy time observed during the sample interval. It is calculated by monitoring the time the service was inactive, and then subtracting that value from 100%.
System	**File Data Operations/sec**	The rate at which the computer issues read and write operations to file system devices. This does not include File Control Operations.
System	**Processor Queue Length**	The instantaneous length of the processor queue in units of threads. This counter is always 0 unless you are also monitoring a thread counter. All processors use a single queue in which threads wait for processor cycles. This length does not include the threads that are currently executing. A sustained processor queue length greater than two generally indicates processor congestion. This is an instantaneous count, not an average over the time interval.

Object	Measurement	Description
Memory	**Page Faults/sec**	This is a count of the page faults in the processor. A page fault occurs when a process refers to a virtual memory page that is not in its Working Set in the main memory. A page fault will not cause the page to be fetched from disk if that page is on the standby list (and hence already in main memory), or if it is in use by another process with which the page is shared.
PhysicalDisk	**% Disk Time**	The percentage of elapsed time that the selected disk drive is busy servicing read or write requests.
Memory	**Pool Nonpaged Bytes**	The number of bytes in the non-paged pool, a system memory area where space is acquired by operating system components as they accomplish their appointed tasks. Non-paged pool pages cannot be paged out to the paging file. They remain in main memory as long as they are allocated.
Memory	**Pages/sec**	The number of pages read from the disk or written to the disk to resolve memory references to pages that were not in memory at the time of the reference. This is the sum of Pages Input/sec and Pages Output/sec. This counter includes paging traffic on behalf of the system cache to access file data for applications. This value also includes the pages to/from non-cached mapped memory files. This is the primary counter to observe if you are concerned about excessive memory pressure (that is, thrashing), and the excessive paging that may result.
System	**Total Interrupts/sec**	The rate at which the computer is receiving and servicing hardware interrupts. The devices that can generate interrupts are the system timer, the mouse, data communication lines, network interface cards, and other peripheral devices. This counter provides an indication of how busy these devices are on a computer-wide basis. See also **Processor:Interrupts/sec**.
Objects	**Threads**	The number of threads in the computer at the time of data collection. Notice that this is an instantaneous count, not an average over the time interval. A thread is the basic executable entity that can execute instructions in a processor.
Process	**Private Bytes**	The current number of bytes that the process has allocated that cannot be shared with other processes.

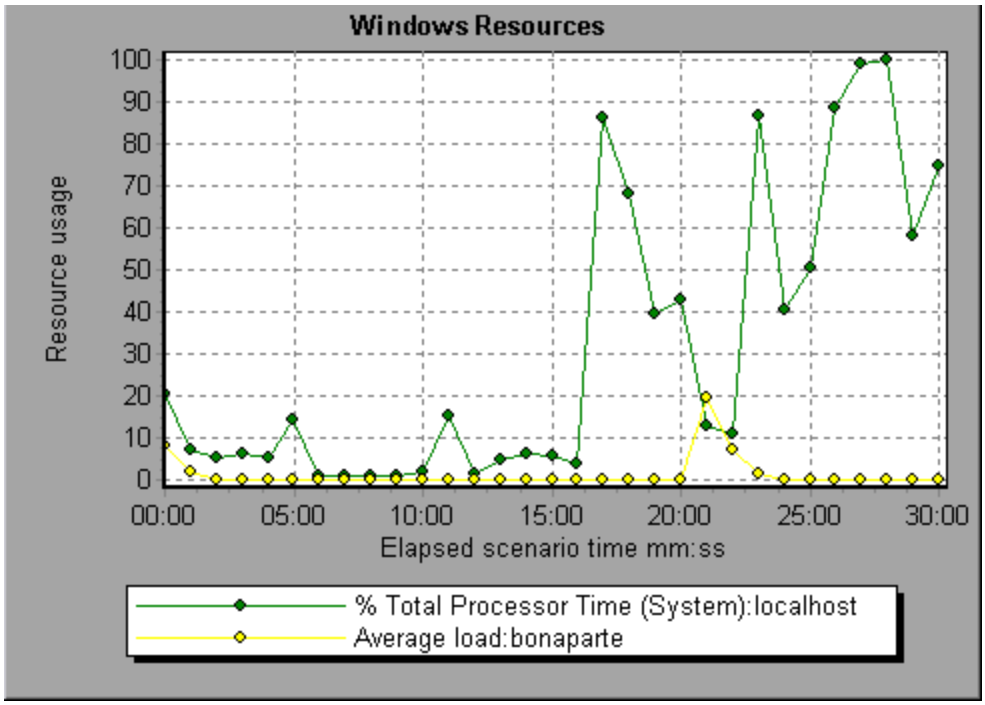
Server Resources Graph

This graph shows the resources (CPU, disk space, memory, or services) used on remote Linux servers measured during the load test scenario.

Purpose	This graph helps you determine the impact of Vuser load on the various system resources.
X-axis	Elapsed time since the start of the run.
Y-axis	The usage of resources on the Linux server.
See also	"System Resource Graphs" on page 180 "Server Resources Performance Counters" on page 180

Example

In the following example, Windows resource utilization is measured during the load test scenario. It is shown as a function of the elapsed scenario time.



Host Resources Graph

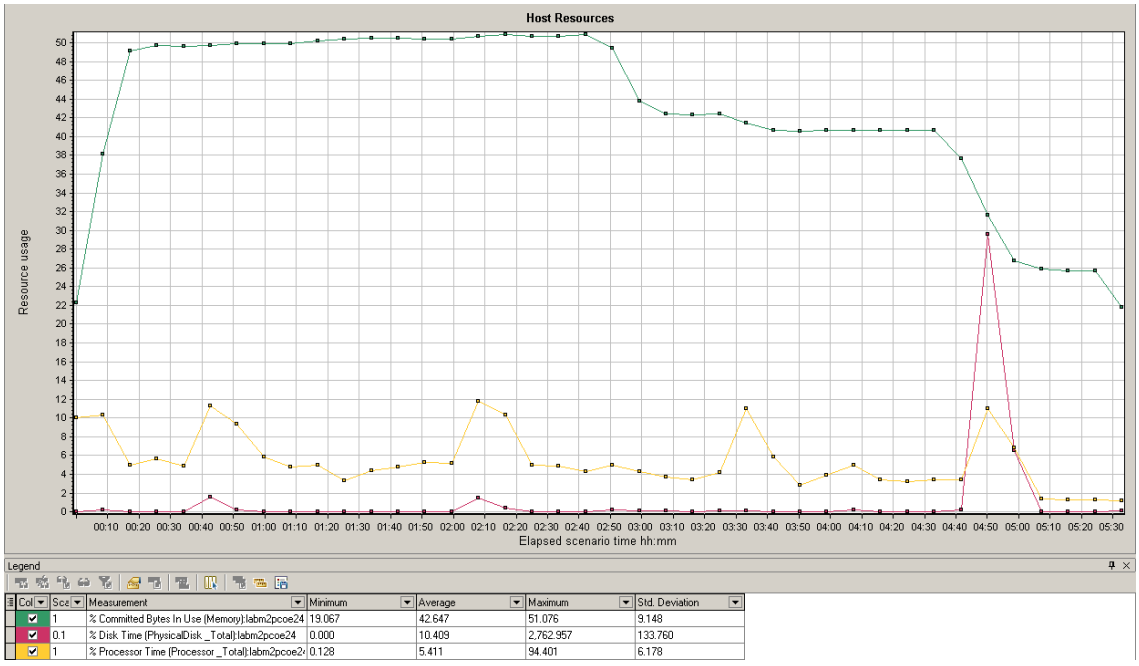
This graph displays a summary of the System Resources usage for each Windows based Performance Center host (Controller and Load Generators). measured during the load test scenario.

Purpose	This graph helps you determine the impact of Vuser load on the various host resources.

X-axis	Elapsed time since the start of the run.
Y-axis	The usage of resources on the Windows hosts.
See also	"System Resource Graphs" on page 180

Example

In the following example, you can see a peak in the usage of Disk Time and Processor Time as the Memory Usage gets less towards the end of the load test.



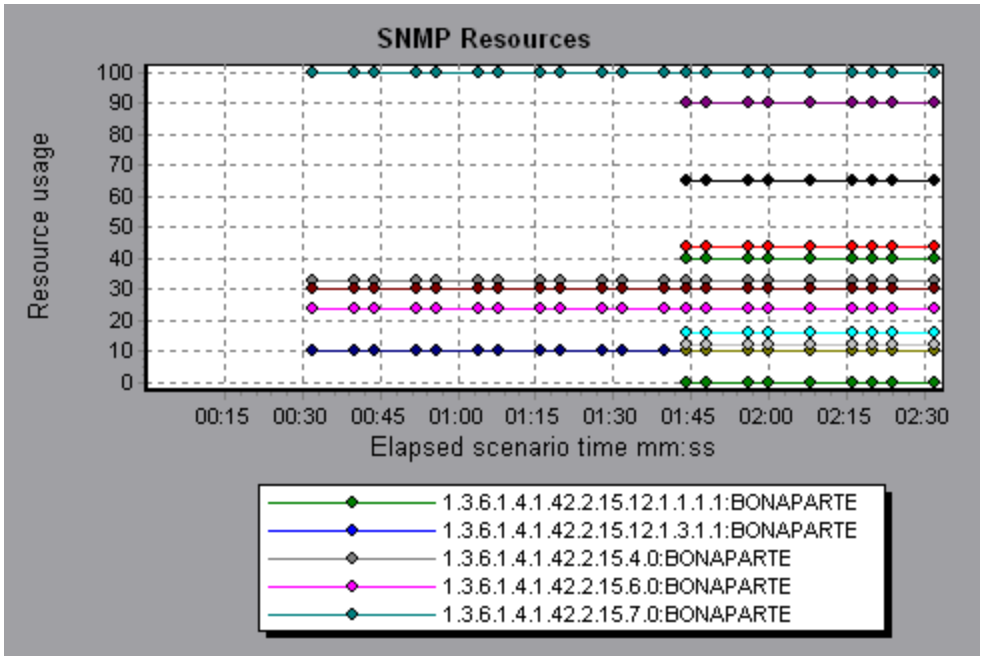
SNMP Resources Graph

This graph shows statistics for machines running an SNMP agent, using the Simple Network Management Protocol (SNMP).

X-axis	Elapsed time since the start of the run.
Y-axis	The usage of resources on a machine running the SNMP agent.
Note	To obtain data for this graph, you need to enable the SNMP monitor (from the Controller) and select the default measurements you want to display, before running the scenario.
See also	"System Resource Graphs" on page 180

Example

In the following example SNMP measurements are displayed for a machine called bonaporte.



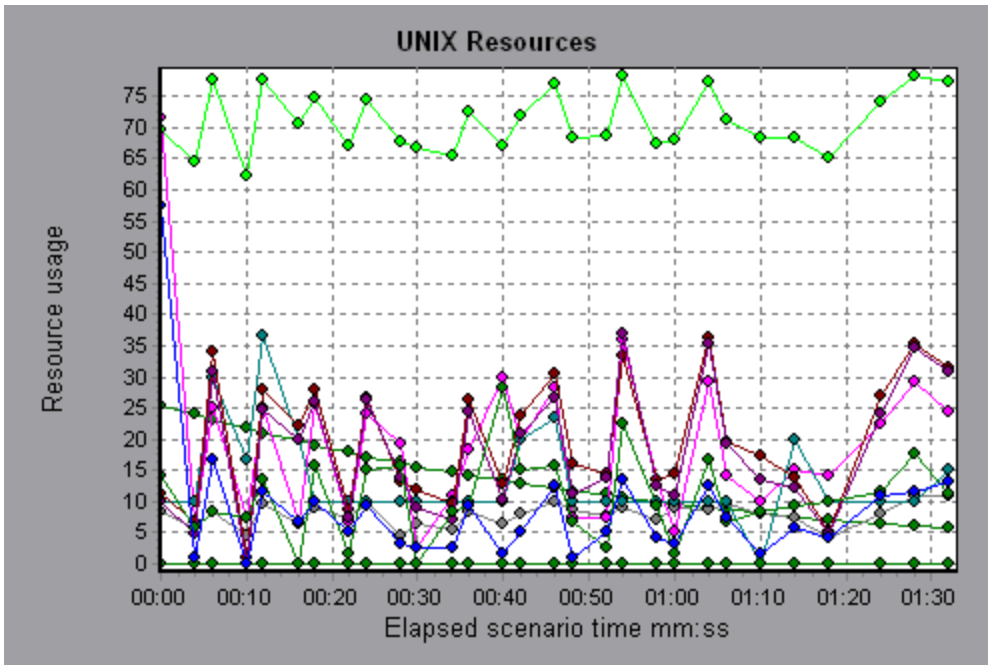
Linux Resources Graph

This graph shows the Linux resources measured during the load test scenario. The Linux measurements include those available by the **rstatd** daemon: average load, collision rate, context switch rate, CPU utilization, incoming packets error rate, incoming packets rate, interrupt rate, outgoing packets error rate, outgoing packets rate, page-in rate, page-out rate, paging rate, swap-in rate, swap-out rate, system mode CPU utilization, and user mode CPU utilization.

Purpose	This graph helps you determine the impact of Vuser load on the various system resources.
X-axis	Elapsed time since the start of the run.
Y-axis	The usage of resources on the Linux machine.
Note	To obtain data for this graph, you need to select the desired measurements for the online monitor (from the Controller) before running the scenario.
See also	"Linux Resources Default Measurements" on page 181

Example

In the following example Linux resources are measured during the load test scenario.



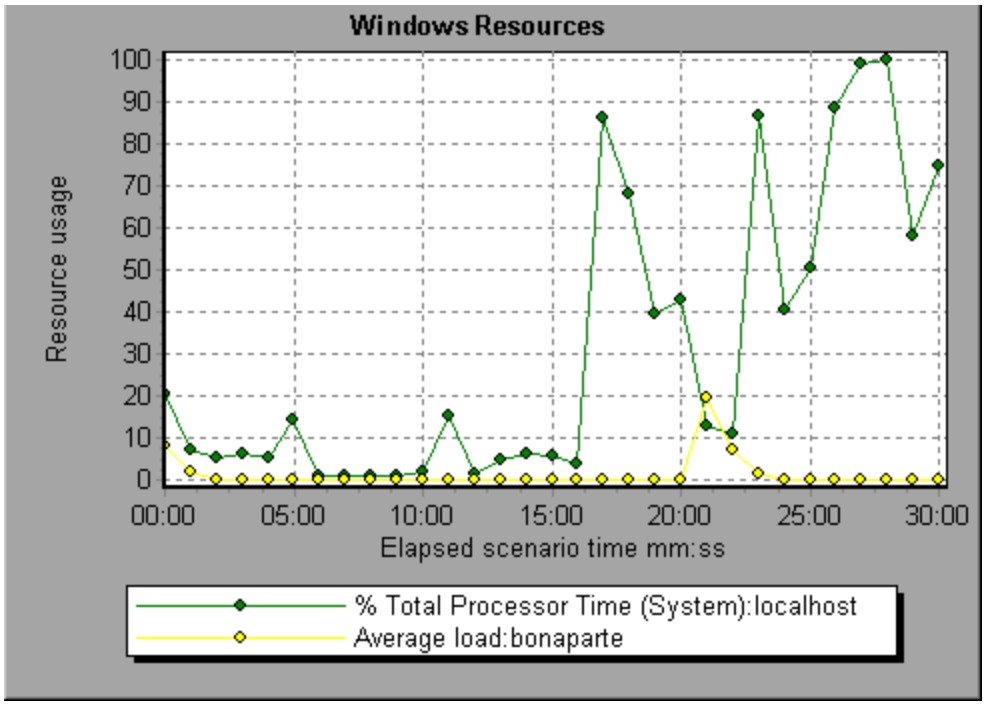
Windows Resources Graph

This graph shows the Windows resources measured during the load test scenario. The Windows measurements correspond to the built-in counters available from the Windows Performance Monitor.

Purpose	This graph helps you determine the impact of Vuser load on the various system resources.
X-axis	Elapsed time since the start of the run.
Y-axis	The usage of resources on the Windows machine running the load test scenario.
Note	To obtain data for this graph, you need to select the desired measurements for the online monitor (from the Controller) before running the scenario.
See also	"System Resource Graphs" on page 180 "Windows Resources Default Measurements" on page 182

Example

In the following example Windows resources are measured on the server running the load test scenario.



Network Virtualization Graphs

LoadRunner integrates with HP Network Virtualization. This enables you to test point-to-point performance of WAN or other network deployed products under real-world network conditions. By installing software on your load generators, you introduce highly probable effects such as latency, packet loss, and link faults over your network. As a result of this, your scenario performs the test in an environment that better represents the actual deployment of your application.

You can create more meaningful results by configuring multiple load generator machines or groups on a single load generator with the same unique set of network effects, and by giving each set a unique location name, such as NY- London. When viewing scenario results in Analysis, you can group the metrics according to their location names.

Packet Loss Graph

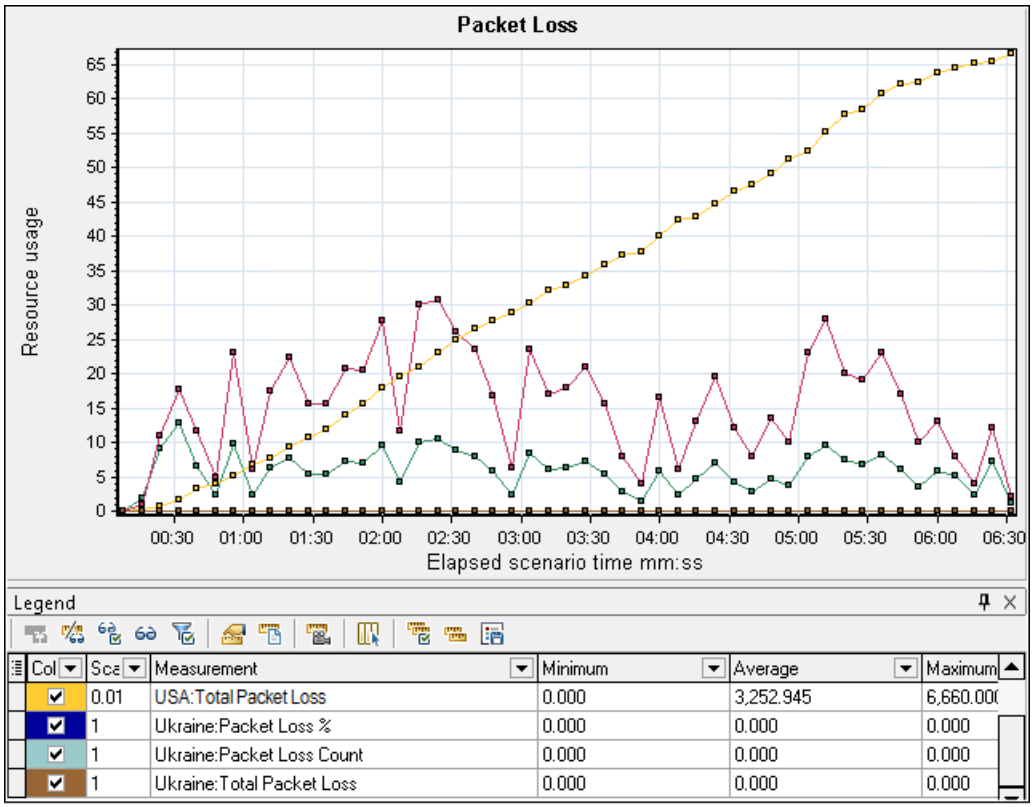
This graph shows packets lost during the last second of the scenario run. Packet loss occurs when data packets fail to reach their destination. It can result from gateway overload, signal degradation, channel congestion, or faulty hardware.

Purpose	Helps you understand how many data packets were lost over a specific time interval.
X-axis	Elapsed time since the start of the run.
Y-axis	The following measurements:

	• The percentage of lost packets from all packets that were sent. • The number of data packets that were lost over 60 seconds. • The total number of packets that were lost.
Note	You cannot change the granularity of the x-axis to a value that is less than the Web granularity you defined in the General tab of the Options dialog box.
Tip	For LoadRunner Analysis (not applicable to monitoring graphs): To view information for a specific location: 1. Click within the graph. 2. Select **Set Filter/ Sort By** from the right-click menu to open the Graph Settings dialog box. 3. In the **Filter condition** section, select the *Location Name* row, and select the desired location from the drop-down list.
See also	"Network Virtualization Graphs" on the previous page

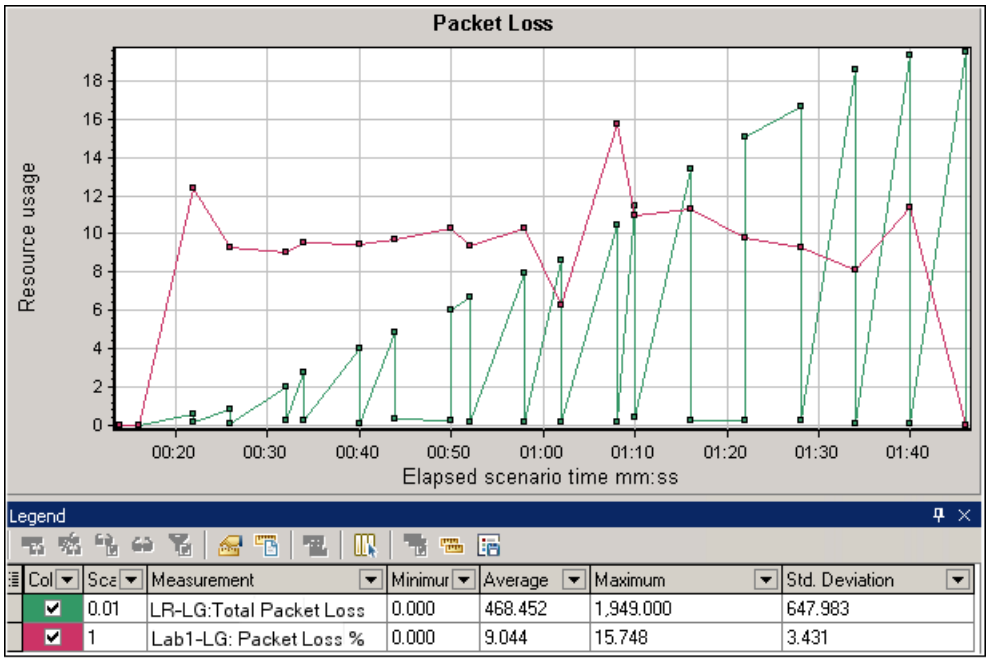
Example - Network Virtualization Per Group

The following example shows how the total of packet loss for the **USA** group increased as the scenario progressed.



Example - Network Virtualization Per Load Generator

In the following example, you can see that the packet loss is grouped by load generator. This was the mode selected when you enabled Network Virtualization for the scenario.



Average Latency Graph

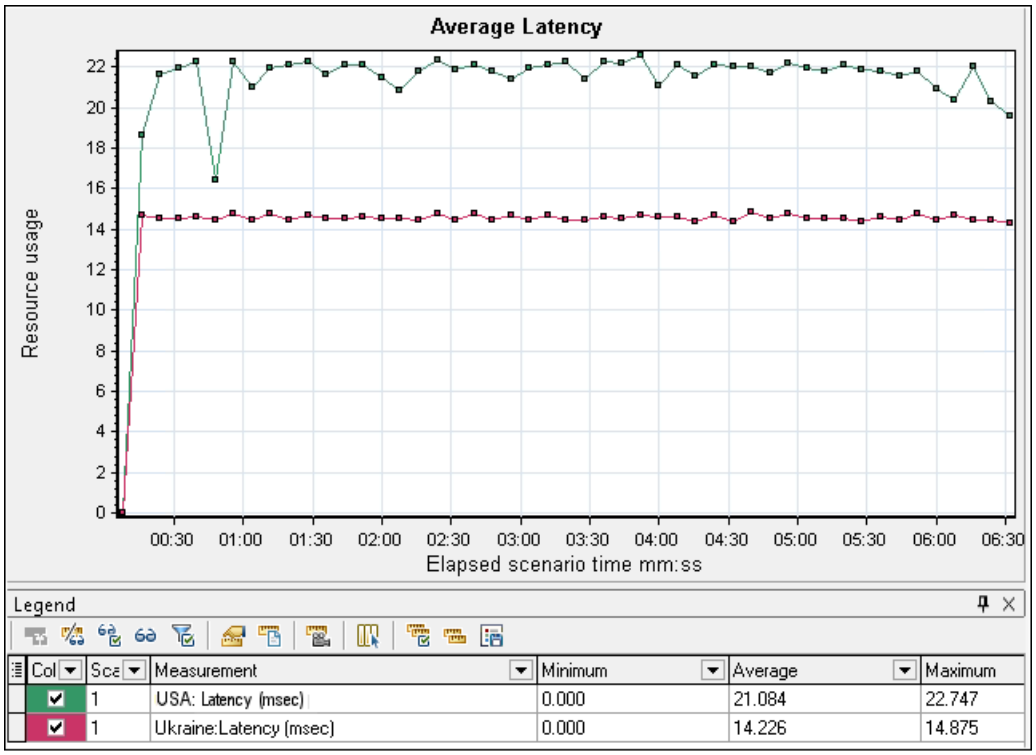
This graph shows the average recorded time required for a packet of data to travel from the indicated source point to the required destination, measured in milliseconds in the last 60 seconds.

Purpose	Helps you evaluate the time required for a packet of data to travel over the network.
X-axis	Elapsed time since the start of the run.
Y-axis	The average latency—the time in milliseconds required for a packet of data to reach its destination, per 60 second intervals.
Note	You cannot change the granularity of the x-axis to a value that is less than the Web granularity you defined in the General tab of the Options dialog box.
Tips	For LoadRunner Analysis (not applicable to monitoring graphs): To view information for a specific location: 1. Click within the graph. 2. Select **Set Filter/ Sort By** from the right-click menu to open the Graph Settings dialog box.

	3. In the **Filter condition** section, select the *Location Name* row, and select the desired location from the drop-down list.
See also	• "Network Virtualization Graphs" on page 188 • "Custom Filter Dialog Box" on page 113

Example - Network Virtualization Per Group

In the following example, you can see that the latency for the **USA** group reached its peak at nearly 4 minutes into the scenario run, while the **Ukraine** group remained fairly constant at approximately 14 msec.



If you enabled Network Virtualization per load generator (and not per group), the graph shows the measurements per load generator, as shown in the "Packet Loss Graph" on page 188.

Average Bandwidth Utilization Graph

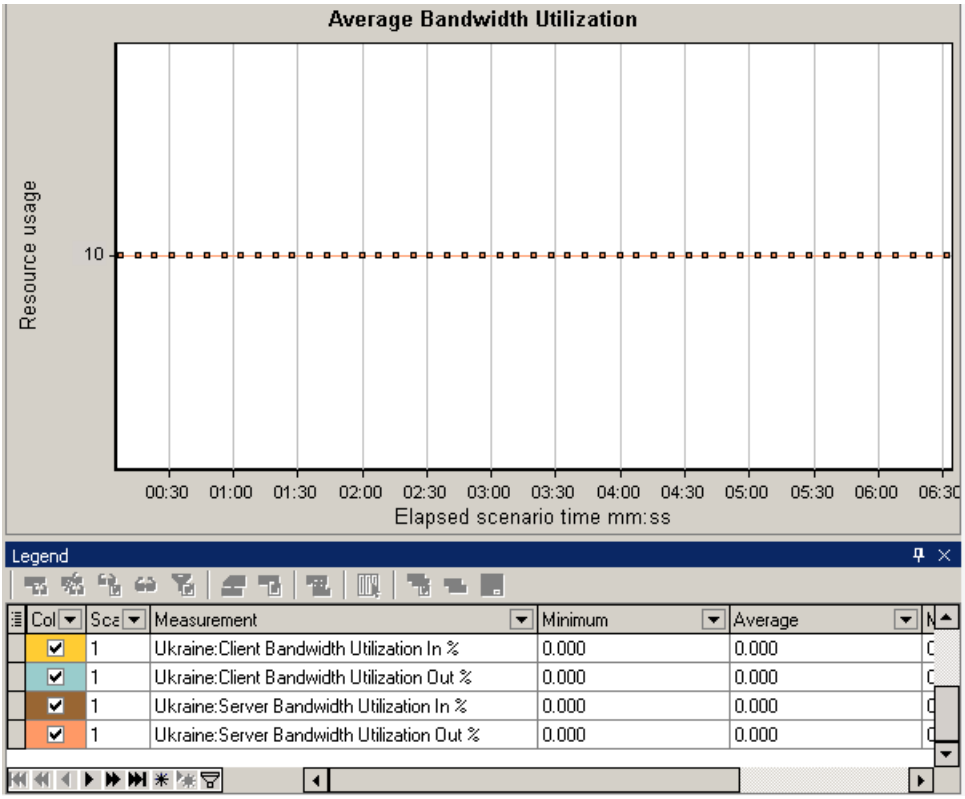
This graph shows the average bandwidth utilized by a virtual user or a virtualized location from the maximal available bandwidth allocated for it during the last second, measured in percentages.

Purpose	Helps you evaluate the bandwidth used over your network.
X-axis	Elapsed time since the start of the run.
Y-axis	The percentage of bandwidth utilization.

Note	You cannot change the granularity of the x-axis to a value that is less than the Web granularity you defined in the General tab of the Options dialog box.
Tips	For LoadRunner Analysis (not applicable to monitoring graphs): To view information for a specific location: 1. Click within the graph. 2. Select **Set Filter/ Sort By** from the right-click menu to open the Graph Settings dialog box. 3. In the **Filter condition** section, select the *Location Name* row, and select the desired location from the drop-down list.
See also	"Network Virtualization Graphs" on page 188

Example

In the following example, you can see that the bandwidth utilization for all locations and measurements, was constant at 10%.



If you enabled Network Virtualization per load generator (and not per group), the graph shows the measurements per load generator, as shown in the "Packet Loss Graph" on page 188.

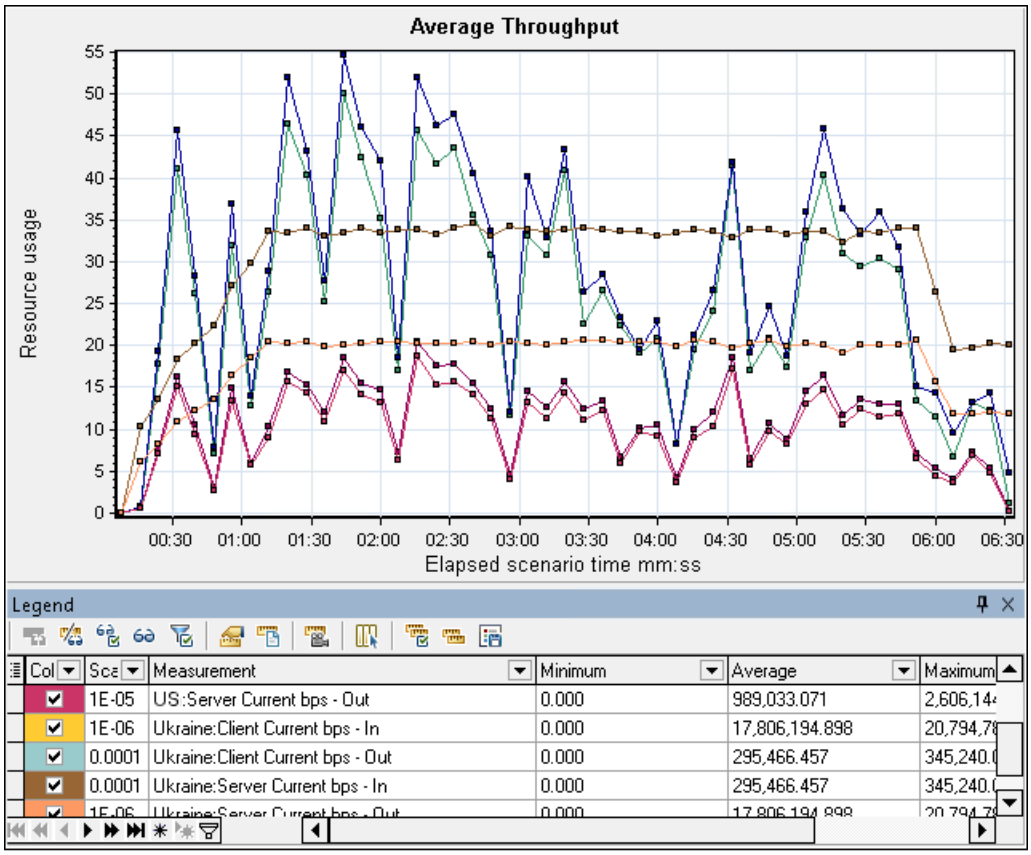
Average Throughput Graph

This graph shows the average data traffic passing to or from the virtualized location, measured in kilobytes per second (kbps).

Purpose	Helps you evaluate the amount of load Vusers generate, in terms of the number of server and client throughput. The graph shows metrics for input and output traffic for both the server and client machines. Use the legend below the graph to determine the line color for each metric.
X-axis	Elapsed time since the start of the run.
Y-axis	The rate of data passing to and from the virtual location, in kbps for the following metrics per group or load generator: • Input to the client machine • Output from the client machine • Input to the server machine • Output from the server machine
Note	You cannot change the granularity of the x-axis to a value that is less than the Web granularity you defined in the General tab of the Options dialog box.
Tips	For LoadRunner Analysis (not applicable to monitoring graphs): To view information for a specific location: 1. Click within the graph. 2. Select **Set Filter/ Sort By** from the right-click menu to open the Graph Settings dialog box. 3. In the **Filter condition** section, select the *Location Name* row, and select the desired location from the drop-down list.
See also	"Total Throughput Graph" on the next page

Example

In the following example, the average server input throughput was the lowest for the **Ukraine** group.



If you enabled Network Virtualization per load generator (and not per group), the graph shows the measurements per load generator, as shown in the "Packet Loss Graph" on page 188.

Total Throughput Graph

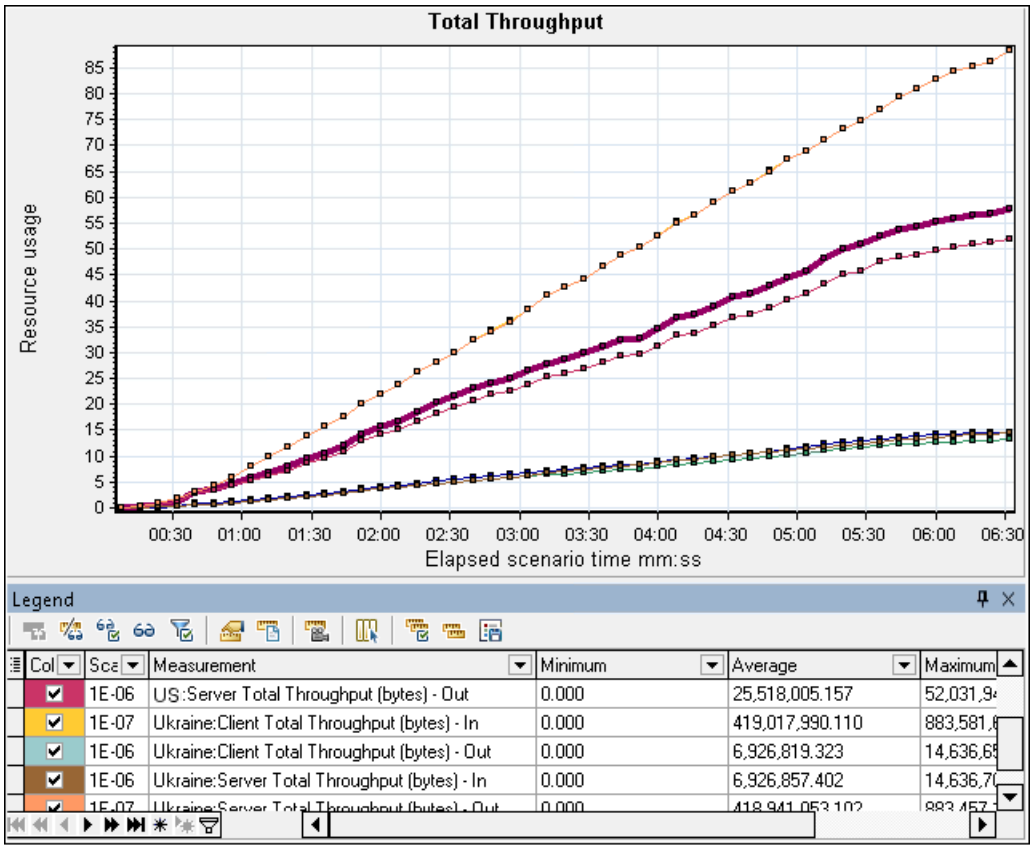
Displays the total data traffic passing to or from the virtualized location, measured in kilobytes.

Purpose	Helps you evaluate the total amount of load that Vusers generate while running a scenario with network virtualization. The graph shows metrics for input and output traffic for both the server and client machines. The legend below the graph indicates the line color for each of these metrics.
X-axis	Elapsed time since the start of the run.
Y-axis	Throughput of the server, in kilobytes per second (Kbps).
Note	You cannot change the granularity of the x-axis to a value that is less than the Web granularity you defined in the **General** tab of the Options dialog box.

Tips	For LoadRunner Analysis (not applicable to monitoring graphs): To view information for a specific location: 1. Click within the graph. 2. Select **Set Filter/ Sort By** from the right-click menu to open the Graph Settings dialog box. 3. In the **Filter condition** section, select the *Location Name* row, and select the desired location from the drop-down list.
See also	"Average Throughput Graph" on page 193

Example

In the following example, the highest throughput level was for the input data to the client, for the **Ukraine** group.



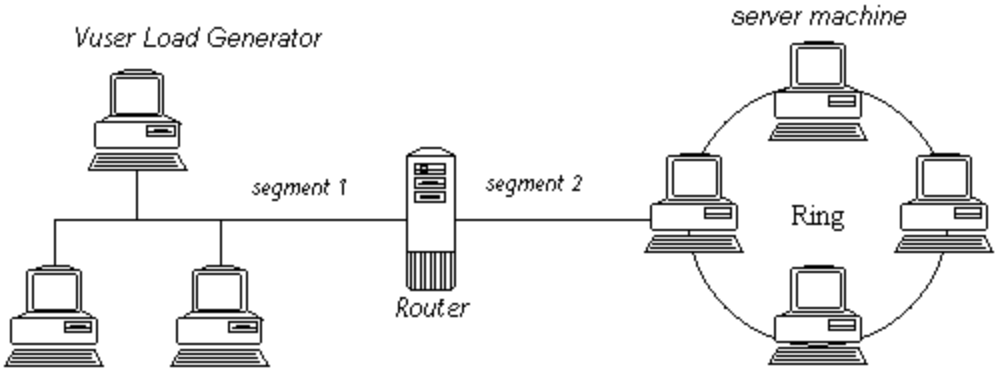
If you enabled Network Virtualization per load generator (and not per group), the graph shows the measurements per load generator, as shown in the "Packet Loss Graph" on page 188.

Network Monitor Graphs

Network Monitor Graphs Overview

Network configuration is a primary factor in the performance of applications and Web systems. A poorly designed network can slow client activity to unacceptable levels. In an application, there are many network segments. A single network segment with poor performance can affect the entire application.

The following diagram shows a typical network. To go from the server machine to the Vuser machine, data must travel over several segments.



To measure network performance, the Network monitor sends packets of data across the network. When a packet returns, the monitor calculates the time it takes for the packet to go to the requested node and return.

The Network Sub-Path Time graph displays the delay from the source machine to each node along the path. The Network Segment Delay graph displays the delay for each segment of the path. The Network Delay Time graph displays the delay for the complete path between the source and destination machines.

Using the Network Monitor graphs, you can determine whether the network is causing a bottleneck. If the problem is network-related, you can locate the problematic segment so that it can be fixed.

In order for Analysis to generate Network monitor graphs, you must activate the Network monitor before executing the load test scenario. In the Network monitor settings, you specify the path you want to monitor. For information about setting up the Network monitor, see Network Delay Monitoring.

Network Delay Time Graph

This graph shows the delays for the complete path between the source and destination machines (for example, the database server and Vuser load generator). The graph maps the delay as a function of the elapsed load test scenario time.

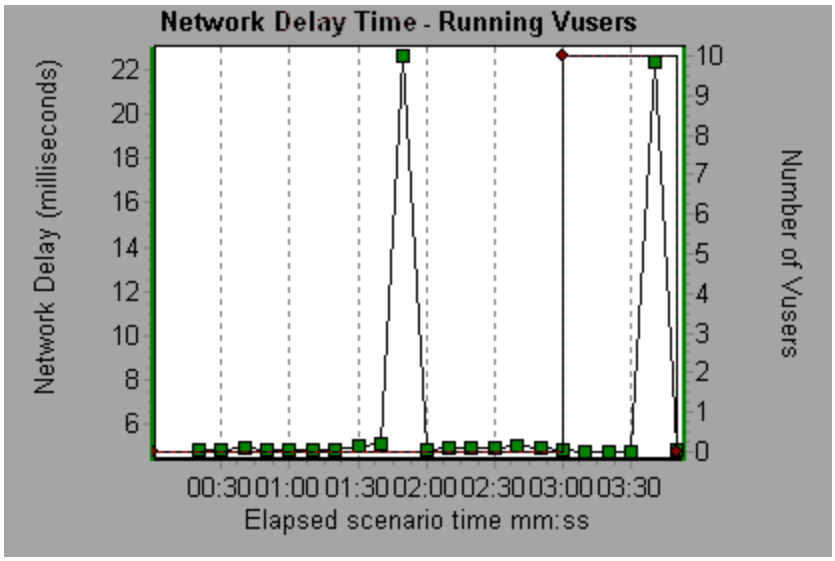
Each path defined in the Controller is represented by a separate line with a different color in the graph.

X-axis	Elapsed time since the start of the run.

Y-axis	Network delay time.
Tips	**Merge graphs to determine network bottleneck** You can merge various graphs to determine if the network is a bottleneck. For example, using the Network Delay Time and Running Vusers graphs, you can determine how the number of Vusers affects the network delay.
See also	"Network Monitor Graphs Overview" on the previous page

Example

In the following example of a merged graph, the network delays are compared to the running Vusers. The graph shows that when all 10 Vusers were running, a network delay of 22 milliseconds occurred, implying that the network may be overloaded.



Network Segment Delay Graph

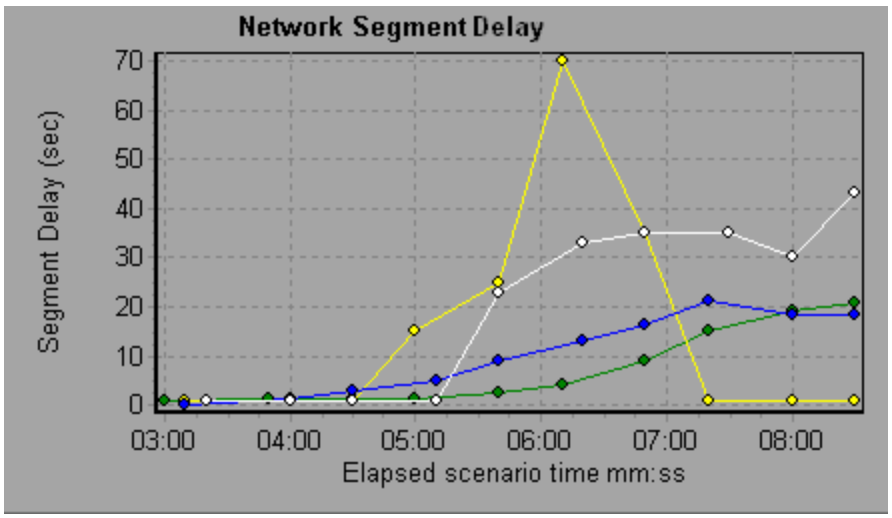
This graph shows the delay for each segment of the path according to the elapsed load test scenario time. Each segment is displayed as a separate line with a different color.

X-axis	Elapsed time since the start of the run.
Y-axis	Network delay time.
Note	The segment delays are measured approximately, and do not add up to the network path delay which is measured exactly. The delay for each segment of the path is estimated by

	calculating the delay from the source machine to one node and subtracting the delay from the source machine to another node. For example, the delay for segment B to C is calculated by measuring the delay from the source machine to point C, and subtracting the delay from the source machine to point B.
See also	"Network Monitor Graphs Overview" on page 196

Example

In the following example, four segments are shown. The graph indicates that one segment caused a delay of 70 seconds in the sixth minute.



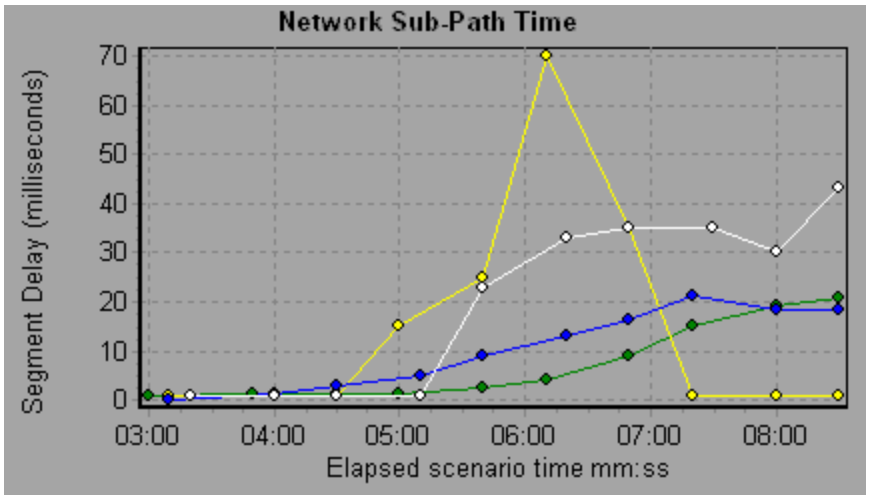
Network Sub-Path Time Graph

This graph displays the delay from the source machine to each node along the path according to the elapsed load test scenario time. Each segment is displayed as a separate line with a different color.

X-axis	Elapsed time since the start of the run.
Y-axis	Network delay time.
Note	The delays from the source machine to each of the nodes are measured concurrently, yet independently. It is therefore possible that the delay from the source machine to one of the nodes could be greater than the delay for the complete path between the source and destination machines.
See also	"Network Monitor Graphs Overview" on page 196

Example

In the following example, four segments are shown. The graph indicates that one segment caused a delay of 70 milliseconds in the sixth minute.



Web Server Resource Graphs

Web Server Resource Graphs Overview

Web Server Resource graphs provide you with information about the resource usage of the Apache and Microsoft IIS Web servers. In order to obtain data for these graphs, you need to activate the online monitor for the server and specify which resources you want to measure before running the load test scenario. For information on activating and configuring the Web Server Resource monitors, see Web Server Resource Monitoring Overview.

In order to display all the measurements on a single graph, Analysis may scale them. The Legend window indicates the scale factor for each resource. To obtain the true value, multiply the scale factor by the displayed value.

Apache Server Measurements

The following default measurements are available for the Apache server:

Measurement	Description
# Busy Servers	The number of servers in the Busy state
# Idle Servers	The number of servers in the Idle state
Apache CPU Usage	The percentage of time the CPU is utilized by the Apache server
Hits/sec	The HTTP request rate
KBytes Sent/sec	The rate at which data bytes are sent from the Web server

IIS Server Measurements

The following default measurements are available for the IIS server:

Object	Measurement	Description
Web Service	**Bytes Sent/sec**	The rate at which the data bytes are sent by the Web service.
Web Service	**Bytes Received/sec**	The rate at which the data bytes are received by the Web service.
Web Service	**Get Requests/sec**	The rate at which HTTP requests using the GET method are made. Get requests are generally used for basic file retrievals or image maps, though they can be used with forms.
Web Service	**Post Requests/sec**	The rate at which HTTP requests using the POST method are made. Post requests are generally used for forms or gateway requests.
Web Service	**Maximum Connections**	The maximum number of simultaneous connections established with the Web service.
Web Service	**Current Connections**	The current number of connections established with the Web service.
Web Service	**Current NonAnonymous Users**	The number of users that currently have a non-anonymous connection using the Web service.
Web Service	**Not Found Errors/sec**	The rate of errors due to requests that could not be satisfied by the server because the requested document could not be found. These are generally reported to the client as an HTTP 404 error code.
Process	**Private Bytes**	The current number of bytes that the process has allocated that cannot be shared with other processes.

Apache Server Graph

This graph shows server statistics as a function of the elapsed load test scenario time.

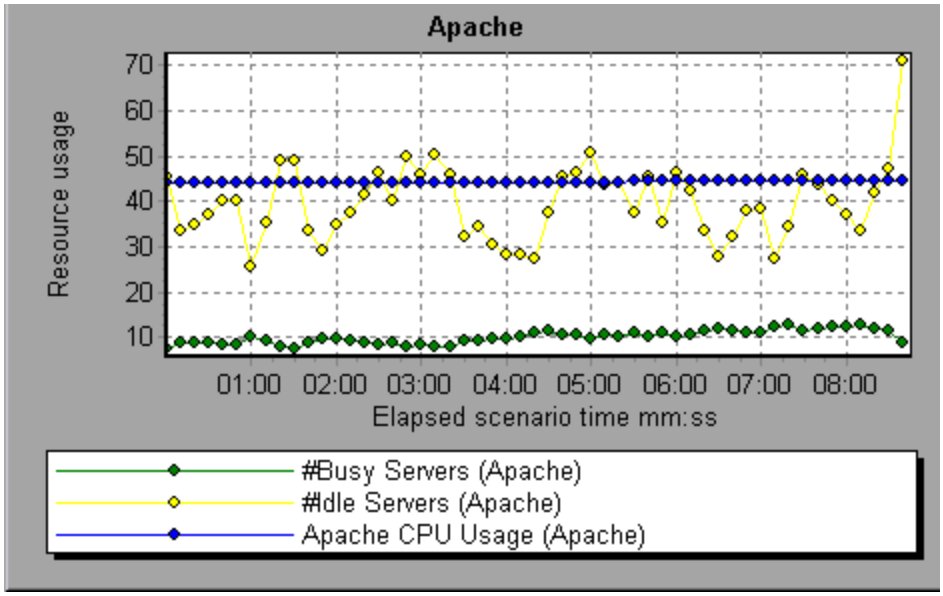
X-axis	Elapsed time since the start of the run.
Y-axis	The resource usage on the Apache server during the scenario run.
Note	To obtain data for this graph, you need to enable the Apache online monitor (from the

	Controller) and select the default measurements you want to display, before running the scenario.
See also	"Web Server Resource Graphs Overview" on page 199 "Apache Server Measurements" on page 199

Example

In the following example, the CPU usage remained steady throughout the scenario. At the end of the scenario, the number of idle servers increased. The number of busy servers remained steady at 1 throughout the scenario, implying that the Vuser only accessed one Apache server.

The scale factor for the **Busy Servers** measurement is 1/10 and the scale factor for **CPU usage** is 10.



Microsoft Information Internet Server (IIS) Graph

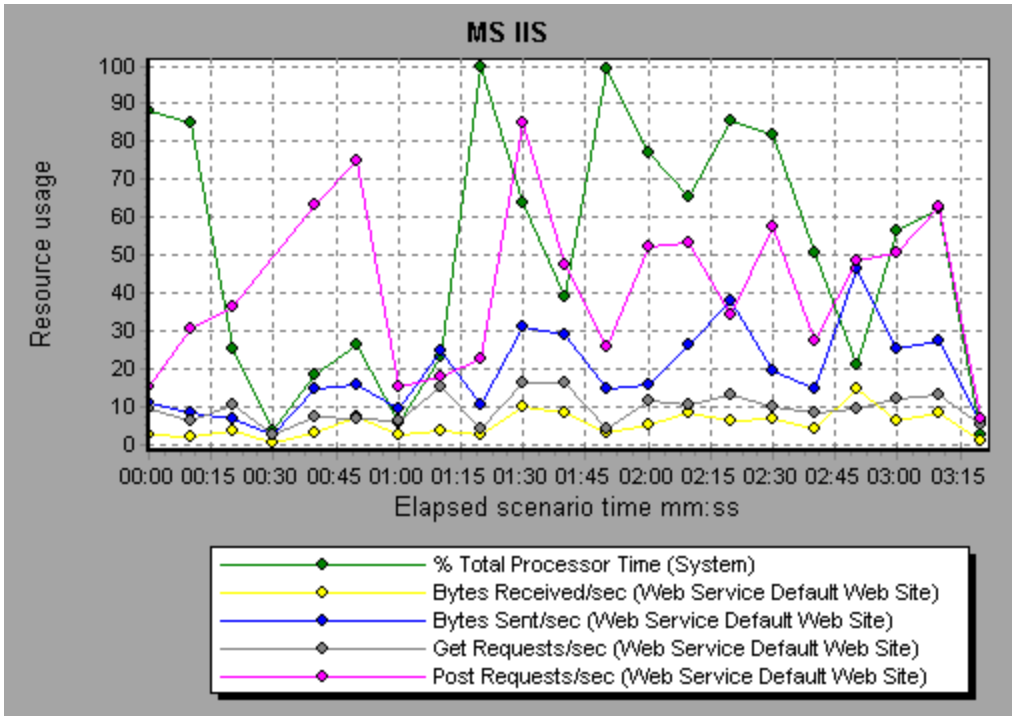
This graph shows server statistics as a function of the elapsed load test scenario time.

X-axis	Elapsed time since the start of the run.
Y-axis	The resource usage on the MS IIS.
Note	To obtain data for this graph, you need to enable the MS IIS online monitor (from the Controller) and select the default measurements you want to display, before running the scenario.
See also	"Web Server Resource Graphs Overview" on page 199 "IIS Server Measurements" on the previous page

Example

In the following example the **Bytes Received/sec** and **Get Requests/sec** measurements remained fairly steady throughout the scenario, while the **% Total Processor Time**, **Bytes Sent/sec**, and **Post Requests/sec** measurements fluctuated considerably.

The scale factor for the **Bytes Sent/sec** and **Bytes Received/sec** measurements is 1/100, and the scale factor for the **Post Requests/sec** measurement is 10.



Web Application Server Resource Graphs

Web Application Server Resource Graphs Overview

Web Application Server Resource graphs provide you with resource usage information about the Ariba, ATG Dynamo, BroadVision, ColdFusion, Fujitsu INTERSTAGE, iPlanet (NAS), Microsoft ASP, Oracle9iAS HTTP, SilverStream, WebLogic (SNMP), WebLogic (JMX), and WebSphere application servers.

In order to obtain data for these graphs, you need to activate the online monitor for the application server and specify which resources you want to measure before running the load test scenario.

When you open a Web Application Server Resource graph, you can filter it to show only the relevant application. When you need to analyze other applications, you can change the filter conditions and display the desired resources.

In order to display all the measurements on a single graph, Analysis may scale them. The Legend window indicates the scale factor for each resource. To obtain the true value, multiply the scale factor by the

displayed value. For more information on scaled measurements, see the example in "Web Server Resource Graphs Overview" on page 199.

Web Application Server Resource Graphs Measurements

Microsoft Active Server Pages (ASP) Measurements

The following default measurements are available for Microsoft Active Server Pages:

>Measurement	Description
Errors per Second	The number of errors per second.
Requests Wait Time	The number of milliseconds the most recent request was waiting in the queue.
Requests Executing	The number of requests currently executing.
Requests Queued	The number of requests waiting in the queue for service.
Requests Rejected	The total number of requests not executed because there were insufficient resources to process them.
Requests Not Found	The number of requests for files that were not found.
Requests/sec	The number of requests executed per second.
Memory Allocated	The total amount of memory (in bytes) currently allocated by Active Server Pages.
Errors During Script Runtime	The number of failed requests due to runtime errors.
Sessions Current	The current number of sessions being serviced.
Transactions/sec	The number of transactions started per second.

Oracle9iAS HTTP Server Modules

The following table describes some of the modules that are available for the Oracle9iAS HTTP server:

Measurement	Description
mod_mime.c	Determines document types using file extensions.
mod_mime_magic.c	Determines document types using "magic numbers".

Measurement	Description
mod_auth_anon.c	Provides anonymous user access to authenticated areas.
mod_auth_dbm.c	Provides user authentication using DBM files.
mod_auth_digest.c	Provides MD5 authentication.
mod_cern_meta.c	Supports HTTP header metafiles.
mod_digest.c	Provides MD5 authentication (deprecated by mod_auth_digest).
mod_expires.c	Applies Expires: headers to resources.
mod_headers.c	Adds arbitrary HTTP headers to resources.
mod_proxy.c	Provides caching proxy abilities.
mod_rewrite.c	Provides powerful URI-to-filename mapping using regular expressions.
mod_speling.c	Automatically corrects minor typos in URLs.
mod_info.c	Provides server configuration information.
mod_status.c	Displays server status.
mod_usertrack.c	Provides user tracking using cookies.
mod_dms.c	Provides access to DMS Apache statistics.
mod_perl.c	Allows execution of Perl scripts.
mod_fastcgi.c	Supports CGI access to long-lived programs.
mod_ssl.c	Provides SSL support.
mod_plsql.c	Handles requests for Oracle stored procedures.

Measurement	Description
mod_isapi.c	Provides Windows ISAPI extension support.
mod_ setenvif.c	Sets environment variables based on client information.
mod_ actions.c	Executes CGI scripts based on media type or request method.
mod_imap.c	Handles imagemap files.
mod_asis.c	Sends files that contain their own HTTP headers.
mod_log_ config.c	Provides user-configurable logging replacement for mod_log_common.
mod_env.c	Passes environments to CGI scripts.
mod_alias.c	Maps different parts of the host file system in the document tree, and redirects URLs.
mod_ userdir.c	Handles user home directories.
mod_cgi.c	Invokes CGI scripts.
mod_dir.c	Handles the basic directory.
mod_ autoindex.c	Provides automatic directory listings.
mod_ include.c	Provides server-parsed documents.
mod_ negotiation.c	Handles content negotiation.
mod_auth.c	Provides user authentication using text files.
mod_ access.c	Provides access control based on the client host name or IP address.
mod_so.c	Supports loading modules (.so on UNIX, .dll on Win32) at runtime.
mod_ oprocmgr.c	Monitors JServ processes and restarts them if they fail.
mod_jserv.c	Routes HTTP requests to JServ server processes. Balances load across multiple

Measurement	Description
	JServs by distributing new requests in round-robin order.
mod_ose.c	Routes requests to the JVM embedded in Oracle's database server.
http_core.c	Handles requests for static Web pages.

Oracle9iAS HTTP Server Counters

The following table describes the counters that are available for the Oracle9iAS HTTP server:

Measurement	Description
handle.minTime	The minimum time spent in the module handler.
handle.avg	The average time spent in the module handler.
handle.active	The number of threads currently in the handle processing phase.
handle.time	The total amount of time spent in the module handler.
handle.completed	The number of times the handle processing phase was completed.
request.maxTime	The maximum amount of time required to service an HTTP request.
request.minTime	The minimum amount of time required to service an HTTP request.
request.avg	The average amount of time required to service an HTTP request.
request.active	The number of threads currently in the request processing phase.
request.time	The total amount of time required to service an HTTP request.
request.completed	The number of times the request processing phase was completed.
connection.maxTime	The maximum amount of time spent servicing any HTTP connection.
connection.minTime	The minimum amount of time spent servicing any HTTP connection.
connection.avg	The average amount of time spent servicing HTTP connections.
connection.active	The number of connections with currently open threads.
connection.time	The total amount of time spent servicing HTTP connections.
connection.completed	The number of times the connection processing phase was completed.
numMods.value	The number of loaded modules.

Measurement	Description
childFinish.count	The number of times the Apache parent server started a child server, for any reason.
childStart.count	The number of times "children"finished "gracefully."There are some ungraceful error/crash cases that are not counted in childFinish.count.
Decline.count	The number of times each module declined HTTP requests.
internalRedirect.count	The number of times that any module passed control to another module using an "internal redirect".
cpuTime.value	The total CPU time utilized by all processes on the Apache server (measured in CPU milliseconds).
heapSize.value	The total heap memory utilized by all processes on the Apache server (measured in kilobytes).
pid.value	The process identifier of the parent Apache process.
upTime.value	The amount of time the server has been running (measured in milliseconds).

WebLogic (SNMP) Server Table Measurements

The Server Table lists all WebLogic (SNMP) servers that are being monitored by the agent. A server must be contacted or be reported as a member of a cluster at least once before it will appear in this table. Servers are only reported as a member of a cluster when they are actively participating in the cluster, or shortly thereafter.

Measurement	Description
ServerState	The state of the WebLogic server, as inferred by the SNMP agent. **Up** implies that the agent can contact the server. **Down** implies that the agent cannot contact the server.
ServerLoginEnable	**True** if client logins are enabled on the server.
ServerMaxHeapSpace	The maximum heap size for this server (in KB).
ServerHeapUsedPct	The percentage of heap space currently in use on the server.
ServerQueueLength	The current length of the server execute queue.
ServerQueueThroughput	The current throughput of execute queue, expressed as the number of requests processed per second.

Measurement	Description
ServerNumEJBDeployment	The total number of EJB deployment units known to the server.
ServerNumEJBBeansDeployed	The total number of EJB beans actively deployed on the server.

WebLogic (SNMP) Listen Table Measurements

The Listen Table is the set of protocol, IP address, and port combinations on which servers are listening. There will be multiple entries for each server: one for each (protocol, ipAddr, port) combination. If clustering is used, the clustering-related MIB objects will assume a higher priority.

Measurement	Description
ListenPort	Port number.
ListenAdminOK	**True** if admin requests are allowed on this (protocol, ipAddr, port) combination; otherwise false.
ListenState	**Listening** if the (protocol, ipAddr, port) combination is enabled on the server; **Not Listening** if it is not. The server may be listening but not accepting new clients if its server Login Enable state is false. In this case, existing clients will continue to function, but new ones will not.

WebLogic (SNMP) ClassPath Table Measurements

The ClassPath Table is the table of classpath elements for Java, WebLogic (SNMP) server, and servlets. There are multiple entries in this table for each server. There may also be multiple entries for each path on a server. If clustering is used, the clustering-related MIB objects will assume a higher priority.

Measurement	Description
CPType	The type of CP element: Java, WebLogic, servlet. A Java CPType means the CP element is one of the elements in the normal Java classpath. A WebLogic CPType means the CP element is one of the elements in weblogic.class.path. A servlet CPType means the CP element is one of the elements in the dynamic servlet classpath.
CPIndex	The position of an element within its path. The index starts at 1.

Websphere Application Server Monitor Runtime Resource Measurements

Contains resources related to the Java Virtual Machine runtime, as well as the ORB.

Measurement	Description
MemoryFree	The amount of free memory remaining in the Java Virtual Machine.
MemoryTotal	The total memory allocated for the Java Virtual Machine.
MemoryUse	The total memory in use on the Java Virtual Machine.

Websphere Application Server Monitor BeanData Measurements

Every home on the server provides performance data, depending on the type of bean deployed in the home. The top level bean data holds an aggregate of all the containers.

Measurement	Description
BeanDestroys	The number of times an individual bean object was destroyed. This applies to any bean, regardless of its type.
StatelessBeanDestroys	The number of times a stateless session bean object was destroyed.
StatefulBeanDestroys	The number of times a stateful session bean object was destroyed.

Websphere Application Server Monitor BeanObjectPool Measurements

The server holds a cache of bean objects. Each home has a cache and there is therefore one BeanObjectPoolContainer per container. The top level, BeanObjectPool, holds an aggregate of all the containers data.

Measurement	Description
NumGetFound	The number of calls to the pool that resulted in finding an available bean.
NumPutsDiscarded	The number of times releasing a bean to the pool resulted in the bean being discarded because the pool was full.

Websphere Application Server Monitor OrbThreadPool Measurements

These are resources related to the ORB thread pool that is on the server.

Measurement	Description
ActiveThreads	The average number of active threads in the pool.
TotalThreads	The average number of threads in the pool.
PercentTimeMaxed	The average percent of the time that the number of threads in the pool reached or exceeded the desired maximum number.

Websphere Application Server Monitor DBConnectionMgr Measurements

These are resources related to the database connection manager. The manager consists of a series of data sources, as well as a top-level aggregate of each of the performance metrics.

Measurement	Description
ConnectionWaitTime	The average time (in seconds) of a connection grant.
ConnectionTime	The average time (in seconds) that a connection is in use.
ConnectionPercentUsed	The average percentage of the pool that is in use.

Websphere Application Server Monitor TransactionData Measurements

These are resources that pertain to transactions.

Measurement	Description
NumTransactions	The number of transactions processed.
ActiveTransactions	The average number of active transactions.
TransactionRT	The average duration of each transaction.
RolledBack	The number of transactions rolled back.
Timeouts	The number of transactions that timed out due to inactivity timeouts.
TransactionSuspended	The average number of times that a transaction was suspended.

Websphere Application Server Monitor ServletEngine Measurements

These are resources that are related to servlets and JSPs.

Measurement	Description
ServletErrors	The number of requests that resulted in an error or an exception.

Websphere Application Server Monitor Session Measurements

These are general metrics regarding the HTTP session pool.

Measurement	Description
SessionsInvalidated	The number of invalidated sessions. May not be valid when using sessions in the database mode.

Microsoft Active Server Pages (ASP) Graph

This graph displays statistics about the resource usage on the ASP server during the load test scenario run.

X-axis	Elapsed time since the start of the run.
Y-axis	The resource usage on the ASP server.
Note	To obtain data for this graph, you need to enable the Microsoft ASP online monitor (from the Controller) and select the default measurements you want to display, before running the scenario.
See also	"Web Application Server Resource Graphs Overview" on page 202 "Web Application Server Resource Graphs Measurements" on page 203

Oracle9iAS HTTP Server Graph

This graph displays statistics about the resource usage on the Oracle9iAS HTTP server during the load test scenario run.

X-axis	Elapsed time since the start of the run.
Y-axis	The resource usage on the Oracle9iAS HTTP server.
Note	To obtain data for this graph, you need to enable the Oracle9iAS HTTP online monitor (from the Controller), and select the default measurements you want to display, before running the scenario.
See also	"Web Application Server Resource Graphs Overview" on page 202 "Web Application Server Resource Graphs Measurements" on page 203

WebLogic (SNMP) Graph

This graph displays statistics about the resource usage on the WebLogic (SNMP) server (version 6.0 and earlier) during the load test scenario run.

X-axis	The elapsed time since the start of the run.
Y-	The resource usage on the WebLogic (SNMP) server.

axis	
Note	To obtain data for this graph, you need to enable the WebLogic (SNMP) online monitor (from the Controller) and select the default measurements you want to display, before running the scenario.
See also	"Web Application Server Resource Graphs Overview" on page 202 "Web Application Server Resource Graphs Measurements" on page 203

WebSphere Application Server Graph

This graph displays statistics about the resource usage on the WebSphere application server during the load test scenario run.

X-axis	Elapsed time since the start of the run.
Y-axis	The resource usage on the WebSphere Application server.
Note	To obtain data for this graph, you need to configure the WebSphere Application Server online monitor (from the Controller) and select the default measurements you want to display, before running the scenario.
See also	"Web Application Server Resource Graphs Overview" on page 202 "Web Application Server Resource Graphs Measurements" on page 203

Database Server Resource Graphs

The Database Server Resource graphs show statistics for several database servers. Currently DB2, Oracle, SQL server, and Sybase databases are supported. These graphs require that you specify the resources you want to measure *before* running the load test scenario. For more information, see the section on online monitors in the LoadRunner Controller documentation.

DB2 Database Manager Counters

Measurement	Description
rem_cons_in	The current number of connections initiated from remote clients to the instance of the database manager that is being monitored.
rem_cons_in_exec	The number of remote applications that are currently connected to a database and are currently processing a unit of work within the database manager instance being

Measurement	Description
	monitored.
local_cons	The number of local applications that are currently connected to a database within the database manager instance being monitored.
local_cons_in_exec	The number of local applications that are currently connected to a database within the database manager instance being monitored and are currently processing a unit of work.
con_local_dbases	The number of local databases that have applications connected.
agents_registered	The number of agents registered in the database manager instance that is being monitored (coordinator agents and subagents).
agents_waiting_on_token	The number of agents waiting for a token so they can execute a transaction in the database manager.
idle_agents	The number of agents in the agent pool that are currently unassigned to an application and are therefore "idle".
agents_from_pool	The number of agents assigned from the agent pool.
agents_created_empty_pool	The number of agents created because the agent pool was empty.
agents_stolen	The number of times that agents are stolen from an application. Agents are stolen when an idle agent associated with an application is reassigned to work on a different application.
comm_private_mem	The amount of private memory that the instance of the database manager has currently committed at the time of the snapshot.
inactive_gw_agents	The number of DRDA agents in the DRDA connections pool that are primed with a connection to a DRDA database, but are inactive.
num_gw_conn_switches	The number of times that an agent from the agents pool was primed with a connection and was stolen for use with a different DRDA database.
sort_heap_allocated	The total number of allocated pages of sort heap space for all sorts at the level chosen and at the time the snapshot was taken.
post_	The number of sorts that have requested heaps after the sort heap threshold has

Measurement	Description
threshold_ sorts	been reached.
piped_sorts_ requested	The number of piped sorts that have been requested.
piped_sorts_ accepted	The number of piped sorts that have been accepted.

DB2 Database Counters

Measurement	Description
appls_cur_ cons	Indicates the number of applications that are currently connected to the database.
appls_in_db2	Indicates the number of applications that are currently connected to the database, and for which the database manager is currently processing a request.
total_sec_ cons	The number of connections made by a sub-agent to the database at the node.
num_assoc_ agents	At the application level, this is the number of sub-agents associated with an application. At the database level, it is the number of sub-agents for all applications.
sort_heap_ allocated	The total number of allocated pages of sort heap space for all sorts at the level chosen and at the time the snapshot was taken.
total_sorts	The total number of sorts that have been executed.
total_sort_ time	The total elapsed time (in milliseconds) for all sorts that have been executed.
sort_ overflows	The total number of sorts that ran out of sort heap and may have required disk space for temporary storage.
active_sorts	The number of sorts in the database that currently have a sort heap allocated.
total_hash_ joins	The total number of hash joins executed.
total_hash_ loops	The total number of times that a single partition of a hash join was larger than the available sort heap space.
hash_join_	The number of times that hash join data exceeded the available sort heap space.

Measurement	Description
overflows	
hash_join_small_overflows	The number of times that hash join data exceeded the available sort heap space by less than 10%.
pool_data_l_reads	The number of logical read requests for data pages that have gone through the buffer pool.
pool_data_p_reads	The number of read requests that required I/O to get data pages into the buffer pool.
pool_data_writes	Indicates the number of times a buffer pool data page was physically written to disk.
pool_index_l_reads	The number of logical read requests for index pages that have gone through the buffer pool.
pool_index_p_reads	The number of physical read requests to get index pages into the buffer pool.
pool_index_writes	The number of times a buffer pool index page was physically written to disk.
pool_read_time	The total amount of elapsed time spent processing read requests that caused data or index pages to be physically read from disk to buffer pool.
pool_write_time	The total amount of time spent physically writing data or index pages from the buffer pool to disk.
files_closed	The total number of database files closed.
pool_async_data_reads	The number of pages read asynchronously into the buffer pool.
pool_async_data_writes	The number of times a buffer pool data page was physically written to disk by either an asynchronous page cleaner, or a pre-fetcher. A pre-fetcher may have written dirty pages to disk to make space for the pages being pre-fetched.
pool_async_index_writes	The number of times a buffer pool index page was physically written to disk by either an asynchronous page cleaner, or a pre-fetcher. A pre-fetcher may have written dirty pages to disk to make space for the pages being pre-fetched.
pool_async_index_reads	The number of index pages read asynchronously into the buffer pool by a pre-fetcher.

Measurement	Description
pool_async_read_time	The total elapsed time spent reading by database manager pre-fetchers.
pool_async_write_time	The total elapsed time spent writing data or index pages from the buffer pool to disk by database manager page cleaners.
pool_async_data_read_reqs	The number of asynchronous read requests.
pool_lsn_gap_clns	The number of times a page cleaner was invoked because the logging space used had reached a pre-defined criterion for the database.
pool_drty_pg_steal_clns	The number of times a page cleaner was invoked because a synchronous write was needed during the victim buffer replacement for the database.
pool_drty_pg_thrsh_clns	The number of times a page cleaner was invoked because a buffer pool had reached the dirty page threshold criterion for the database.
prefetch_wait_time	The time an application spent waiting for an I/O server (pre-fetcher) to finish loading pages into the buffer pool.
pool_data_to_estore	The number of buffer pool data pages copied to extended storage.
pool_index_to_estore	The number of buffer pool index pages copied to extended storage.
pool_data_from_estore	The number of buffer pool data pages copied from extended storage.
pool_index_from_estore	The number of buffer pool index pages copied from extended storage.
direct_reads	The number of read operations that do not use the buffer pool.
direct_writes	The number of write operations that do not use the buffer pool.
direct_read_reqs	The number of requests to perform a direct read of one or more sectors of data.
direct_write_reqs	The number of requests to perform a direct write of one or more sectors of data.

Measurement	Description
direct_read_time	The elapsed time (in milliseconds) required to perform the direct reads.
direct_write_time	The elapsed time (in milliseconds) required to perform the direct writes.
cat_cache_lookups	The number of times that the catalog cache was referenced to obtain table descriptor information.
cat_cache_inserts	The number of times that the system tried to insert table descriptor information into the catalog cache.
cat_cache_overflows	The number of times that an insert into the catalog cache failed due the catalog cache being full.
cat_cache_heap_full	The number of times that an insert into the catalog cache failed due to a heap-full condition in the database heap.
pkg_cache_lookups	The number of times that an application looked for a section or package in the package cache. At a database level, it indicates the overall number of references since the database was started, or monitor data was reset.
pkg_cache_inserts	The total number of times that a requested section was not available for use and had to be loaded into the package cache. This count includes any implicit prepares performed by the system.
pkg_cache_num_overflows	The number of times that the package cache overflowed the bounds of its allocated memory.
appl_section_lookups	Lookups of SQL sections by an application from its SQL work area.
appl_section_inserts	Inserts of SQL sections by an application from its SQL work area.
sec_logs_allocated	The total number of secondary log files that are currently being used for the database.
log_reads	The number of log pages read from disk by the logger.
log_writes	The number of log pages written to disk by the logger.
total_log_	The total amount of active log space currently used (in bytes) in the database.

Measurement	Description
used	
locks_held	The number of locks currently held.
lock_list_in_use	The total amount of lock list memory (in bytes) that is in use.
deadlocks	The total number of deadlocks that have occurred.
lock_escals	The number of times that locks have been escalated from several row locks to a table lock.
x_lock_escals	The number of times that locks have been escalated from several row locks to one exclusive table lock, or the number of times an exclusive lock on a row caused the table lock to become an exclusive lock.
lock_timeouts	The number of times that a request to lock an object timed-out instead of being granted.
lock_waits	The total number of times that applications or connections waited for locks.
lock_wait_time	The total elapsed time waited for a lock.
locks_waiting	The number of agents waiting on a lock.
rows_deleted	The number of row deletions attempted.
rows_inserted	The number of row insertions attempted.
rows_updated	The number of row updates attempted.
rows_selected	The number of rows that have been selected and returned to the application.
int_rows_deleted	The number of rows deleted from the database as a result of internal activity.
int_rows_updated	The number of rows updated from the database as a result of internal activity.
int_rows_inserted	The number of rows inserted into the database as a result of internal activity caused by triggers.

Measurement	Description
static_sql_stmts	The number of static SQL statements that were attempted.
dynamic_sql_stmts	The number of dynamic SQL statements that were attempted.
failed_sql_stmts	The number of SQL statements that were attempted, but failed.
commit_sql_stmts	The total number of SQL COMMIT statements that have been attempted.
rollback_sql_stmts	The total number of SQL ROLLBACK statements that have been attempted.
select_sql_stmts	The number of SQL SELECT statements that were executed.
uid_sql_stmts	The number of SQL UPDATE, INSERT, and DELETE statements that were executed.
ddl_sql_stmts	The number of SQL Data Definition Language (DDL) statements that were executed.
int_auto_rebinds	The number of automatic rebinds (or recompiles) that have been attempted.
int_commits	The total number of commits initiated internally by the database manager.
int_rollbacks	The total number of rollbacks initiated internally by the database manager.
int_deadlock_rollbacks	The total number of forced rollbacks initiated by the database manager due to a deadlock. A rollback is performed on the current unit of work in an application selected by the database manager to resolve the deadlock.
binds_precompiles	The number of binds and pre-compiles attempted.

DB2 Application Counters

Measurement	Description
agents_stolen	The number of times that agents are stolen from an application. Agents are stolen when an idle agent associated with an application is reassigned to work on a

Measurement	Description
	different application.
num_assoc_agents	At the application level, this is the number of sub-agents associated with an application. At the database level, it is the number of sub-agents for all applications.
total_sorts	The total number of sorts that have been executed.
total_sort_time	The total elapsed time (in milliseconds) for all sorts that have been executed.
sort_overflows	The total number of sorts that ran out of sort heap and may have required disk space for temporary storage.
total_hash_joins	The total number of hash joins executed.
total_hash_loops	The total number of times that a single partition of a hash join was larger than the available sort heap space.
hash_join_overflows	The number of times that hash join data exceeded the available sort heap space
hash_join_small_overflows	The number of times that hash join data exceeded the available sort heap space by less than 10%.
pool_data_l_reads	The number of logical read requests for data pages that have gone through the buffer pool.
pool_data_p_reads	The number of read requests that required I/O to get data pages into the buffer pool.
pool_data_writes	The number of times a buffer pool data page was physically written to disk.
pool_index_l_reads	The number of logical read requests for index pages that have gone through the buffer pool.
pool_index_p_reads	The number of physical read requests to get index pages into the buffer pool.
pool_index_writes	The number of times a buffer pool index page was physically written to disk.
pool_read_time	The total amount of elapsed time spent processing read requests that caused data or index pages to be physically read from disk to buffer pool.

Measurement	Description
prefetch_wait_time	The time an application spent waiting for an I/O server (pre-fetcher) to finish loading pages into the buffer pool.
pool_data_to_estore	The number of buffer pool data pages copied to extended storage.
pool_index_to_estore	The number of buffer pool index pages copied to extended storage.
pool_data_from_estore	The number of buffer pool data pages copied from extended storage.
pool_index_from_estore	The number of buffer pool index pages copied from extended storage.
direct_reads	The number of read operations that do not use the buffer pool.
direct_writes	The number of write operations that do not use the buffer pool.
direct_read_reqs	The number of requests to perform a direct read of one or more sectors of data.
direct_write_reqs	The number of requests to perform a direct write of one or more sectors of data.
direct_read_time	The elapsed time (in milliseconds) required to perform the direct reads.
direct_write_time	The elapsed time (in milliseconds) required to perform the direct writes.
cat_cache_lookups	The number of times that the catalog cache was referenced to obtain table descriptor information.
cat_cache_inserts	The number of times that the system tried to insert table descriptor information into the catalog cache.
cat_cache_overflows	The number of times that an insert into the catalog cache failed due to the catalog cache being full.
cat_cache_heap_full	The number of times that an insert into the catalog cache failed due to a heap-full condition in the database heap.
pkg_cache_lookups	The number of times that an application looked for a section or package in the package cache. At a database level, it indicates the overall number of references since the database was started, or monitor data was reset.

Measurement	Description
pkg_cache_ inserts	The total number of times that a requested section was not available for use and had to be loaded into the package cache. This count includes any implicit prepares performed by the system.
appl_ section_ lookups	Lookups of SQL sections by an application from its SQL work area.
appl_ section_ inserts	Inserts of SQL sections by an application from its SQL work area.
uow_log_ space_used	The amount of log space (in bytes) used in the current unit of work of the monitored application.
locks_held	The number of locks currently held.
deadlocks	The total number of deadlocks that have occurred.
lock_escals	The number of times that locks have been escalated from several row locks to a table lock.
x_lock_ escals	The number of times that locks have been escalated from several row locks to one exclusive table lock, or the number of times an exclusive lock on a row caused the table lock to become an exclusive lock.
lock_ timeouts	The number of times that a request to lock an object timed-out instead of being granted.
lock_waits	The total number of times that applications or connections waited for locks.
lock_wait_ time	The total elapsed time waited for a lock.
locks_ waiting	The number of agents waiting on a lock.
uow_lock_ wait_time	The total amount of elapsed time this unit of work has spent waiting for locks.
rows_deleted	The number of row deletions attempted.
rows_ inserted	The number of row insertions attempted.
rows_ updated	The number of row updates attempted.

Measurement	Description
rows_selected	The number of rows that have been selected and returned to the application.
rows_written	The number of rows changed (inserted, deleted or updated) in the table.
rows_read	The number of rows read from the table.
int_rows_deleted	The number of rows deleted from the database as a result of internal activity.
int_rows_updated	The number of rows updated from the database as a result of internal activity.
int_rows_inserted	The number of rows inserted into the database as a result of internal activity caused by triggers.
open_rem_curs	The number of remote cursors currently open for this application, including those cursors counted by `open_rem_curs_blk'.
open_rem_curs_blk	The number of remote blocking cursors currently open for this application.
rej_curs_blk	The number of times that a request for an I/O block at server was rejected and the request was converted to non-blocked I/O.
acc_curs_blk	The number of times that a request for an I/O block was accepted.
open_loc_curs	The number of local cursors currently open for this application, including those cursors counted by `open_loc_curs_blk'.
open_loc_curs_blk	The number of local blocking cursors currently open for this application.
static_sql_stmts	The number of static SQL statements that were attempted.
dynamic_sql_stmts	The number of dynamic SQL statements that were attempted.
failed_sql_stmts	The number of SQL statements that were attempted, but failed.
commit_sql_stmts	The total number of SQL COMMIT statements that have been attempted.
rollback_sql_stmts	The total number of SQL ROLLBACK statements that have been attempted.

Measurement	Description
select_sql_ stmts	The number of SQL SELECT statements that were executed.
uid_sql_ stmts	The number of SQL UPDATE, INSERT, and DELETE statements that were executed.
ddl_sql_ stmts	This element indicates the number of SQL Data Definition Language (DDL) statements that were executed.
int_auto_ rebinds	The number of automatic rebinds (or recompiles) that have been attempted.
int_commits	The total number of commits initiated internally by the database manager.
int_rollbacks	The total number of rollbacks initiated internally by the database manager.
int_ deadlock_ rollbacks	The total number of forced rollbacks initiated by the database manager due to a deadlock. A rollback is performed on the current unit of work in an application selected by the database manager to resolve the deadlock.
binds_ precompiles	The number of binds and pre-compiles attempted.

Oracle Server Monitoring Measurements

The following measurements are most commonly used when monitoring the Oracle server (from the V$SYSSTAT table):

Measurement	Description
CPU used by this session	The amount of CPU time (in tens of milliseconds) used by a session between the time a user call started and ended. Some user calls can be completed within 10 milliseconds and, as a result, the start- and end-user call time can be the same. In this case, 0 milliseconds are added to the statistic. A similar problem can exist in the operating system reporting, especially on systems that suffer from many context switches.
Bytes received via SQL*Net from client	The total number of bytes received from the client over Net8.
Logons current	The total number of current logons.

Measurement	Description
Opens of replaced files	The total number of files that needed to be reopened because they were no longer in the process file cache.
User calls	Oracle allocates resources (Call State Objects) to keep track of relevant user call data structures every time you log in, parse, or execute. When determining activity, the ratio of user calls to RPI calls gives you an indication of how much internal work is generated as a result of the type of requests the user is sending to Oracle.
SQL*Net roundtrips to/from client	The total number of Net8 messages sent to, and received from, the client.
Bytes sent via SQL*Net to client	The total number of bytes sent to the client from the foreground process(es).
Opened cursors current	The total number of current open cursors.
DB block changes	Closely related to consistent changes, this statistic counts the total number of changes that were made to all blocks in the SGA that were part of an update or delete operation. These are changes that generate redo log entries and hence cause permanent changes to the database if the transaction is committed. This statistic is a rough indication of total database work and indicates (possibly on a per-transaction level) the rate at which buffers are being dirtied.
Total file opens	The total number of file opens being performed by the instance. Each process needs a number of files (control file, log file, database file) in order to work against the database.

SQL Server Default Counters

Measurement	Description
% Total Processor Time	The average percentage of time that all the processors on the system are busy executing non-idle threads. On a multi-processor system, if all processors are always busy, this is 100%, if all processors are 50% busy this is 50% and if 1/4 of the processors are 100% busy this is 25%. It can be viewed as the fraction of the time spent doing useful work. Each processor is assigned an Idle thread in the Idle process which consumes those unproductive processor cycles not used by any

Measurement	Description
	other threads.
Cache Hit Ratio	The percentage of time that a requested data page was found in the data cache (instead of being read from disk).
I/O - Batch Writes/sec	The number of pages written to disk per second, using Batch I/O. The checkpoint thread is the primary user of Batch I/O.
I/O - Lazy Writes/sec	The number of pages flushed to disk per second by the Lazy Writer.
I/O - Outstanding Reads	The number of physical reads pending.
I/O - Outstanding Writes	The number of physical writes pending.
I/O - Page Reads/sec	The number of physical page reads per second.
I/O - Transactions/sec	The number of Transact-SQL command batches executed per second.
User Connections	The number of open user connections.
% Processor Time	The percentage of time that the processor is executing a non-idle thread. This counter was designed as a primary indicator of processor activity. It is calculated by measuring the time that the processor spends executing the thread of the idle process in each sample interval, and subtracting that value from 100%. (Each processor has an idle thread which consumes cycles when no other threads are ready to run). It can be viewed as the percentage of the sample interval spent doing useful work. This counter displays the average percentage of busy time observed during the sample interval. It is calculated by monitoring the time the service was inactive, and then subtracting that value from 100%.

Sybase Server Monitoring Measurements

The following tables describe the measurements that can be monitored on a Sybase server:

Object	Measurement	Description
Network	**Average packet**	Reports the number of network packets received.

Object	Measurement	Description
	size (Read)	
	Average packet size (Send)	Reports the number of network packets sent.
	Network bytes (Read)	Reports the number of bytes received, over the sampling interval.
	Network bytes (Read)/sec	Reports the number of bytes received, per second.
	Network bytes (Send)	Reports the number of bytes sent, over the sampling interval.
	Network bytes (Send)/sec	Reports the number of bytes sent, per second.
	Network packets (Read)	Reports the number of network packets received, over the sampling interval.
	Network packets (Read)/sec	Reports the number of network packets received, per second.
	Network packets (Send)	Reports the number of network packets sent, over the sampling interval.
	Network packets (Send)/sec	Reports the number of network packets sent, per second.
Memory	**Memory**	Reports the amount of memory (in bytes) allocated for the page cache.
Disk	**Reads**	Reports the number of reads made from a database device.
	Writes	Reports the number of writes made to a database device.
	Waits	Reports the number of times that access to a device had to wait.
	Grants	Reports the number of times access to a device was granted.
Engine	**Server is busy (%)**	Reports the percentage of time during which the Adaptive Server is in a "busy" state.
	CPU time	Reports how much "busy" time was used by the engine.
	Logical pages (Read)	Reports the number of data page reads, whether satisfied from cache or from a database device.
	Pages from disk	Reports the number of data page reads that could not be satisfied

Object	Measurement	Description
	(Read)	from the data cache.
	Pages stored	Reports the number of data pages written to a database device.
Stored Procedures	**Executed (sampling period)**	Reports the number of times a stored procedure was executed, over the sampling interval.
	Executed (session)	Reports the number of times a stored procedure was executed, during the session.
	Average duration (sampling period)	Reports the time (in seconds) spent executing a stored procedure, over the sampling interval.
	Average duration (session)	Reports the time (in seconds) spent executing a stored procedure, during the session.
Locks	**% Requests**	Reports the percentage of successful requests for locks.
	Locks count	Reports the number of locks. This is an accumulated value.
	Granted immediately	Reports the number of locks that were granted immediately, without having to wait for another lock to be released.
	Granted after wait	Reports the number of locks that were granted after waiting for another lock to be released.
	Not granted	Reports the number of locks that were requested but not granted.
	Wait time (avg.)	Reports the average wait time for a lock.
SqlSrvr	**Locks/sec**	Reports the number of locks. This is an accumulated value.
	% Processor time (server)	Reports the percentage of time that the Adaptive Server is in a "busy" state.
	Transactions	Reports the number of committed Transact-SQL statement blocks (transactions).
	Deadlocks	Reports the number of deadlocks.
Cache	**% Hits**	Reports the percentage of times that a data page read could be satisfied from cache without requiring a physical page read.
	Pages (Read)	Reports the number of data page reads, whether satisfied from

Object	Measurement	Description
		cache or from a database device.
Cache	**Pages (Read) /sec**	Reports the number of data page reads, whether satisfied from cache or from a database device, per second.
	Pages from disk (Read)	Reports the number of data page reads that could not be satisfied from the data cache.
	Pages from disk (Read)/sec	Reports the number of data page reads, per second, that could not be satisfied from the data cache.
	Pages (Write)	Reports the number of data pages written to a database device.
	Pages (Write) /sec	Reports the number of data pages written to a database device, per second.
Process	**% Processor time (process)**	Reports the percentage of time that a process running a given application was in the "Running" state (out of the time that all processes were in the "Running" state).
	Locks/sec	Reports the number of locks, by process. This is an accumulated value.
	% Cache hit	Reports the percentage of times that a data page read could be satisfied from cache without requiring a physical page read, by process.
	Pages (Write)	Reports the number of data pages written to a database device, by process.
Transaction	**Transactions**	Reports the number of committed Transact-SQL statement blocks (transactions), during the session.
Transaction	**Rows (Deleted)**	Reports the number of rows deleted from database tables during the session.
	Inserts	Reports the number of insertions into a database table during the session.
	Updates	Reports the updates to database tables during the session.
	Updates in place	Reports the sum of expensive, in-place and not-in-place updates (everything except updates deferred) during the session.
	Transactions/sec	Reports the number of committed Transact-SQL statement blocks (transactions) per second.
	Rows (Deleted)	Reports the number of rows deleted from database tables, per

Object	Measurement	Description
	/sec	second.
	Inserts/sec	Reports the number of insertions into a database table, per second.
	Updates/sec	Reports the updates to database tables, per second.
	Updates in place/sec	Reports the sum of expensive, in-place and not-in-place updates (everything except updates deferred), per second.

DB2 Graph

This graph shows the resource usage on the DB2 database server machine as a function of the elapsed load test scenario time.

X-axis	Elapsed time since the start of the run.
Y-axis	The resource usage on the DB2 database server.
Note	In order to monitor the DB2 database server machine, you must first set up the DB2 monitor environment. You then enable the DB2 monitor (from the Controller) by selecting the counters you want the monitor to measure.
See also	"Database Server Resource Graphs" on page 212 "DB2 Database Manager Counters" on page 212 "DB2 Database Counters" on page 214 "DB2 Application Counters" on page 219

Oracle Graph

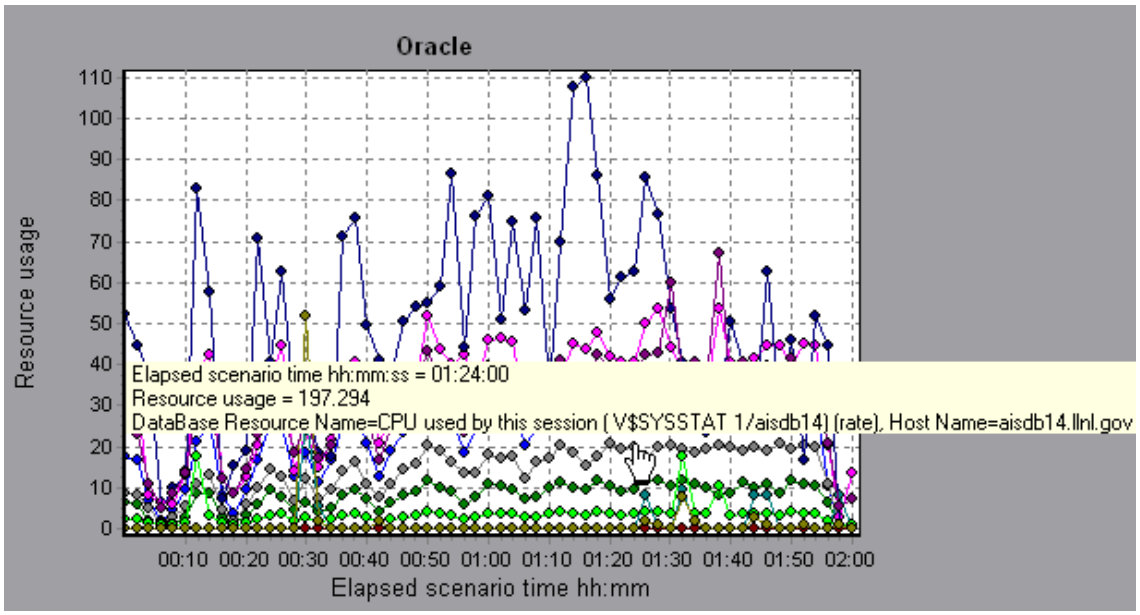
This graph displays information from Oracle V$ tables: Session statistics, V$SESSTAT, system statistics, V$SYSSTAT, and other table counters defined by the user in the custom query.

X-axis	Elapsed time since the start of the run.
Y-axis	The resource usage on the Oracle server.
Note	To obtain data for this graph, you need to enable the Oracle online monitor (from the Controller) and select the default measurements you want to display, before running the

	scenario.
See also	"Database Server Resource Graphs" on page 212 "Oracle Server Monitoring Measurements" on page 224

Example

In the following example, the V$SYSSTAT resource values are shown as a function of the elapsed load test scenario time:

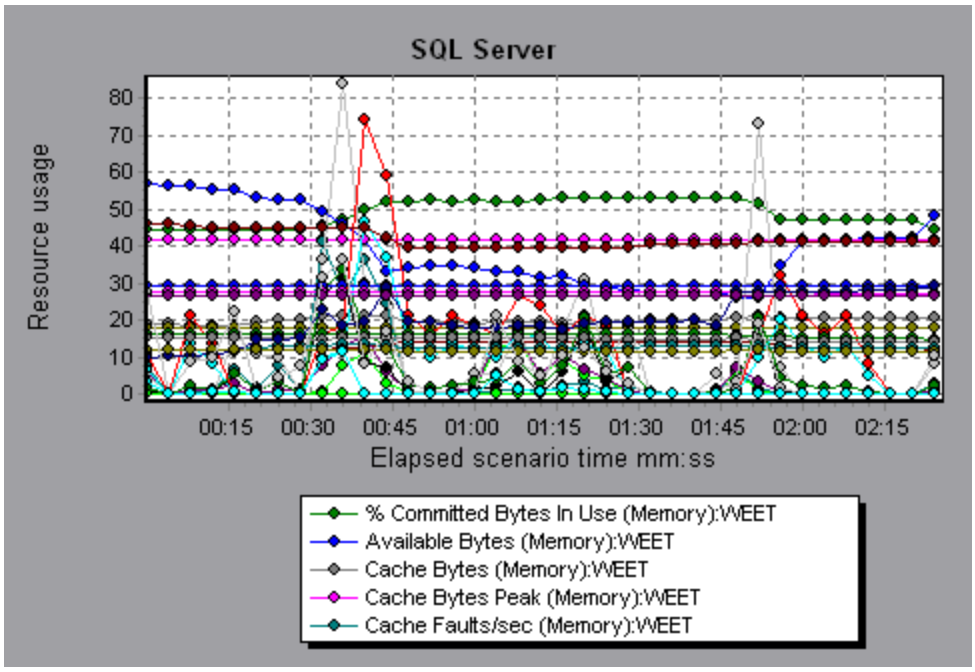


SQL Server Graph

This graph shows the standard Windows resources on the SQL server machine.

X-axis	Elapsed time since the start of the load test scenario run.
Y-axis	Resource usage
Note	To obtain data for this graph, you need to enable the SQL Server online monitor (from the Controller) and select the default measurements you want to display, before running the scenario.
See also	"Database Server Resource Graphs" on page 212 "SQL Server Default Counters" on page 225

Example



Sybase Graph

This graph shows the resource usage on the Sybase database server machine as a function of the elapsed load test scenario time.

X-axis	Elapsed time since the start of the run.
Y-axis	The resource usage on the Sybase database server.
Note	In order to monitor the Sybase database server machine, you must first set up the Sybase monitor environment. You then enable the Sybase monitor (from the Controller) by selecting the counters you want the monitor to measure.
See also	"Database Server Resource Graphs" on page 212 "SQL Server Default Counters" on page 225

Streaming Media Graphs

Streaming Media Graphs Overview

Streaming Media Resource graphs provide you with performance information for the RealPlayer Client, RealPlayer Server, Windows Media Server, and Media Player Client machines.

In order to obtain data for Streaming Media Resource graphs, you need to install the RealPlayer Client and activate the online monitor for the RealPlayer Server or Windows Media Server before running the load test scenario.

When you set up the online monitor for the RealPlayer Server or Windows Media Server, you indicate which statistics and measurements to monitor. For more information on installing and configuring the Streaming Media Resource monitors, see Media Player Client Performance Counters.

In order to display all the measurements on a single graph, Analysis may scale them. The Legend window indicates the scale factor for each resource. To obtain the true value, multiply the scale factor by the displayed value.

Media Player Client Monitoring Measurements

The following table describes the Media Player Client measurements that are monitored:

Measurement	Description
Average Buffering Events	The number of times Media Player Client had to buffer incoming media data due to insufficient media content.
Average Buffering Time (sec)	The time spent by Media Player Client waiting for sufficient amount of media data in order to continue playing media clip.
Current bandwidth (Kbits/sec)	The number of kbits per second received.
Number of Packets	The number of packets sent by server for a particular media clip.
Stream Interruptions	The number of interruptions encountered by Media Player Client while playing a media clip. This measurement includes the number of times Media Player Client had to buffer incoming media data, and any errors that occurred during playback.
Stream Quality (Packet-level)	The percentage ratio of packets received to total packets.
Stream Quality (Sampling-level)	The percentage of stream samples received on time (no delays in reception).
Total number	The number of lost packets that were recovered. This value is only relevant during

Measurement	Description
of recovered packets	network playback.
Total number of lost packets	The number of lost packets that were not recovered. This value is only relevant during network playback.

RealPlayer Client Monitoring Measurements

The following table describes the RealPlayer Client measurements that are monitored:

Measurement	Description
Current Bandwidth (Kbits/sec)	The number of kilobytes in the last second.
Buffering Event Time (sec)	The average time spent on buffering.
Network Performance	The ratio (percentage) between the current bandwidth and the actual bandwidth of the clip.
Percentage of Recovered Packets	The percentage of error packets that were recovered.
Percentage of Lost Packets	The percentage of packets that were lost.
Percentage of Late Packets	The percentage of late packets.
Time to First Frame Appearance (sec)	The time for first frame appearance (measured from the start of the replay).
Number of Buffering Events	The average number of all buffering events.
Number of Buffering Seek Events	The average number of buffering events resulting from a seek operation.
Buffering Seek Time	The average time spent on buffering events resulting from a seek operation.
Number of Buffering Congestion Events	The average number of buffering events resulting from network congestion.
Buffering Congestion Time	The average time spent on buffering events resulting from network congestion.
Number of Buffering Live Pause Events	The average number of buffering events resulting from live pause.

Measurement	Description
Buffering Live Pause Time	The average time spent on buffering events resulting from live pause.

RealPlayer Server Monitoring Measurements

The following table describes the RealPlayer Client measurements that are monitored:

Measurement	Description
Current Bandwidth (Kbits/sec)	The number of kilobytes in the last second.
Buffering Event Time (sec)	The average time spent on buffering.
Network Performance	The ratio (percentage) between the current bandwidth and the actual bandwidth of the clip.
Percentage of Recovered Packets	The percentage of error packets that were recovered.
Percentage of Lost Packets	The percentage of packets that were lost.
Percentage of Late Packets	The percentage of late packets.
Time to First Frame Appearance (sec)	The time for first frame appearance (measured from the start of the replay).
Number of Buffering Events	The average number of all buffering events.
Number of Buffering Seek Events	The average number of buffering events resulting from a seek operation.
Buffering Seek Time	The average time spent on buffering events resulting from a seek operation.
Number of Buffering Congestion Events	The average number of buffering events resulting from network congestion.
Buffering Congestion Time	The average time spent on buffering events resulting from network congestion.
Number of Buffering Live Pause Events	The average number of buffering events resulting from live pause.
Buffering Live Pause Time	The average time spent on buffering events resulting from live pause.

Windows Media Server Default Measurements

Measurement	Description
Active Live Unicast Streams (Windows)	The number of live unicast streams that are being streamed.
Active Streams	The number of streams that are being streamed.
Active TCP Streams	The number of TCP streams that are being streamed.
Active UDP Streams	The number of UDP streams that are being streamed.
Aggregate Read Rate	The total, aggregate rate (bytes/sec) of file reads.
Aggregate Send Rate	The total, aggregate rate (bytes/sec) of stream transmission.
Connected Clients	The number of clients connected to the server.
Connection Rate	The rate at which clients are connecting to the server.
Controllers	The number of controllers currently connected to the server.
HTTP Streams	The number of HTTP streams being streamed.
Late Reads	The number of late read completions per second.
Pending Connections	The number of clients that are attempting to connect to the server, but are not yet connected. This number may be high if the server is running near maximum capacity and cannot process a large number of connection requests in a timely manner.
Stations	The number of station objects that currently exist on the server.
Streams	The number of stream objects that currently exist on the server.
Stream Errors	The cumulative number of errors occurring per second.

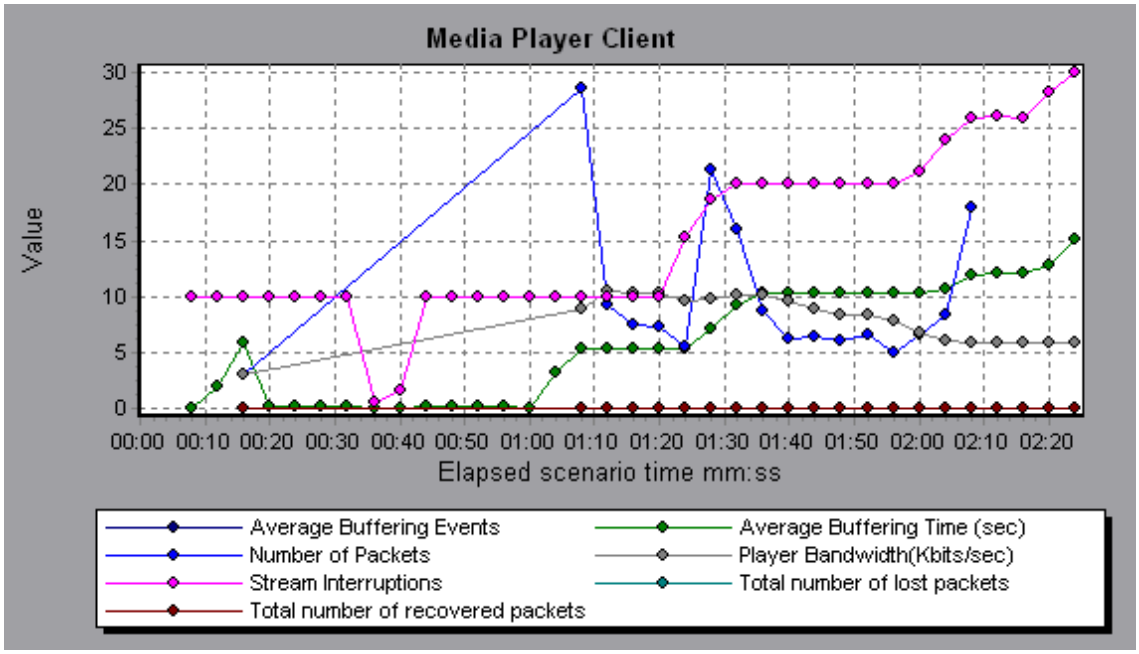
Media Player Client Graph

This graph shows statistics on the Windows Media Player client machine as a function of the elapsed load test scenario time.

X-axis	Elapsed time since the start of the run.
Y-axis	The resource usage on the Windows Media Player client machine.
See also	"Streaming Media Graphs Overview" on page 232 "Media Player Client Monitoring Measurements" on page 233

Example

In the following example the **Total number of recovered packets** remained steady during the first two and a half minutes of the scenario. The **Number of Packets** and **Stream Interruptions** fluctuated significantly. The **Average Buffering Time** increased moderately, and the **Player Bandwidth** increased and then decreased moderately. The scale factor for the **Stream Interruptions** and **Average Buffering Events** measurements is 10, and the scale factor for **Player Bandwidth** is 1/10.



Real Client Graph

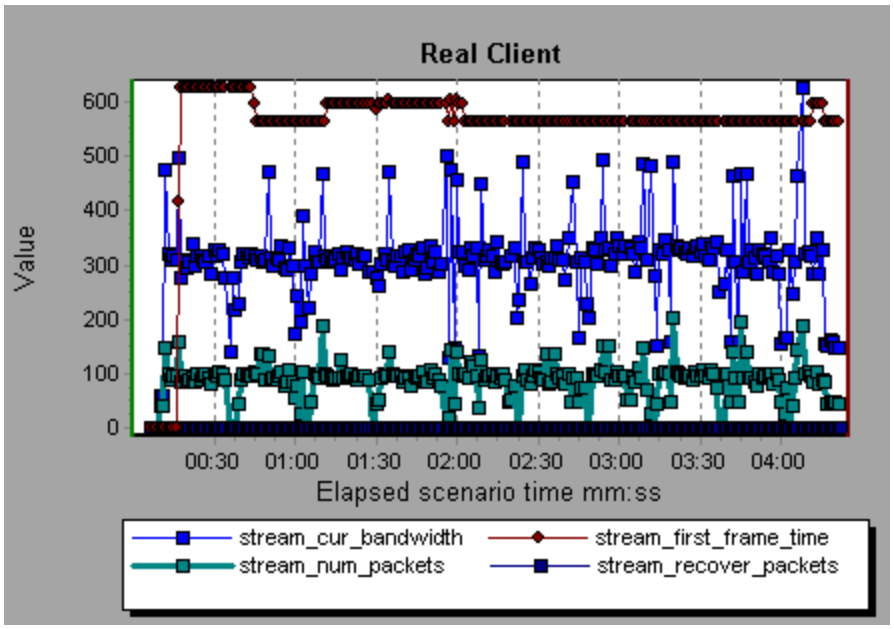
This graph shows statistics on the RealPlayer client machine as a function of the elapsed load test scenario time.

X-axis	Elapsed time since the start of the run.

Y-axis	The resource usage on the RealPlayer client machine.
See also	"Streaming Media Graphs Overview" on page 232 "RealPlayer Client Monitoring Measurements" on page 234

Example

In the following example this graph displays the **Total Number of Packets, Number of Recovered Packets, Current Bandwidth,** and **First Frame Time** measurements during the first four and a half minutes of the scenario. The scale factor is the same for all of the measurements.



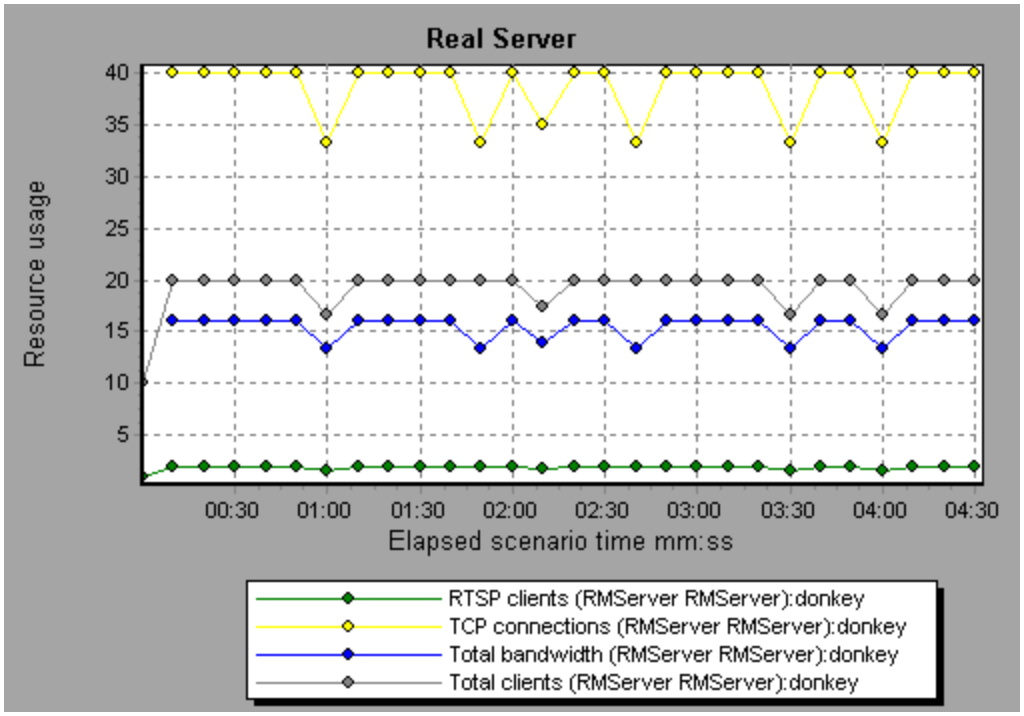
Real Server Graph

This graph shows RealPlayer server statistics as a function of the elapsed load test scenario time.

X-axis	Elapsed time since the start of the run.
Y-axis	The resource usage of the RealPlayer server machine.
Note	To obtain data for this graph, you need to enable the RealPlayer Server online monitor (from the Controller) and select the default measurements you want to display, before running the scenario.
See also	"Streaming Media Graphs Overview" on page 232 "RealPlayer Server Monitoring Measurements" on page 235

Example

In the following example this graph displays the **Total Number of Packets, Number of Recovered Packets, Current Bandwidth,** and **First Frame Time** measurements during the first four and a half minutes of the scenario. The scale factor is the same for all of the measurements.



Windows Media Server Graph

This graph shows the Windows Media server statistics as a function of the elapsed load test scenario time.

X-axis	Elapsed time since the start of the run.
Y-axis	Resource usage.
Note	To obtain data for this graph, you need to enable the Windows Media Server online monitor (from the Controller) and select the default measurements you want to display, before running the scenario.
See also	"Streaming Media Graphs Overview" on page 232 "Windows Media Server Default Measurements" on page 236

J2EE & .NET Diagnostics Graphs

J2EE & .NET Diagnostics Graphs Overview

The J2EE & .NET Diagnostics graphs in LoadRunner Analysis enable you to trace, time, and troubleshoot individual transactions and server requests through J2EE & .NET Web, application, and database servers. You can also pinpoint problem servlets and JDBC calls to maximize business process performance, scalability, and efficiency.

The J2EE & .NET Diagnostics graphs are comprised of two groups:

- **J2EE & .NET Diagnostics Graphs.** These graphs show you the performance of requests and methods generated by virtual user transactions. They show you the transaction that generated each request.
- **J2EE & .NET Server Diagnostics Graphs.** These graphs show you the performance of all the requests and methods in the application you are monitoring. These include requests generated by virtual user transactions and by real users.

How to Enable Diagnostics for J2EE & .NET

To generate Diagnostics for J2EE & .NET data, you must first install HP Diagnostics.

Before you can use HP Diagnostics with LoadRunner, you need to ensure that you have specified the Diagnostics Server details in LoadRunner. Before you can view Diagnostics for J2EE & .NET data in a particular load test scenario, you need to configure the Diagnostics parameters for that scenario. For more information, see the section on online monitors in the LoadRunner Controller documentation.

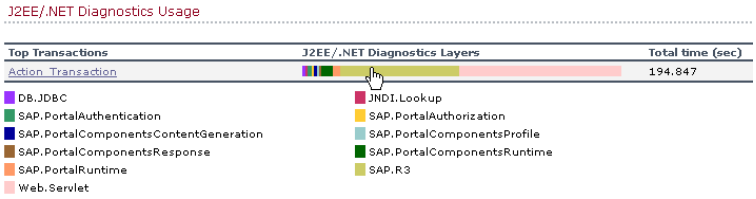
> **Note:** To ensure that valid J2EE/.NET diagnostics data is generated during the scenario run, you must manually mark the beginning and end of each transaction in the Vuser script, rather than using automatic transactions.

Viewing J2EE to SAP R3 Remote Calls

The *Remote Function Call (*RFC) protocol in SAP allows communication to take place between SAP J2EE and SAP R3 environments. When remote calls take place between SAP J2EE and SAP R3 environments, Analysis displays information about the RFC functions, including the name of each function.

You view information about RFC functions by breaking down the SAP R3 layer. You can view the RFC function information in a graph display or in the Chain Of Calls window.

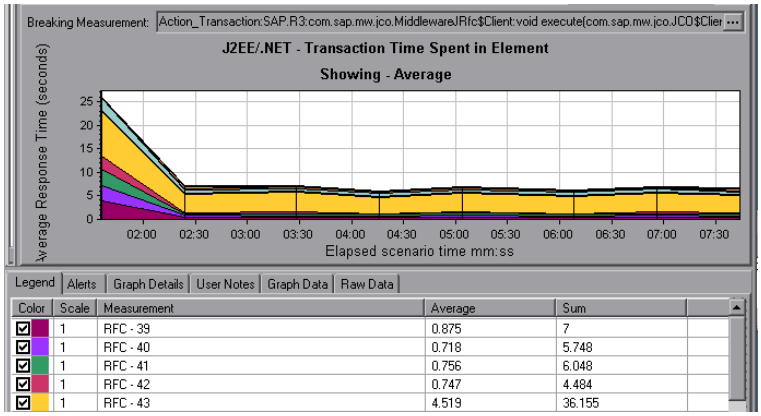
1. Go to the **J2EE/.NET Diagnostics Usage** section of the Summary Report. Next to the relevant transaction, click the color representing the **SAP.R3** layer.



The J2EE/.NET - Transaction Time Spent in Element graph opens, representing the SAP.R3 layer.

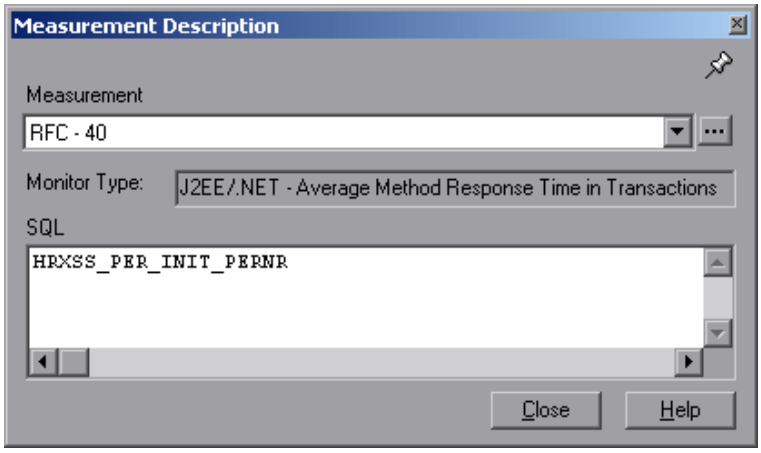
2. Right click the graph and choose **J2EE/.NET Diagnostics > Break down the class to methods**.
3. Break down the graph further by right clicking the graph and choosing **J2EE/.NET Diagnostics > Break down the method to SQLs**.

The graph is broken down into the different RFC functions.



4. To view the name of each RFC function, right click an RFC measurement in the **Measurement** column in the graph legend and choose **Show measurement description**.

The Measurement Description dialog box opens. The name of the RFC function is displayed in the **SQL** box.



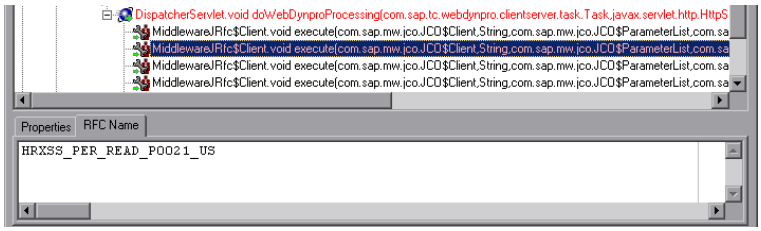
View RFC function information in the Chain Of Calls window

1. Go to the **J2EE/.NET Diagnostics Usage** section of the Summary Report. Next to the relevant transaction, click the color representing the **SAP.R3** layer.

The J2EE/.NET - Transaction Time Spent in Element graph opens, representing the SAP.R3 layer.

2. Right click the graph and choose **J2EE/.NET Diagnostics > Show chain of calls**.

The Transaction chain of calls window opens. When you click any of the RFC functions, in the **Measurement** column, the name of the function is displayed in the lower pane in the **RFC Name** tab.



J2EE & .NET Diagnostics Data

The J2EE & .NET Diagnostics graphs provide an overview of the entire chain of activity on the server side of the system. At the same time, you can break down J2EE/.NET layers into classes and methods to enable you to pinpoint the exact location where time is consumed. In addition, you can view custom classes or packages that you set the J2EE/.NET probe to monitor. You can also view the transaction chain of calls and call stack statistics to track the percentage of time spent on each part of the transaction.

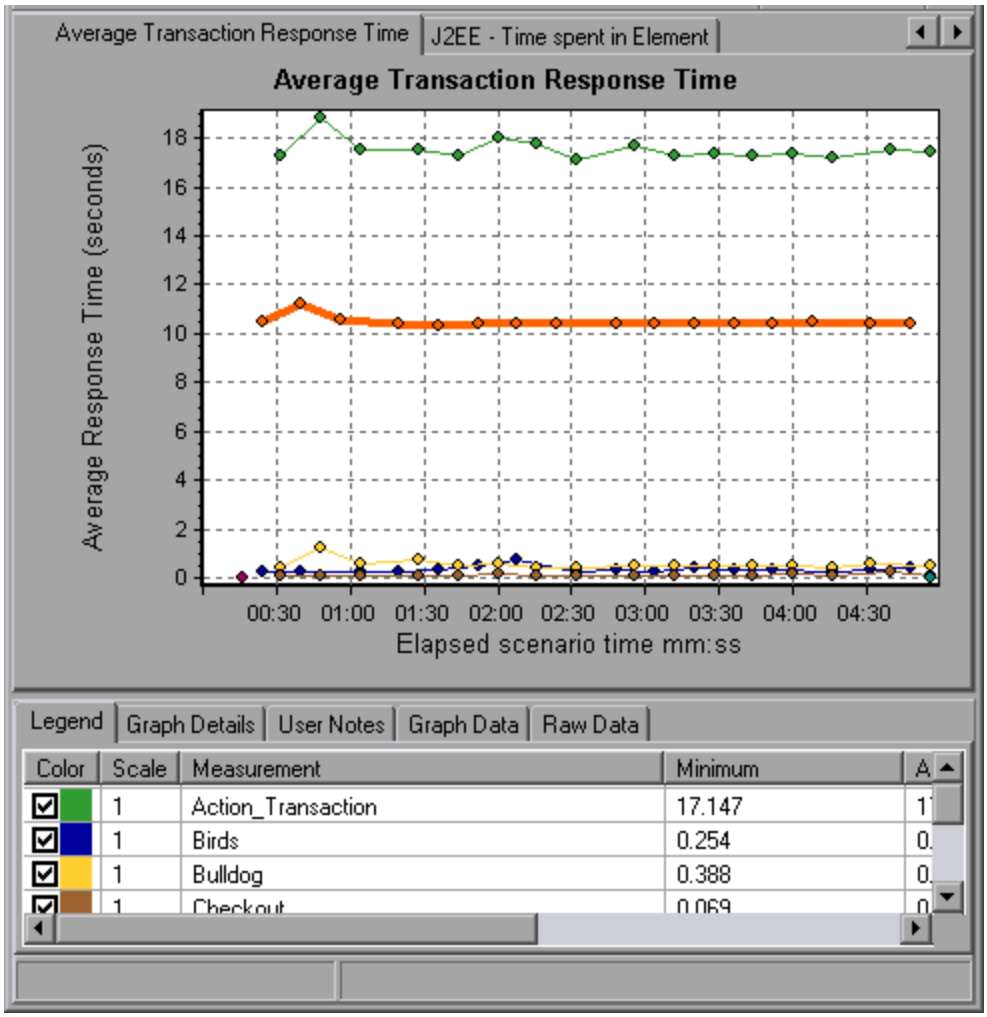
You can correlate the end user response time with the Web server activity (Servlets and JSPs data), application server activity (JNDIs), and back-end activity of database requests (JDBC methods and SQL queries).

Example Transaction Breakdown

The following graphs illustrate the breakdown of a transaction to its layers, classes, and methods.

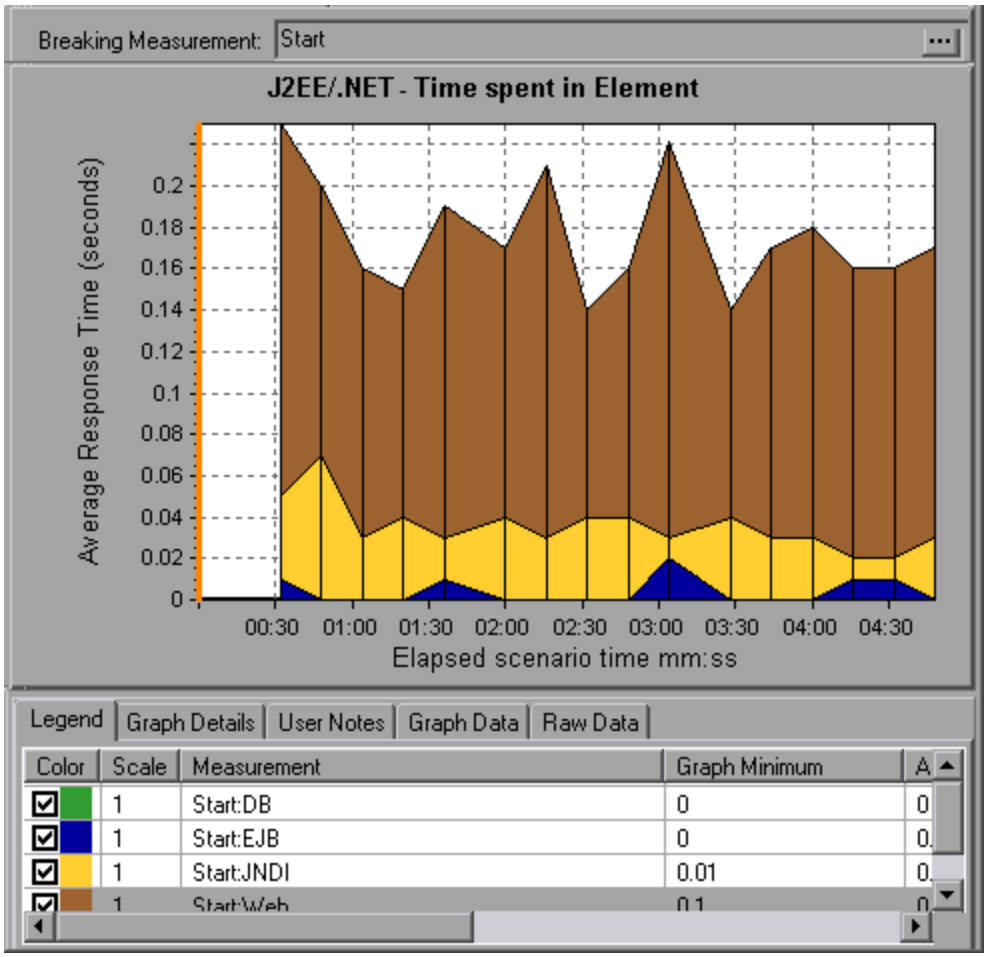
Transaction Level

The following figure shows the top level Average Transaction Response Time graph. The graph displays several transactions: **Birds**, **Bulldog**, **Checkout**, **Start**, and so on.



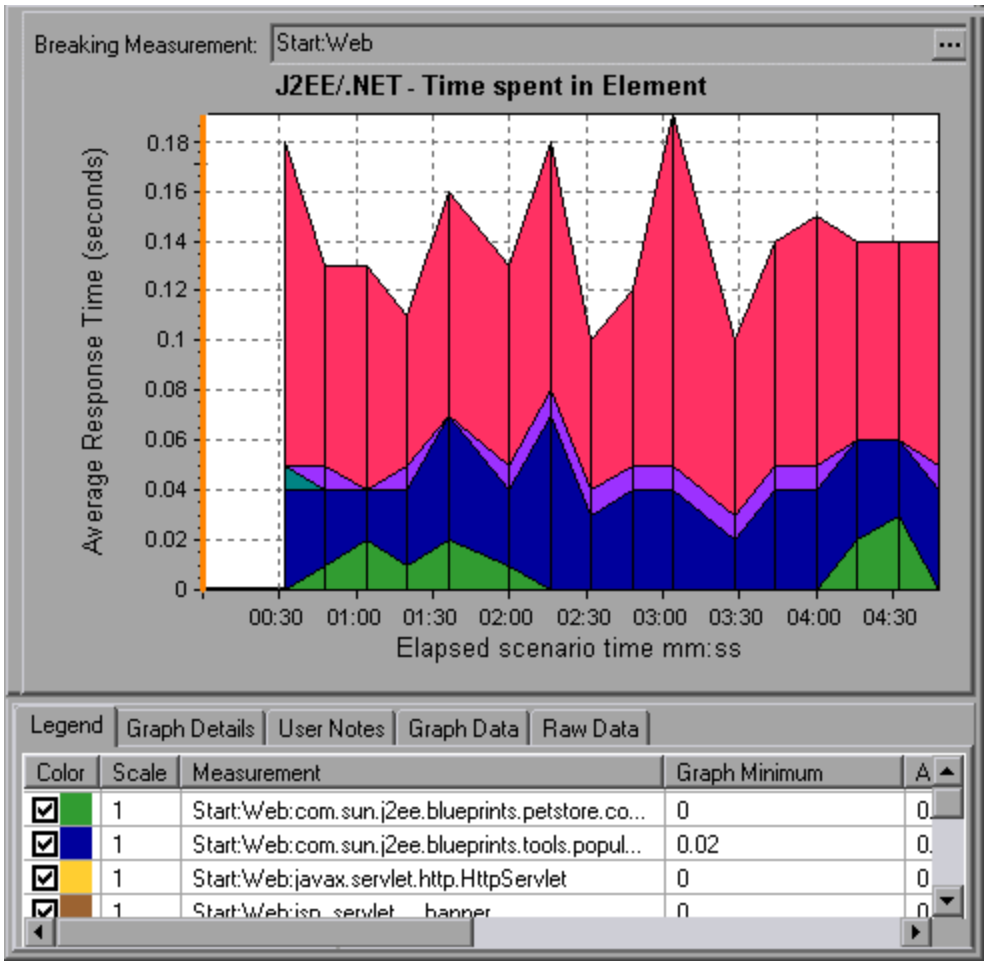
Layer Level

In the following figure, the **Start** transaction has been broken down to its layers (DB, EJB, JNDI, and Web). In J2EE/.NET transactions, the Web layer is generally the largest.



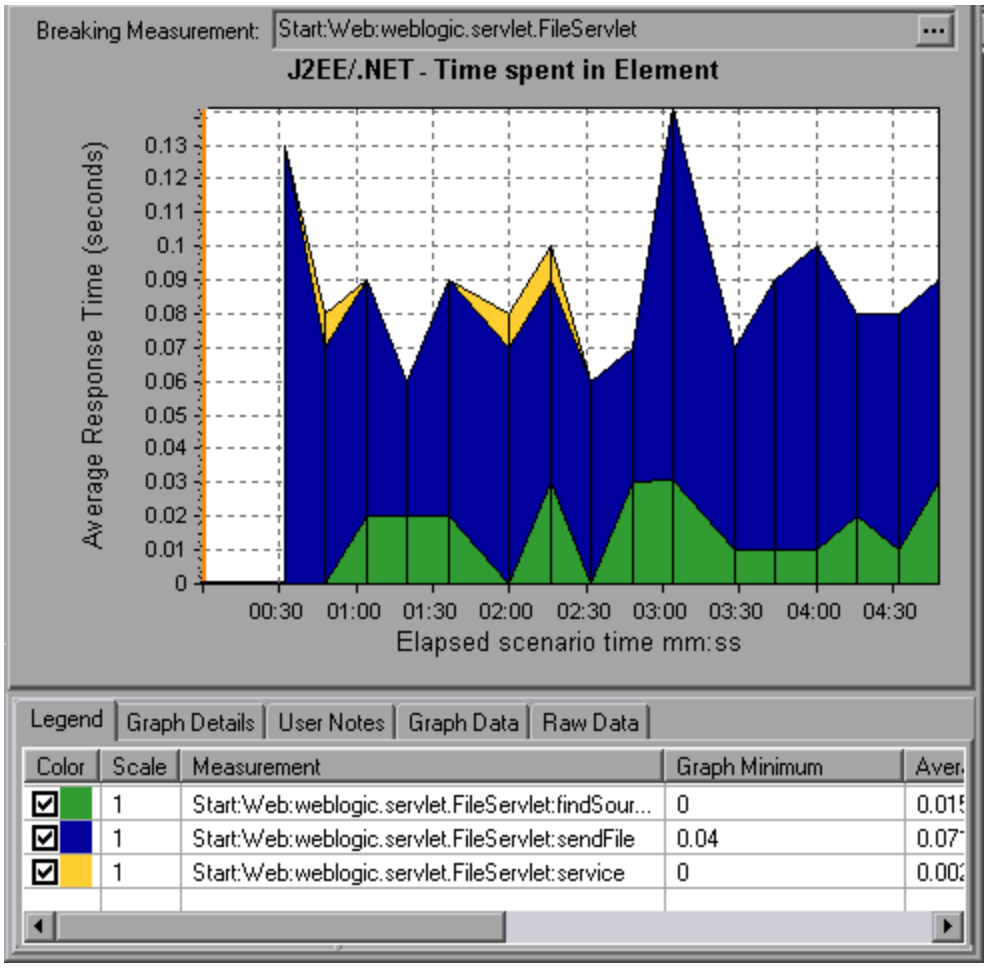
Class Level

In the following figure, the Web layer of the **Start** transaction has been broken down to its classes.



Method/Query Level

In the following figure, the **weblogic.servlet.FileServlet** component of the **Web** layer of the **Start** transaction has been broken down to its methods.



> **Note:** Some JDBC methods can invoke SQLs which can be broken down further. In this case there is another level of breakdown, that is SQL Statements. For the methods that can not be further broken down into SQL statements when reaching this level of breakdown, you see **NoSql**.

Cross VM Analysis

When a server request makes a remote method invocation, the J2EE & .NET Diagnostics graphs display certain measurements relating to the classes and methods involved in these requests. These measurements are displayed at a layer, class and method level. The VM making the call is referred to as the *caller VM*, and the VM that executes the remote call is the *callee VM*.

The measurements are described below:

Measurements	Description
Cross VM	A measurement that represents a dummy layer that integrates the data from the

Measurements	Description
Layer	remote classes and methods in server requests that take place across two or more virtual machines.
Remote-Class	A measurement that represents a dummy class that integrates the data from the remote methods in server requests that take place across two or more virtual machines.
Remote-Class: Remote Method	A measurement that represents a dummy method. Remote-Class: Remote Method measures the total time, call count, exclusive latency, minimum and maximum values, standard deviation, and so on of the methods that are executed remotely, relative to the caller virtual machine.

Note: Since this data is measured on the caller virtual machine the exclusive latency will include all of the time required for making the remote method invocation such as network latency.

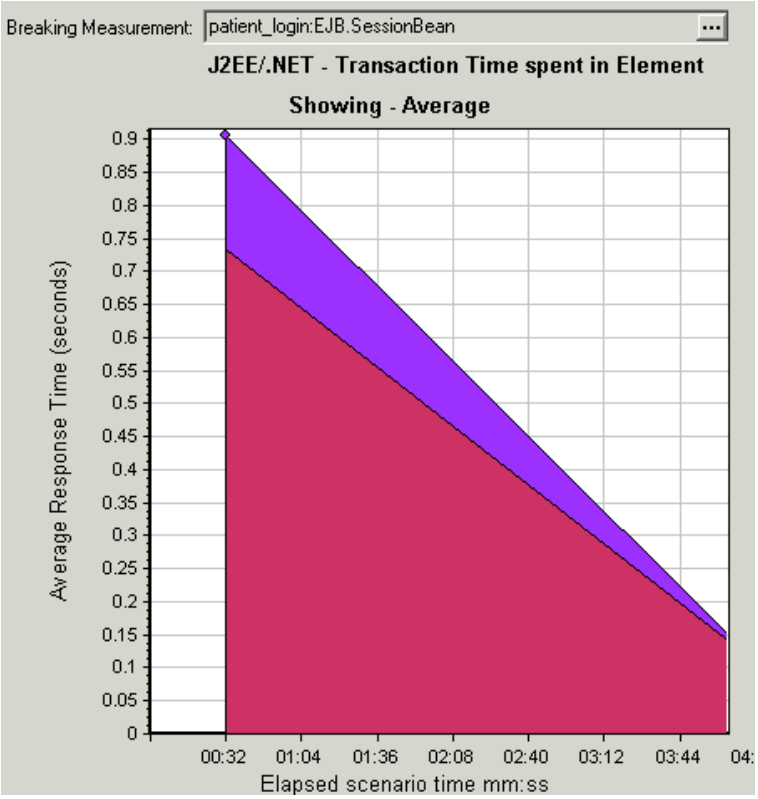
Using the J2EE & .NET Breakdown Options

J2EE & .NET breakdown options are described.

To access	Use one of the following to access breakdown options: • **<J2EE & .NET Graphs> View > J2EE & .NET Diagnostics** • **<J2EE & .NET Diagnostics Graphs>** > select transaction > short-cut menu > **J2EE & .NET Diagnostics** • See toolbar options for each breakdown level
Notes	• The breakdown menu options and buttons are not displayed until an element (transaction, server request, layer) is selected. • If there is no URI in the SQL, URI-None appears in front of the full measurement description in the Measurement Description dialog box.
See also	"J2EE & .NET Diagnostics Graphs Overview" on page 240

User interface elements are described below :

UI Element	Description
<Right-click>	Choose J2EE/.NET Diagnostics > Show Server Requests. A new graph opens showing the breakdown of the selected transaction. The name of the transaction is displayed in the Breaking Measurement box.

UI Element	Description
transaction in Average Response Time Graph	 You can view the full SQL statement for a selected SQL element by choosing **Show measurement description** from the Legend window right-click menu. The Measurement Description dialog box opens displaying the name of the selected measurement and the full SQL statement.
	To view transaction properties for the breakdown measurement, click the **Breaking Measurement** button. To disable this feature, choose **View > Display Options**, and clear the **Show Breaking Measurement** check box.
	Select **View > J2EE/.NET Diagnostics > Break down the server request to layers**, or click the measurement breakdown button in the toolbar above the graph. **Note**: The option in the J2EE/.NET Diagnostics menu, and the tool tip of the measurement breakdown button, vary according to the element that you want to break down. For example, when you select a server request, the menu option and tool tip are **Break down server request to layers**.
	Select **View > J2EE/.NET Diagnostics > Show VM**, or click the **Show VM** button in the toolbar above the graph. This breaks the data down to the application host name (VM).
	Select **View > J2EE/.NET Diagnostics > Undo Break down the server request to**

UI Element	Description
	layers, or click the **Undo <***Measurement Breakdown***>** button in the toolbar above the graph. **Note:** The option in the J2EE/.NET Diagnostics menu, and the tool tip of the measurement breakdown button, vary according to the element whose breakdown you want to undo. For example, when you select a layer, the menu option and tool tip are Undo break down server request to layers.
	Select **View > J2EE/.NET Diagnostics > Hide VM**, or click the **Hide VM** button in the toolbar above the graph.
	Display the chain of call or call stack statistics in the measurements tree window: Drag the orange time line on to the graph to the time specifying the end of the period for which you want to view data, and select **View > J2EE/.NET Diagnostics > Show Chain of Calls**, or click the Show Chain of Calls button in the toolbar above the graph. **Note:** A measurement that is broken down in the Average Method Response Time in Transactions graph will be different from the same measurement broken down in the J2EE/.NET - Transaction Time Spent in Element graph. This is because the J2EE/.NET - Average Method Response Time in Transactions graph displays the average transaction time, whereas the J2EE/.NET - Transaction Time Spent in Element graph displays the average time per transaction event (sum of method execution time).

Viewing Chain of Calls and Call Stack Statistics

You can view the chain of calls for transactions and methods. The chain of calls answers the question "Whom did I call?"

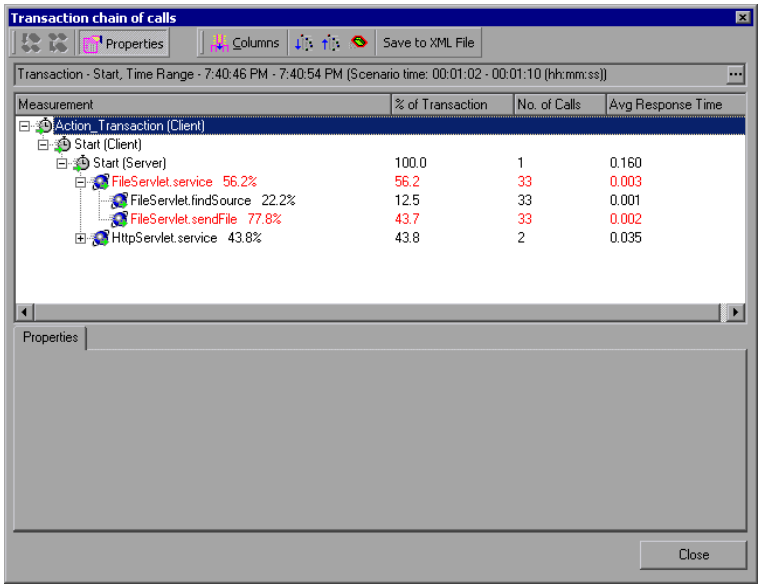
You can also view the call stack statistics for methods. Call stack statistics answer the question "Who called me?"

Chain of call and call stack statistics data are shown in the measurements tree window. The title of the window changes depending on which kind of data you are viewing.

- To set the point to which the measurements tree window relates, you must drag the orange time line to the desired spot.
- To view transaction call chains, right-click a component and choose **J2EE/.NET Diagnostics > Show Chain of Calls**. The Chain of Calls window opens displaying the chain of calls from the parent transaction downwards.
- To view method statistics, in the Chain of Calls window right-click a method and choose **Show Method Chain of Calls** or **Show Method Call Stack Statistics**.

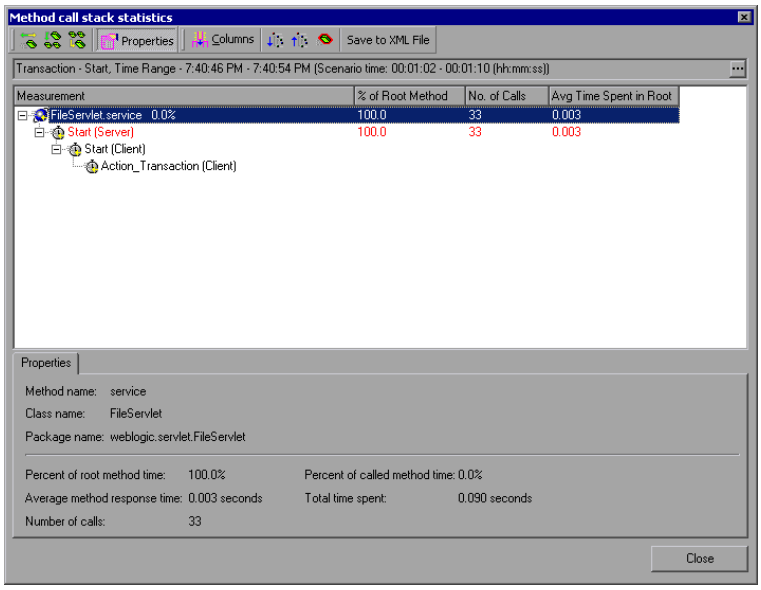
The Chain of Calls Windows

You use the Chain of Calls window to view the components that the selected transaction or method called. In the following figure, all the calls in the critical path of the Start server-side transaction are displayed.



> **Note:** Each red node signifies the most time consuming child of its parent.

You use the Call Stack Statistics window to view which components called the selected component. In the following figure, the **FileServlet.service** was called by Start (Server), which was called by Start (Client), and so on, down to the transaction at the bottom of the chain.



Understanding the Chain of Calls Window

User interface elements are described below:

UI Element	Description
	Switch to Method Chain of Calls. When the call stack statistics data is displayed, displays the method chain of calls data (only if the root is a method).
	Switch to Method Call Stack Statistics. When the method chain of calls data is displayed, displays the method call stack statistics data (only if the root is a method).
	Show Method Chain of Calls. Displays the Chain of Calls window.
	Show Method Call Stack Statistics. Displays the Call Stack Statistics window.
	Properties. Hides or displays the properties area (lower pane).
	Columns. Enables you to select the columns shown in the Calls window. To display additional fields, drag them to the desired location in the Calls window. To remove fields, drag them from the Calls window back to the Columns chooser.
	Expand All. Expands the entire tree.
	Collapse All. Collapses the entire tree.
	Expand Worst Path. Expands only the parts of the path on the critical path.
Save to XML File	Saves the tree data to an XML file.
Method Properties	Area**.** Displays the full properties of the selected method.
SQL Query	Displays the SQL query for the selected method. (For Database only.)The following columns are available in the Chain of Calls window:

The following columns are available in the Chain of Calls window:

Column	Description
Measurement	Name of the method, displayed as **ComponentName:MethodName**. In the case of a database call, query information is also displayed. The percent shown indicates the percentage of calls to this component from its parent.
% of Root	Percentage of the total time of the method from the total time of the root tree item.

Column	Description
Method	
No of Calls	Displays the amount of times this transaction or method was executed.
Avg Response Time	Response time is the time from the beginning of execution until the end. Average response time is the total response time divided by the number of divided by the number of instances of the method.
STD Response Time	The standard deviation response time.
Min Response Time	The minimum response time.
Max Response Time	The maximum response time.
% of Caller	Displays the percentage of method time in relation the parent method time.
Total time	Displays the total method execution time, including the child execution time.

The following columns are available in the Call Stack Statistics window:

Column	Description
Measurement	Name of the method, displayed as **ComponentName.MethodName**. In the case of a database call, query information is also displayed. The percent shown indicates the percentage of calls to this component from its child.
% of Root Method	Percentage of the total time of the transaction (or method) from the total time of the root tree item.
No. of Calls to Root	Displays the amount of times this transaction or method was executed.
Avg Time Spent in Root	Time spent in root is the time that the sub-area spent in the root sub-area/area/transaction. Average Time Spent in Root time is the total time spent in the root divided by the number of instances of the method.
STD Time Spent in Root	The standard deviation time spent in the root.
Min Time	The minimum time spent in the root.

Column	Description
Spent in Root	
Max Time Spent in Root	The maximum time spent in the root.
% of Called	Displays the percentage of method time in relation the child method time.
Total Time Spent in Root	Displays the total method execution time, including the child execution time.

Graph Filter Properties

You can filter the J2EE & .NET Diagnostics graphs so that the displayed data is more suitable to your needs. You can filter using the following methods:

- Before opening a graph, enter filter criteria in the **Graph Properties** box of the **Open Graph** dialog box. For more information, see "Open a New Graph Dialog Box" on page 125.
- From an open graph, enter filter criteria in the **Filter condition** fields in a filter dialog box. For more information, see "Filter Dialog Boxes" on page 114 and "Drilling Down in a Graph" on page 90.

User interface elements are described below:

UI Element	Description
Class Name	Shows data for specified classes.
Layer Name	Shows data for specified layers.
Scenario Elapsed Time	Shows data for transactions that ended during the specified time.
SQL Logical Name	Shows data for specified SQL logical names. Due to the length of some SQL names, after you choose an SQL statement it is assigned a "logical name." This logical name is used in the filter dialog, legend, grouping, and other places in place of the full SQL statement. You can view the full SQL statement in the Measurement Description dialog box (**View > Show Measurement Description**).
Transaction Name - J2EE/.NET	Shows data for a specified transaction.

Some JDBC methods have the ability to invoke SQL's (each method can invoke several different SQL's) so there is another level of breakdown which is the SQL statements.

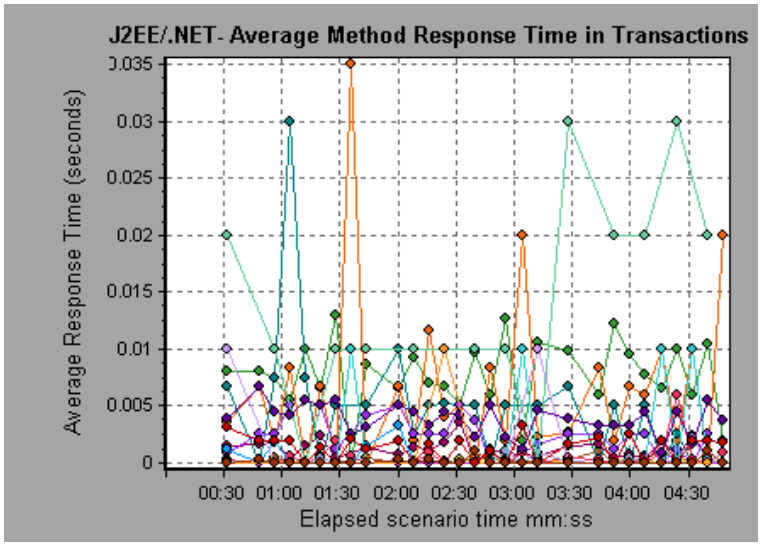
> **Note:** For the methods that do not have SQL statement when reaching this level of breakdown you see **NoSql**.

J2EE/.NET - Average Method Response Time in Transactions Graph

This graph displays the average response time for the server side methods, computed as Total Method Response Time/Number of Method calls. For example, if a method was executed twice by an instance of transaction A and once by another instance of the same transaction, and it took three seconds for each execution, the average response time is 9/3, or 3 seconds. The method time does not include calls made from the method to other methods.

X-axis	Elapsed time.
Y-axis	Average response time (in seconds) per method
Breakdown options	"Using the J2EE & .NET Breakdown Options" on page 247
See also	"J2EE & .NET Diagnostics Graphs Overview" on page 240

Example

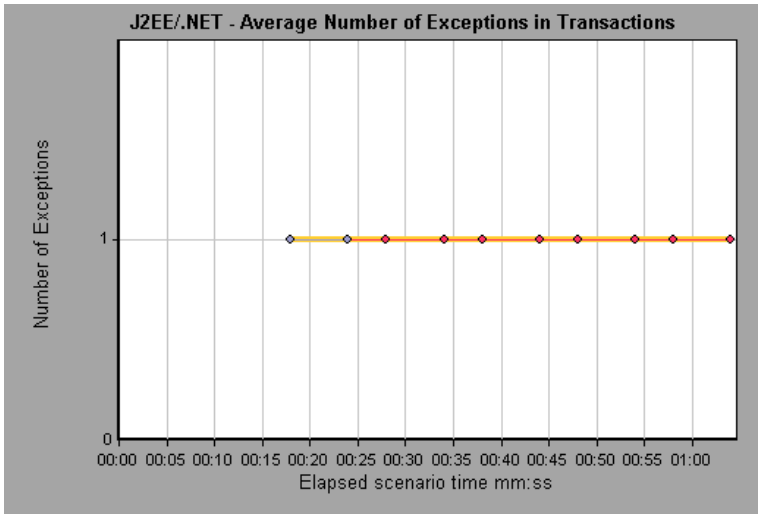


J2EE/.NET - Average Number of Exceptions in Transactions Graph

This graph displays the average number of code exceptions per method, transaction, or request that were monitored during the selected time range.

X-axis	Elapsed time.
Y-axis	Represents the number of events.
Breakdown options	To break the displayed elements down further, see "Using the J2EE & .NET Breakdown Options" on page 247.
See also	"J2EE & .NET Diagnostics Graphs Overview" on page 240

Example

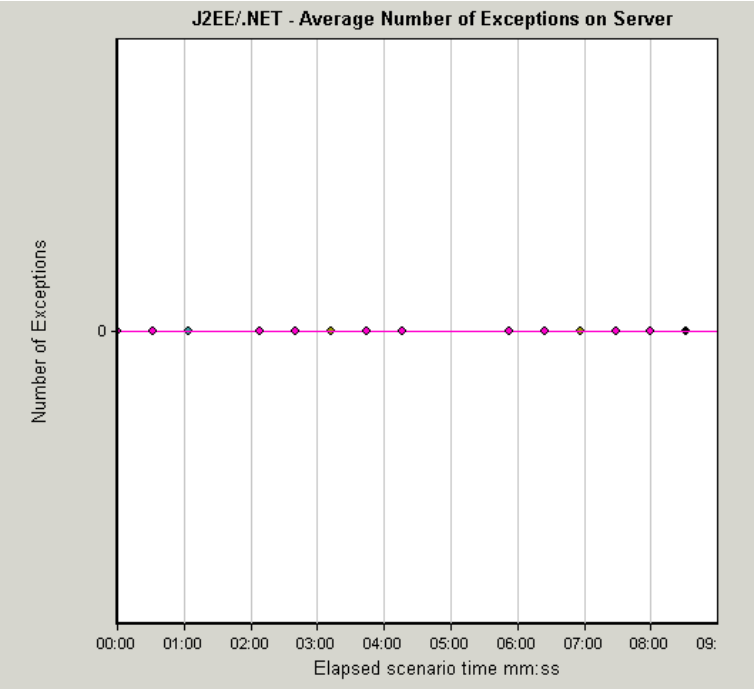


J2EE/.NET - Average Number of Exceptions on Server Graph

This graph displays the average number of code exceptions per method that were monitored during the selected time range.

X-axis	Elapsed time of the scenario run.
Y-axis	Number of events.
Breakdown options	"Using the J2EE & .NET Breakdown Options" on page 247
See also	"J2EE & .NET Diagnostics Graphs Overview" on page 240

Example

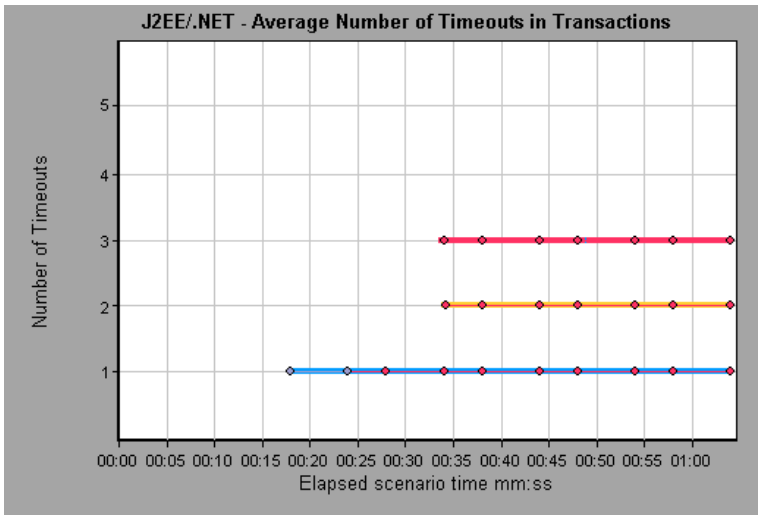


J2EE/.NET - Average Number of Timeouts in Transactions Graph

This graph displays the average number of timeouts per method, transaction, or request that were monitored during the selected time range.

X-axis	Elapsed time since the scenario run.
Y-axis	Represents number of events.
Breakdown options	"Using the J2EE & .NET Breakdown Options" on page 247
See also	"J2EE & .NET Diagnostics Graphs Overview" on page 240

Example

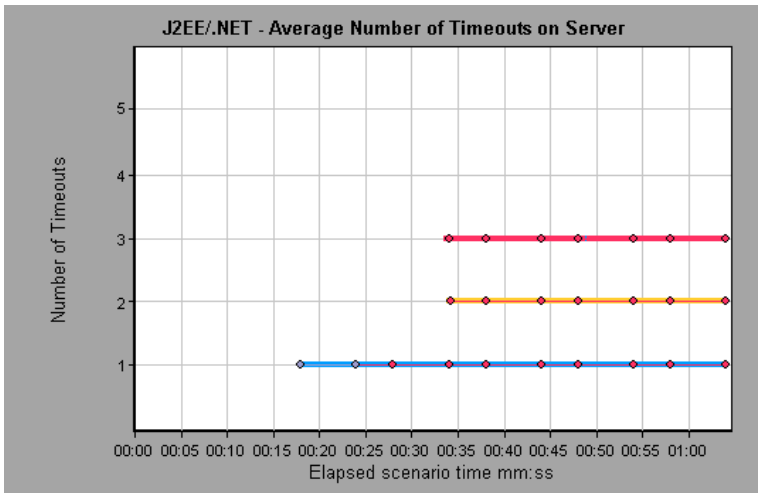


J2EE/.NET - Average Number of Timeouts on Server Graph

This graph displays the average number of timeouts per method that were monitored during the selected time range.

X-axis	Elapsed time since the scenario run.
Y-axis	Number of events.
Breakdown options	"Using the J2EE & .NET Breakdown Options" on page 247
See also	"J2EE & .NET Diagnostics Graphs Overview" on page 240

Example

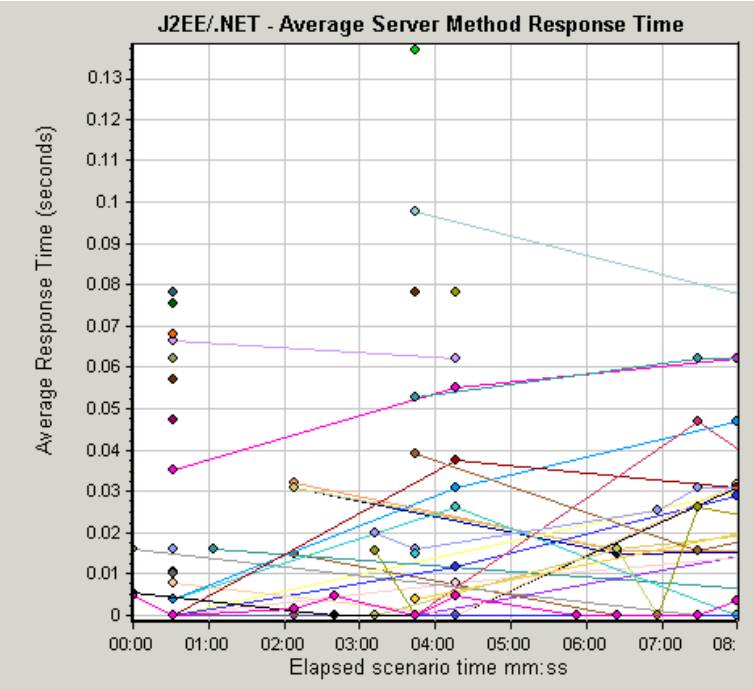


J2EE/.NET - Average Server Method Response Time Graph

This graph displays the average response time for the server side methods, computed as Total Method Response Time/Number of Method calls.

X-axis	Elapsed time since the scenario run.
Y-axis	Average response time (in seconds) per method.
Breakdown options	"Using the J2EE & .NET Breakdown Options" on page 247
Note	The method time does not include calls made from the method to other methods.
See also	"J2EE & .NET Diagnostics Graphs Overview" on page 240

Example



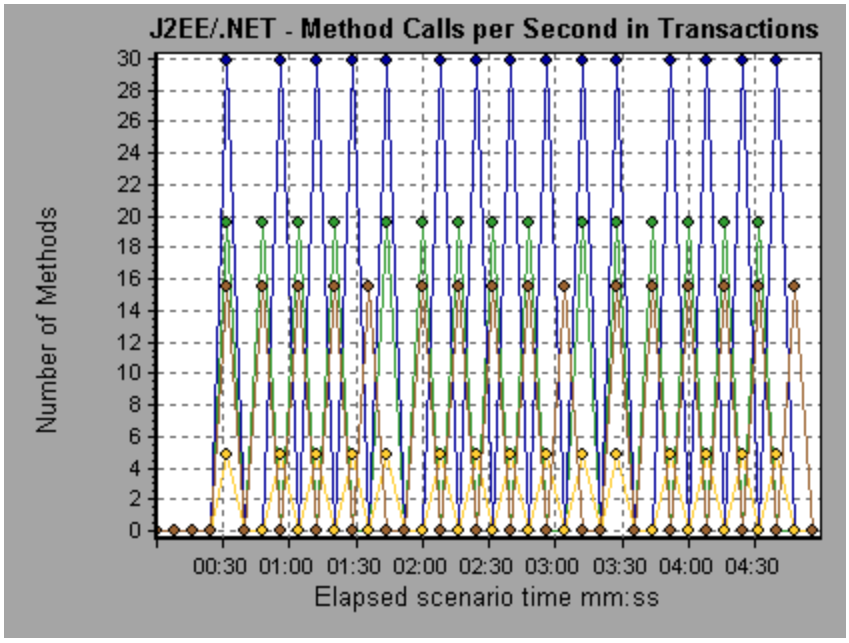
J2EE/.NET - Method Calls per Second in Transactions Graph

This graph displays the number of completed sampled transactions during each second of a load test scenario run.

The number of transactions included in the sample is determined by the sampling percentage set in the Diagnostics Distribution dialog box in the Controller (**Diagnostics > Configuration**).

X-axis	Elapsed time.
Y-axis	Represents the number of completed sampled transactions per second.
Breakdown options	To break the displayed elements down further, see "Using the J2EE & .NET Breakdown Options" on page 247.
See also	"J2EE & .NET Diagnostics Graphs Overview" on page 240

Example



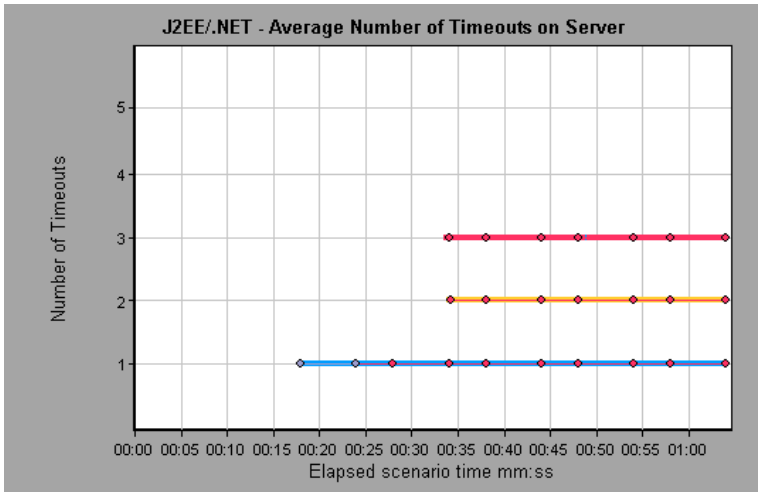
J2EE/.NET - Probes Metrics Graph

This graph displays performance metrics collected by HP Diagnostics probes. Metrics include JVM related data such as Heap usage and Garbage Collection, application server specific metrics, JDBC (Java Database Connectivity) metrics, and more.

X-axis	Elapsed time since the scenario run.
Y-axis	Resource usage. The following probe metric data is provided for offline analysis: • **HeapUsed** • **GC Collections/sec** • **GC time Spent in Collections** To include additional Probe metric data in offline Analysis, you use the Diagnostics configuration file, **etc./offline.xml**. For more information, see the *HP Diagnostics Server Installation and Administration Guide*.

Data Grouping	By default, the data in the graph is grouped by Category Name (the Diagnostics metric category name) and Probe Name. As a result, the default format for the measurement name is the graph is: <Name of metric from Diagnostics (unit of metric)>:<Diagnostics metric category name>:<Probe name> If the measurement unit is a count, no unit name is displayed in parentheses.
Important Information	By default, the following probe metric data is provided for offline analysis: **HeapUsed**, **GC Collections/sec**, and **GC time Spent in Collections**. To include additional Probe metric data in offline Analysis, you use the Diagnostics configuration file, **etc/offline.xml**. For more information, see the *HP Diagnostics LoadRunner and Performance Center-Diagnostics Integration Guide* . For example, for the following measurement name: • the name of the metric is **GC Time Spent in Collections**. • the value is measured as a percentage. • the metric category name is **GC**. • the Probe name is **MyJBossDev** In addition to the regular Analysis filter criteria, you can also filter and group by the Diagnostics metrics collector name and the host name.
Note	You need to synchronize the operating system time settings on the Controller machine and the Diagnostics Servers to ensure accurate display of the elapsed scenario time in the Probe Metrics graph.
See also	"J2EE & .NET Diagnostics Graphs Overview" on page 240

Example

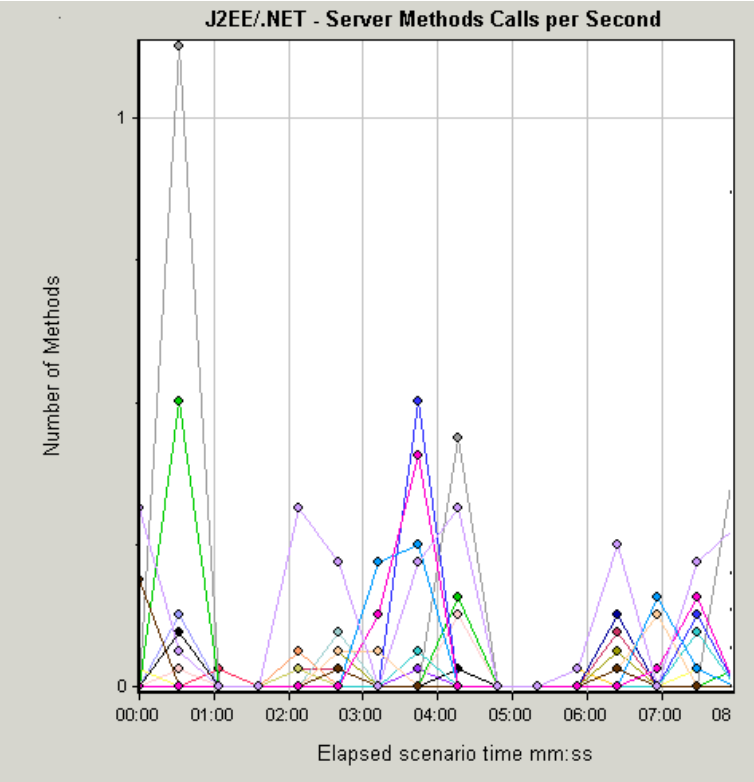


J2EE/.NET - Server Methods Calls per Second Graph

This graph displays the number of completed sampled methods during each second of a load test scenario run.

X-axis	Elapsed time of the scenario run.
Y-axis	Number of completed sampled methods per second.
Breakdown options	"Using the J2EE & .NET Breakdown Options" on page 247
Note	The number of methods included in the sample is determined by the sampling percentage set in the Diagnostics Distribution dialog box in the Controller (**Diagnostics > Configuration**).
See also	"J2EE & .NET Diagnostics Graphs Overview" on page 240

Example

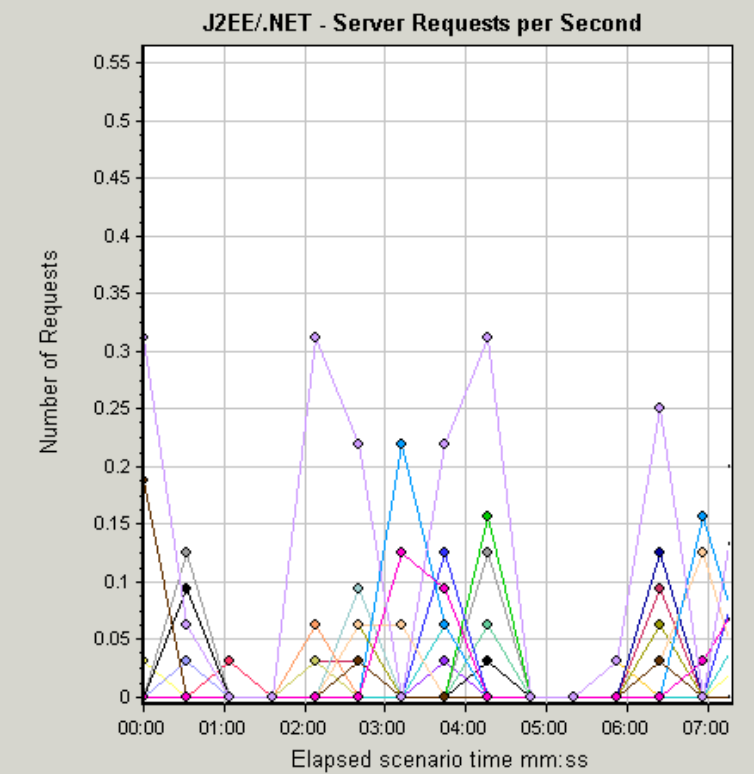


J2EE/.NET - Server Requests per Second Graph

This graph displays the number of completed sampled requests during each second of a load test scenario run.

X-axis	Elapsed time of the scenario run.
Y-axis	Number of completed sampled requests per second.
Breakdown options	"Using the J2EE & .NET Breakdown Options" on page 247
Note	The number of requests included in the sample is determined by the sampling percentage set in the Diagnostics Distribution dialog box in the Controller (**Diagnostics > Configuration**). For more information, see the section on online monitors in the LoadRunner Controller documentation.
See also	"J2EE & .NET Diagnostics Graphs Overview" on page 240

Example



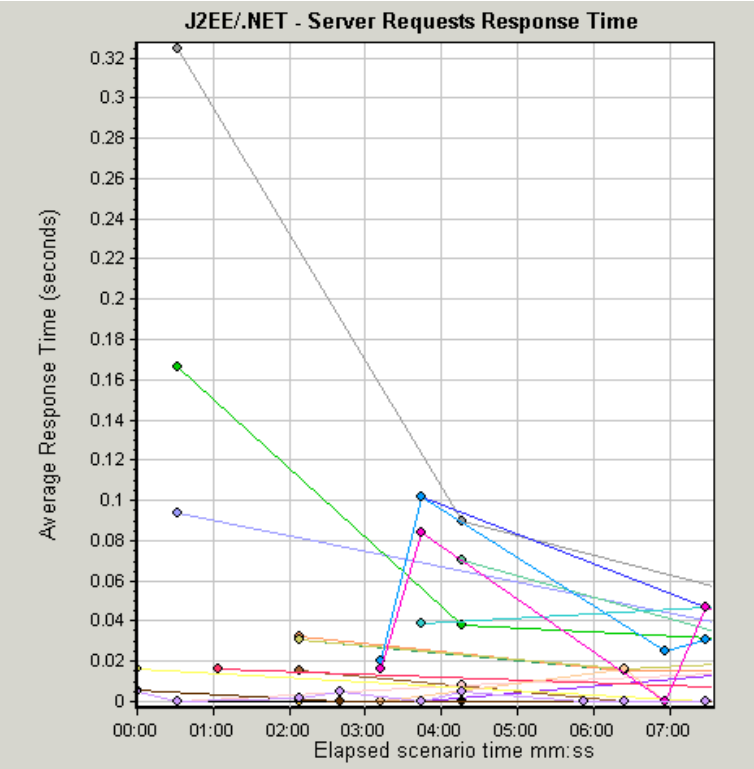
J2EE/.NET - Server Request Response Time Graph

This graph displays the server response time of requests that include steps that cause activity on the J2EE/.NET backend.

X-axis	Elapsed time of the scenario time.
Y-axis	Average time (in seconds) taken to perform each request.

Breakdown options	"Using the J2EE & .NET Breakdown Options" on page 247
Note	The reported times, measured from the point when the request reached the Web server to the point it left the Web server, include only the time that was spent in the J2EE/.NET backend.
See also	"J2EE & .NET Diagnostics Graphs Overview" on page 240

Example



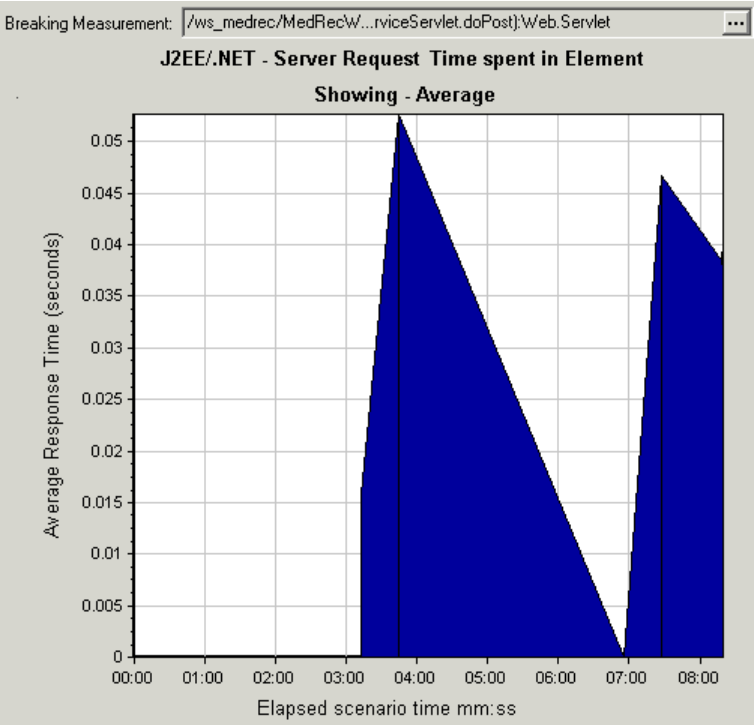
J2EE/.NET - Server Request Time Spent in Element Graph

This graph displays the server response time for the selected element (layer, class, or method) within each server request.

Purpose	The time is computed as Total Response Time/Total Number of Server Requests. For example, if a method was executed twice by an instance of server request A and once by another instance of the same server request, and it took three seconds for each execution, the average response time is 9/2, or 4.5 seconds. The server request time does not include the nested calls from within each server request.
X-axis	Elapsed time of the scenario run.

Y-axis	Average response time (in seconds) per element within the server request.
Breakdown options	"Using the J2EE & .NET Breakdown Options" on page 247
Filtering properties	The display of the graph is determined by the Graph Properties selected when the graph is opened, as described: **None** • Time spent in each server request **Server request** • Filtered by server request. Grouped by layer. **Server request and layer** • Filtered by server request and layer. Grouped by class. **Server request, layer, and class** • Filtered by server request, layer, and class. Grouped by method.
Tips	To obtain data for this graph, you must first install HP Diagnostics. Before you can view Diagnostics for J2EE & .NET data in a particular load test scenario, you need to configure the Diagnostics parameters for that scenario. For more information, see the section on online monitors in the LoadRunner Controller documentation.
See also	"J2EE & .NET Diagnostics Graphs Overview" on page 240

Example



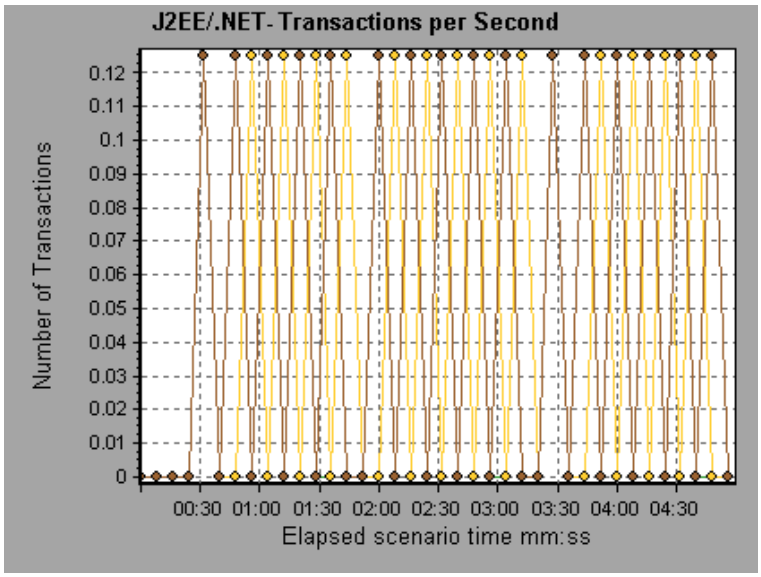
J2EE/.NET - Transactions per Second Graph

This graph displays the number of completed sampled transactions during each second of a load test scenario run.

The number of transactions included in the sample is determined by the sampling percentage set in the Diagnostics Distribution dialog box in the Controller (**Diagnostics > Configuration**). For more information, see the section on online monitors in the LoadRunner Controller documentation.

X-axis	Elapsed time.
Y-axis	Number of completed sampled transactions per second
Breakdown options	To break the displayed elements down further, see "Using the J2EE & .NET Breakdown Options" on page 247.
See also	"J2EE & .NET Diagnostics Graphs Overview" on page 240

Example

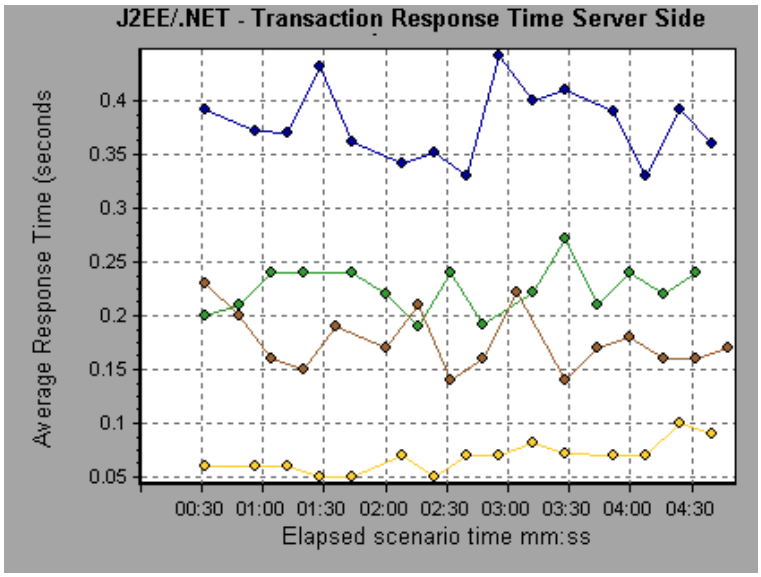


J2EE/.NET - Transaction Response Time Server Side Graph

This graph displays the transaction server response time of transactions that include steps that cause activity on the J2EE/.NET backend. The reported times, measured from the point when the transaction reached the Web server to the point it left the Web server, include only the time that was spent in the J2EE/.NET backend.

X-axis	Elapsed time.
Y-axis	Average response time (in seconds) of each transaction.
Breakdown options	"Using the J2EE & .NET Breakdown Options" on page 247
See also	"J2EE & .NET Diagnostics Graphs Overview" on page 240

Example

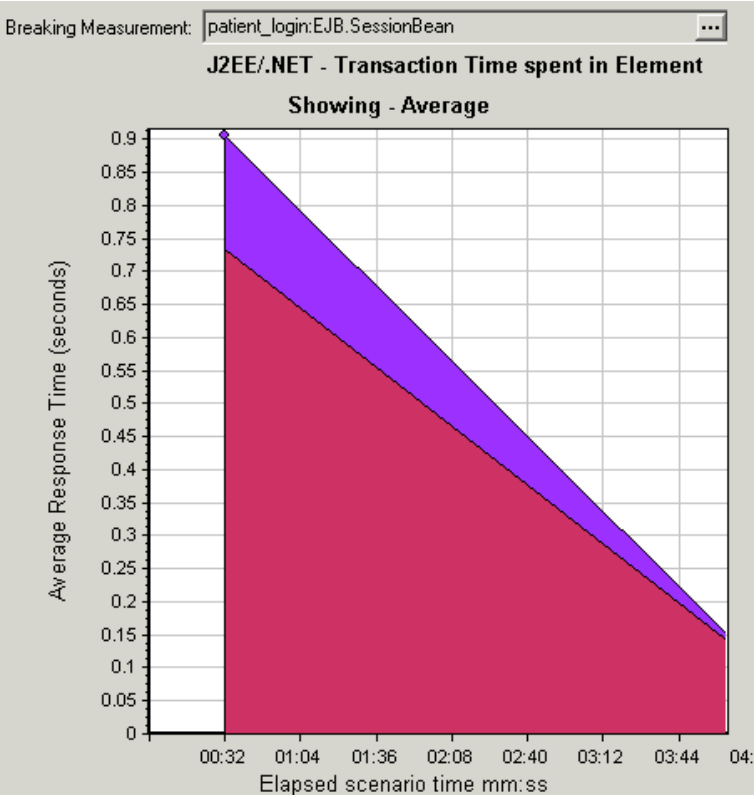


J2EE/.NET - Transaction Time Spent in Element Graph

This graph displays the server response time for the selected element (layer, class, or method) within each transaction.

X-axis	Elapsed time.
Y-axis	Average response time (in seconds) per element within the transaction.
Breakdown options	The display of graph data is determined by the graph properties selected when the graph was opened, as described in the following table: For information on filtering on graph data, see "Filtering Graph Data Overview" on page 103. You can break down the displayed elements. For more information, see "Using the J2EE & .NET Breakdown Options" on page 247.
Tips	To obtain data for this graph, you must enable the J2EE & .NET Diagnostics module (from the Controller) before running the load test scenario.
Note	The time is computed as Total Response Time/Total Number of Transactions. For example, if a method was executed twice by an instance of transaction A and once by another instance of the same transaction, and it took three seconds for each execution, the average response time is 9/2, or 4.5 seconds. The transaction time does not include the nested calls from within each transaction.
See also	"J2EE & .NET Diagnostics Graphs Overview" on page 240 "Filtering and Sorting Graph Data" on page 103

Example



Graph Data Display

If you filter by these properties...	The graph data is displayed like this
None	Time spent in each transaction.
Transaction	Filtered by transaction. Grouped by layer.
Transaction and layer	Filtered by transaction and layer. Grouped by class.
Transaction, layer, and class	Filtered by transaction, layer, and class. Grouped by method.

Application Component Graphs

Microsoft COM+ performance graphs provide you with performance information for COM+ interfaces and methods.

To obtain data for these graphs, you need to activate the various Microsoft COM+ performance monitors before running the load test scenario.

When you set up the Microsoft COM+ performance online monitors, you indicate which statistics and measurements to monitor.

The **.NET CLR performance graphs** provide you with performance information for .NET classes and methods. To obtain data for these graphs, you must activate the .NET CLR performance monitor before running the load test scenario run.

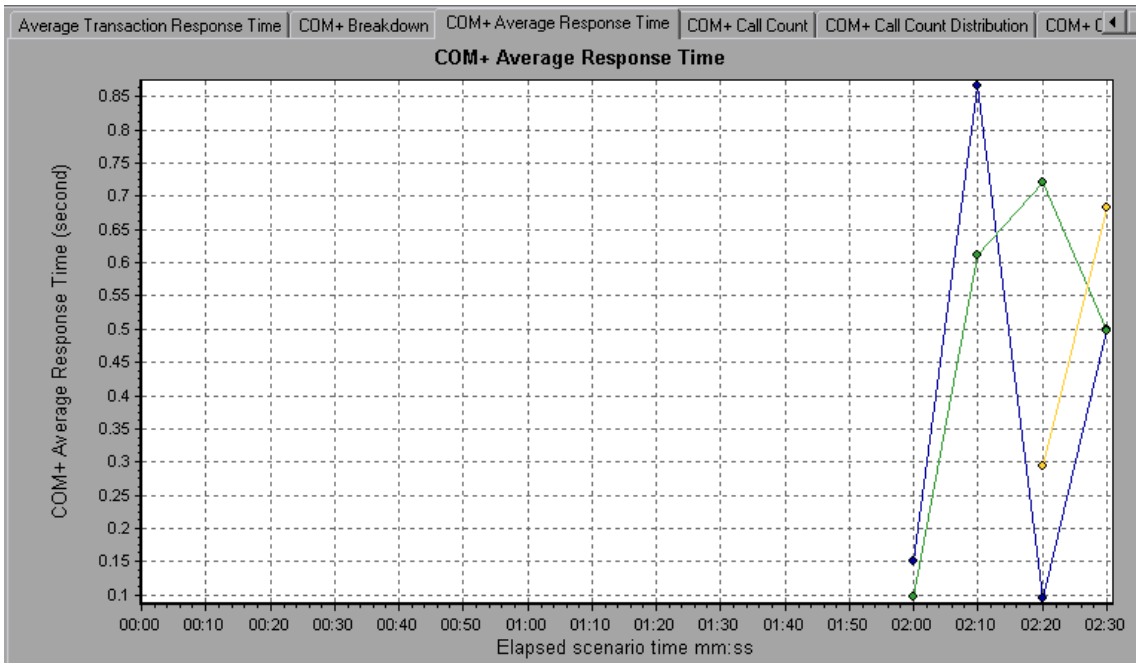
Displayed measurements are specified using the .NET monitor.

For more information, see the section on online monitors in the LoadRunner Controller documentation.

COM+ Average Response Time Graph

This graph specifies the average time COM+ interfaces or methods take to perform during the load test scenario.

X-axis	Elapsed time from the beginning of the scenario run.
Y-axis	Average response time of a COM+ interface or method.
Breakdown options	Each interface or method is represented by a different colored line on the graph. The legend frame (which is found below the graph) identifies the interfaces by color: Color | Scale | Measurement | Minimum | Average | Maximum ☑ 1 ContrRnd\COMPlusServer.ConstTime\IDispatch 0.096 0.499 1.501 ☑ 1 ContrRnd\COMPlusServer.ConstTime_ConstTime 0 0.5 1.502 ☑ 1 ContrRnd\COMPlusServer.RandomTime_RandomTime 0.058 0.391 0.747 This legend shows that the blue colored line belongs to the COM+ interface **_ ConstTime.** Looking at the graph above, we see that this interface has higher response times than all other COM+ interfaces. At 2:10 minutes into the scenario, it records an average response time of 0.87 seconds. **Note:** The 0.87 second data point is an average, taken from all data points recorded within a 10 second interval (the default granularity). You can change the length of this sample interval. Viewing CON+ Methods The table initially displays COM+ interfaces, but you can also view the list of COM+ methods by using drill-down or filtering techniques. For more information, see "Filtering and Sorting Graph Data" on page 103 and "Drilling Down in a Graph" on page 90.
Tips	To highlight a specific interface line in the graph, select the interface row in the legend.
See also	"Application Component Graphs" on the previous page

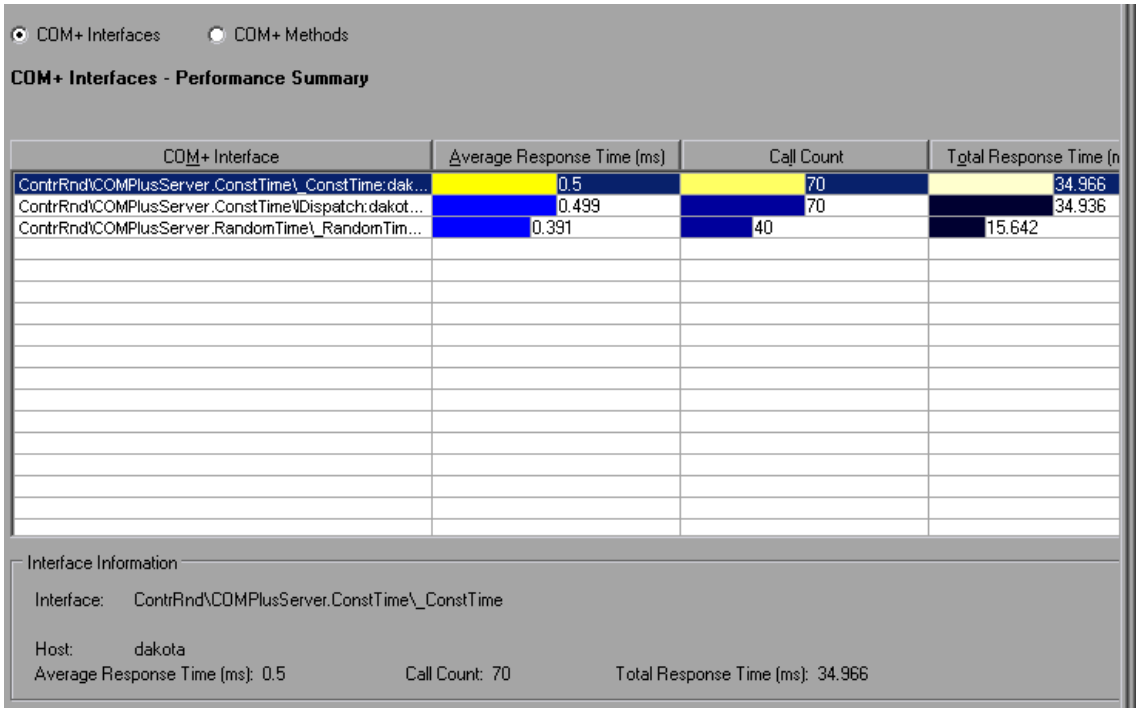


COM+ Breakdown Graph

This graph summarizes fundamental result data about COM+ interfaces or methods and presents it in table format.

Purpose	Using the COM+ Breakdown table, you can identify the COM+ interfaces or methods which consume the most time during the test. The table can be sorted by column, and the data can be viewed either by COM+ interface or COM+ method.
Breakdown options	**Average Response Time** The **Average Response Time** column shows how long, on average, an interface or method takes to perform. The graphical representation of this column is the "COM+ Average Response Time Graph" on the previous page. **Call Count** The next column, **Call Count**, specifies the number of times the interface or method was invoked. The graphical representation of this column is the "COM+ Average Response Time Graph" on the previous page. **Total Response Time** The final column, **Total Response Time**, specifies how much time was spent overall on the interface or method. It is calculated by multiplying the first two data columns together. The graphical representation of this column is the "COM+ Average Response Time Graph" on the previous page.

	The graphical representations of each of these columns are the "COM+ Average Response Time Graph" on page 269, the "COM+ Call Count Distribution Graph" on the next page and the "COM+ Total Operation Time Distribution Graph" on page 275 Interfaces are listed in the **COM+ Interface** column in the form **Interface:Host**. In the table above, the **_ConstTime** interface took an average of .5 seconds to execute and was called 70 times. Overall, this interface took 34.966 seconds to execute.
Tips	**Sorting List** To sort the list by a column, click on the column heading. The list above is sorted by **Average Response Time** which contains the triangle icon specifying a sort in descending order. **Viewing COM+ Methods** The table initially displays COM+ interfaces, but you can also view the list of COM+ methods. To view the methods of a selected interface, select the **COM+ Methods** option. You can also double-click on the interface row to view the methods. The methods of the specified interface are listed in the **COM+ Method** column.
See also	"Application Component Graphs" on page 268



COM+ Call Count Distribution Graph

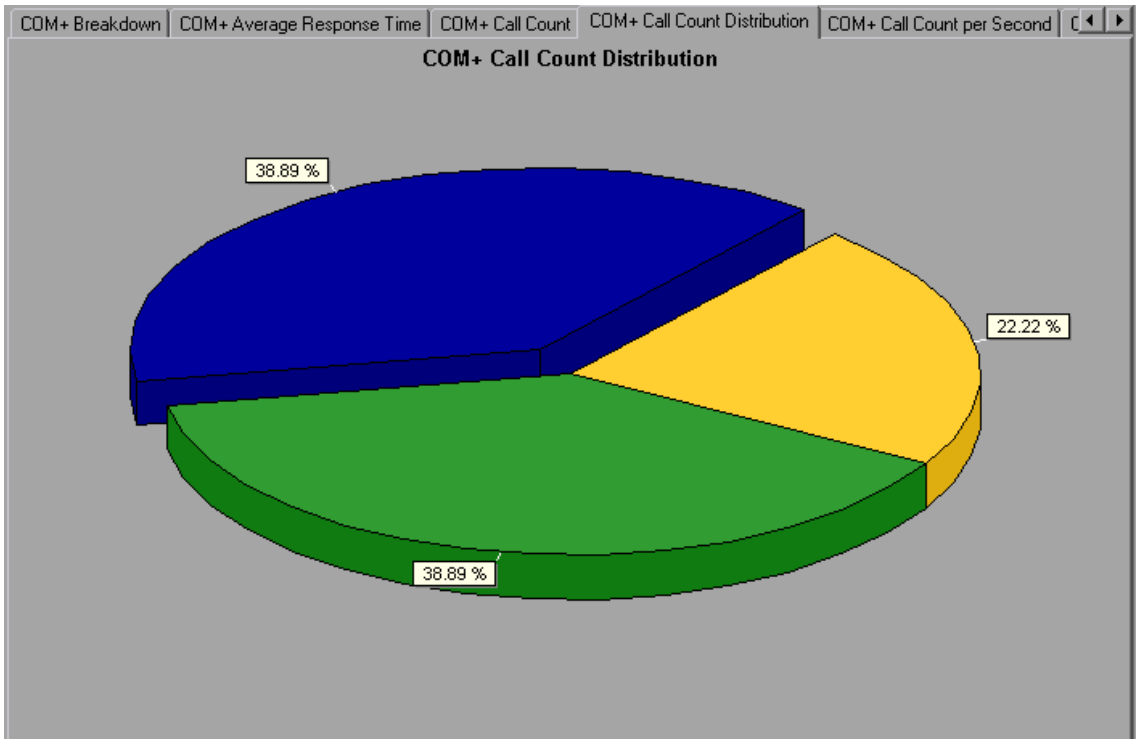
This graph shows the percentage of calls made to each COM+ interface compared to all COM+ interfaces. It can also show the percentage of calls made to a specific COM+ method compared to other methods within the interface

<table>
<tr><td>Breakdown options</td><td>
The number of calls made to the interface or method is listed in the Call Count column of the "COM+ Breakdown Graph" on page 270 table.

Each interface or method is represented by a different colored area on the pie graph. The legend frame (which is found below the graph) identifies the interfaces by color:
<table>
<tr><th>Color</th><th>Scale</th><th>Measurement</th><th>Graph Average</th></tr>
<tr><td></td><td>1</td><td>ContrRnd\COMPlusServer.ConstTime\IDispatch</td><td>70</td></tr>
<tr><td></td><td>1</td><td>ContrRnd\COMPlusServer.ConstTime_ConstTime</td><td>70</td></tr>
<tr><td></td><td>1</td><td>ContrRnd\COMPlusServer.RandomTime_RandomTime</td><td>40</td></tr>
</table>
This legend shows that the green colored area belongs to the COM+ interface IDispatch. Looking at the example graph below, we see that 38.89% of calls are made to this interface. The actual figures can be seen in the Call Count column of the "COM+ Breakdown Graph" on page 270 table.

Viewing COM+ Methods

The table initially displays COM+ interfaces, but you can also view the list of COM+ methods by using drill-down or filtering techniques. For more information, see "Filtering and Sorting Graph Data" on page 103 and "Drilling Down in a Graph" on page 90.
</td></tr>
<tr><td>Tips</td><td>To highlight a specific interface line in the graph, select the interface row in the legend.</td></tr>
<tr><td>See also</td><td>"Application Component Graphs" on page 268</td></tr>
</table>

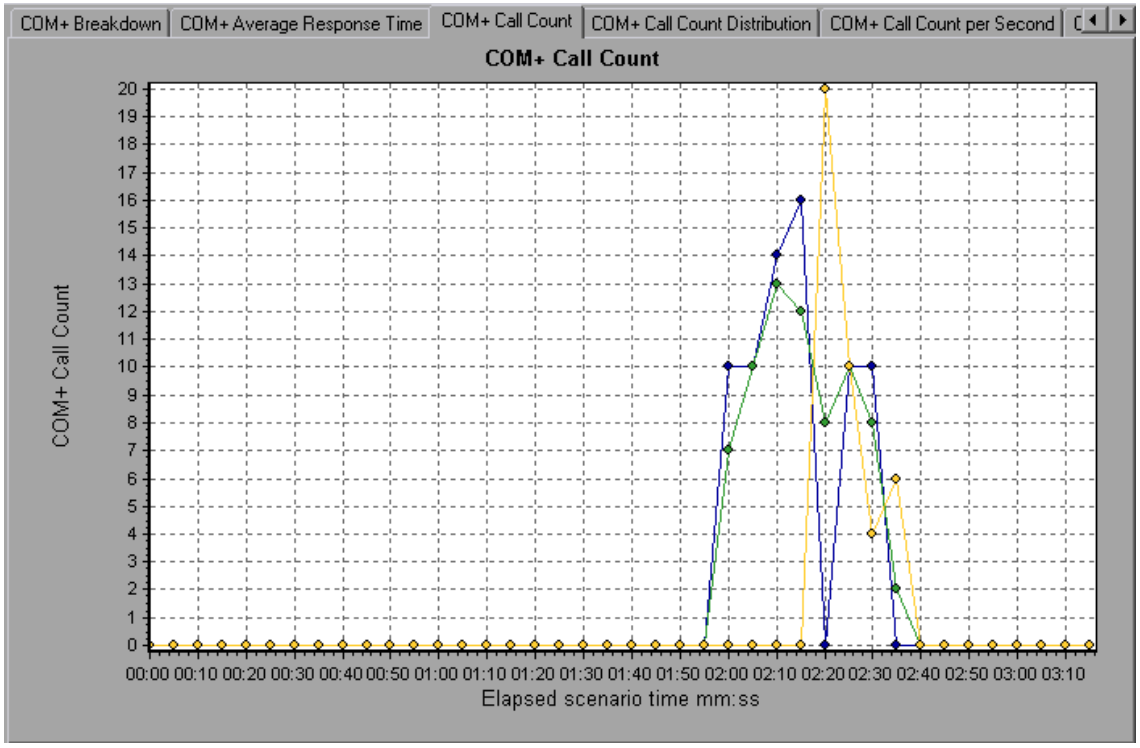


COM+ Call Count Graph

This graph displays the number of times COM+ interfaces and methods are invoked during the test.

X-axis	Elapsed time from the beginning of the scenario run.
Y-axis	How many calls were made to a COM+ interface or method.
Breakdown options	Each interface or method is represented by a different colored line on the graph. The legend frame (which is found below the graph) identifies the interfaces by color: Color | Scale | Measurement | Graph Minimum | Average | Graph Maximum 1 | ContrRnd\COMPlusServer.ConstTime\IDispatch | 0 | 1.777 | 13 1 | ContrRnd\COMPlusServer.ConstTime_ConstTime | 0 | 1.777 | 16 1 | ContrRnd\COMPlusServer.RandomTime_RandomTime | 0 | 1.015 | 20 This legend shows that the yellow colored line belongs to the COM+ interface **_RandomTime.** Looking at the graph above, we see that calls to this interface begin at the beginning of the scenario run. There are 20 calls at the 2:20 minute point. Viewing COM+ Methods The table initially displays COM+ interfaces, but you can also view the list of COM+ methods by using drill-down or filtering techniques. For more information, see "Filtering and Sorting Graph Data" on page 103 and "Drilling Down in a Graph" on page 90.
Note	The call count is computed by multiplying the call frequency by a time interval. As a result, the reported measurement may be rounded.

Tips	To highlight a specific interface line in the graph, select the interface row in the legend.
See also	"Application Component Graphs" on page 268

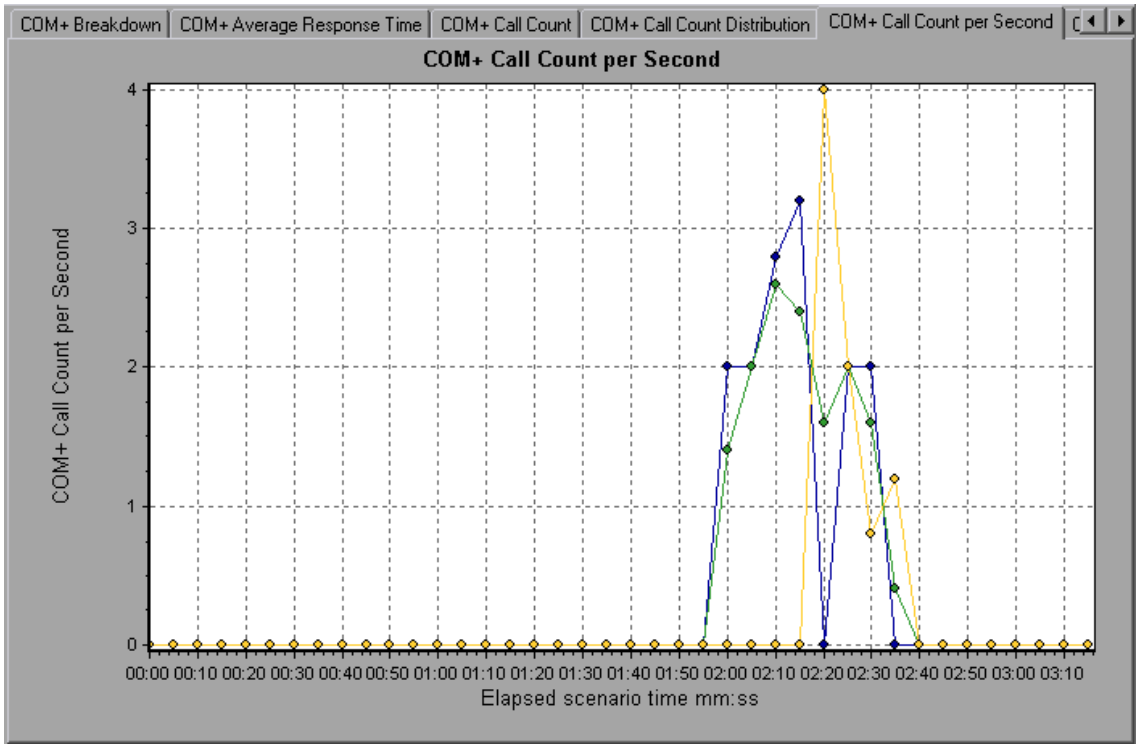


COM+ Call Count Per Second Graph

This graph shows the number of times per second a COM+ interface or method is invoked.

Breakdown options	This graph is similar to the "COM+ Call Count Graph" on the previous page except that the y-axis indicates how many invocations were made to a COM+ interface or method per second. Each interface or method is represented by a different colored line on the graph. The legend frame (which is found below the graph) identifies the interfaces by color: Legend | Graph Details | User Notes | Graph Data | Raw Data Color | Scale | Measurement | Graph Minimum | Average | Graph Maximum 1 | ContrRnd\COMPlusServer.ConstTime\IDispatch | 0 | 0.355 | 2.6 1 | ContrRnd\COMPlusServer.ConstTime_ConstTime | 0 | 0.355 | 3.2 1 | ContrRnd\COMPlusServer.RandomTime_RandomTime | 0 | 0.203 | 4 This legend shows that the green colored line belongs to the COM+ interface **IDispatch.** Looking at the graph above, we see that calls to this interface begins 1:55 minutes into the scenario run. There is an average of 2.5 calls per second at the 2:10 minute mark. Viewing COM+ Methods

	To view the average response time of the individual methods within a COM+ interface, see "Filtering and Sorting Graph Data" on page 103 and "Drilling Down in a Graph" on page 90.
Tips	To highlight a specific interface line in the graph, select the interface row in the legend.
See also	"Application Component Graphs" on page 268



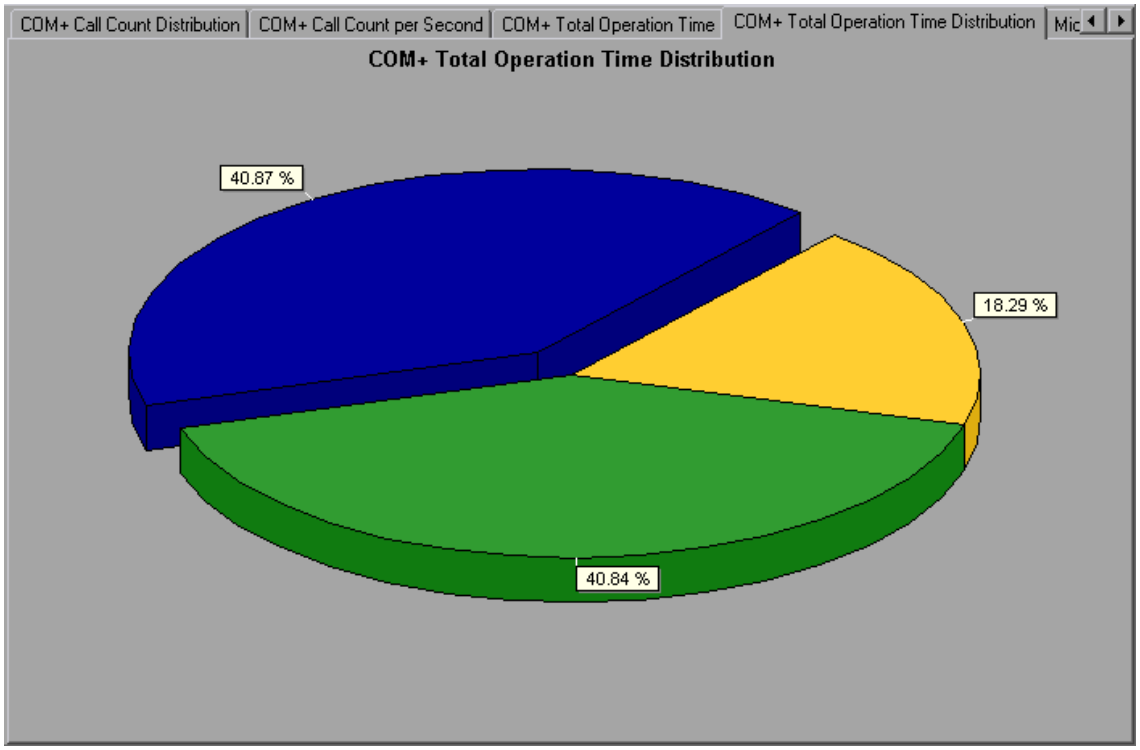
COM+ Total Operation Time Distribution Graph

This graph shows the percentage of time a specific COM+ interface takes to execute in relation to all COM+ interfaces. It can also show the percentage of time a COM+ method takes to execute in relation to all COM+ methods within the interface.

Purpose	Use it to identify those interfaces or methods which take up an excessive amount of time.
Breakdown options	Each interface or method is represented by a different colored area on the pie graph. The legend frame (which is found below the graph) identifies the interfaces by color:

Color	Scale	Measurement	Graph Average
	1	ContrRnd\COMPlusServer.ConstTime\IDispatch	34.936
	1	ContrRnd\COMPlusServer.ConstTime_ConstTime	34.966
	1	ContrRnd\COMPlusServer.RandomTime_RandomTime	15.642

	This legend shows that the green colored line belongs to the COM+ interface **IDispatch.** Looking at the graph above, we see that this interface takes up 40.84% of the COM+ operational time. Viewing COM+ Methods To view the average response time of the individual methods within a COM+ interface, see "Filtering and Sorting Graph Data" on page 103 and "Drilling Down in a Graph" on page 90.
Tips	To highlight a specific interface line in the graph, select the interface row in the legend.
See also	"Application Component Graphs" on page 268

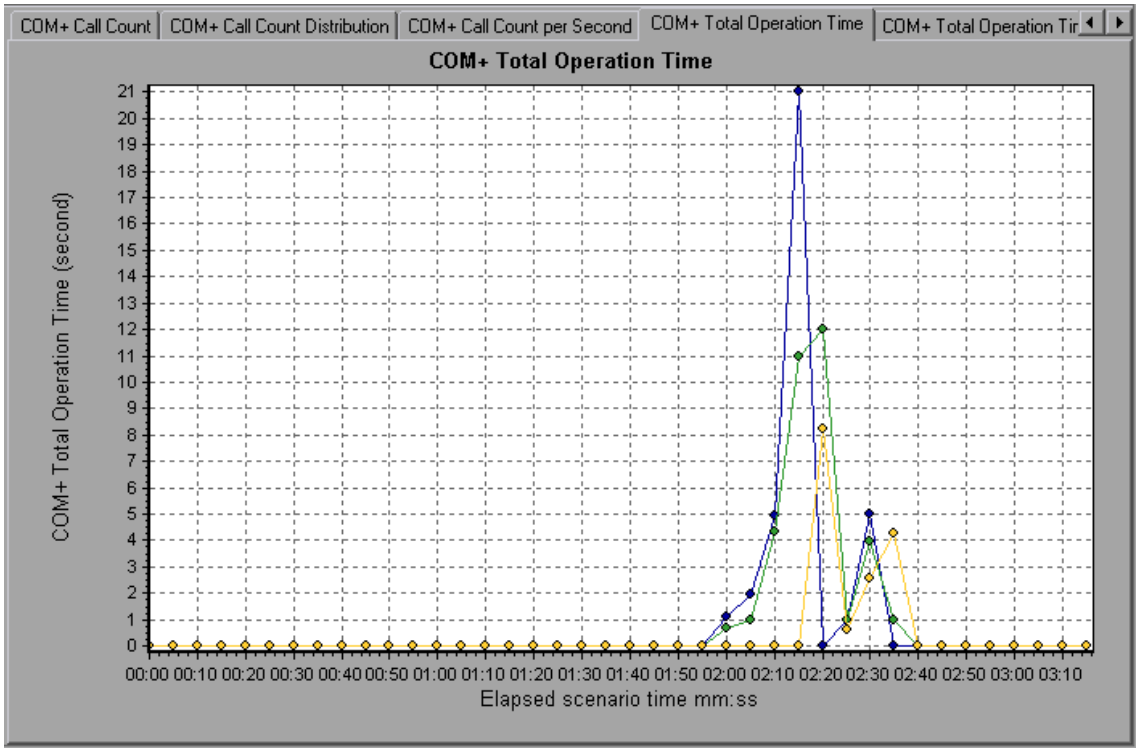


COM+ Total Operation Time Graph

This graph displays the amount of time each COM+ interface or method takes to execute during the test.

Purpose	Use it to identify those interfaces or methods which take up an excessive amount of time.
X-axis	Elapsed time from the beginning of the scenario run.
Y-axis	Total time a COM+ interface or method is in operation.

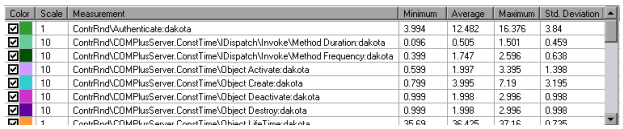
Breakdown options	Each interface or method is represented by a different colored line on the graph. The legend frame (which is found below the graph) identifies the interfaces by color: ☑ 1 ContrRnd\COMPlusServer.ConstTime\IDispatch 0 0.887 12.008 ☑ 1 ContrRnd\COMPlusServer.ConstTime_ConstTime 0 0.887 21.026 ☑ 1 ContrRnd\COMPlusServer.RandomTime_RandomTime 0 0.397 8.24 This legend shows that the blue colored line belongs to the COM+ interface **_ ConstTime.** Looking at the graph above, we see that throughout the scenario, this interface consumes more time than any other, especially at 2 minutes and 15 seconds into the scenario run, where the calls to this interface take an average of 21 seconds. Viewing COM+ Methods The table initially displays COM+ interfaces, but you can also view the list of COM+ methods by using drill-down or filtering techniques. For more information, see "Filtering and Sorting Graph Data" on page 103 and "Drilling Down in a Graph" on page 90.
Tips	To highlight a specific interface line in the graph, select the interface row in the legend.
See also	"Application Component Graphs" on page 268



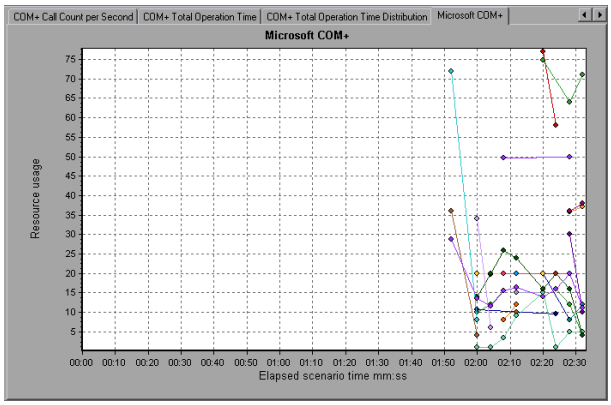
Microsoft COM+ Graph

This graph shows the resource usage of COM+ objects as a function of the elapsed load test scenario time.

X-axis	Elapsed time since the start of the run.
Y-axis	The resource usage of COM+ objects.
Breakdown Options	Each COM+ object is represented by a different colored line on the graph. The legend frame (which is found below the graph) identifies the objects by color:
See also	"Application Component Graphs" on page 268



Color	Scale	Measurement	Minimum	Average	Maximum	Std. Deviation
	1	ContrRnd\Authenticate:dakota	3.994	12.482	16.376	3.84
	10	ContrRnd\COMPlusServer.ConstTime\IDispatch\Invoke\Method Duration:dakota	0.096	0.505	1.501	0.459
	10	ContrRnd\COMPlusServer.ConstTime\IDispatch\Invoke\Method Frequency:dakota	0.399	1.747	2.596	0.638
	10	ContrRnd\COMPlusServer.ConstTime\Object Activate:dakota	0.599	1.997	3.395	1.398
	10	ContrRnd\COMPlusServer.ConstTime\Object Create:dakota	0.799	3.995	7.19	3.195
	10	ContrRnd\COMPlusServer.ConstTime\Object Deactivate:dakota	0.999	1.998	2.996	0.998
	10	ContrRnd\COMPlusServer.ConstTime\Object Destroy:dakota	0.999	1.998	2.996	0.998



Authentication Metrics

Measurement	Description
Authenticate	Frequency of successful method call level authentication. When you set an authentication level for an application, you determine what degree of authentication is performed when clients call into the application.
Authenticate Failed	Frequency of failed method call level authentication.

Application Event

Measurement	Description
Activation	Frequency of application activation or startup.
Shutdown	Frequency of application shutdown or termination.

Thread Event

Measurement	Description
Thread Start	Rate at which single-threaded apartment (STA) thread for application have been started.
Thread Terminate	Rate at which single-threaded apartment (STA) thread for application have been terminated.
Work Enque	Event sent if a work is queued in single thread apartment object (STA). Note: These events are not signaled/sent in Windows Server 2003 and later.
Work Reject	Event sent if a work is rejected from single thread apartment object (STA). Note: These events are not signaled/sent in Windows Server 2003 and later.

Transaction Events

Measurement	Description
Transaction Duration	Duration of COM+ transactions for selected application.
Transaction Start	Rate at which transactions have started.
Transaction Prepared	Rate at which transactions have completed the prepare phase of the two-phase protocol.
Transaction Aborted	Rate at which transactions have been aborted.
Transaction Commit	Rate at which transactions have completed the commit protocol.

Object Events

Measurement	Description
Object Life Time	Duration of object existence (from instantiation to destruction).
Object Create	Rate at which new instances of this object are created.
Object Destroy	Rate at which instances of the object are destroyed.

Measurement	Description
Object Activate	Rate of retrieving instances of a new JIT-activated object.
Object Deactivation	Rate of freeing JIT-activated object via SetComplete or SetAbort.
Disable Commit	Rate of client calls to DisableCommit on a context. DisableCommit declares that the object's transactional updates are inconsistent and can't be committed in their present state.
Enable Commit	Rate of client calls to EnableCommit on a context. EnableCommit declares that the current object's work is not necessarily finished, but that its transactional updates are consistent and could be committed in their present form.
Set Complete	Rate of client calls to SetComplete on a context. SetComplete declares that the transaction in which the object is executing can be committed, and that the object should be deactivated on returning from the currently executing method call.
Set Abort	Rate of client calls to SetAbort on a context. SetAbort declares that the transaction in which the object is executing must be aborted, and that the object should be deactivated on returning from the currently executing method call.

Method Events

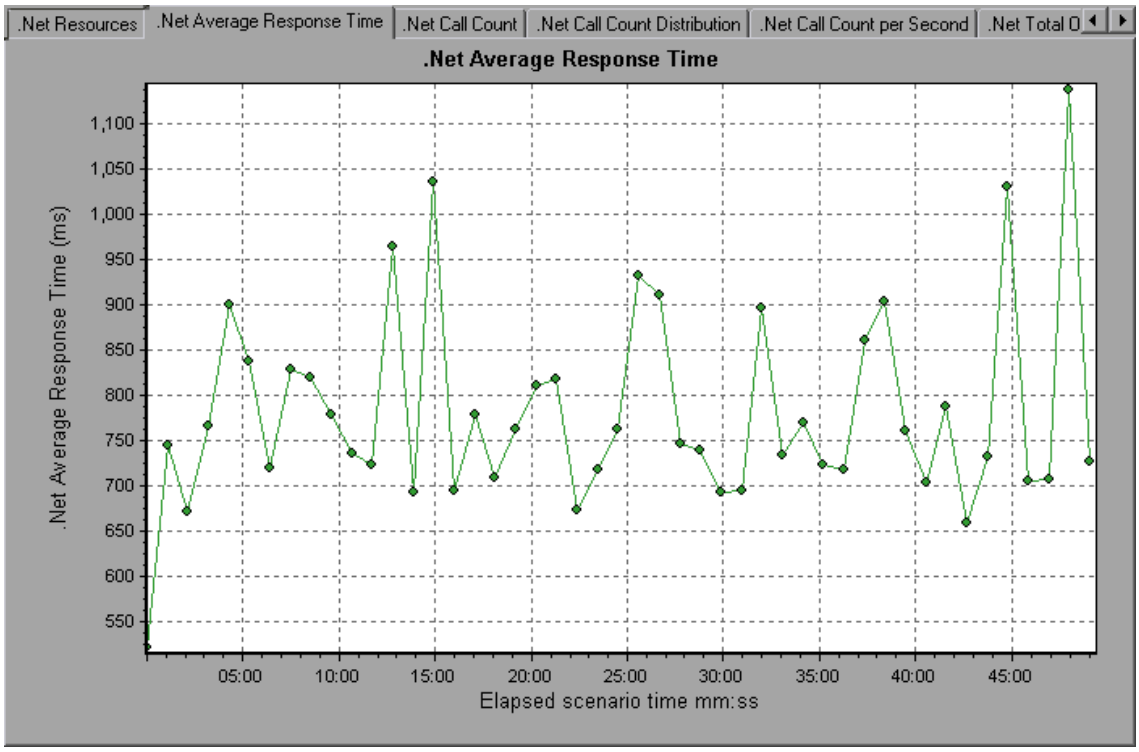
Measurement	Description
Method Duration	Average duration of method.
Method Frequency	Frequency of method invocation.
Method Failed	Frequency of failed methods (i.e. methods that return error HRESULT codes).
Method Exceptions	Frequency of exceptions thrown by selected method.

.NET Average Response Time Graph

This graph specifies the average time that .NET classes or methods took to perform during the load test scenario run.

X-axis	Elapsed time from the beginning of the scenario run.
Y-axis	Average response time of a .NET class or method.
Breakdown	The graph initially displays .NET classes, but you can also view the individual methods

options	within a .NET class by using drill-down or filtering techniques. For more information, see "Filtering and Sorting Graph Data" on page 103 and "Drilling Down in a Graph" on page 90.
Tips	You can change the length of the sample interval. **Hint**: To highlight a specific class line in the graph, select the class row in the legend (displayed below the graph).
See also	"Application Component Graphs" on page 268

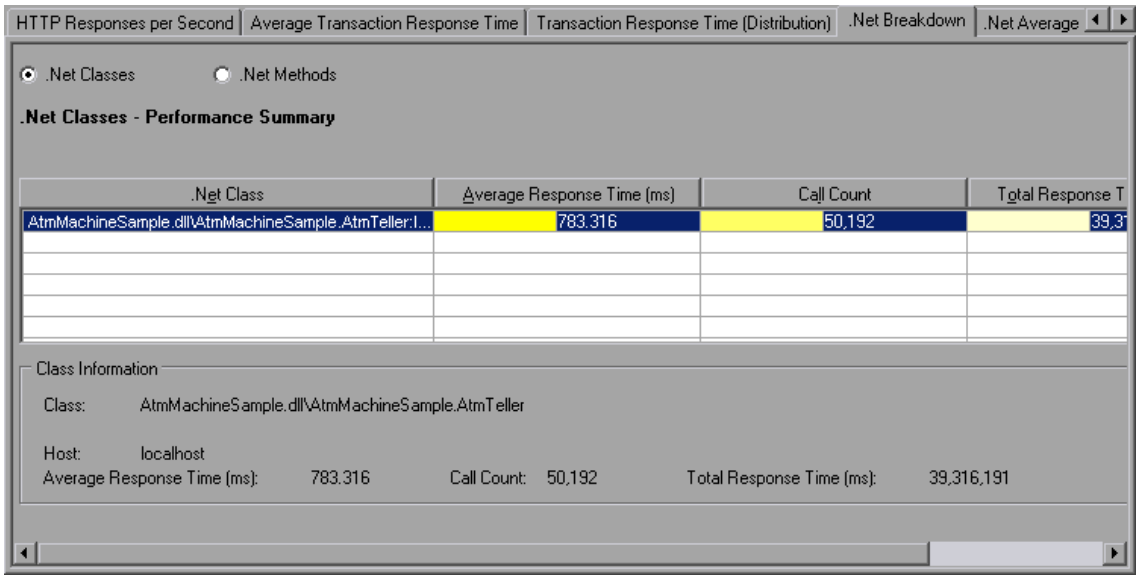


.NET Breakdown Graph

This graph summarizes fundamental result data about .NET classes or methods and presents it in table format.

Purpose	Using the .NET Breakdown table, you can identify the .NET classes or methods which consume the most time during the test. The table can be sorted by column, and the data can be viewed either by .NET class or .NET method.
Breakdown options	The **Average Response Time** column shows how long, on average, a class or method took to perform. The next column, **Call Count**, specifies the number of times the class or method was invoked. The final column, **Total Response Time**, specifies how much time was spent overall on the class or method. It is calculated by multiplying the results from the first two columns together.

	Classes are listed in the **.NET Class** column in the form **Class:Host**. In the table above, the **AtmMachineSample.AtmTeller** class took an average of 783 seconds to execute and was called 50,912 times. Overall, this class took 39,316 seconds to execute. To sort the list by a column, click the column heading. Each column in the .NET Breakdown graph is graphically represented by another graph. The table initially displays .NET classes, but you can also view the list of .NET methods. To view .NET methods, select the **.NET Methods** option, or double-click the class row. The methods of the specified class are listed in the **.NET Method** column.
See also	"Application Component Graphs" on page 268



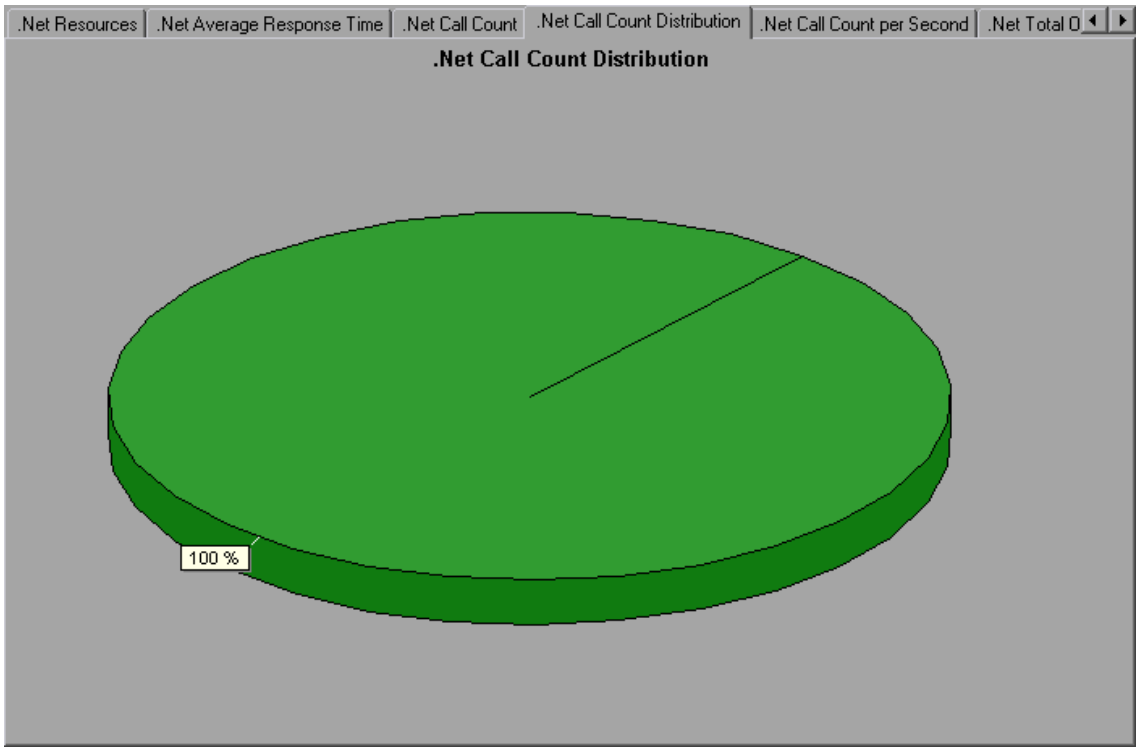
.NET Breakdown graph

.NET Breakdown Column	Graphical Representation
Average Response Time	.NET Average Response Time Graph.
Call Count	.NET Call Count Graph.
Total Response Time	.NET Total Operation Time Distribution Graph.

.NET Call Count Distribution Graph

This graph shows the percentage of calls made to each .NET class compared to all .NET classes. It can also show the percentage of calls made to a specific .NET method compared to other methods within the class

Breakdown options	The number of calls made to the class or method is listed in the **Call Count** column of the .NET Breakdown graph table. The graph initially displays .NET classes, but you can also view the individual methods within a .NET class by using drill-down or filtering techniques. For more information, see "Filtering and Sorting Graph Data" on page 103 and "Drilling Down in a Graph" on page 90.
Tips	To highlight a specific class line in the graph, select the class row in the legend (displayed below the graph).
See also	"Application Component Graphs" on page 268

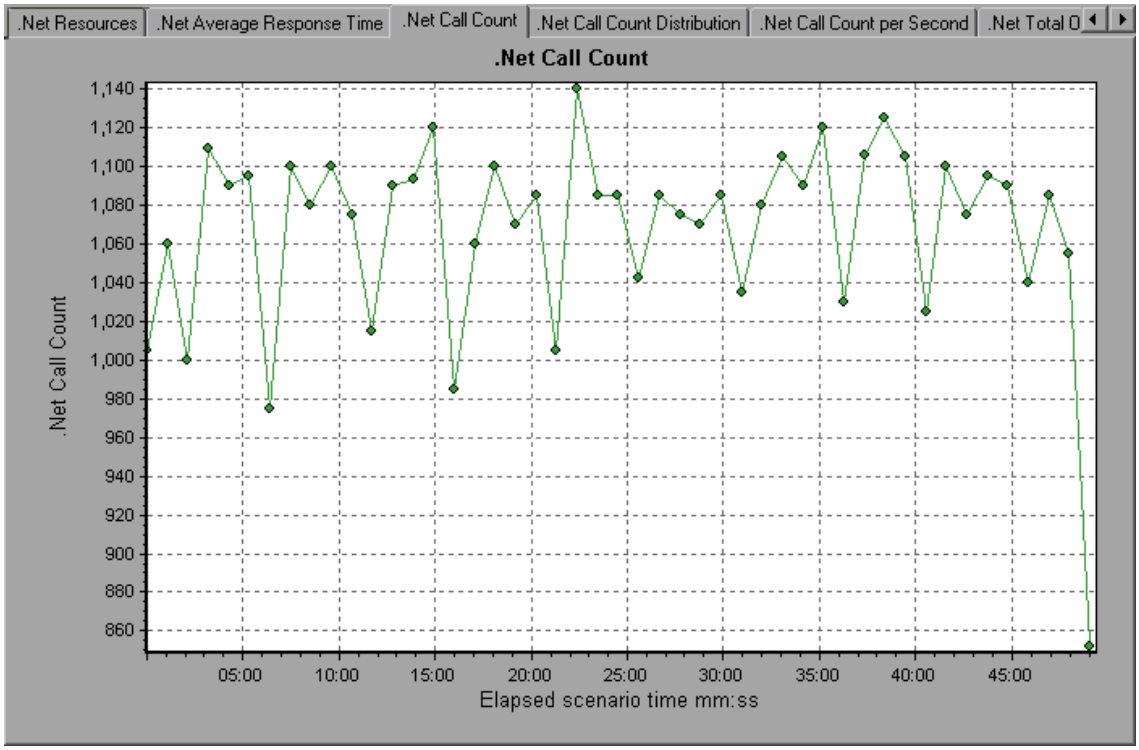


.NET Call Count Graph

This graph displays the number of times that .NET classes and methods are invoked during the test.

X-axis	Elapsed time from the beginning of the scenario run.
Y-axis	Indicates how many calls were made to a .NET class or method.
Breakdown options	The graph initially displays .NET classes, but you can also view the individual methods within a .NET class by using drill-down or filtering techniques. For more information, see "Filtering and Sorting Graph Data" on page 103 and "Drilling Down in a Graph" on page 90.

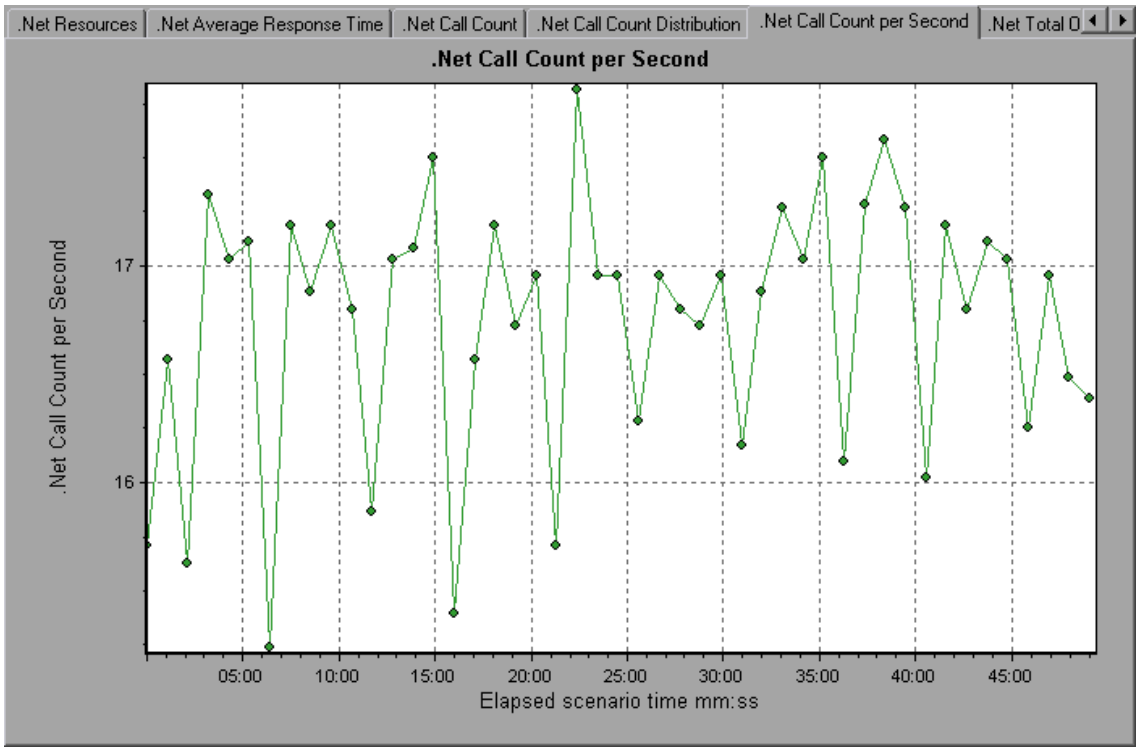
Tips	To highlight a specific class line in the graph, select the class row in the legend (displayed below the graph).
Note	The call count is computed by multiplying the call frequency by a time interval. As a result, the reported measurement may be rounded.
See also	"Application Component Graphs" on page 268



.NET Call Count per Second Graph

This graph shows the number of times per second that a .NET class or method is invoked.

Breakdown options	This graph is similar to the .NET Call Count graph except that the y-axis indicates how many invocations were made to a .NET class or method per second. The graph initially displays .NET classes, but you can also view the individual methods within a .NET class by using drill-down or filtering techniques. For more information, see "Filtering and Sorting Graph Data" on page 103 and "Drilling Down in a Graph" on page 90.
Tips	To highlight a specific class line in the graph, select the class row in the legend (displayed below the graph).
See also	"Application Component Graphs" on page 268



.NET Resources Graph

This graph shows the resource usage of .NET methods as a function of the elapsed load test scenario time.

Breakdown options

Each .NET method is represented by a different colored line on the graph. The legend frame (located below the graph) identifies the methods by color:

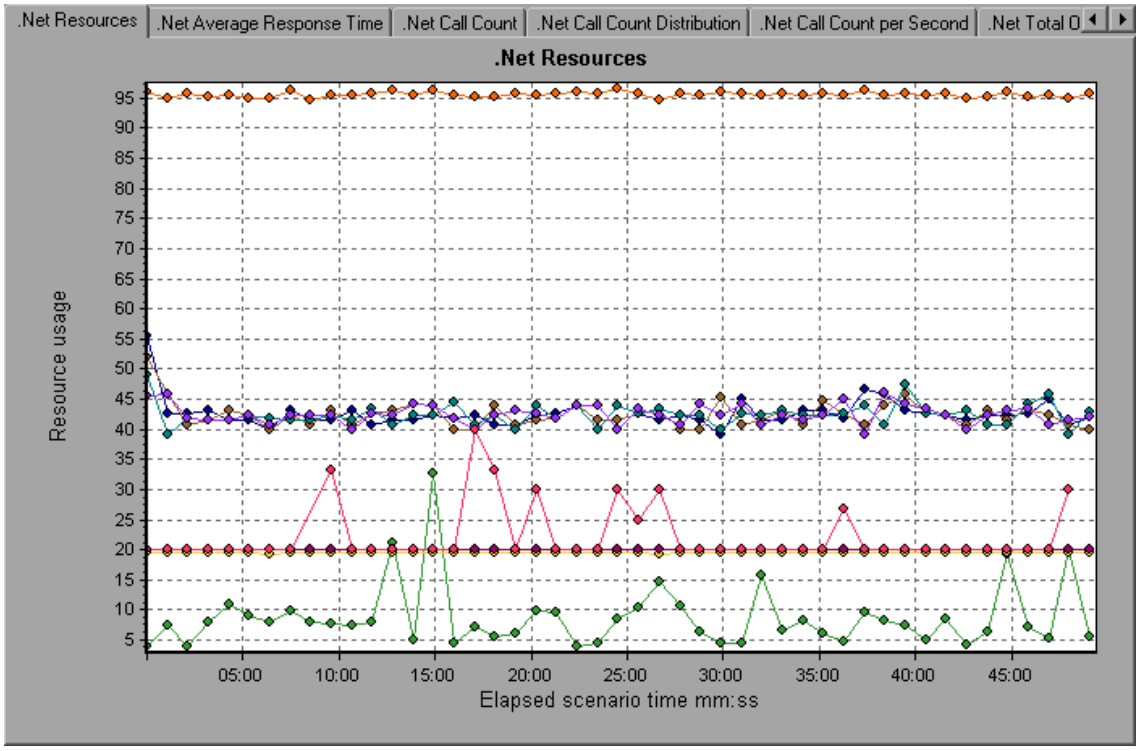
Color	Scale	Measurement	Minimum	Average	Maximum
☑	0.01	AtmMachineSample.dll\AtmMachineSample.At...	390.749	888.061	37848.727
☑	10	AtmMachineSample.dll\AtmMachineSample.At...	1	4.244	10
☑	0.1	AtmMachineSample.dll\AtmMachineSample.At...	190.944	194.783	207.318
☑	10	AtmMachineSample.dll\AtmMachineSample.At...	1	4.235	10

You can monitor .NET counters at the application, assembly, class, and method levels. Measurements that take place before the application is fully loaded (such as Assembly Load Time, that measures the time it takes to load an assembly) will not be measured.

The following tables describe the counters that can be measured at each level. All durations are reported in seconds, and all frequencies are reported per five-second polling periods. For example, if 20 events occur in a 5 second polling period, the reported frequency is 4.

- "Application Level" on the next page
- "Assembly Level" on page 288
- "Class Level" on page 288

	• "Method Level" on page 288
See also	"Application Component Graphs" on page 268



Application Level

Measurement	Description
Application Lifetime	Monitors the duration of the application in seconds.
Exception Frequency	Monitors the number of exceptions per second, in the five second polling period.
JIT (Just In Time) Duration	Monitors the time (in seconds) it takes for the JIT to compile code.
Thread Creation Frequency	Monitors the number of threads that are created in a polling period.
Thread	Monitors the duration of threads.

Measurement	Description
Lifetime	
Domain Creation Frequency	Monitors the number of domain creations in a polling period. (Domains protect areas of code. All applications run in a domain which keeps them encapsulated, so that they cannot interfere with other applications outside the domain.)
Domain Load Time	Monitors the time it takes to load a domain. (Domains protect areas of code. All applications run in a domain which keeps them encapsulated, so that they cannot interfere with other applications outside the domain).
Domain Unload Time	Monitors the time it takes to unload a domain. (Domains protect areas of code. All applications run in a domain which keeps them encapsulated, so that they cannot interfere with other applications outside the domain).
Domain Lifetime	Monitors the duration of a domain. (Domains protect areas of code. All applications run in a domain which keeps them encapsulated, so that they cannot interfere with other applications outside the domain).
Module Creation Frequency	Monitors the number of modules that get created in a polling period. (Modules are groups of assemblies that make up a DLL or EXE).
Module Load Time	Monitors the time it takes to load a module. (Modules are groups of assemblies that make up a dll or exe).
Module Unload Time	Monitors the time it takes to unload a module. (Modules are groups of assemblies that make up a dll or exe).
Module Lifetime	Monitors the duration of a module. (Modules are groups of assemblies that make up a dll or exe).
Garbage Collection Duration	Monitors the duration between the start and stop of Garbage Collection.
Garbage Collection Frequency	Monitors the number of breaks for Garbage Collections in a polling period.
Unmanaged Code Duration	Monitors the duration of the calls to unmanaged code.
Unmanaged	Monitors the number of calls to unengaged code in a polling period.

Measurement	Description
Code Frequency	

Assembly Level

Measurement	Description
Assembly Creation Frequency	Monitors the number of assembly creations in a polling period. (Assemblies hold the .NET byte code and metadata).
Assembly Load Time	Monitors the time it takes to load an assembly. (Assemblies hold the .NET byte code and metadata).
Assembly Unload Time	Monitors the time it takes to unload an assembly. (Assemblies hold the .NET byte code and metadata).
Assembly Lifetime	Monitors the duration of an assembly. (Assemblies hold the .NET byte code and metadata).

Class Level

Measurement	Description
Class Lifetime	Monitors the duration of a class.
Class Load Time	Monitors the time it takes to load a class.
Class Unload Time	Monitors the time it takes to unload a class.

Method Level

At the method level, the measured time is per method, exclusive of other methods, calls to unmanaged code, and garbage collection time.

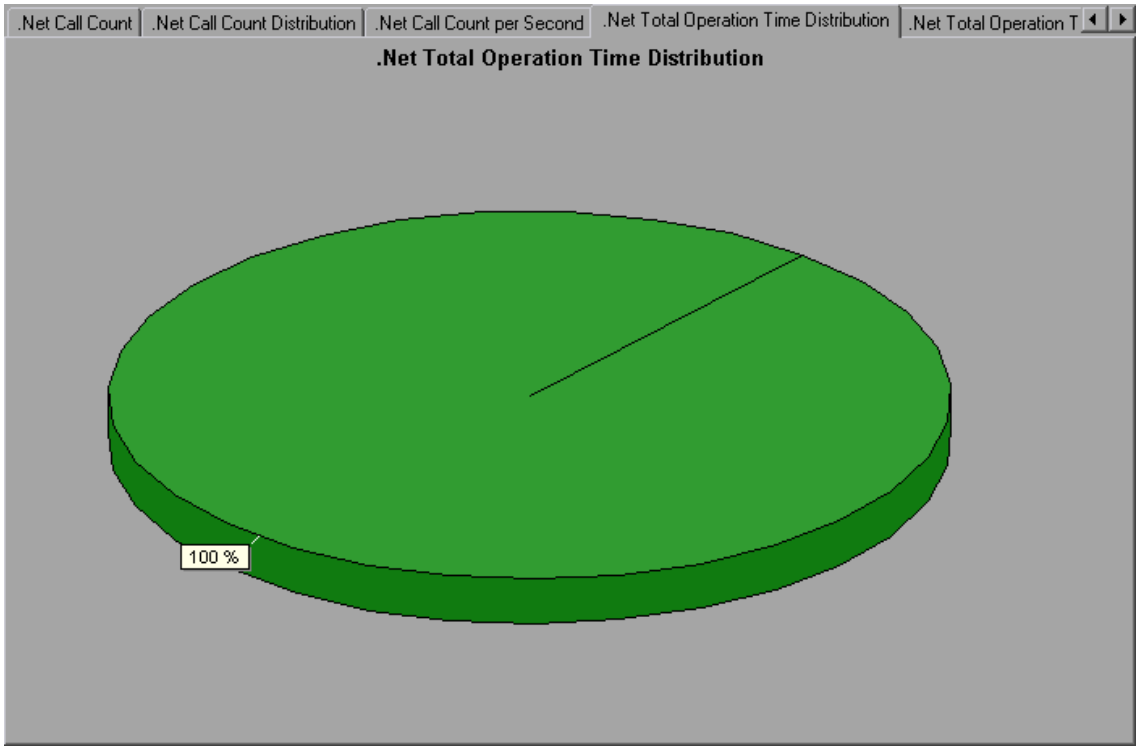
Measurement	Description
Method Duration	Monitors the duration of a method.
Method Frequency	Monitors the number of methods called in a polling period.

.NET Total Operation Time Distribution Graph

This graph shows the percentage of time that a specific .NET class took to execute in relation to all the .NET classes. It can also show the percentage of time that a .NET method took to execute in relation to

all the .NET methods within the class.

Purpose	Use this graph to identify those classes or methods that take an excessive amount of time.
Breakdown options	The graph initially displays .NET classes, but you can also view the individual methods within a .NET class by using drill-down or filtering techniques. For more information, see "Filtering and Sorting Graph Data" on page 103 and "Drilling Down in a Graph" on page 90.
Tips	To highlight a specific class line in the graph, select the class row in the legend (displayed below the graph).
See also	"Application Component Graphs" on page 268

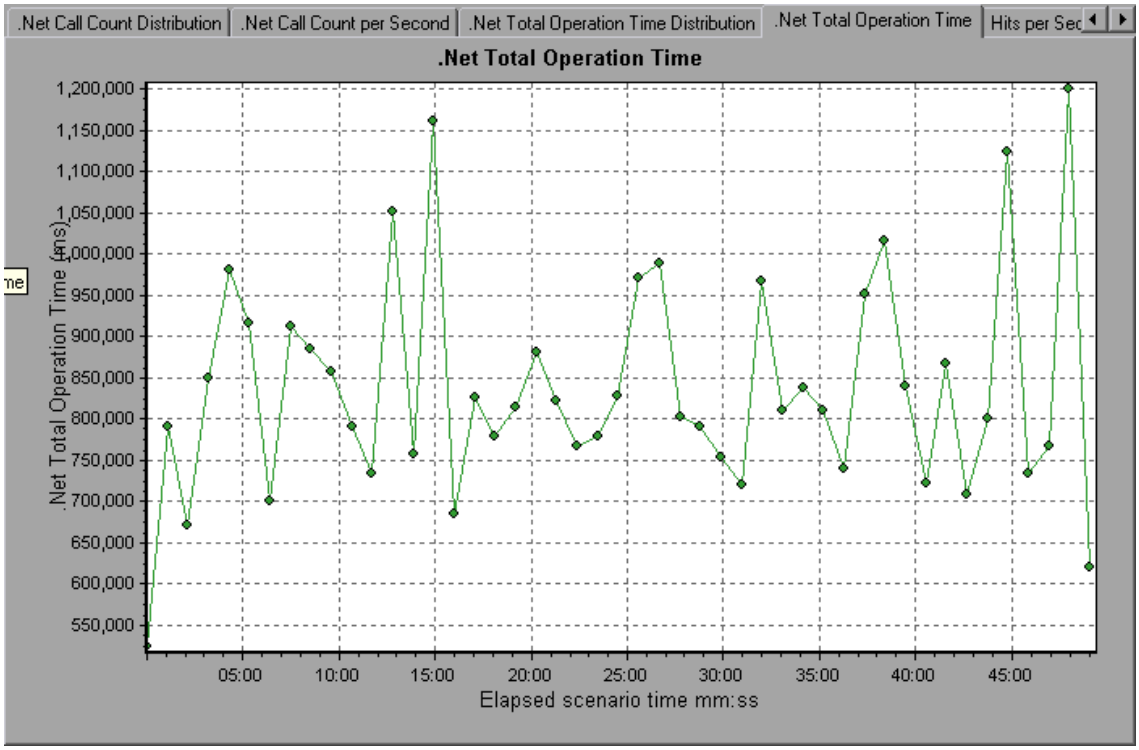


.NET Total Operation Time Graph

This graph displays the amount of time that each .NET class or method took to execute during the test.

Purpose	Use this graph to identify those classes or methods that take an excessive amount of time.
X-axis	Elapsed time from the beginning of the scenario run.
Y-axis	Total time a .NET class or method is in operation.

Breakdown options	The graph initially displays .NET classes, but you can also view the individual methods within a .NET class by using drill-down or filtering techniques. For more information, see "Filtering and Sorting Graph Data" on page 103 and "Drilling Down in a Graph" on page 90.
Tips	To highlight a specific class line in the graph, select the class row in the legend (displayed below the graph).
See also	"Application Component Graphs" on page 268



Application Deployment Solutions Graphs

LoadRunner's Citrix Server monitor provides you with information about the application deployment usage of the Citrix server during a load test scenario execution. In order to obtain performance data, before you execute the scenario you need to activate the online monitor for the server and specify which resources you want to measure.

For more information on activating and configuring the Citrix monitors, see the section on online monitors in the LoadRunner Controller documentation.

Citrix Measurements

Non-Virtual Counters

Measurement	Description
% Disk Time	The percentage of elapsed time that the selected disk drive services read or write requests.
% Processor Time	The percentage of time that the processor executes a non-Idle thread. This counter is a primary indicator of processor activity. It is calculated by measuring the time that the processor spends executing the thread of the Idle process in each sample interval, and subtracting that value from 100%. (Each processor has an Idle thread which consumes cycles when no other threads are ready to run.) It can be viewed as the percentage of the sample interval spent doing useful work. This counter displays the average percentage of busy time observed during the sample interval. It is calculated by monitoring the time the service was inactive, and then subtracting that value from 100%.
File data Operations/sec	The rate that the computer issues Read and Write operations to file system devices. It does not include File Control Operations.
Interrupts/sec	The average number of hardware interrupts the processor receives and services per second. It does not include DPCs, which are counted separately. This value is an indirect indicator of the activity of devices that generate interrupts, such as the system clock, the mouse, disk drivers, data communication lines, network interface cards and other peripheral devices. These devices normally interrupt the processor when they have completed a task or require attention. Normal thread execution is suspended during interrupts. Most system clocks interrupt the processor every 10 milliseconds, creating a background of interrupt activity. This counter displays the difference between the values observed in the last two samples, divided by the duration of the sample interval.
Output Session Line Speed	This value represents the line speed from server to client for a session in bps.
Input Session Line Speed	This value represents the line speed from client to server for a session in bps.
Page Faults/sec	A count of the Page Faults in the processor. A page fault occurs when a process refers to a virtual memory page that is not in its Working Set in main memory. A Page Fault will not cause the page to be fetched from disk if that page is on the standby list, and hence already in main memory, or if it is in use by another process with whom the page is shared.

Measurement	Description
Pages/sec	The number of pages read from the disk or written to the disk to resolve memory references to pages that were not in memory at the time of the reference. This is the sum of Pages Input/sec and Pages Output/sec. This counter includes paging traffic on behalf of the system Cache to access file data for applications. This value also includes the pages to/from non-cached mapped memory files. This is the primary counter to observe if you are concerned about excessive memory pressure (that is, thrashing), and the excessive paging that may result.
Pool Nonpaged Bytes	The number of bytes in the Nonpaged Pool, a system memory area where space is acquired by operating system components as they accomplish their appointed tasks. Nonpaged Pool pages cannot be paged out to the paging file, but instead remain in main memory as long as they are allocated.
Private Bytes	The current number of bytes this process has allocated that cannot be shared with other processes.
Processor Queue Length	The instantaneous length of the processor queue in units of threads. This counter is always 0 unless you are also monitoring a thread counter. All processors use a single queue in which threads wait for processor cycles. This length does not include the threads that are currently executing. A sustained processor queue length greater than two generally indicates processor congestion. This is an instantaneous count, not an average over the time interval.
Threads	The number of threads in the computer at the time of data collection. Notice that this is an instantaneous count, not an average over the time interval. A thread is the basic executable entity that can execute instructions in a processor.
Latency – Session Average	The average client latency over the life of a session.
Latency – Last Recorded	The last recorded latency measurement for this session.
Latency – Session Deviation	The difference between the minimum and maximum measured values for a session.
Input Session Bandwidth	The bandwidth (in bps) from client to server traffic for a session in bps.
Input Session Compression	The compression ratio for client to server traffic for a session.
Output Session	The bandwidth (in bps) from server to client traffic for a session.

Measurement	Description
Bandwidth	
Output Session Compression	The compression ratio for server to client traffic for a session.
Output Session Linespeed	The line speed (in bps) from server to client for a session.

Virtual Channel Counters

All the counters in the following table are measured in bytes per second (bps):

Measurement	Description
Input Audio Bandwidth	The bandwidth from client to server traffic on the audio mapping channel.
Input Clipboard Bandwidth	The bandwidth from client to server traffic on the clipboard mapping channel.
Input COM1 Bandwidth	The bandwidth from client to server traffic on the COM1 channel.
Input COM2 Bandwidth	The bandwidth from client to server traffic on the COM2 channel.
Input COM Bandwidth	The bandwidth from client to server traffic on the COM channel.
Input Control Channel Bandwidth	The bandwidth from client to server traffic on the ICA control channel.
Input Drive Bandwidth	The bandwidth from client to server traffic on the client drive mapping channel.
Input Font Data Bandwidth	The bandwidth from client to server traffic on the local text echo font and keyboard layout channel.
Input Licensing Bandwidth	The bandwidth from server to client traffic on the licensing channel.
Input LPT1 Bandwidth	The bandwidth from client to server traffic on the LPT1 channel.
Input LPT2 Bandwidth	The bandwidth from client to server traffic on the LPT2 channel.
Input Management Bandwidth	The bandwidth from client to server traffic on the client management channel.
Input PN Bandwidth	The bandwidth from client to server traffic on the Program Neighborhood channel.

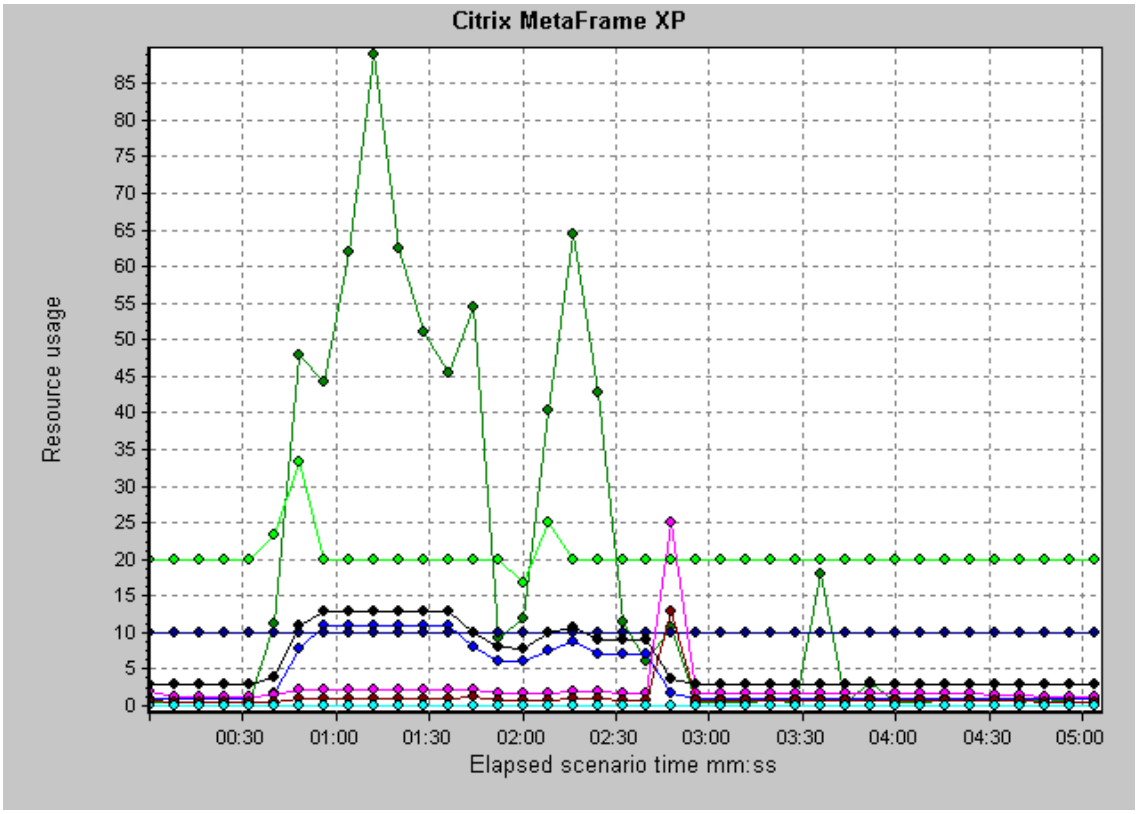
Measurement	Description
Input Printer Bandwidth	The bandwidth from client to server traffic on the printer spooler channel.
Input Seamless Bandwidth	The bandwidth from client to server traffic on the Seamless channel.
Input Text Echo Bandwidth	The bandwidth from client to server traffic on the local text echo data channel.
Input Thinwire Bandwidth	The bandwidth from client to server traffic on the Thinwire (graphics) channel.
Input VideoFrame Bandwidth	The bandwidth from client to server traffic on the VideoFrame channel.
Output Audio Bandwidth	The bandwidth from server to client traffic on the audio mapping channel.
Output Clipboard Bandwidth	The bandwidth from server to client traffic on the clipboard mapping channel.
Output COM1 Bandwidth	The bandwidth from server to client traffic on the COM1 channel.
Output COM2 Bandwidth	The bandwidth from server to client traffic on the COM2 channel.
Output COM Bandwidth	The bandwidth from server to client traffic on the COM channel.
Output Control Channel Bandwidth	The bandwidth from server to client traffic on the ICA control channel.
Output Drive Bandwidth	The bandwidth from server to client traffic on the client drive channel.
Output Font Data Bandwidth	The bandwidth from server to client traffic on the local text echo font and keyboard layout channel.
Output Licensing Bandwidth	The bandwidth from server to client traffic on the licensing channel.
Output LPT1 Bandwidth	The bandwidth from server to client traffic on the LPT1 channel.
Output LPT2 Bandwidth	The bandwidth from server to client traffic on the LPT2 channel.
Output Management Bandwidth	The bandwidth from server to client traffic on the client management channel.
Output PN Bandwidth	The bandwidth from server to client traffic on the Program Neighborhood channel.

Measurement	Description
Output Printer Bandwidth	The bandwidth from server to client traffic on the printer spooler channel.
Output Seamless Bandwidth	The bandwidth from server to client traffic on the Seamless channel.
Output Text Echo Bandwidth	The bandwidth from server to client traffic on the local text echo data channel.
Output Thinwire Bandwidth	The bandwidth from server to client traffic on the Thinwire (graphics) channel.
Output VideoFrame Bandwidth	The bandwidth from server to client traffic on the VideoFrame channel.

Citrix Server Graph

This graph is an Application Deployment solution which delivers applications across networks. The Citrix Server monitor is an Application Deployment Solution monitor, which provides performance information for the Citrix server.

X-axis	Elapsed time since the start of the run.
Y-axis	The resource usage on the Citrix server.
Note	To obtain data for this graph, you need to enable the Citrix Server monitor (from the Controller) and select the default measurements you want to display, before running the scenario.
See also	"Application Deployment Solutions Graphs" on page 290 "Citrix Measurements" on page 291



Middleware Performance Graphs

A primary factor in a transaction's response time is the middleware performance usage. LoadRunner's Middleware Performance monitors provide you with information about the middleware performance usage of the Tuxedo and IBM WebSphere MQ servers during a load test scenario execution. To obtain performance data, you need to activate the online monitor for the server and specify which resources you want to measure before executing the scenario.

For more information, see the section on online monitors in the LoadRunner Controller documentation.

IBM WebSphere MQ Counters

Queue Performance Counters

Measurement	Description
Event - Queue Depth High (events per second)	An event triggered when the queue depth reaches the configured maximum depth.
Event - Queue Depth Low	An event triggered when the queue depth reaches the configured

Measurement	Description
(events per second)	minimum depth.
Event - Queue Full (events per second)	An event triggered when an attempt is made to put a message on a queue that is full.
Event - Queue Service Interval High (events per second)	An event triggered when no messages are put to or retrieved from a queue within the timeout threshold.
Event - Queue Service Interval OK (events per second)	An event triggered when a message has been put to or retrieved from a queue within the timeout threshold.
Status - Current Depth	The current count of messages on a local queue. This measurement applies only to local queues of the monitored queue manager.
Status - Open Input Count	The current count of open input handles. Input handles are opened so that an application may "put" messages to a queue.
Status - Open Output Count	The current count of open output handles. Output handles are opened so that an application may "get" messages from a queue.

Channel Performance Counters

Measurement	Description
Event - Channel Activated (events per second)	An event generated when a channel, waiting to become active but inhibited from doing so due to a shortage of queue manager channel slots, becomes active due to the sudden availability of a channel slot.
Event - Channel Not Activated (events per second)	An event generated when a channel attempts to become active but is inhibited from doing so due to a shortage of queue manager channel slots.
Event - Channel Started (events per second)	An event generated when a channel is started.
Event - Channel Stopped (events per second)	An event generated when a channel is stopped, regardless of source of stoppage.
Event - Channel	An event generated when a channel is stopped by a user.

Measurement	Description
Stopped by User (events per second)	
Status - Channel State	The current state of a channel. Channels pass through several states from stopped (inactive state) to running (fully active state). Channel states range from 0 (stopped) to 6 (running).
Status - Messages Transferred	The count of messages that have been sent over the channel. If no traffic is occurring over the channel, this measurement will be zero. If the channel has not been started since the queue manager was started, no measurement will be available.
Status - Buffer Received	The count of buffers that have been received over the channel. If no traffic is occurring over the channel, this measurement will be zero. If the channel has not been started since the queue manager was started, no measurement will be available.
Status - Buffer Sent	The count of buffers that have been sent over the channel. If no traffic is occurring over the channel, this measurement will be zero. If the channel has not been started since the queue manager was started, no measurement will be available.
Status - Bytes Received	The count of bytes that have been received over the channel. If no traffic is occurring over the channel, this measurement will appear as zero. If the channel has not been started since the queue manager was started, no measurement will be available.
Status - Bytes Sent	The count of bytes that have been sent over the channel. If no traffic is occurring over the channel, this measurement will appear as zero. If the channel has not been started since the queue manager was started, no measurement will be available.

Tuxedo Resources Graph Measurements

The following table describes the default counters that can be measured. It is recommended to pay particular attention to the following measurements: % Busy Clients, Active Clients, Busy Clients, Idle Clients, and all the queue counters for relevant queues.

Monitor	Measurements
Machine	**% Busy Clients.** The percentage of active clients currently logged in to the Tuxedo application server that are waiting for a response from the application server.

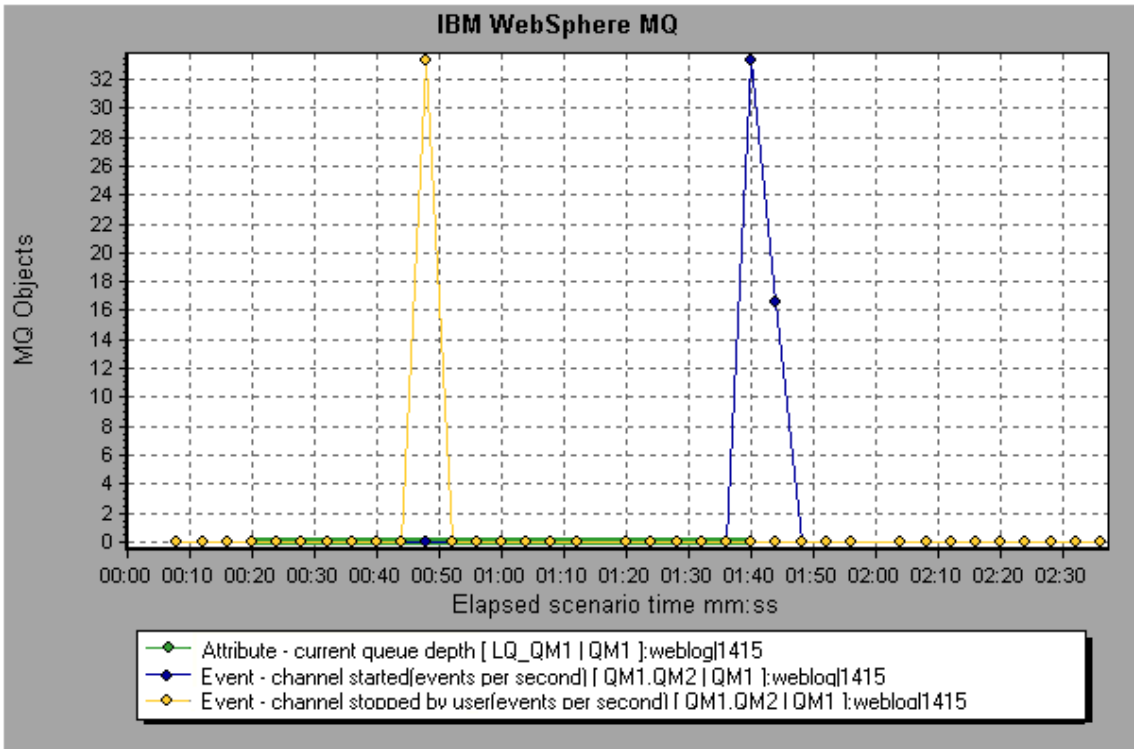
Monitor	Measurements
	Active Clients. The total number of active clients currently logged in to the Tuxedo application server.
	Busy Clients. The total number of active clients currently logged in to the Tuxedo application server that are waiting for a response from the application server.
	Current Accessers. The number of clients and servers currently accessing the application either directly on this machine or through a workstation handler on this machine.
	Current Transactions. The number of in use transaction table entries on this machine.
	Idle Clients. The total number of active clients currently logged in to the Tuxedo application server that are not waiting for a response from the application server.
	Workload Completed/second. The total workload on all the servers for the machine that was completed, per unit time.
	Workload Initiated/second. The total workload on all the servers for the machine that was initiated, per unit time.
Queue	**% Busy Servers.** The percentage of active servers currently handling Tuxedo requests.
	Active Servers. The total number of active servers either handling or waiting to handle Tuxedo requests.
	Busy Servers. The total number of active servers currently busy handling Tuxedo requests.
	Idle Servers. The total number of active servers currently waiting to handle Tuxedo requests.
	Number Queued. The total number of messages which have been placed on the queue.
Server	**Requests/second.** The number of server requests handled per second.
	Workload/second. The workload is a weighted measure of the server requests. Some requests could have a different weight than others. By default, the workload is always 50 times the number of requests.
Workstation Handler (WSH)	**Bytes Received/sec.** The total number of bytes received by the workstation handler, per second.
	Bytes Sent/sec. The total number of bytes sent back to the clients by the workstation handler, per second.
	Messages Received/sec. The number of messages received by the workstation

Monitor	Measurements
	handler, per second.
	Messages Sent/sec. The number of messages sent back to the clients by the workstation handler, per second.
	Number of Queue Blocks/sec. The number of times the queue for the workstation handler blocked, per second. This gives an idea of how often the workstation handler was overloaded.

IBM WebSphere MQ Graph

This graph shows the resource usage of IBM WebSphere MQ Server channel and queue performance counters as a function of the elapsed load test scenario time.

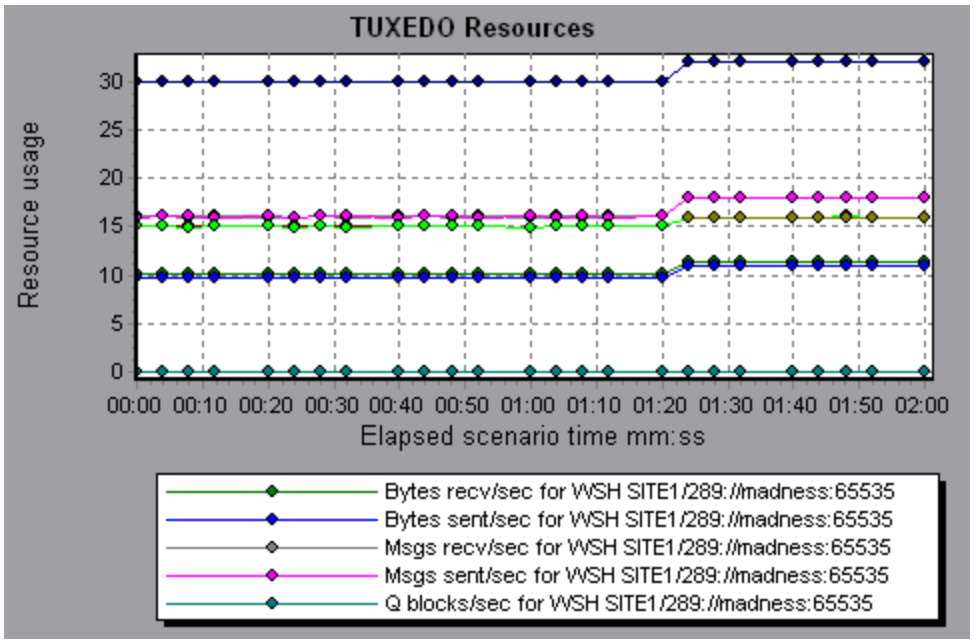
X-axis	Elapsed time since the start of the run.
Y-axis	The resource usage of the IBM WebSphere MQ Server channel and queue performance counters.
Note	To obtain data for this graph, you need to enable the IBM WebSphere MQ monitor (from the Controller) and select the default measurements you want to display, before running the scenario.
See also	"Middleware Performance Graphs" on page 296 "IBM WebSphere MQ Counters" on page 296



Tuxedo Resources Graph

This graph provides information about the server, load generator machine, workstation handler, and queue in a Tuxedo system.

X-axis	Elapsed time since the start of the run.
Y-axis	The resource usage on the Tuxedo system.
Note	To obtain data for this graph, you need to enable the TUXEDO monitor (from the Controller) and select the default measurements you want to display, before running the scenario.
See also	"Middleware Performance Graphs" on page 296 "Tuxedo Resources Graph Measurements" on page 298



Infrastructure Resources Graphs

LoadRunner's Infrastructure Resources monitor provides you with information about the performance of FTP, POP3, SMTP, IMAP, and DNS Vusers on the network client during load test scenario execution.

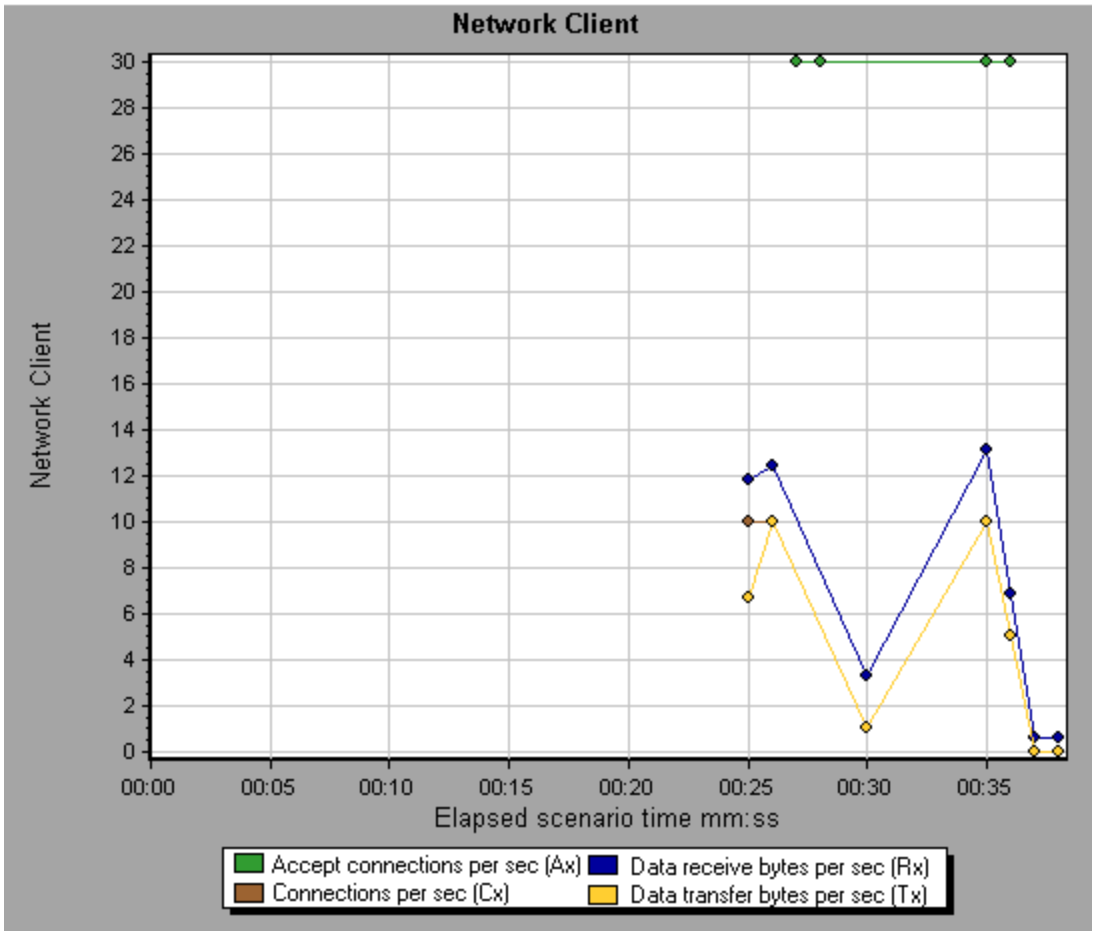
Network Client Measurements

Measurement	Description
Pings per sec	Number of pings per second.
Data transfer bytes per sec	Number of data bytes transferred per second.
Data receive bytes per sec	Number of data bytes received per second.
Connections per sec	Number of connections per second.
Accept connections per sec	Number of connections accepted per seconds.
SSL Connections per sec	Number of SSL connections per second.
SSL Data transfer bytes per sec	Number of SSL data bytes transferred per second.
SSL Data receive bytes per sec	Number of SSL data bytes received per second.
SSL Accept connections per sec	Number of SSL connections accepted per seconds.

Network Client Graph

This graph displays network client data points for FTP, POP3, SMTP, IMAP, and DNS Vusers during a load test scenario run.

X-axis	Elapsed time since the start of the run.
Y-axis	The resource value of the network client data points..
See also	"Infrastructure Resources Graphs" on the previous page



HP Service Virtualization Graphs

The Service Virtualization graphs are similar to the corresponding monitors used by the LoadRunner Controller. For details, see Service Virtualization Monitoring Overview.

Service Virtualization Graphs Overview

The Service Virtualization graphs are similar to the corresponding monitors used by the LoadRunner Controller. For details, see Service Virtualization Monitoring Overview.

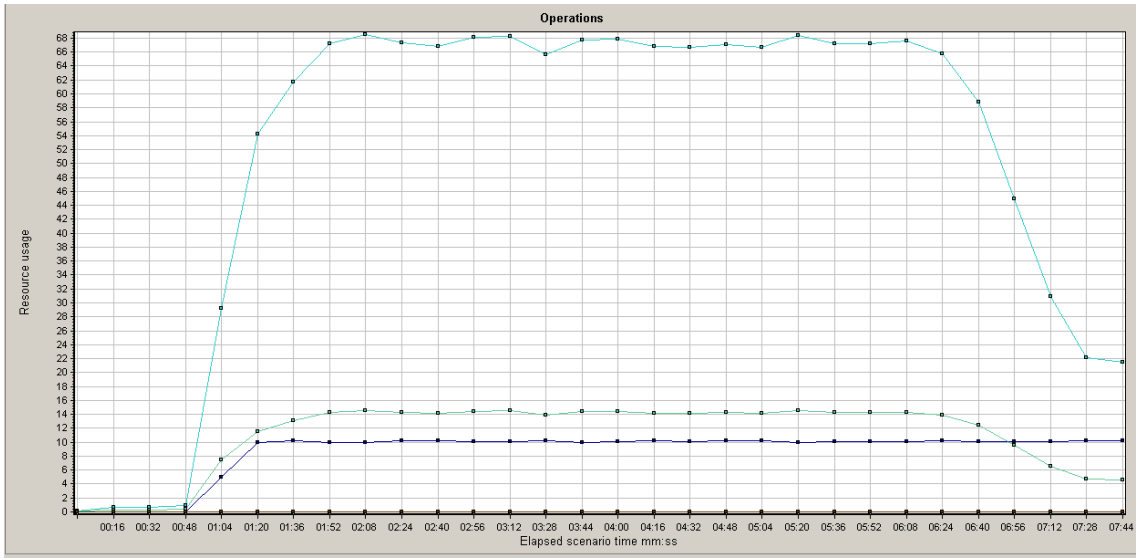
HP Service Virtualization Operations Graph

This graph displays a summary for HP Service Virtualization - Operations.

X-axis	The elapsed time from the beginning of the scenario run.
Y-axis	The number of resources used.
Tips	• To isolate the measurement with the most problems, it may be helpful to sort the legend window according to the average number of resources used. To sort the legend by average, double-click the **Average** column heading. • To identify a measurement in the graph, you can select it. The corresponding line in the legend window is selected.
Note	To use this graph, you must first open a Service Virtualization project in the Controller.
See also	Web Page Diagnostics Graph

Example

Using the graph, you can track which resources were most problematic, and at which point(s) during the scenario the problem(s) occurred.



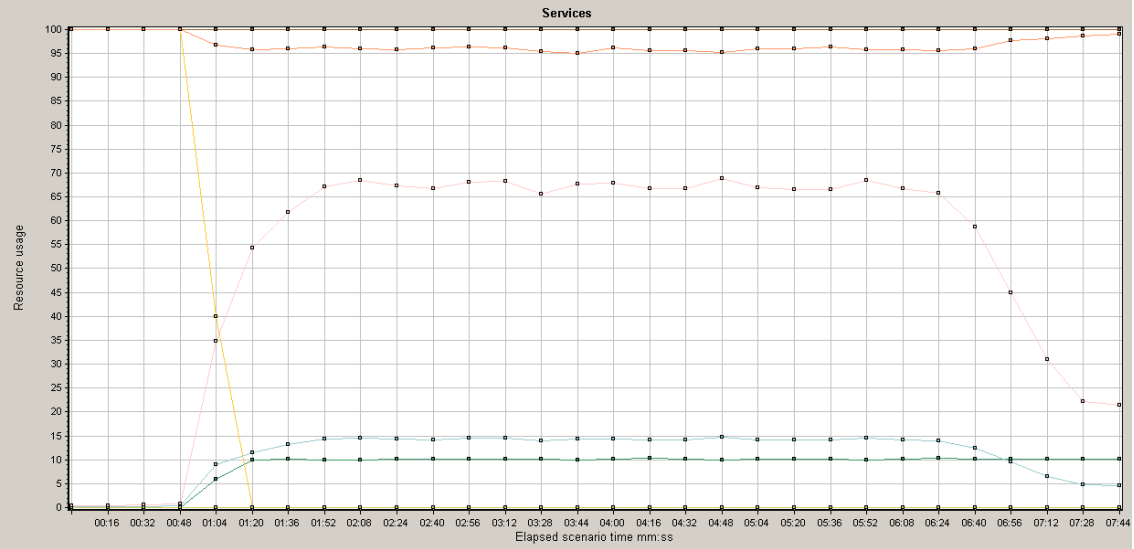
HP Service Virtualization Services Graph

This graph displays a summary for HP Service Virtualization - Services.

X-axis	The elapsed time from the beginning of the scenario run.
Y-axis	The number of resources used.
Tips	• To isolate the measurement with the most problems, it may be helpful to sort the legend window according to the average number of resources used. To sort the legend by average, double-click the **Average** column heading. • To identify a measurement in the graph, you can select it. The corresponding line in the legend window is selected.
Note	To use this graph, you must first open a Service Virtualization project in the Controller scenario.
See also	Web Page Diagnostics Graph

Example

Using the graph, you can track which resources were most problematic, and at which point(s) during the scenario the problem(s) occurred.



Flex Graphs

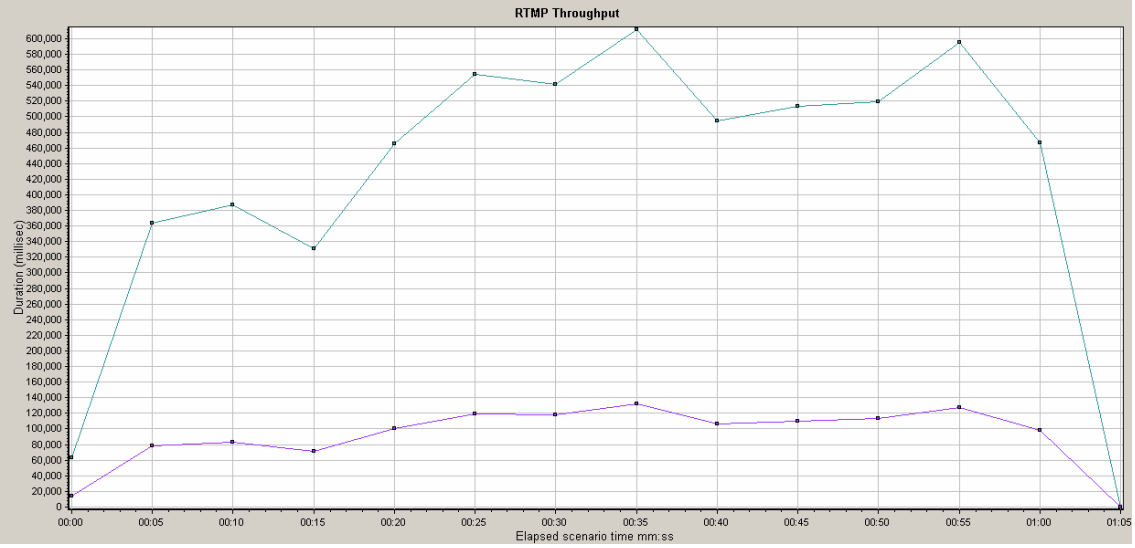
Flex graphs provide you with information about the performance of your Flex server. You use the Flex graphs to analyze the following data:

Flex RTMP Throughput Graph

This graph shows the amount of throughput (in bytes) on the RTMP/T server during each second of the load test scenario run. The throughput represents the amount of data that the Vusers received from the server or sent to the server at any given second.

Purpose	Helps you evaluate the amount of load that Vusers generate, in terms of server throughput.
X-axis	Elapsed time since the start of the scenario run.
Y-axis	Throughput of the server in bytes
Note	You cannot change the granularity of the x-axis to a value that is less than the Web granularity you defined in the General tab of the Options dialog box.

Example
In the following example, the highest throughput is over 600,000 bytes during the thirty-fifth second of the scenario.



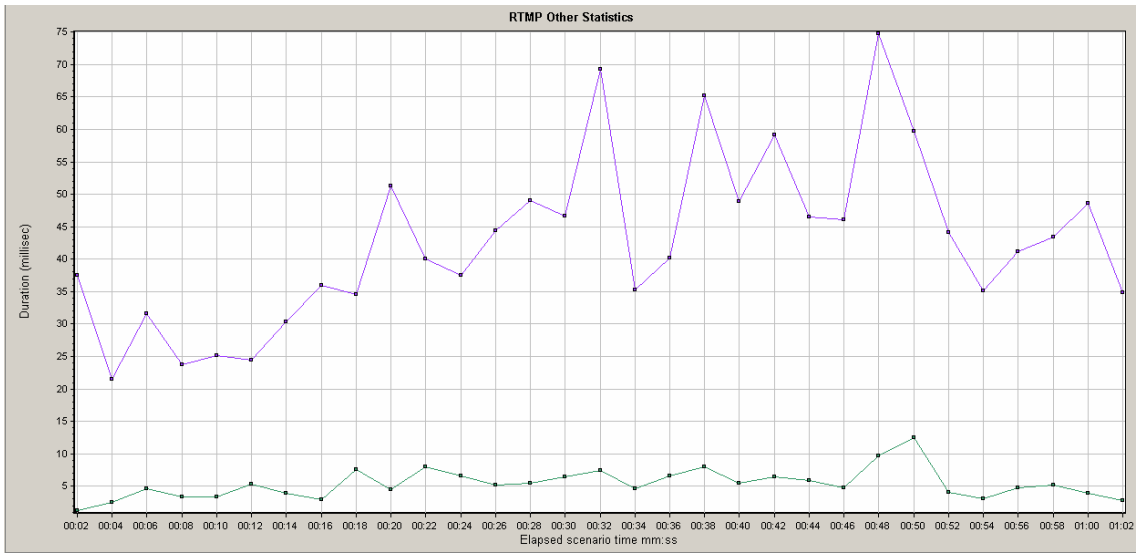
Flex RTMP Other Statistics Graph

This graph shows various statistics about Flex RTMP Vusers.

Purpose	The graph shows the duration taken to perform various RTMP tasks.
X-axis	Elapsed time since the start of the scenario run.
Y-axis	Task duration (in milliseconds).

Example

In the following example,the RTMP Handshake has a duration of seventy five milliseconds at the forty eighth second of the scenario.



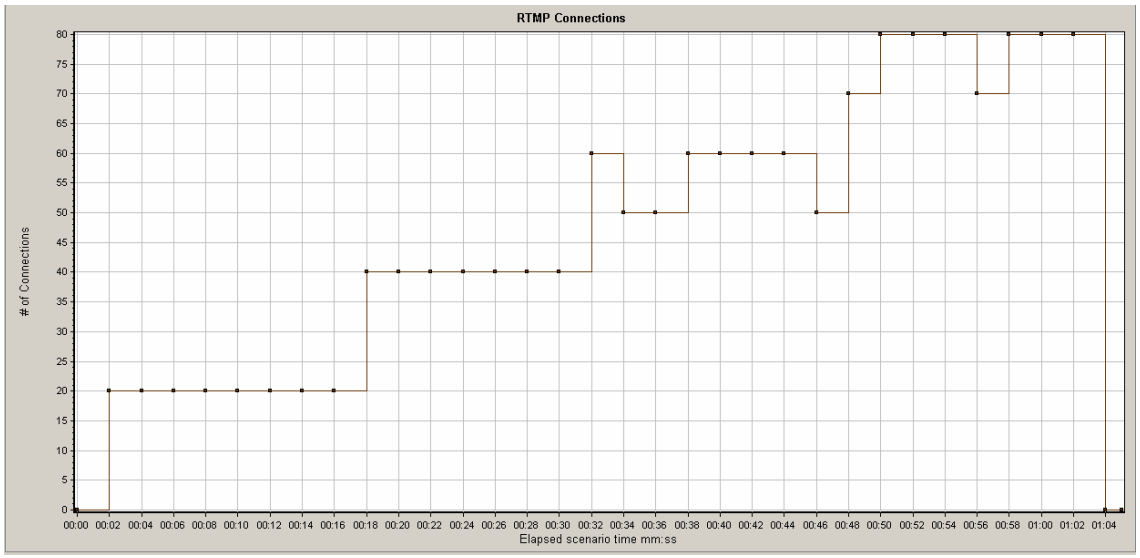
Flex RTMP Connections Graph

This graph shows the number of open RTMP connections at any time during the load test scenario run. The throughput represents the amount of data that the Vusers received from the server or sent to the server at any given second.

Purpose	This graph is useful in indicating when additional connections are needed. For example, if the number of connections reaches a plateau, and the transaction response time increases sharply, adding connections would probably cause a dramatic improvement in performance (reduction in the transaction response time).
X-axis	Elapsed time since the start of the scenario run.
Y-axis	Number of connections.

Example

In the following example,between the forty-eighth second and the fifty-sixth second of the scenario there are eighty open connections.



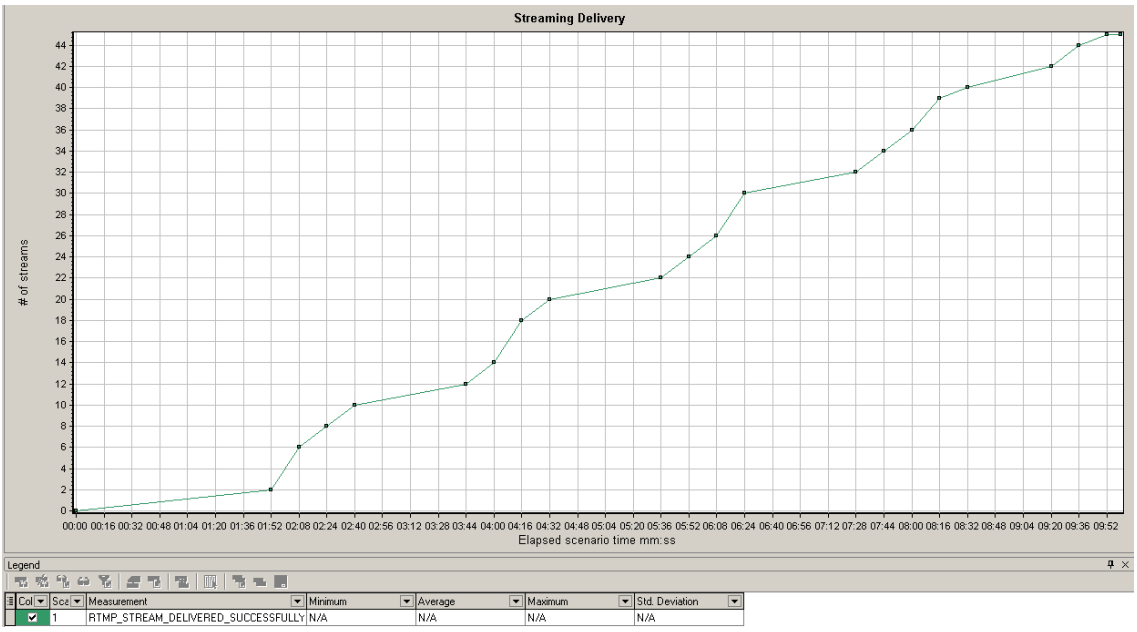
TruClient CPU Utilization Percentage Graph

This graph displays the total number of streams that were successfully delivered by the server. A successful delivery is indicated when the server initiates a "NetStream.Stop" message at the end of the requested stream.

Purpose	Helps you evaluate the amount of load that Vusers generate, in terms of server throughput.
X-axis	Elapsed time since the start of the scenario run.
Y-axis	Number of streams delivered

Example

In the following example, the graph rises at a forty five degree angle, indicating a constant number of streams being delivered over time.



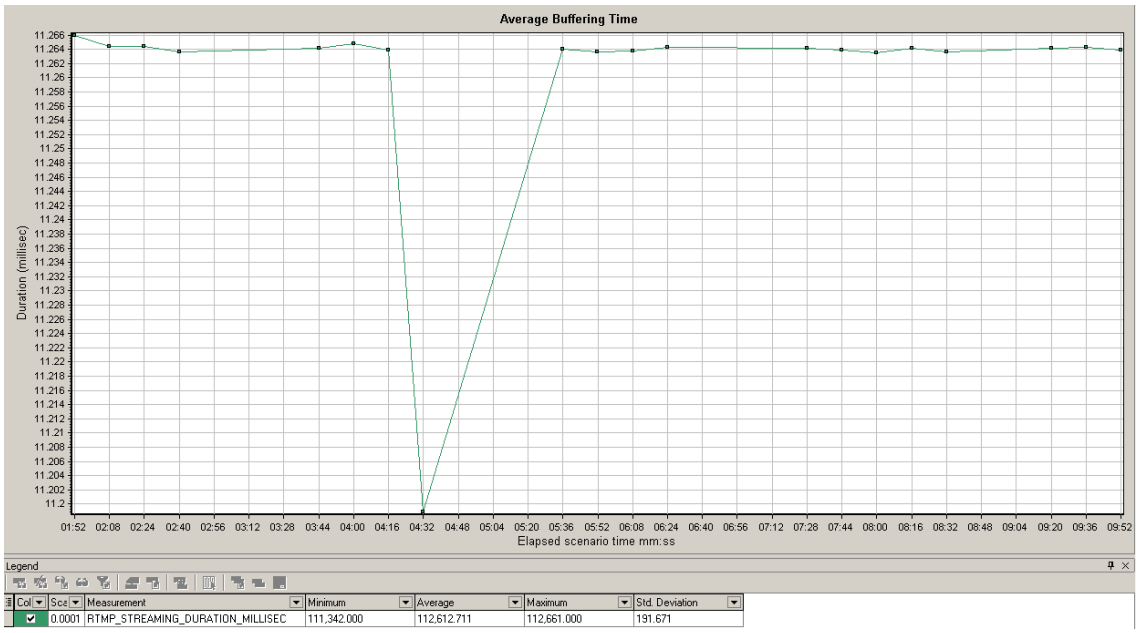
Flex Average Buffering Time Graph

This graph displays the average buffering time for RTMP streams.

Purpose	Helps you evaluate the amount of load that Vusers generate, in terms of time spent for streams in the buffer.
X-axis	Elapsed time since the start of the scenario run.
Y-axis	Buffering time in milliseconds

Example

In the following example, the buffering time reaches its lowest after 4 minutes and 32 seconds of the scenario before climbing up to a peak again. You should compare it to other graphs to see what happened at that time.



WebSocket Statistics Graphs

The **WebSocket Statistics** graphs provides you with statistics for the WebSocket data during the scenario run, such as byte rate, connection status, and the number of messages.

X-axis	Elapsed time since the start of the run.
Y-axis	WebSocket per second throughout the whole scenario.

The WebSocket Statistics graphs are:

- **WebSocket Bytes per second.** This graph shows the number of bytes that were sent and received per second.
- **WebSocket Connections per second.** This graph shows the number of new, failed, and closed connections. I
- **WebSocket Messages per second.** This graph shows the number of WebSocket messages that were sent, per second.

To gather these statistics, enable the WebSocket Statistics monitors before running your scenario.

Diagnostics Graphs

You can open Diagnostics graphs that were generated in earlier versions of LoadRunner.

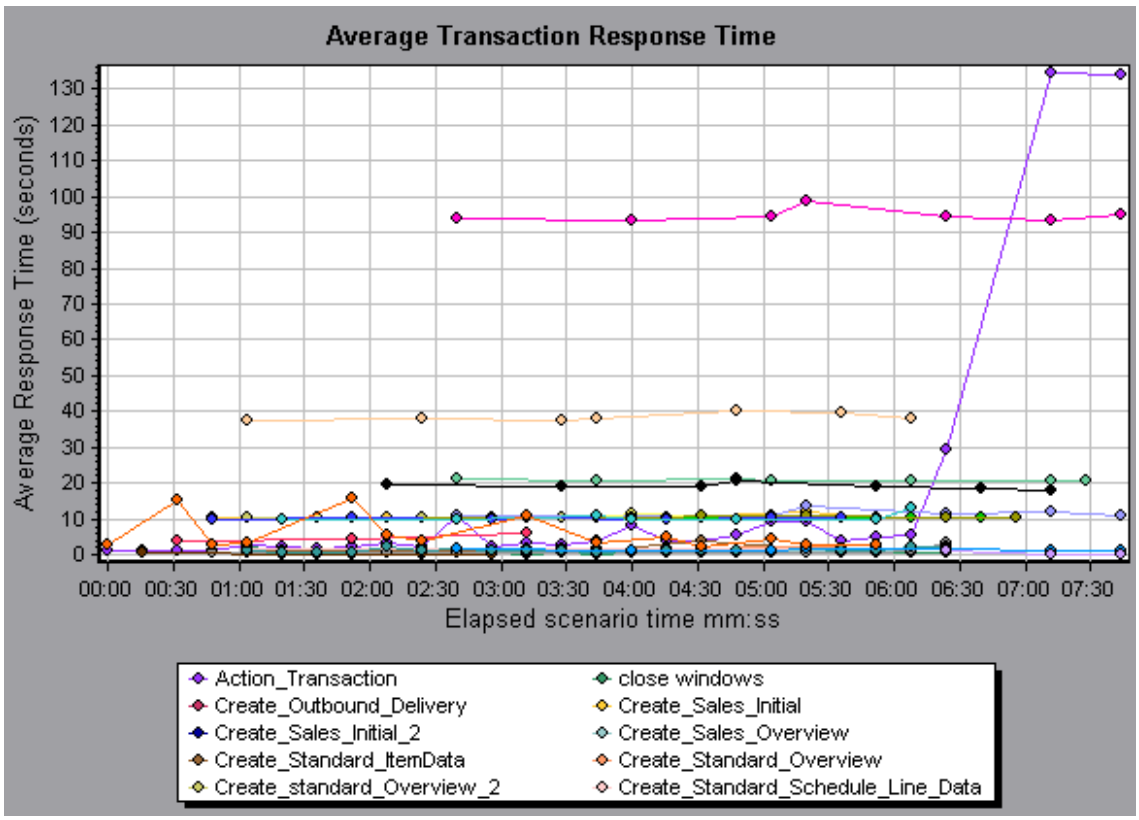
Siebel Diagnostics Graphs

Siebel Diagnostics Graphs Overview

Siebel Diagnostics graphs enable you to trace, time, and troubleshoot individual transactions through Web, application, and database servers.

To analyze where problems are occurring, you correlate the data in the Siebel Diagnostics graphs with data in the Transaction Response Time graphs.

You begin analyzing these graphs with the transaction graphs that display the average transaction response time during each second of the load test scenario run. For example, the following Average Transaction Response Time graph demonstrates that the average transaction response time for the **Action_Transaction** transaction was high.



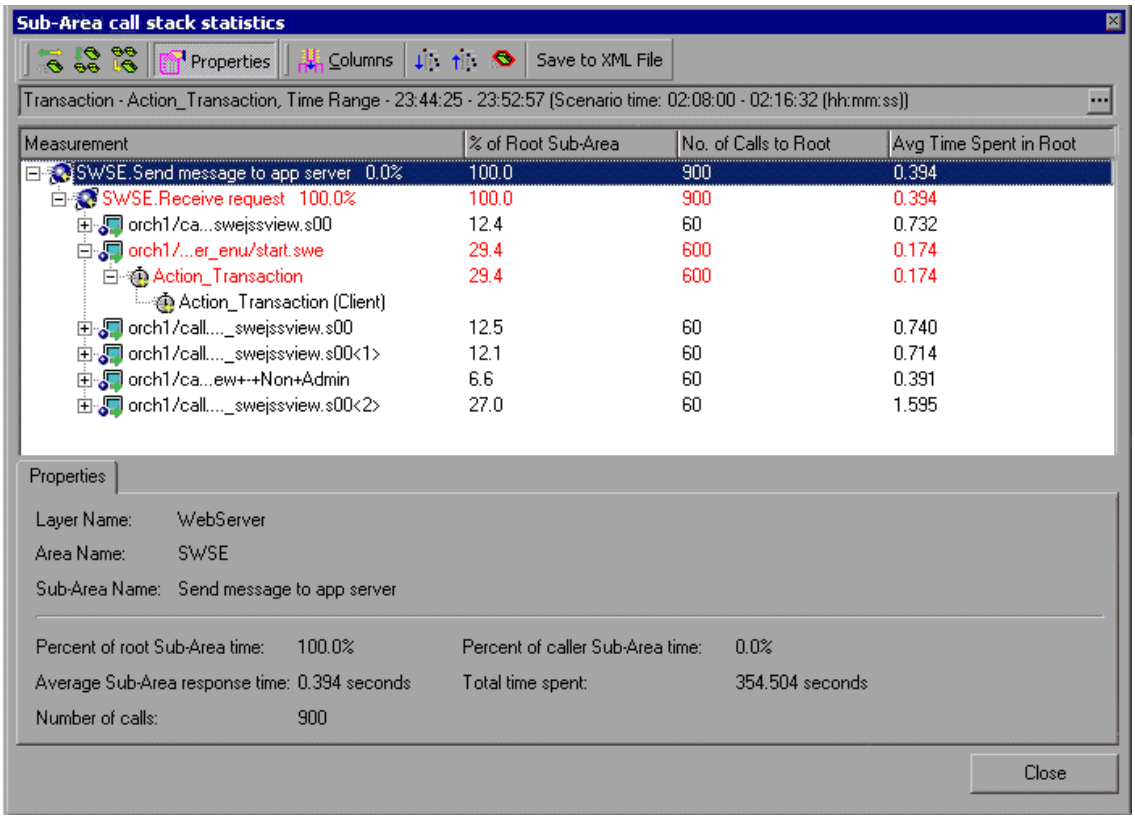
Using the Siebel Diagnostics graphs, you can pinpoint the cause of the delay in response time for this transaction.

Alternatively, you can use the Summary Report to view individual transactions broken down into Web, application, and database layers, and the total usage time for each transaction. For more information, see "Siebel Diagnostics Graphs Summary Report" on page 321.

> **Note:** A measurement that is broken down in the Average Transaction Response Time graph will be different from the same measurement broken down in the Siebel Diagnostics graph. This is because the Average Transaction Response Time graph displays the average transaction response time, whereas the Siebel Diagnostics graph displays the average time per transaction event (sum of Siebel Area response time).

Call Stack Statistics Window

This window enables you to view which components called the selected component.



To access	Analysis window > <Siebel> graph > right click sub-area and select **Siebel Diagnostics > Show Sub-Area Call Stack Statistics**
See also	"Siebel Diagnostics Graphs Overview" on the previous page

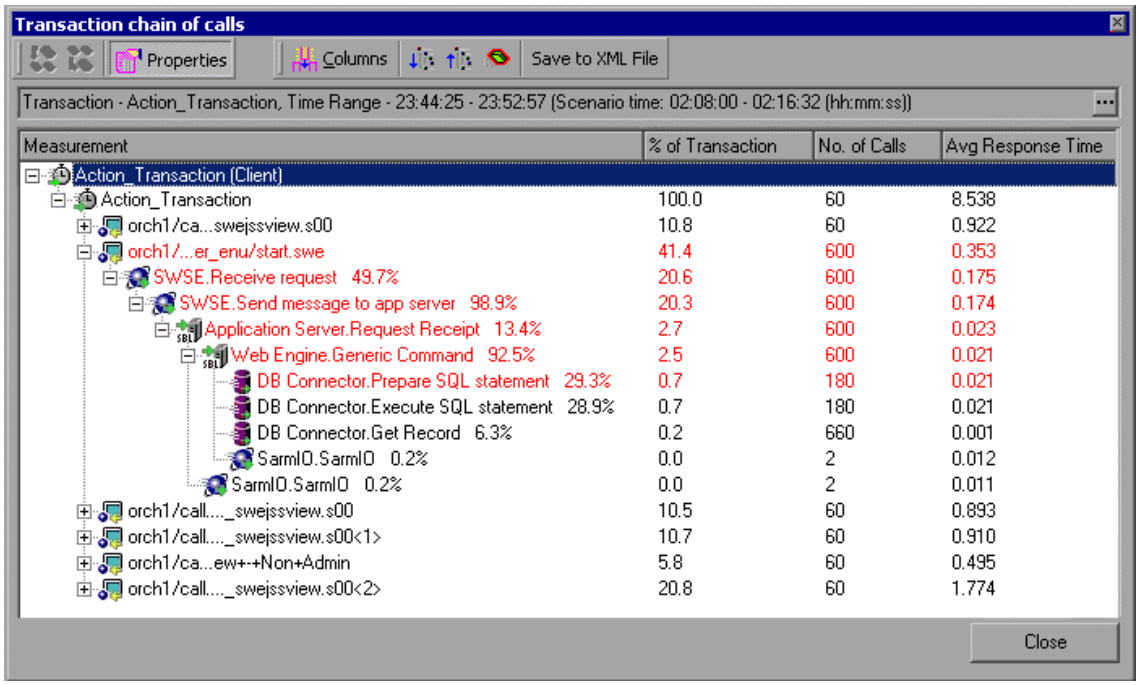
User interface elements are described below:

UI Element	Description
Measurement	Name of the sub-area, displayed as **AreaName:SubAreaName**. In the case of a database call, query information is also displayed. The percent shown indicates the percentage of calls to this component from its child.

UI Element	Description
% of Root Sub-Area	Displays the percentage of sub-area time in relation the total root sub-area time.
No. of Calls to Root	Displays the amount of times this transaction or sub-area was executed.
Avg Time Spent in Root	Time spent in root is the time that the sub-area spent in the root sub-area//transaction. Average Time Spent in Root time is the total time spent in the root divided by the number of instances of the sub-area.
STD Time Spent in Root	The standard deviation time spent in the root.
Min Time Spent in Root	The minimum time spent in the root.
Max Time Spent in Root	The maximum time spent in the root.
% of Called	Displays the percentage of sub-area time in relation the child sub-area time.
Total Time Spent in Root	Displays the total sub-area execution time, including the child execution time.
	Expand All. Expands the entire tree.
	Collapse All. Collapses the entire tree.
	Expand Worst Path. Expands only the parts of the path on the critical path.
Save to XML File	Saves the tree data to an XML file.
Properties	**Properties** Area**.** Displays the full properties of the selected sub-area.
SQL Query	**SQL Query.** Displays the SQL query for the selected sub-area (For Database only).

Chain of Calls Window

This window enables you to view the components that the selected transaction or sub-area called. The following figure shows all the calls in the critical path of the parent **Action_Transaction** server-side transaction are displayed.



To access	Use one of the following: • To view transaction call chains - right click a component and select **Siebel Diagnostics > Show Chain of Calls** • To view sub-area statistics - right click sub-area and select **Show Sub-Area Chain of Calls**
Note	Each red node signifies the most time consuming child to its parent.

User interface elements are described below:

UI Element	Description
	Switch to Sub-Area Chain of Calls. When the sub-area call stack statistics data is displayed, this displays the sub-area chain of calls data (only if the root is a sub-area).
	Switch to Sub-Area Call Stack Statistics. When the sub-area chain of calls data is displayed, this displays the sub-area call stack statistics data (only if the root is a sub-area).
	Show Sub-Area Chain of Calls. Displays the Sub-Area Chain of Calls window.
	Show Sub-Area Call Stack Statistics. Displays the Sub-Area Call Stack Statistics window.
	Properties. Hides or displays the properties area (lower pane).

UI Element	Description
	Columns. Enables you to select the columns shown in the Calls window. To display additional fields, drag them to the desired location in the Calls window. To remove fields, drag them from the Calls window back to the Columns chooser.
Measurement	Name of the sub-area, displayed as **AreaName:SubAreaName**. In the case of a database call, query information is also displayed. The percent shown indicates the percentage of calls to this component from its parent.
% of Transaction/ Root Sub-Area	Displays the percentage of sub-area time in relation the total transaction/root sub-area time.
No of Calls	Displays the amount of times this transaction or sub-area was executed.
Avg Response Time	Response time is the time from the beginning of execution until the end. Average response time is the total response time divided by the number of instances of the area/sub-area.
STD Response Time	The standard deviation response time.
Min Response Time	The minimum response time.
Max Response Time	The maximum response time.
% of Caller	Displays the percentage of sub-area time in relation the parent sub-area time.
Total time	Displays the total sub-area execution time, including the child execution time.

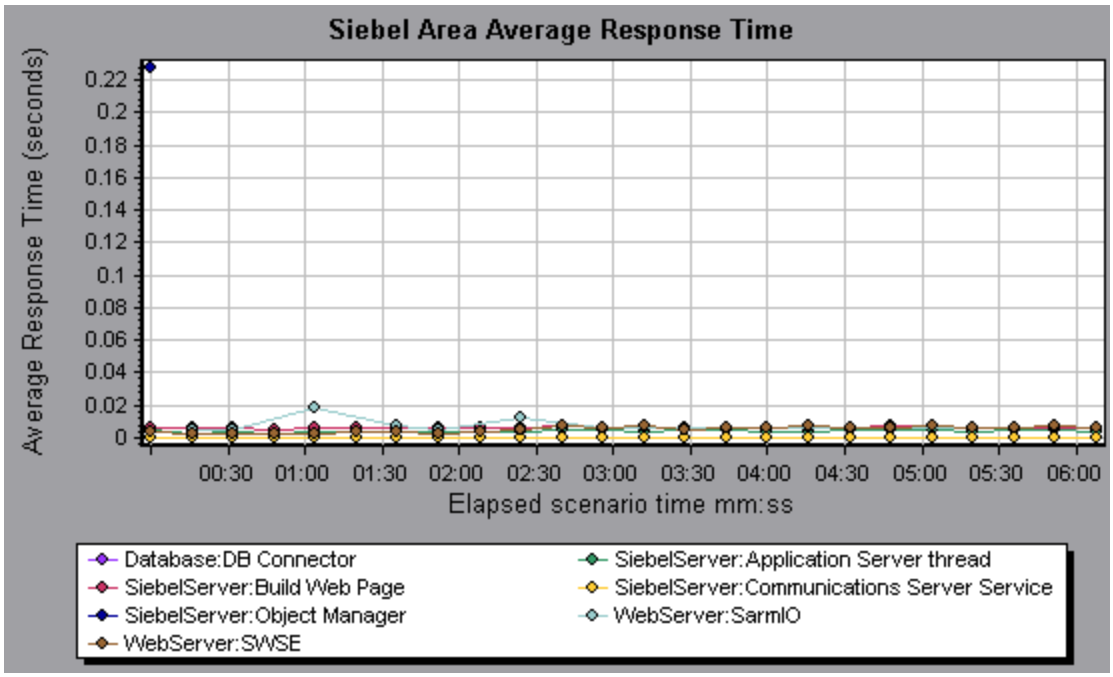
Siebel Area Average Response Time Graph

This graph displays the average response time for the server side areas, computed as the total area response time divided by the number of area calls.

Purpose	For example, if an area was executed twice by one instance of transaction A, and once by another instance of the same transaction, and it took three seconds for each execution, then the average response time is 9/3, or 3 seconds. The area time does not include calls made from the area to other areas.

X-axis	Elapsed time since the start of the run.
Y-axis	Average response time (in seconds) per area.
Breakdown options	For breakdown options, see "Siebel Breakdown Levels" on page 318.
Tips	You can filter the Siebel graphs by the following fields: • **Transaction Name.** Shows data for the specified transaction. • **Scenario Elapsed Time.** Shows data for transactions that ended during the specified time. For more information on filtering, see "Filtering and Sorting Graph Data" on page 103.
See also	"Siebel Breakdown Levels" on page 318

Example



Siebel Area Call Count Graph

This graph displays the number of times that each Siebel area is called.

X-axis	Elapsed time since the start of the run.
Y-axis	The call count.
Breakdown options	For breakdown options, see "Siebel Breakdown Levels" on page 318.

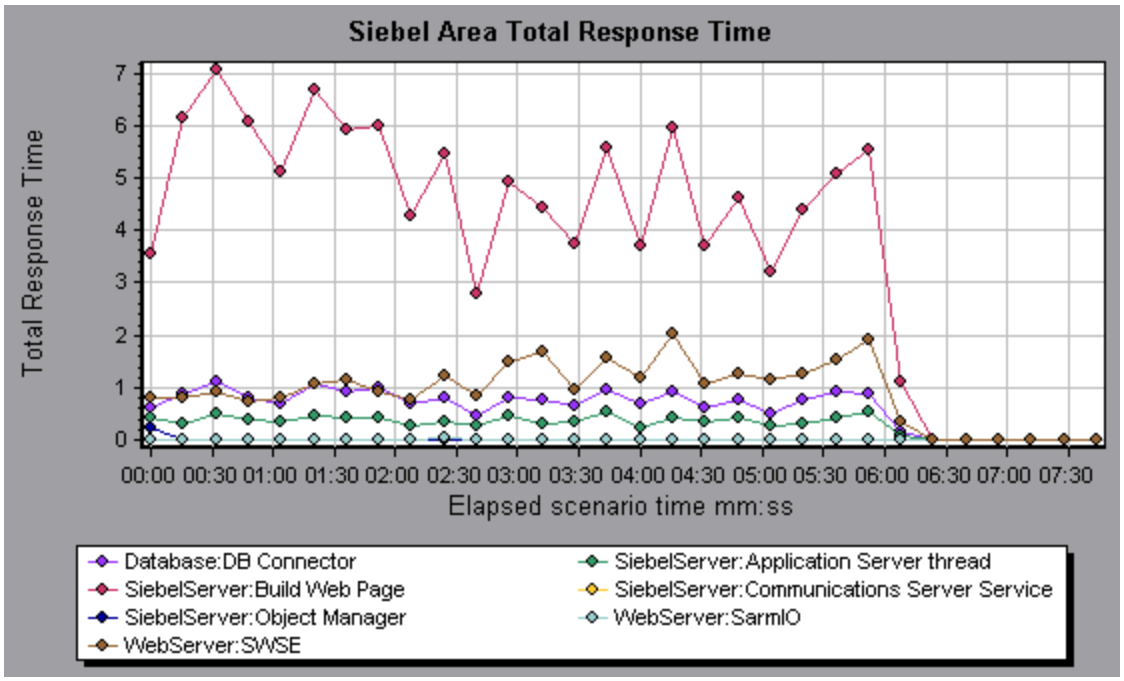
Tips	You can filter the Siebel graphs by the following fields: • **Transaction Name.** Shows data for the specified transaction. • **Scenario Elapsed Time.** Shows data for transactions that ended during the specified time. For more information on filtering, see "Filtering and Sorting Graph Data" on page 103.
See also	"Siebel Diagnostics Graphs Overview" on page 311

Siebel Area Total Response Time Graph

This graph displays the total response time of each Siebel area.

X-axis	Elapsed time since the start of the run.
Y-axis	Average response time (in seconds) per area.
Breakdown options	For breakdown options, see "Siebel Breakdown Levels" on the next page.
Tips	You can filter the Siebel graphs by the following fields: • **Transaction Name.** Shows data for the specified transaction. • **Scenario Elapsed Time.** Shows data for transactions that ended during the specified time. For more information on filtering, see "Filtering and Sorting Graph Data" on page 103.
See also	"Siebel Diagnostics Graphs Overview" on page 311

Example



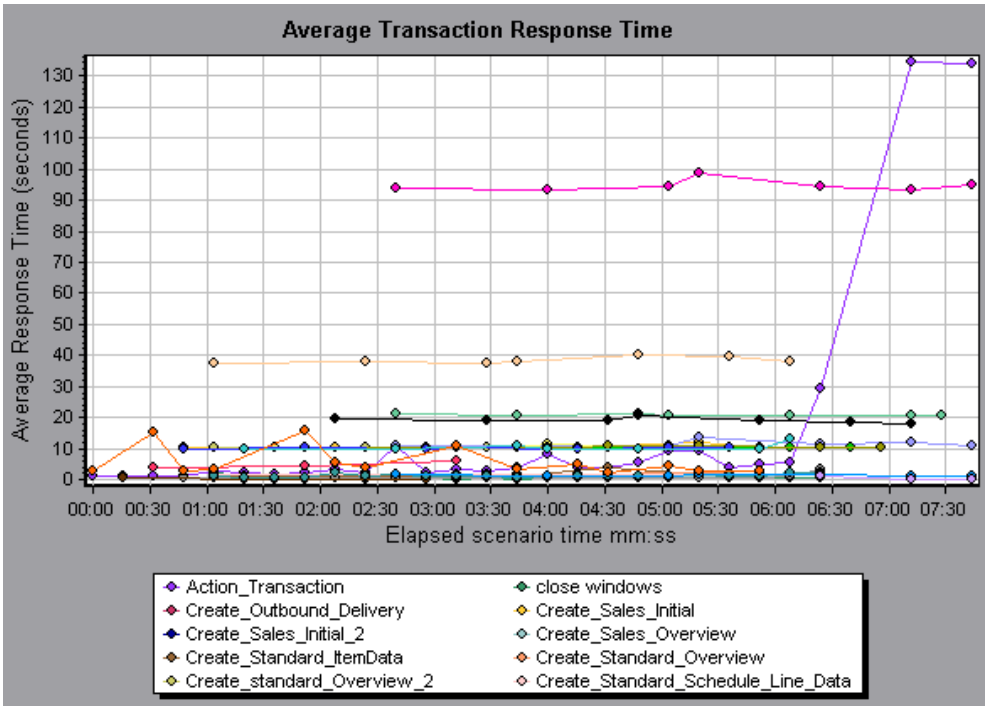
Siebel Breakdown Levels

You can break down Siebel layers into areas, sub-areas, servers, and scripts to enable you to pinpoint the exact location where time is consumed.

To access	Use one of the following to access breakdown options: • **<Siebel Diagnostics Graphs> > View > Siebel Diagnostics** • **<Siebel Diagnostics Graphs> >** select transaction **>** short-cut menu **> Siebel Diagnostics** See toolbar options for each breakdown level.
Important Information	The breakdown menu options and buttons are not displayed until an element (transaction, layer, area, sub-area) is selected.
See also	"Siebel Diagnostics Graphs Overview" on page 311

Siebel Breakdown Levels are described below:

Transaction Level	The following figure displays the top level Average Transaction Response Time graph. The graph displays several transactions.

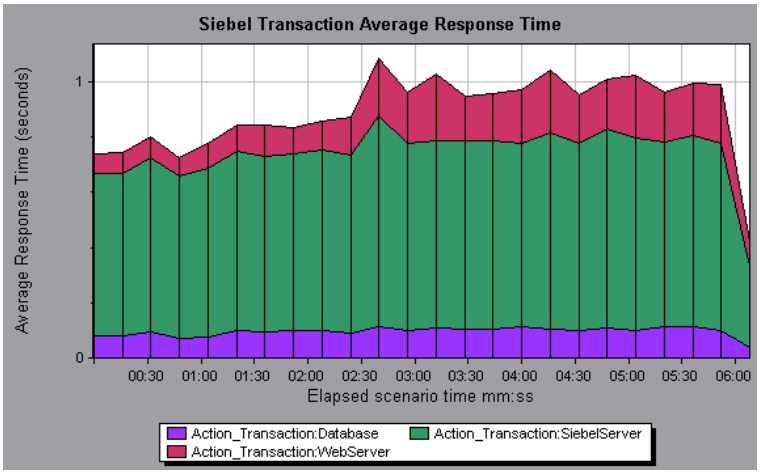


Layer Level

Siebel Layer Breakdown button shows the breakdown of the selected transaction.

Undo Siebel Layer Breakdown returns the graph to the transaction level.

In the following figure, the Action_Transaction transaction has been broken down to its layers (Siebel Database, Application, and Web).

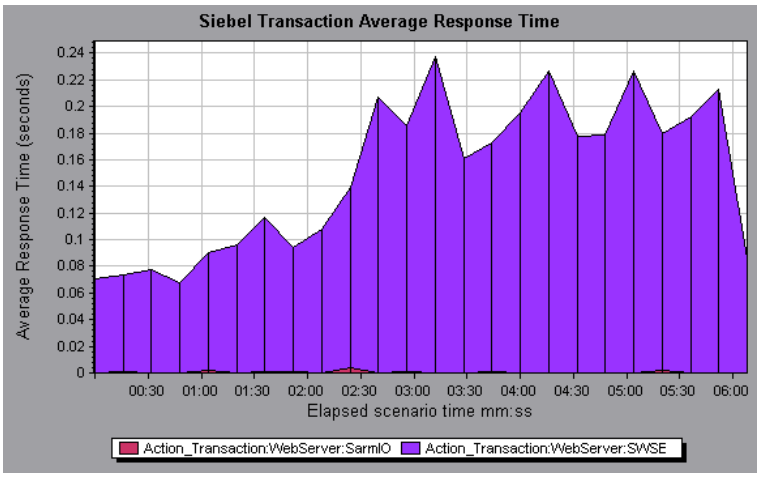
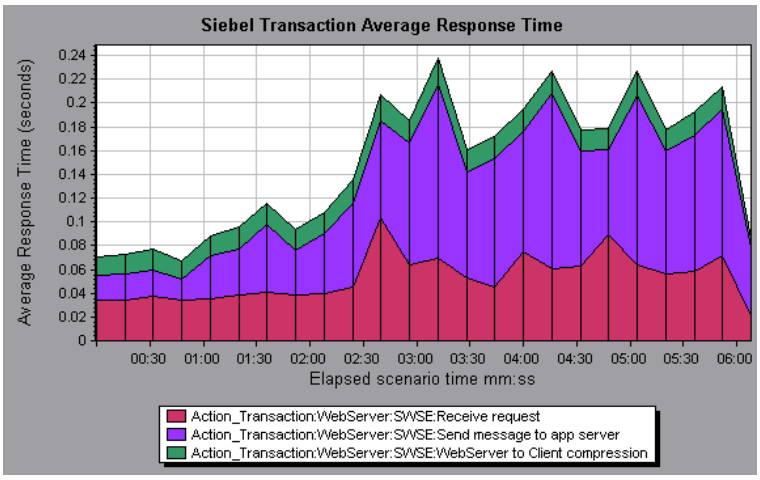


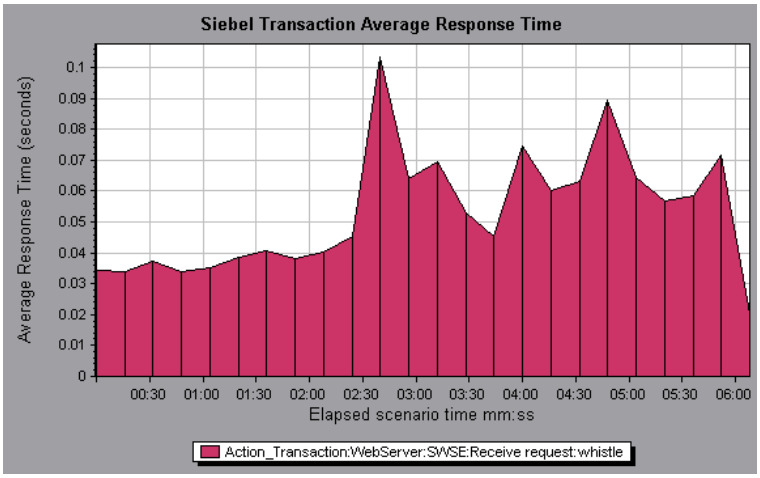
Area Level

Siebel Area Breakdown button breaks the data down to its Siebel areas.

Undo Siebel Area Breakdown button returns the graph to the layer level.

In the following figure, the Web layer of the Action_Transaction transaction has been

	broken down to its Siebel areas. 
Script Level	**Siebel Script Breakdown** button breaks the data down to its Siebel scripts. You can only break down to the script level from the scripting engine area. **Undo Siebel Script Breakdown** button returns the graph to the sub-area level. You can break a transaction down further to its Siebel script level. You can only break down to the script level from the scripting engine area.
Sub-Area Level	**Siebel Sub-Area Breakdown** button breaks the data down to its Siebel sub-areas. You can only break down to the sub-area level from the area level. **Undo Siebel Sub-Area Breakdown** button returns the graph to the area level. In the following figure, the area level of the Action_Transaction transaction has been broken down to its Siebel sub-area. 
Server	**Siebel Server Breakdown** button to group the data by Siebel server.

Level	**Undo Siebel Server Breakdown** button ungroups data in the graph. In the following figure, the Action_Transaction;WebServer:SWSE:Receive Request transaction has been broken down to its Siebel servers. Server level breakdown is usual for pin pointing overloaded servers and for load balancing. 
See also	"Siebel Diagnostics Graphs Overview" on page 311

Siebel Diagnostics Graphs Summary Report

The Siebel Usage section of the Summary Report provides a usage chart for the Siebel layer breakdown. This report is available from the Session Explorer or as a tab in the Analysis window.

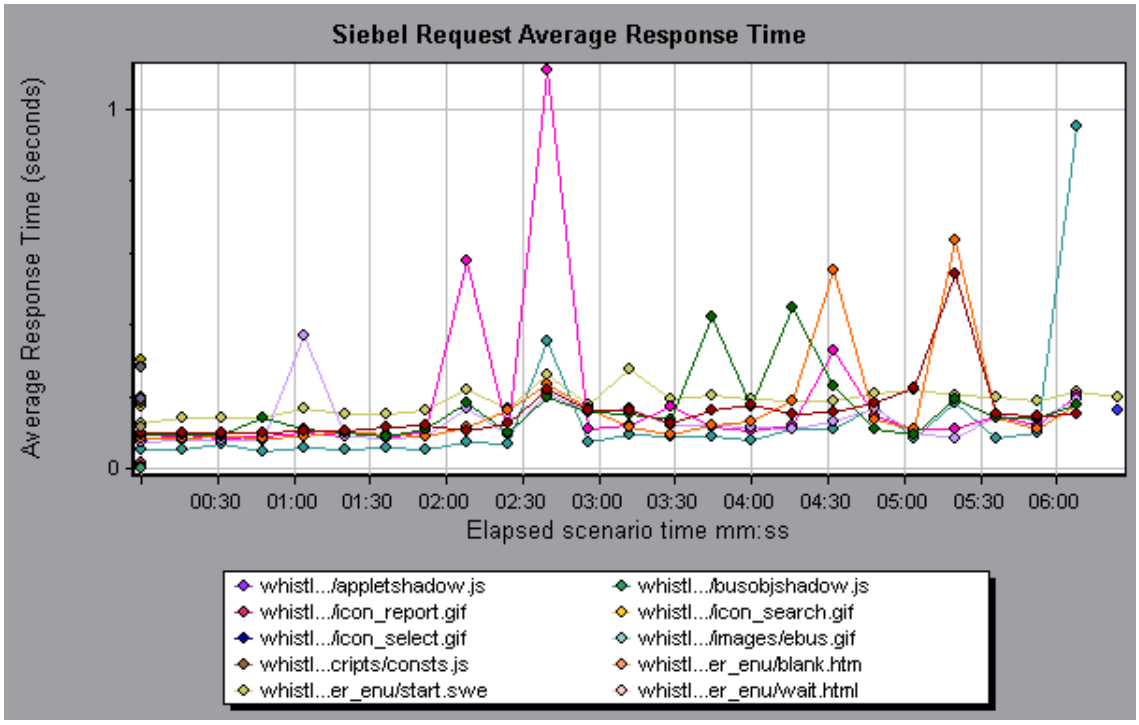
Breakdown options	The Siebel Layer Usage section breaks the individual transactions into: • Web Server • Siebel Server • Database Layers • Total usage time for each transaction
Tips	To view server side diagnostics data from the Summary Report, click the Siebel layer on which you want to perform transaction breakdown. The Siebel Transaction Response Time graph opens displaying the breakdown of the selected transaction.
Note	If you do not see diagnostics data on the Summary Report, check if you are using a user-defined template. To view relevant data, choose a different template from the list of templates, or create and apply a new template. For more information about using templates, see "Apply/Edit Template Dialog Box" on page 84.
See also	"Siebel Diagnostics Graphs Overview" on page 311

Siebel Request Average Response Time Graph

This graph displays the response time per HTTP request.

Purpose	The time is computed as the total request response time divided by the total number of instances of the specific request. For example, if a request was executed twice by one instance of transaction A, and once by a second instance of transaction A, and it took three seconds to execute each request, then the average response time is 9/3, or 3 seconds. The request time does not include the nested calls from within each request.
X-axis	Elapsed time since the start of the run.
Y-axis	Average response time (in seconds) per area.
Breakdown options	For breakdown options, see "Siebel Breakdown Levels" on page 318.
Tips	You can filter the Siebel graphs by the following fields: • **Transaction Name.** Shows data for the specified transaction. • **Scenario Elapsed Time.** Shows data for transactions that ended during the specified time. For more information on filtering, see "Filtering and Sorting Graph Data" on page 103.
See also	"Siebel Diagnostics Graphs Overview" on page 311

Example

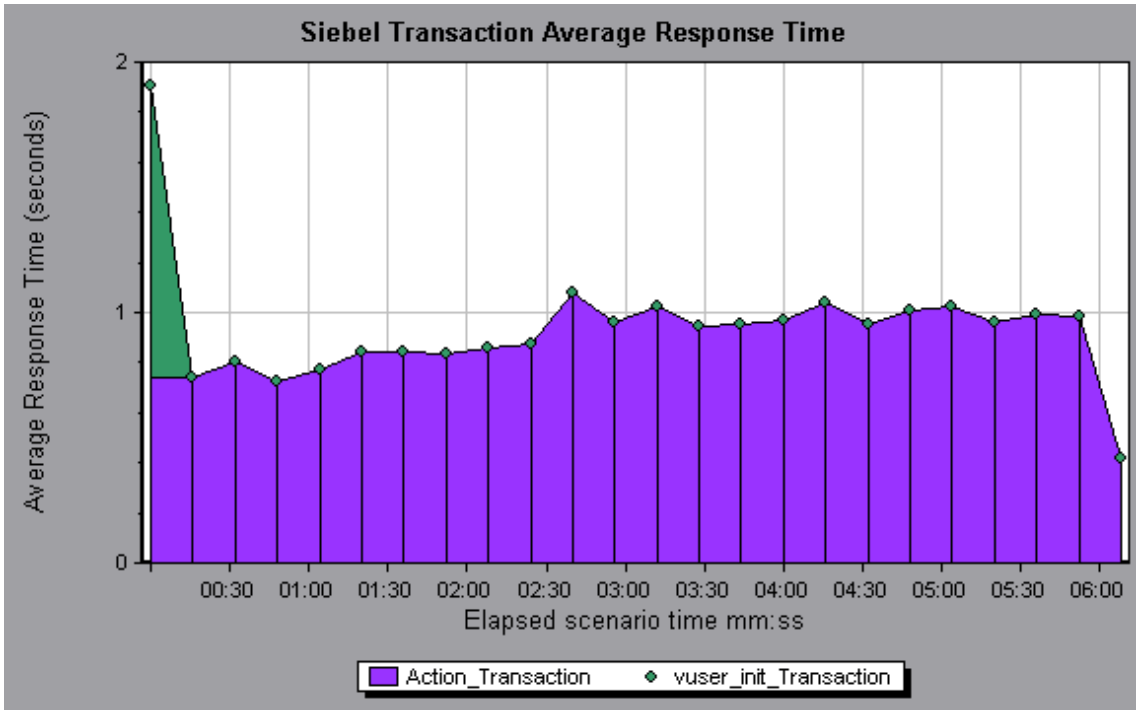


Siebel Transaction Average Response Time Graph

This graph displays the server response time for the selected area (layer, area, or sub-area) within each transaction, computed as the total response time for that layer or area divided by the total number of relevant transactions.

X-axis	Elapsed time since the start of the run.
Y-axis	Average response time (in seconds) per area.
Breakdown options	For breakdown options, see "Siebel Breakdown Levels" on page 318.
Tips	You can filter the Siebel graphs by the following fields: • **Transaction Name.** Shows data for the specified transaction. • **Scenario Elapsed Time.** Shows data for transactions that ended during the specified time. For more information on filtering, see "Filtering and Sorting Graph Data" on page 103.
See also	"Siebel Breakdown Levels" on page 318

Example



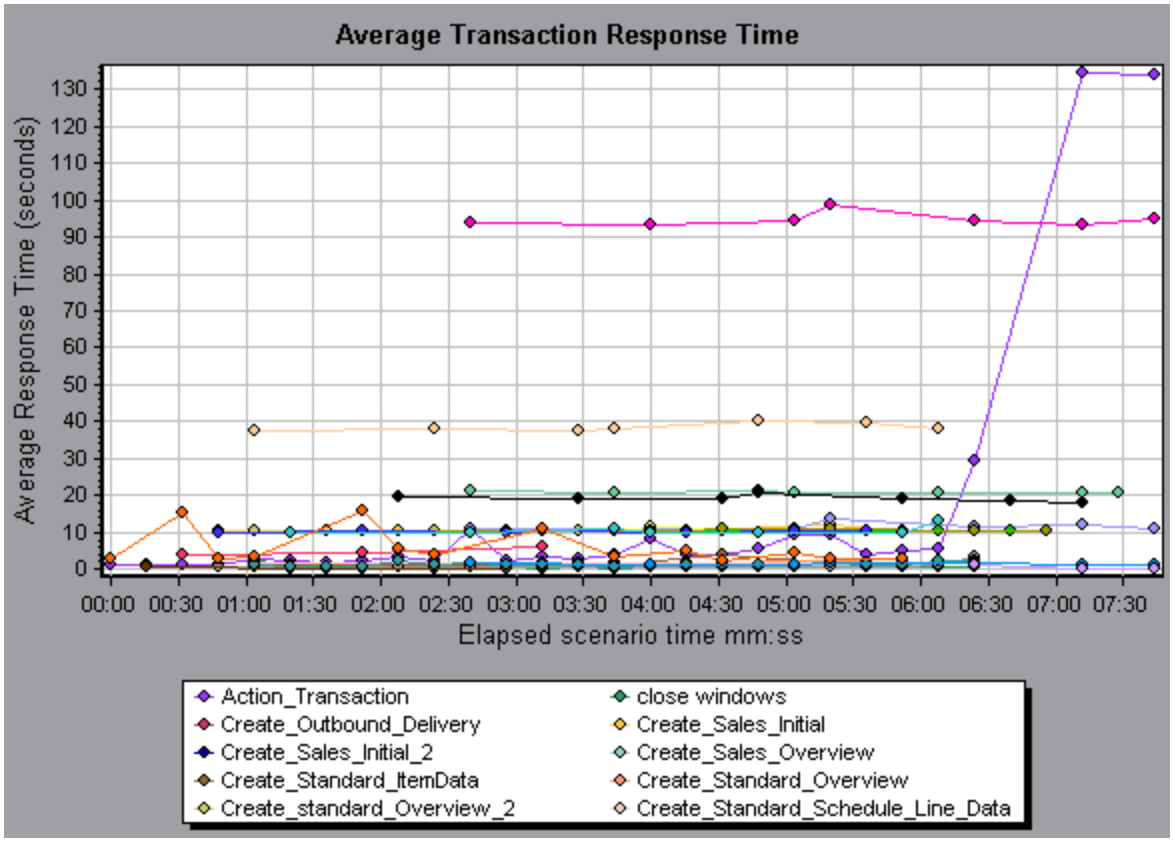
Siebel DB Diagnostics Graphs

Siebel DB Diagnostics Graphs Overview

Siebel DB Diagnostics graphs provide you with performance information for SQLs generated by transactions on the Siebel system. You can view the SQLs for each transaction, identify the problematic SQL queries of each script, and identify at what point problems occurred.

To analyze where problems are occurring, you correlate the data in the Siebel DB Diagnostics graphs with data in the Transaction Response Time graphs.

You begin analyzing these graphs with the transaction graphs that display the average transaction response time during each second of the load test scenario run. For example, the following Average Transaction Response Time graph demonstrates that the average transaction response time for the **query_for_contact** transaction was high.



Using the Siebel DB Diagnostics graphs, you can pinpoint the cause of the delay in response time for this transaction.

> **Note:** A measurement that is broken down in the Average Transaction Response Time graph will be different from the same measurement broken down in the Siebel DB Side Transactions graph. This is because the Average Transaction Response Time graph displays the average transaction time, whereas the Siebel DB Side Transactions graph displays the average time per transaction event (sum of SQL component response times).

How to Synchronize Siebel Clock Settings

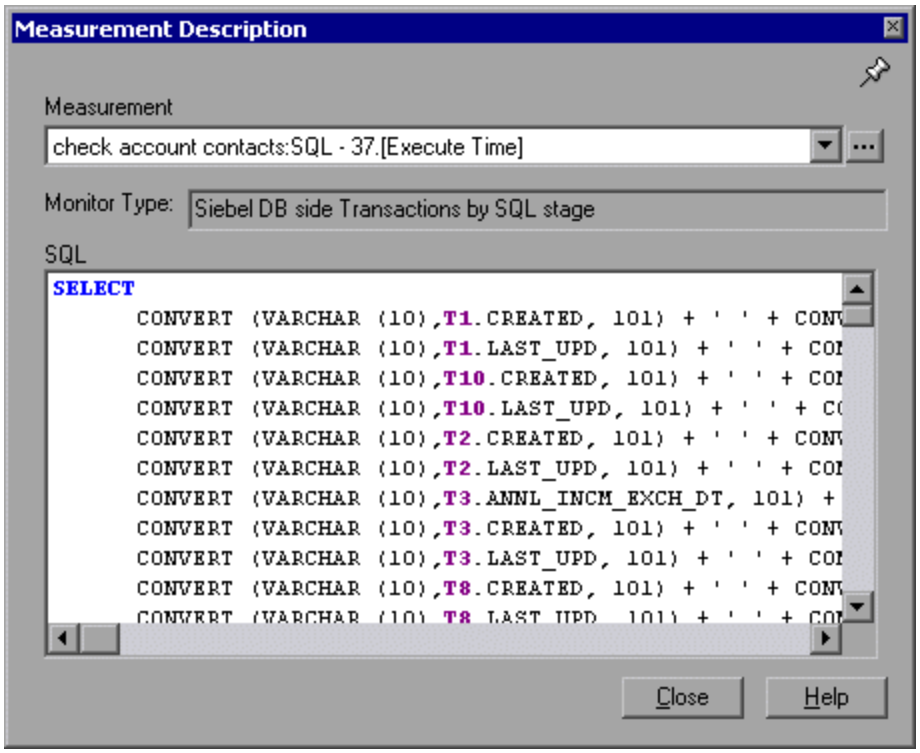
This task describes how to synchronize the Load Generator and Siebel application server clocks to ensure that the correlation of SQLs to transactions is correct.

1. Choose **Tools > Siebel Database Diagnostics Options**.
2. Select **Apply Application Server time settings.**
3. Click **Add** and enter the information as described in "Siebel Database Diagnostics Options Dialog Box" on page 328.
4. Click **OK** to save the data and close the dialog box.

> **Note:** You must reopen the results file for time synchronization to take effect.

Measurement Description Dialog Box

You can view the full SQL statement for a selected SQL element by choosing **Show measurement description** from the Legend window. The Measurement Description dialog box opens displaying the name of the selected measurement and the full SQL statement.



To access	Legend window >
See also	"Siebel Database Breakdown Levels" on the next page

User interface elements are described below:

UI Element	Description
	Break the data down to a lower level.
	Return to the previous level.
	To keep the focus on the Measurement Description dialog box, click the **Stay on Top** button. This enables you to view the full SQL statement of any measurement by selecting it in the Legend window. Click the button again to remove the focus.
	Click the **Breaking Measurement** button to display the Transaction Name and SQL Alias Name of the selected measurement.

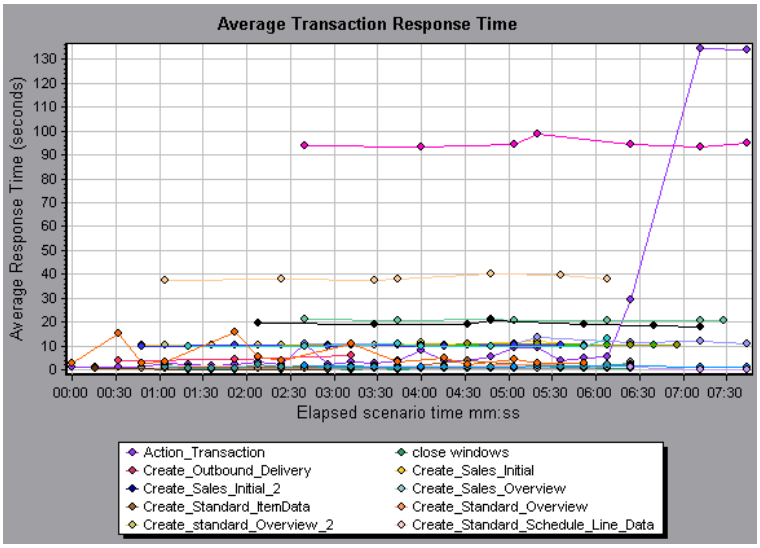
Siebel Database Breakdown Levels

You can break down Siebel layers into areas, sub-areas, servers, and scripts to enable you to pinpoint the exact location where time is consumed.

To access	Use one of the following to access breakdown options**:** • **<Siebel DB Diagnostics Graphs> > View > Siebel DB Diagnostics** • **<Siebel DB Diagnostics Graphs> >** select transaction **>** short-cut menu **> Siebel DB Diagnostics** • See toolbar options for each breakdown level
Important information	The breakdown menu options and buttons are not displayed until a transaction is selected.
See also	"Siebel DB Diagnostics Graphs Overview" on page 324

Siebel Breakdown Levels are described below:

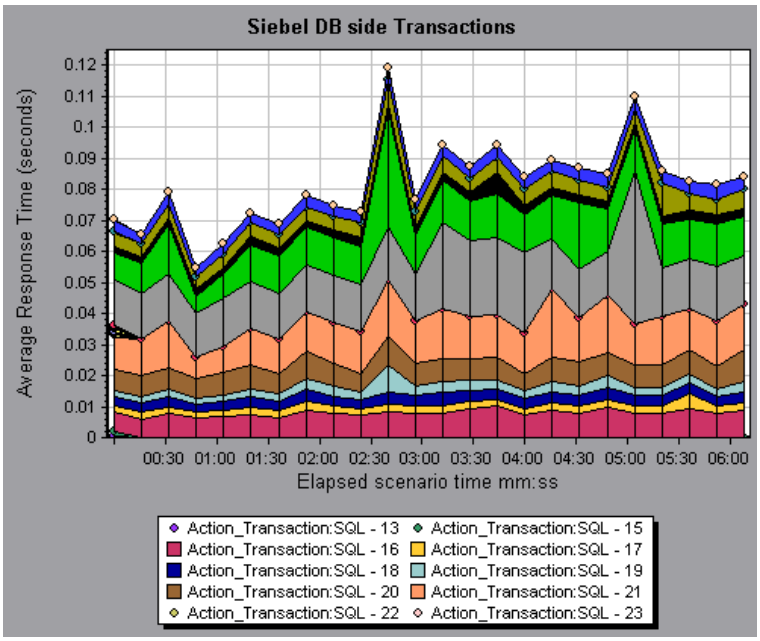
Transaction Level	The following figure displays the top level Average Transaction Response Time graph. The graph displays several transactions. You can break this graph down to show the SQL statements and the SQL stages level.



SQL Statements Level

Siebel SQL Statements Breakdown button shows the breakdown of the selected transaction.

In the following figure, the Siebel DB Side Transactions graph displays the Action_ Transaction broken down to its SQL statements.

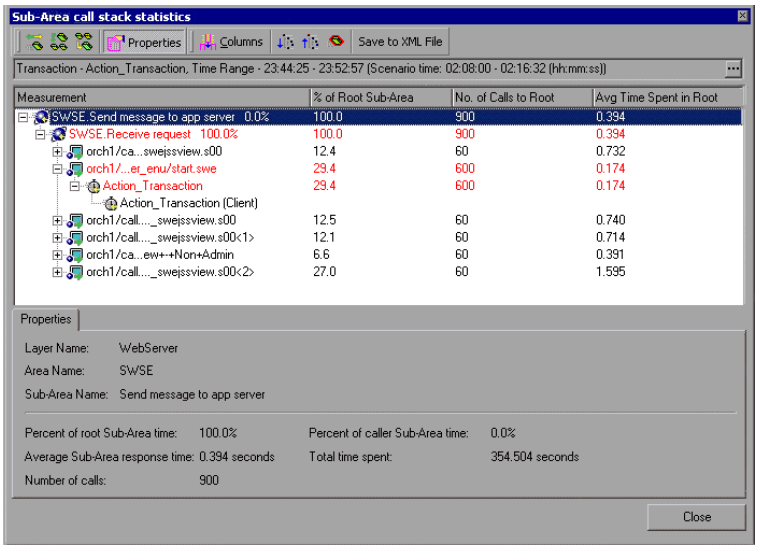
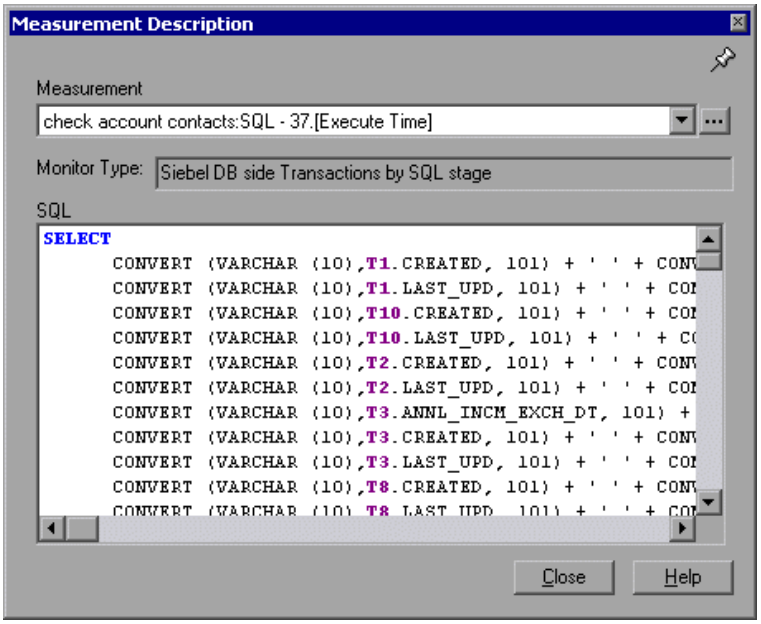


SQL Stages Level

Measurement Breakdown button breaks the data down to a lower level.

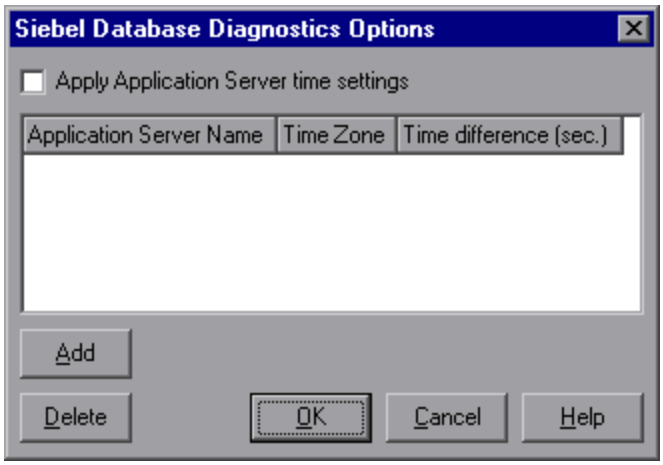
Undo Breakdown Measurement button returns to the previous level.

In the following figure, the Siebel DB Side Transactions by SQL Stage graph displays

	Action_Transaction:SQL-33 broken down to its SQL stage: Prepare, Execute, and Initial Fetch. 
Show measurement description	You can view the full SQL statement for a selected SQL element by choosing **Show measurement description** from the Legend window. The Measurement Description dialog box opens displaying the name of the selected measurement and the full SQL statement. 
See also	"Siebel DB Diagnostics Graphs Overview" on page 324

Siebel Database Diagnostics Options Dialog Box

This dialog box enables you to synchronize the Load Generator and Siebel application server clocks.



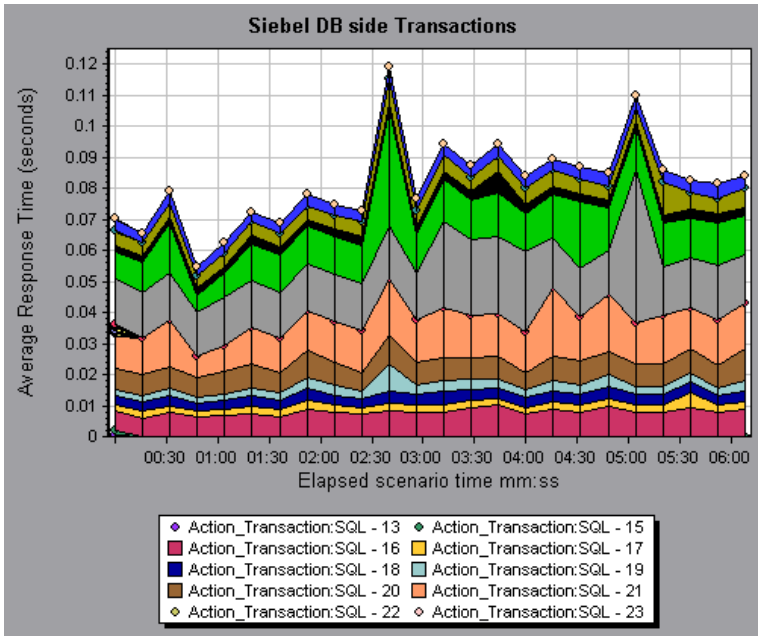
To access	**Tools > Siebel Database Diagnostics Options**
Note	You must reopen the results file for time synchronization to take effect.
See also	"How to Synchronize Siebel Clock Settings" on page 325

User interface elements are described below:

UI Element	Description
Apply Application Server time settings	Enables the synchronized time settings option.
Application Server Name	Enter the name of the Siebel application server.
Time Zone	Enter the time zone of the Siebel application server (GMT or Local). GMT means the application server time is reported in GMT time, and local means the application server time is reported in local time.
Time Difference (sec.)	Enter the time difference (in seconds) between the load generator and the Siebel application server. Use the minus sign ("-") if the time on Siebel application server is ahead of the load generator. For example, if the application server time is two minutes ahead of the load generator time, enter `-120` in the time difference field.
Add	Enables you to add an application server's time settings to the list.
Delete	Deletes the server breakdown time settings from the list.

Siebel DB Side Transactions Graph

This graph displays the average transaction execution time in the Siebel database.

X-axis	Elapsed time since the start of the run.
Y-axis	Average response time (in seconds) of each transaction.
Breakdown options	You can break down a transaction in the Siebel DB Side Transactions graph to view its SQL statements. In the following figure, the **Action_Transaction** transaction is broken down to its SQL statements. 
See also	"Siebel DB Diagnostics Graphs Overview" on page 324

Siebel DB Side Transactions by SQL Stage Graph

This graph displays the time taken by each SQL, grouped by SQL stage: Prepare, Execute, and Initial Fetch.

X-axis	Elapsed time since the start of the run.
Y-axis	Average time (in seconds) taken to perform each SQL stage.
Breakdown options	"Siebel Database Breakdown Levels" on page 326
See also	"Siebel DB Diagnostics Graphs Overview" on page 324

Siebel SQL Average Execution Time Graph

This graph displays the average execution time of each SQL performed in the Siebel database.

Purpose	This enables you to identify problematic SQLs regardless of the transaction that produced them. You can then choose **Show measurement description** from the Legend window to view the full SQL statement. The SQL statements are listed by a numeric ID.
X-axis	Elapsed time since the start of the run.
Y-axis	Average response time (in seconds) of each SQL.
Breakdown options	"Siebel Database Breakdown Levels" on page 326
See also	"Siebel DB Diagnostics Graphs Overview" on page 324

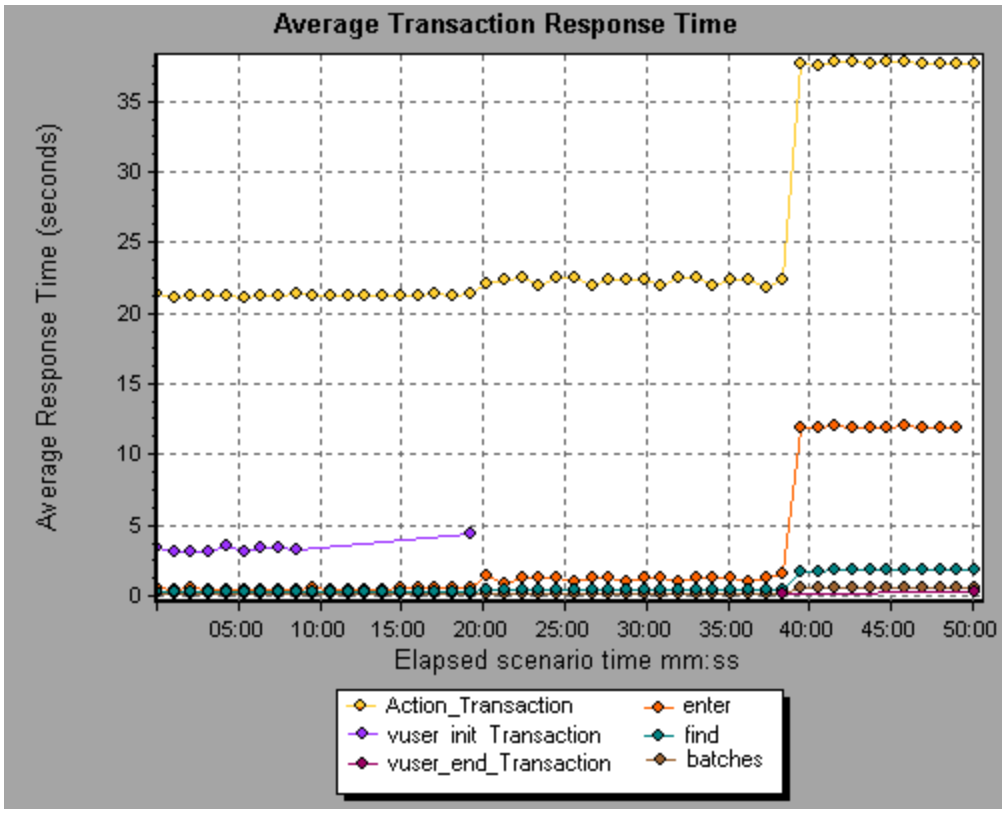
Oracle - Web Diagnostics Graphs

Oracle - Web Diagnostics Graphs Overview

Oracle - Web Diagnostics graphs provide you with performance information for SQLs generated by transactions on the Oracle NCA system. You can view the SQLs for each transaction, identify the problematic SQL queries of each script, and identify at what point problems occurred.

To analyze where problems are occurring, you correlate the data in the Oracle - Web Diagnostics graphs with data in the Transaction Response Time graphs.

You begin analyzing these graphs with the transaction graphs that display the average transaction response time during each second of the load test scenario run. For example, the following Average Transaction Response Time graph demonstrates that the average transaction response time for the **enter** transaction was high.



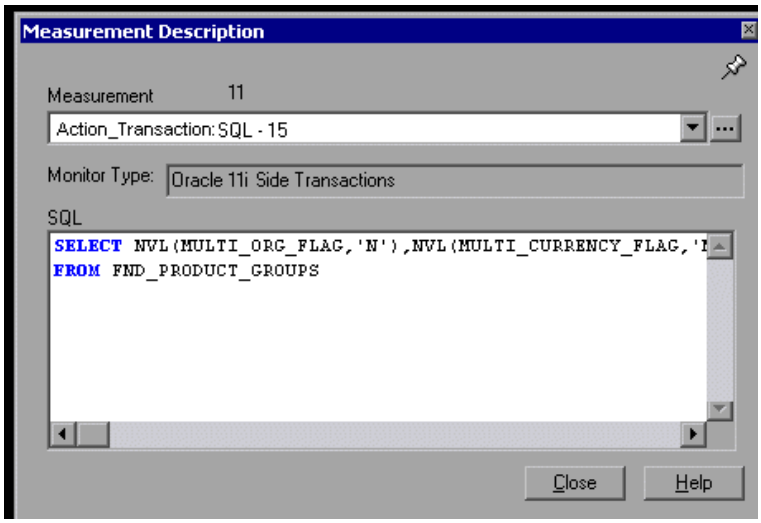
Using the Oracle - Web Diagnostics graphs, you can pinpoint the cause of the delay in response time for this transaction.

Note:

- A measurement that is broken down in the Average Transaction Response Time graph will be different from the same measurement broken down in the Oracle - Web(DB) Side Transactions graph. This is because the Average Transaction Response Time graph displays the average transaction time, whereas the Oracle - WebDB Side Transactions graph displays the average time per transaction event (sum of SQL component response times).
- **vuser_init** and **vuser_end** actions in Oracle cannot be broken down.

Measurement Description Dialog Box

This dialog box enables you to view the full SQL statement for a selected SQL element.



To access	Legend window >
See also	• "Oracle - Web Diagnostics Graphs Overview" on page 331 • "Oracle Breakdown Levels" below

User interface elements are described below:

UI Element	Description
	To keep the focus on the Measurement Description dialog box, click the Stay on Top button. This enables you to view the full SQL statement of any measurement by selecting it in the Legend window. Click the button again to remove the focus.
	Click the Breaking Measurement button to display the Transaction Name and SQL Alias Name of the selected measurement.

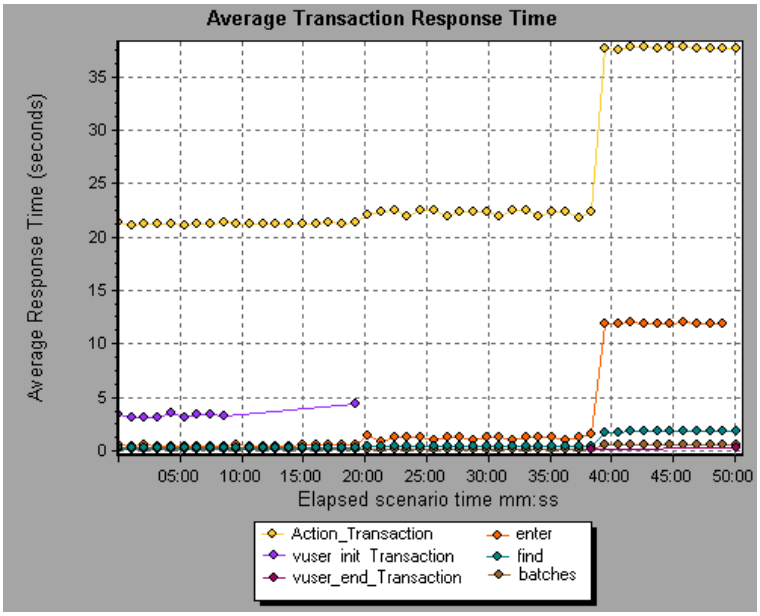
Oracle Breakdown Levels

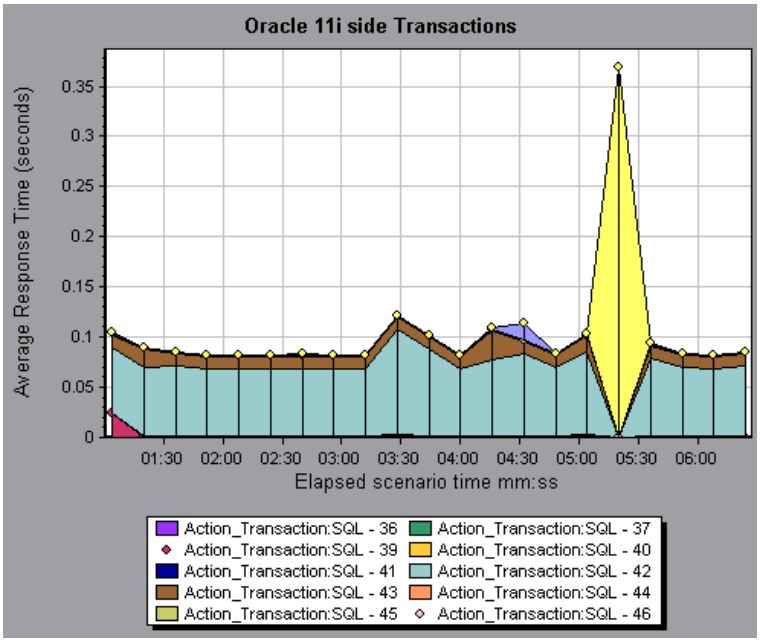
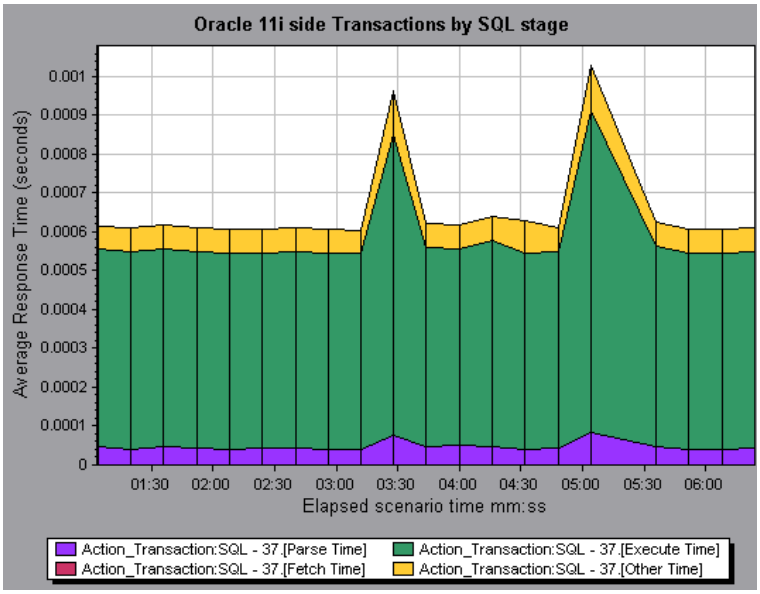
After you have enabled Oracle - Web Diagnostics on the Controller machine and run the load test scenario, you can view the diagnostics data.

To access	Use one of the following to access breakdown options: • **<Oracle Diagnostics Graphs> > View > Oracle Diagnostics** • **<Oracle Diagnostics Graphs>** > select transaction > shortcut menu > **Oracle Diagnostics** • See toolbar options for each breakdown level
Important Information	The breakdown menu options and buttons are not displayed until a transaction is selected.

See also	"Oracle - Web Diagnostics Graphs Overview" on page 331

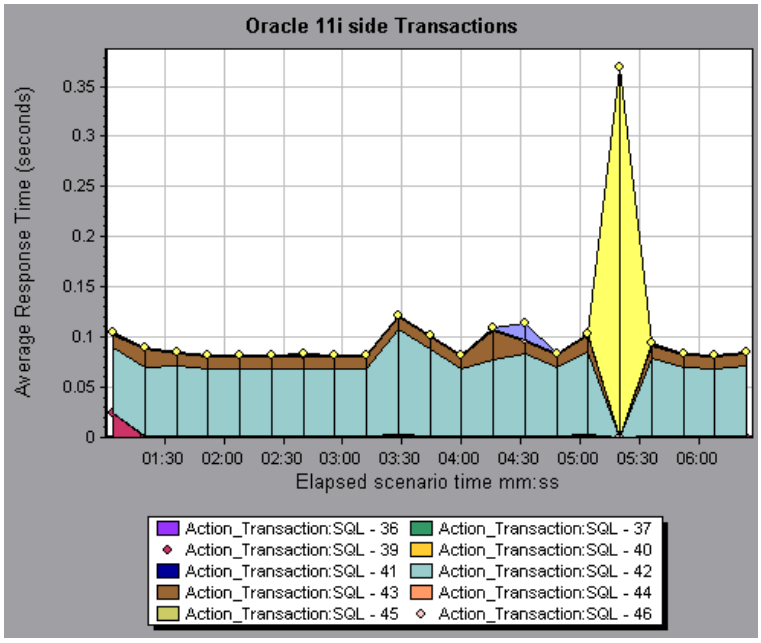
Oracle Breakdown Levels are described below:

Transaction Level	The following figure illustrates the top level Average Transaction Response Time graph. The graph displays several transactions. 
SQL Statements Level	 **Oracle SQL Statement Breakdown** button shows the breakdown of the selected transaction. In the following figure, the Oracle - WebDB Side Transactions graph displays the Action_Transaction transaction broken down to its SQL statements.

	
SQL Stages Level	In the following figure, the Oracle - WebDB Side Transactions by SQL Stage graph displays Action_Transaction:SQL-37 broken down to its SQL stages: Parse Time, Execute Time, Fetch Time, and Other Time. Other Time includes other database time such as bind time. 
	You can break the data down to a lower level.
	Enables you to return to a previous level.

Oracle - WebDB Side Transactions Graph

This graph displays the average transaction execution time in the Oracle database.

X-axis	Elapsed time of the scenario run.
Y-axis	Response time (in seconds) of each transaction.
Breakdown options	You can break down a transaction in the Oracle - WebDB Side Transactions graph to view its SQL statements. In the following figure, the Action_Transaction transaction is broken down to its SQL statements.  To break the displayed elements down further, see "Oracle Breakdown Levels" on page 333.
See also	"Oracle - Web Diagnostics Graphs Overview" on page 331

Oracle - WebDB Side Transactions by SQL Stage Graph

This graph displays the time taken by each SQL, divided by the SQL stages: Parse Time, Execute Time, Fetch Time, and Other Time. Other Time includes other database time such as bind time.

X-axis	Elapsed time since the scenario run.
Y-axis	Average response time (in seconds) of each SQL stage.
Breakdown options	"Oracle Breakdown Levels" on page 333
See also	"Oracle - Web Diagnostics Graphs Overview" on page 331

Oracle - Web SQL Average Execution Time Graph

This graph displays the average execution time of each SQL performed in the Oracle database.

Purpose	The graph enables you to identify problematic SQLs regardless of the transaction that produced them.
X-axis	Elapsed time since the scenario run.
Y-axis	Average response time (in seconds) of each SQL.
Breakdown options	"Oracle Breakdown Levels" on page 333
Tips	You can select **Show measurement description** from the Legend window to view the full SQL statement.
Note	The SQL statements are shortened to a numeric indicator.
See also	"Oracle - Web Diagnostics Graphs Overview" on page 331

SAP Diagnostics Graphs

SAP Diagnostics Graphs Overview

SAP Diagnostics enables you to pinpoint the root cause of a certain problem (for example, DBA, Network, WAS, Application, OS/HW) quickly and easily, and engage with the relevant expert only, without having to present the problem to a whole team of people.

Using SAP Diagnostics, you can create graphs and reports, which you can present to the relevant expert when discussing the problems that occurred.

SAP Diagnostics also allow an SAP performance expert (in one of the areas of expertise) to perform the required root-cause analysis more quickly and easily.

How to Configure SAP Alerts

SAP Diagnostics comes with a set of alert rules with pre-defined threshold values.

When you open a LoadRunner results file (.lrr) in Analysis, these alert rules are applied to the load test scenario results, and if a threshold value is exceeded, Analysis generates an alert that there is a problem.

Before opening a LoadRunner results file, you can define new threshold values for the alert rules using the Alerts Configuration dialog box. Then, when you open the results file, the customized alert rules are applied.

> **Note:** When an Analysis session is open, the Alerts Configuration dialog box is not editable. To edit thresholds in the Alerts Configuration dialog box, close all open sessions.

This task describes how to define threshold values for alert rules when analyzing load test scenario results.

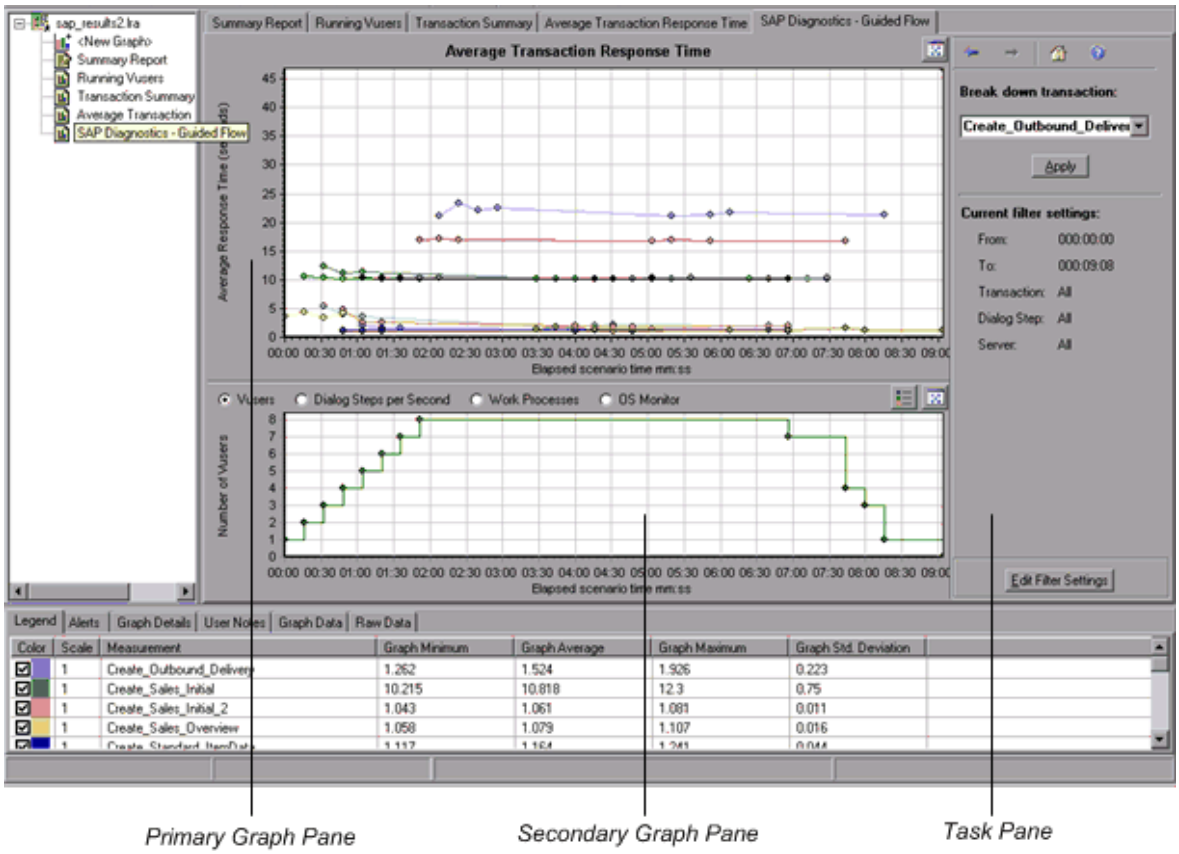
1. Close all open Analysis sessions.
2. From the **Tools** menu, select **SAP Diagnostics Alerts Configuration**.
3. The **Generate alert if** column lists the rules. Set the threshold for each rule in the **Threshold** column.
4. By default, all pre-defined alert rules are enabled. To disable an alert rule, clear the check box next to that rule.
5. Click **OK** to apply your changes and close the Alerts Configuration dialog box.

> **Note:** Modifying the alert rules does not affect the results of a saved Analysis session. You need to re-analyze the results in order for new settings to take effect.

SAP Diagnostics - Guided Flow Tab

You open the SAP Diagnostics graphs from the Analysis Summary Report or from **Session Explorer > Graphs > SAP Diagnostics - Guided Flow.**

This tab remains open throughout the Analysis application flow, and its content varies according to the breakdown flow.



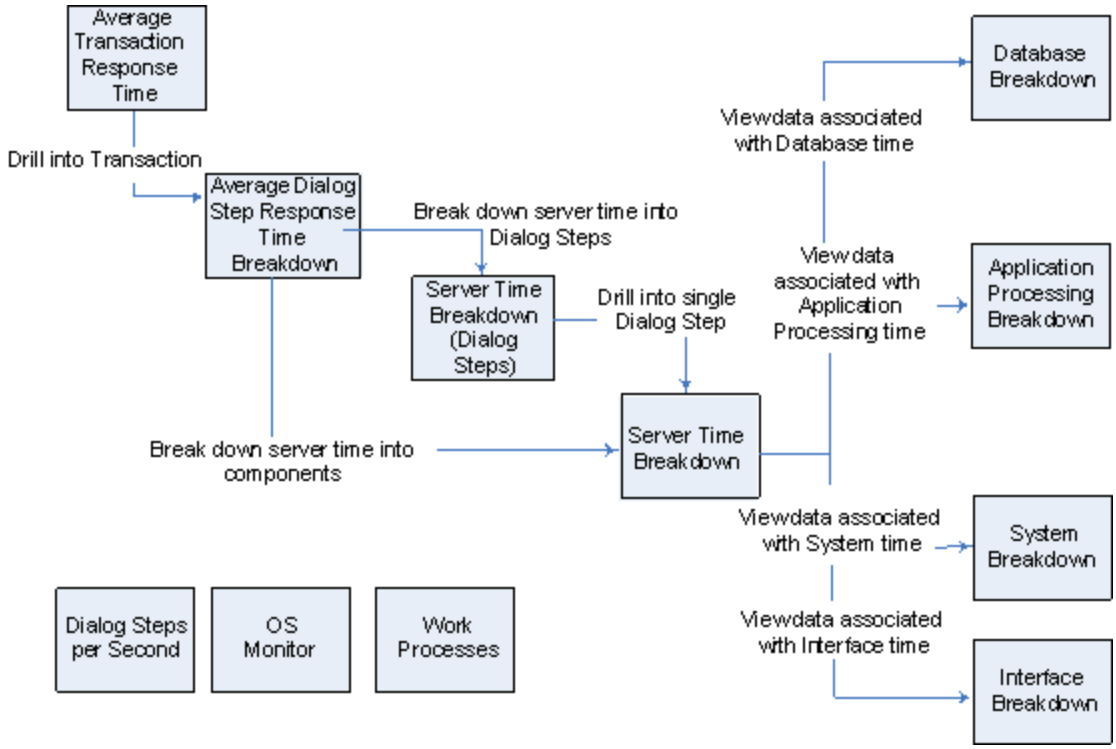
User interface elements are described below:

UI Element	Description
Primary Graph Pane	The upper pane of the SAP Diagnostics - Guided Flow tab is referred to as the *primary graph pane*. This pane displays graphs of the transactions and their broken down dialog steps or components, and other associated resources. You break down the graphs displayed in this pane using the breakdown options provided in the right pane of the guided flow (see "SAP Breakdown Task Pane" on page 346). You can open the displayed graph in full view by clicking the **Enlarge Graph** button in the top right corner of this pane. An enlarged version of the graph opens in a new tab.
Secondary Graph Pane	The lower pane of the SAP Diagnostics - Guided Flow tab is referred to as the *secondary graph pane* and displays graphs showing secondary information supporting the graph displayed in the primary graph pane. To see the legend for the graph displayed in this pane, click the **Graph Legend** button in the top right corner. To see all the data in the Legend, scroll along the horizontal scroll bar. You can open the displayed graph in full view by clicking the **Enlarge Graph** button in the

UI Element	Description
	top right corner of this pane. An enlarged version of the graph opens in a new tab.
Task Pane	The pane on the right side of the SAP Diagnostics - Guided Flow tab is referred to as the *task pane*. You use the task pane to choose the level of breakdown you want to view, to filter and group transaction and server information, and to navigate backwards and forwards through the broken down graphs. For more information, see "SAP Breakdown Task Pane" on page 346.

SAP Diagnostics Application Flow

The following diagram depicts the general flow of SAP Diagnostics:



The main view of SAP Diagnostics displays all of the transactions in a scenario run for which there is SAP diagnostics data. Each transaction can be broken down into server-time components, or first into the dialog steps that comprise a transaction, and then into server-time components. The server components can further be broken down into sub-components or other related data.

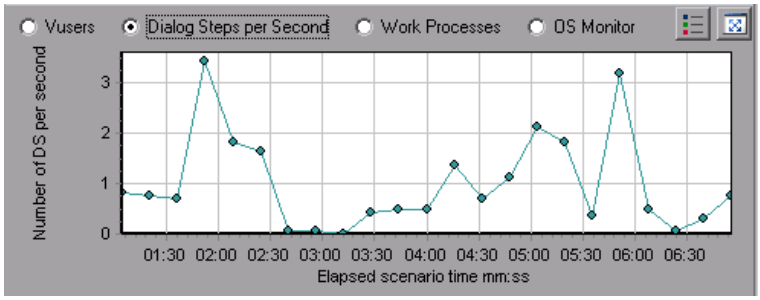
There are three independent/parallel views: **Dialog Steps per Second**, **OS Monitor**, and **Work Processes**. These do not generally participate in the breakdown flow, and you may choose to display or hide them.

Dialog Steps per Second Graph

This graph represents the number of dialog steps that ran on all the servers during each second of the load test scenario run.

X-axis	Elapsed scenario time (in hh:mm:ss).
Y-axis	Number of dialog steps per second.
See also	"SAP Breakdown Task Pane" on page 346 "Vuser Graphs" on page 127 "Work Processes Graph" on page 353 "OS Monitor Graph" below

Example

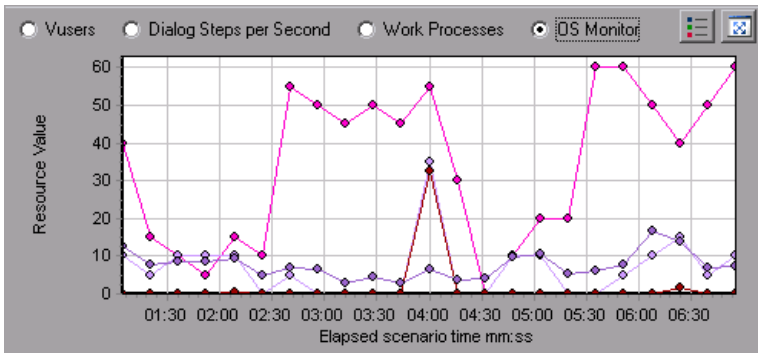


OS Monitor Graph

This graph represents the operating system resources that were measured throughout the load test scenario run.

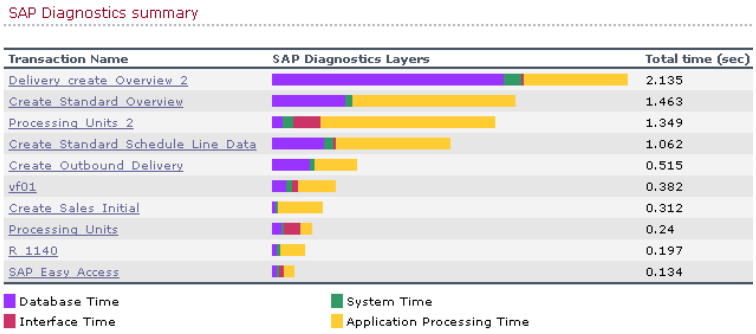
X-axis	Elapsed scenario time (in hh:mm:ss).
Y-axis	Resource value.
Note	This graph is available only when a single server filter is applied.
See also	"SAP Breakdown Task Pane" on page 346 "Dialog Steps per Second Graph" above "Work Processes Graph" on page 353

Example



SAP Alerts Configuration Dialog box

This dialog box enables you to define threshold values for alert rules used when opening the results file (.lrr) in Analysis.



Important information	Modifying the alert rules does not affect the results of a saved Analysis session. You need to re-analyze the results in order for new settings to take effect.
See also	"SAP Diagnostics Graphs Overview" on page 337

User interface elements are described below:

UI Element	Description
Enabled	By default, all pre-defined alert rules are enabled. To disable an alert rule, clear the check box next to that rule.
Generate alert if	The **Generate alert if** column lists the rules.
Threshold	Set the threshold for each rule in the **Threshold** column.

SAP Alerts Window

This Window displays a list of alerts related to the data displayed in the current graph(s) shown in the Analysis window.

To access	**Windows > SAP Alerts**
See also	"SAP Alerts Configuration Dialog box" on the previous page "How to Configure SAP Alerts" on page 337

User interface elements are described below:

UI Element	Description
Type	Displays one of the following icons indicating the type of alert: **Standard Alert.** This alert is generated in the context of a transaction and/or server if the conditions of a pre-defined alert rule are met. **Major Alert**. There are two types of alerts: • **General Application Problem Alert.** If a standard alert was generated in the context of a transaction, and the same alert was generated in the context of all other transactions running in the same time frame, then a major alert of this type is generated, indicating that there is a general application problem. **Note:** If a Dialog Step filter is applied (for a single dialog step), then this alert is not generated. • **Server-Specific Problem Alert.** This alert is generated for a specific server if a certain measurement on that server exceeds its threshold, while the overall server performance for that measurement is satisfactory. This type of alert indicates that there is a server related problem. **Note:** Server-Specific Problem alerts are generated only when the current server context is "All Servers".
Time interval	The time interval during which the problem occurred.
Transaction/Server	The name of the transaction and server where problem occurred.
Description	A description of the alert.
Recommended Step	Recommends what to do in order to understand the problem on a deeper level.
Action	A link to a graph representing the data described in the alert, allowing for a

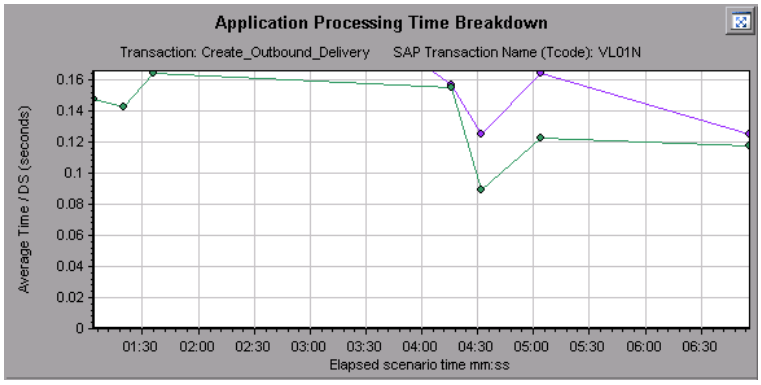
UI Element	Description
	more graphic display of the alert. Double-click the link to open the graph.

SAP Application Processing Time Breakdown Graph

This graph displays the behavior of resources associated with application processing time, namely ABAP time and CPU time.

X-axis	Elapsed load test scenario time (in hh:mm:ss).
Y-axis	Average time per dialog step (in seconds).
See also	"SAP Breakdown Task Pane" on page 346 "SAP Secondary Graphs" on page 353

Example



SAP Primary Graphs

You view the SAP Diagnostics graphs in the primary graph pane.

You can open the graph in full view by clicking  in the top right corner of the primary graph pane. An enlarged version of the graph opens in a new tab.

To filter or group data displayed in these graphs, see "SAP Breakdown Task Pane" on page 346.

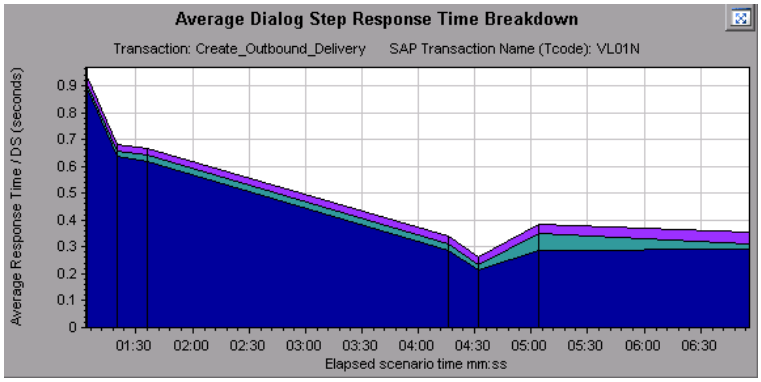
SAP Average Dialog Step Response Time Breakdown Graph

This graph represents a breakdown of the average dialog step response time of a specific transaction. The graph displays the Network Time, Server Response Time, (including the GUI time), and Other Time (the time taken for the client to process the dialog step) of a single transaction.

X-axis	Elapsed time since the start of the run (in hh:mm:ss).

Y-axis	The average response time divided by the number of dialog steps (in seconds).
Breakdown options	**Components** This option opens the "SAP Server Time Breakdown Graph" on page 349 **Dialog Steps** This option opens the "SAP Server Time Breakdown (Dialog Steps) Graphs" on page 348
See also	"SAP Breakdown Task Pane" on the next page "SAP Secondary Graphs" on page 353 "SAP Breakdown Task Pane" on the next page

Example



SAP Average Transaction Response Time Graph

This graph displays all the SAP-related transactions in the load test scenario.

X-axis	Elapsed time since the start of the run.
Y-axis	Average response time (in seconds) of each transaction
Breakdown graph	"SAP Average Dialog Step Response Time Breakdown Graph" on the previous page
Tips	Select a transaction in one of the following ways: • Select the transaction from the Breakdown transaction: list in the task pane. • Highlight the transaction by selecting the line representing it in the graph. • Select the transaction from the graph legend. This highlights the line in the graph.
See also	"SAP Breakdown Task Pane" on the next page

	"SAP Secondary Graphs" on page 353 "SAP Breakdown Task Pane" below

SAP Breakdown Task Pane

The task pane enables you to choose the level of breakdown you want to view, to filter and group transaction and server information, and to navigate backwards and forwards through the broken down graphs.

To access	**Session Explorer > Graphs > SAP Diagnostics > SAP Diagnostics - Guided Flow**
See also	"SAP Diagnostics Graphs Overview" on page 337

SAP Breakdown Toolbar

User interface elements are described below:

UI Element	Description
	Back. Click to view previous breakdown graph, or to ungroup grouped data.
	Next. Click to view next breakdown graph.
	Home. Click to return to the initial SAP Average Transaction Response Time graph.
	Help. Click to get help on the breakdown options.

Breakdown Options

To break down SAP diagnostics data, choose the breakdown and filter options from the task pane.

User interface elements are described below:

UI Element	Description
Break down transaction	Select a transaction from this list to display the average dialog step response time breakdown.
Break down server time into	Displays the breakdown options for the Average Dialog Step Response Time Breakdown graph. • Select **Components** to view a breakdown of the transaction's server components, namely database time, interface time, application processing time, and system time.

UI Element	Description
	• Select **Dialog Steps** to view a breakdown of the transaction's dialog steps.
Break down dialog step <dialog step>	Break down a dialog step into its server-time components, namely database time, interface time, application processing time, and system time.
View data associated with <component>	Break down a server-time component (database time; interface time; application processing time; system time) to view data associated with it.
No available breakdown	There are no further breakdown options.
Apply	Click to apply the selected breakdown option.

Current filter settings

This section displays the filter/grouping settings of the graph currently displayed in the primary graph pane.

User interface elements are described below:

UI Element	Description
From/To	Enter values (in hh:mm:ss) to filter the graph over a specified time interval.
Transaction	Displays the name of the transaction represented in the graph.
Dialog Step	Displays the name of the dialog step represented in the graph.
Server	Displays the name of the server represented in the graph.

Edit filter settings

Click this button to modify filter or grouping settings. When you click **Edit Filter Settings** the filter/grouping options become editable.

User interface elements are described below:

UI Element	Description
Filter	Use this option to filter the current graph by time interval, transaction, dialog step, and/or server. • **From/To.** Enter values (in hh:mm:ss) to filter the graph over a specified time interval. • **By Transaction.** Filter the graph to display information about a specific transaction by

UI Element	Description
	selecting the transaction from the list. • **By Dialog Step.** Filter the graph to display information about a specific dialog step by selecting the dialog step from the list. • **By Server.** Filter the graph to display information about a server by selecting the server name from the list. **Note:** Only servers associated with the data displayed in the current graph are listed in the By Server list
Group	Use this option to group the data represented in the graph by transaction or by server. Select a transaction, component or subcomponent from the list. • **By Transaction**. Select this check box to group by transaction. • **By Server**. Select this check box to group by server. **Note:** After applying grouping to a graph, you need to ungroup the data in order to apply further breakdown options. To ungroup grouped data, click the **Back** button on the toolbar. **Important:** When you open a saved session, the **Back** is disabled. If you have grouped data, you need to click the Home button, or open a new SAP Diagnostics - Guided Flow tab to restart SAP breakdown.
OK	Click **OK** to apply the chosen filter/grouping settings. The **Current filter settings** area displays the chosen settings in non-editable mode. **Notes**: • Global filtering is enabled when viewing SAP Diagnostics graphs (special SAP view) but cannot be applied on these graphs. • Local filtering is disabled in the SAP Diagnostics - Guided Flow tab. To apply local filters to a SAP Diagnostics graph displayed in the Guided Flow tab, open the graph in a new tab by clicking the Enlarge Graph button.

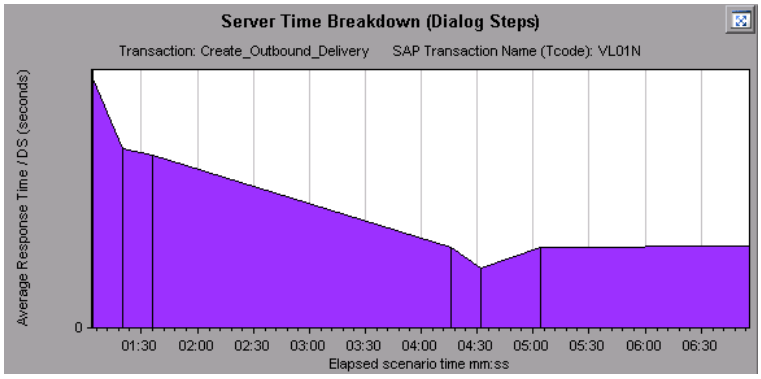
SAP Server Time Breakdown (Dialog Steps) Graphs

This graph displays the dialog steps of a particular transaction.

X-axis	Elapsed time since the start of the run (in hh:mm:ss).
Y-axis	The average response time per dialog step (in seconds).
Breakdown graph	"SAP Server Time Breakdown Graph" on the next page

See also	"SAP Breakdown Task Pane" on page 346 "SAP Secondary Graphs" on page 353 "SAP Breakdown Task Pane" on page 346

Example

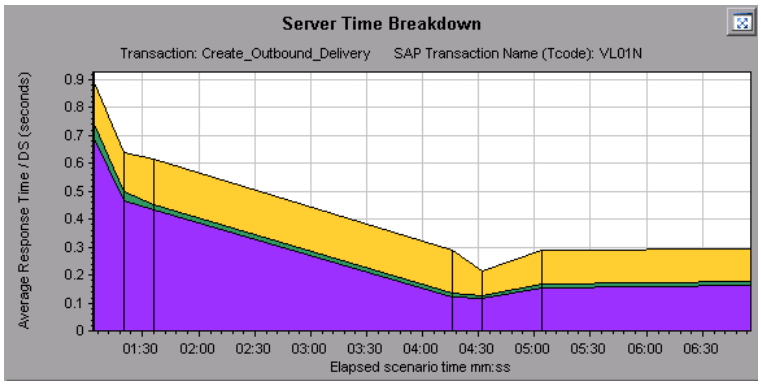


SAP Server Time Breakdown Graph

This graph represents the server-time components of a single transaction, namely database time, application processing time, interface time, and system time.

X-axis	Elapsed time since the start of the run (in hh:mm:ss).
Y-axis	Represents the average response time per dialog step (in seconds).
Breakdown graphs	• "SAP Database Time Breakdown Graph" on the next page • "SAP Application Processing Time Breakdown Graph" on page 344 • "SAP System Time Breakdown Graph" on page 352 • "SAP Interface Time Breakdown Graph" on page 352
Tips	In the task pane, select a component from the **View data associated with** box.
See also	"SAP Breakdown Task Pane" on page 346 "SAP Secondary Graphs" on page 353 "SAP Breakdown Task Pane" on page 346

Example

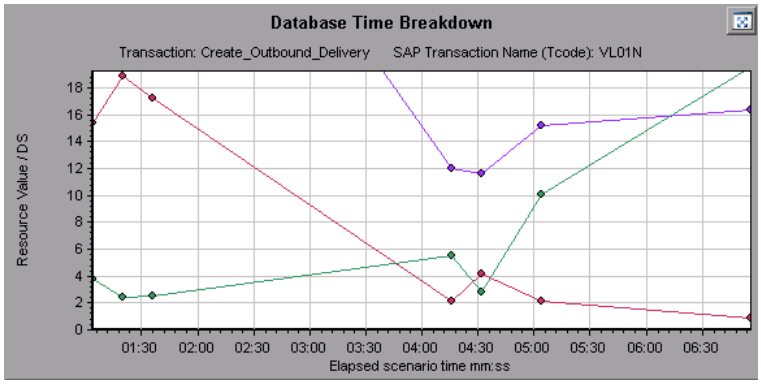


SAP Database Time Breakdown Graph

This graph displays the behavior of resources associated with database time, namely time taken to access a record, database time, and the number of records accessed per dialog step.

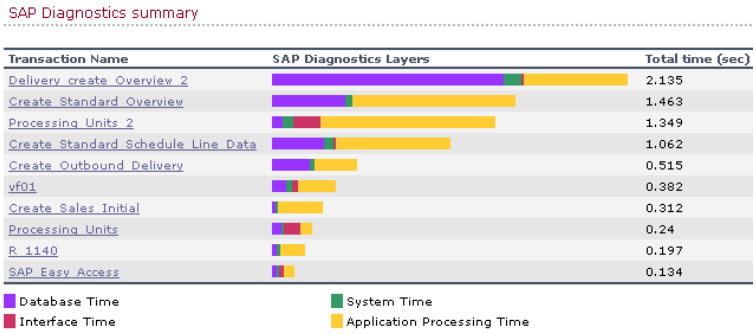
X-axis	Elapsed time since the start of the run (in hh:mm:ss).
Y-axis	Represents the resource value per dialog step (in msec).
Tips	You can open the graph in full view by clicking in the top right corner of the primary graph pane. An enlarged version of the graph opens in a new tab.
See also	"SAP Breakdown Task Pane" on page 346 "SAP Secondary Graphs" on page 353

Example



SAP Diagnostics Summary Report

This report displays a list of major alerts generated when opening the Analysis session, and a summary of the SAP diagnostics data.



To access	Use one of the following: • **Session Explorer > Reports > Summary Report > Major Alerts** • **Session Explorer > Reports > Summary Report > SAP Diagnostics Summary**
Note	If you do not see diagnostics data on the Summary Report, check if you are using a user-defined template. To view relevant data, choose a different template from the list of templates, or create and apply a new template. For more information about using templates, see "Apply/Edit Template Dialog Box" on page 84.
See also	"SAP Diagnostics Graphs Overview" on page 337

SAP Diagnostics Summary

User interface elements are described below:

UI Element	Description
Transaction	Individual transactions. You can click a transaction name to display the server time breakdown for that transaction.
SAP Diagnostics Layers	Relative server-time breakdown in layers. Click a layer to display data associated with the component.
Total time	Total usage time for each transaction.

Major Alerts

User interface elements are described below:

UI Element	Description
Time Interval	The time during which the problem occurred.
Transaction/Server	Which transaction and server were involved.

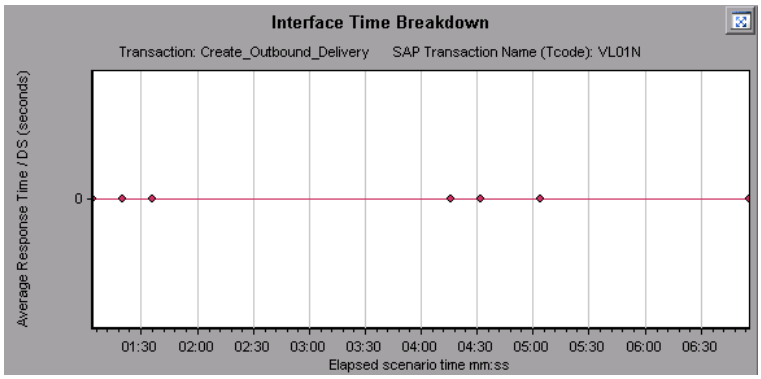
UI Element	Description
Description	A description of the alert.
Action	This column provides a link to a graphic depiction of the problem.

SAP Interface Time Breakdown Graph

This graph displays the behavior of resources associated with interface time, namely GUI time, RFC time, and roll-wait time.

X-axis	Elapsed load test scenario time (in hh:mm:ss)
Y-axis	Average response time per dialog step (in seconds).
See also	"SAP Breakdown Task Pane" on page 346 "SAP Secondary Graphs" on the next page

Example

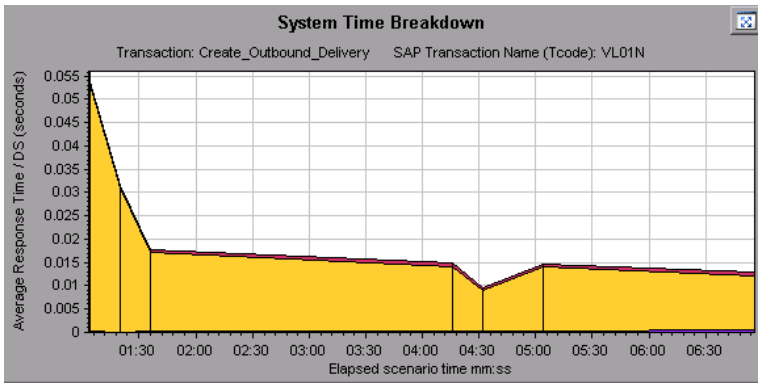


SAP System Time Breakdown Graph

This graph displays the behavior of the sub-components of the system time component, namely the dispatcher wait time, the load and generation time, and the roll-in and roll-out times.

X-axis	Elapsed load test scenario time (in hh:mm:ss)
Y-axis	Average response time per dialog step (in seconds)
See also	"SAP Breakdown Task Pane" on page 346 "Secondary Graph Pane" on page 339

Example



SAP Secondary Graphs

The secondary graph pane of the SAP Diagnostics - Guided Flow tab displays graphs that support the graph displayed in the primary graph pane. You can correlate over time only one graph displayed in the secondary graph pane.

To see the legend for the graph displayed in this pane, click the **Graph Legend** button in the top right corner. To see all the data in the Legend, scroll along the horizontal scroll bar.

You can open the displayed graph in full view by clicking the **Enlarge Graph** button in the top right corner of this pane. An enlarged version of the graph opens in a new tab.

You view the following graphs in the secondary graph pane:

- "Vuser Graphs" on page 127
- "Dialog Steps per Second Graph" on page 341
- "Work Processes Graph" below
- "OS Monitor Graph" on page 341

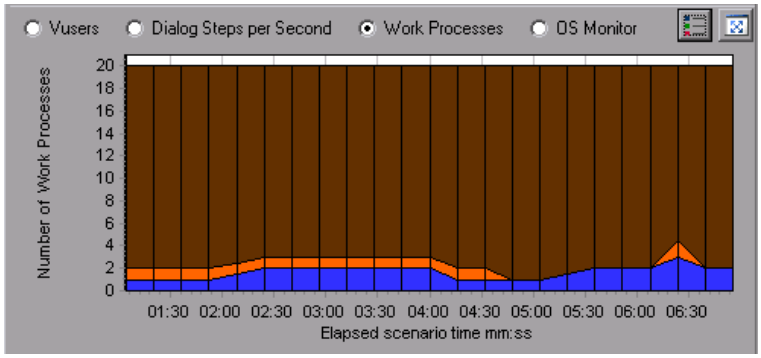
Work Processes Graph

This graph represents the number and distribution of work processes that ran throughout the load test scenario.

X-axis	Elapsed scenario time (in hh:mm:ss).
Y-axis	Number of work processes.
Note	This graph is available only when a single server filter is applied.
See also	"SAP Breakdown Task Pane" on page 346 "Vuser Graphs" on page 127 "Dialog Steps per Second Graph" on page 341

	"OS Monitor Graph" on page 341

Example



TruClient - Native Mobile Graphs

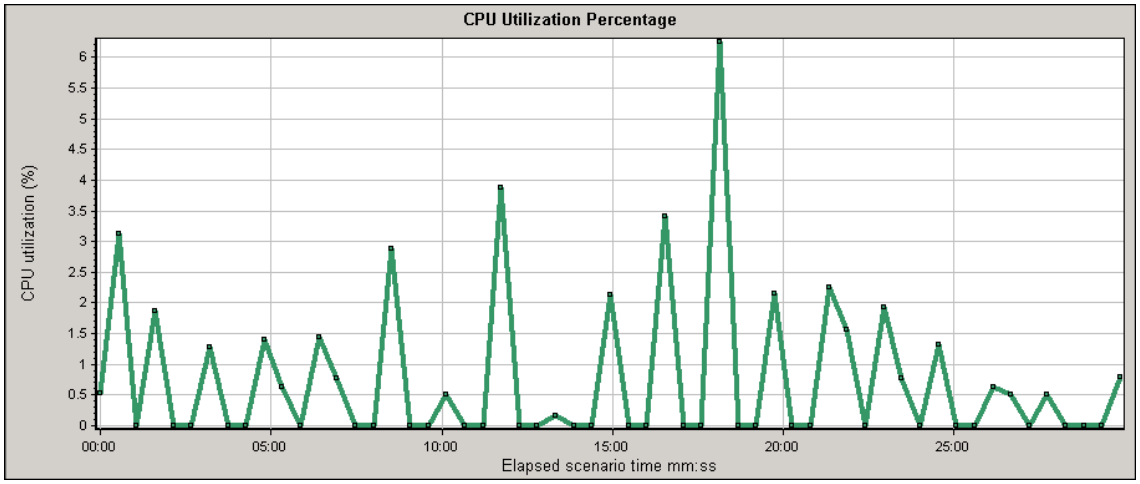
TruClient CPU Utilization Percentage Graph

This graph displays the percentage of the CPU utilized during the test run for TruClient Native Mobile Vuser scripts.

Purpose	Helps you evaluate the amount of CPU utilized by an application.
X-axis	Elapsed time since the start of the scenario run.
Y-axis	The percentage of the CPU utilized during the test run.

Example

In the following example, the CPU utilization peaked to approximately 6% at 18 minutes into the test run.



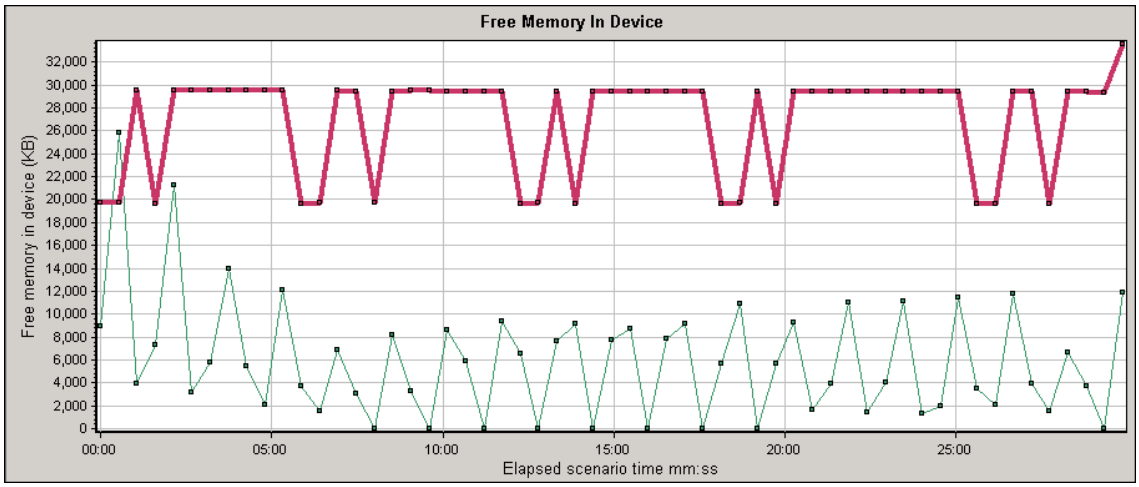
TruClient Free Memory In Device Graph

This graph displays the free memory on a mobile device as a function of time, for TruClient Native Mobile scripts.

Purpose	Helps you evaluate the amount of memory available on the device during the test run.
X-axis	Elapsed time since the start of the scenario run.
Y-axis	The amount of free memory in KBs.

Example

In the following example, the graph shows a free memory of over 33 MBs, at 30 minutes into the test run for one of the transactions.



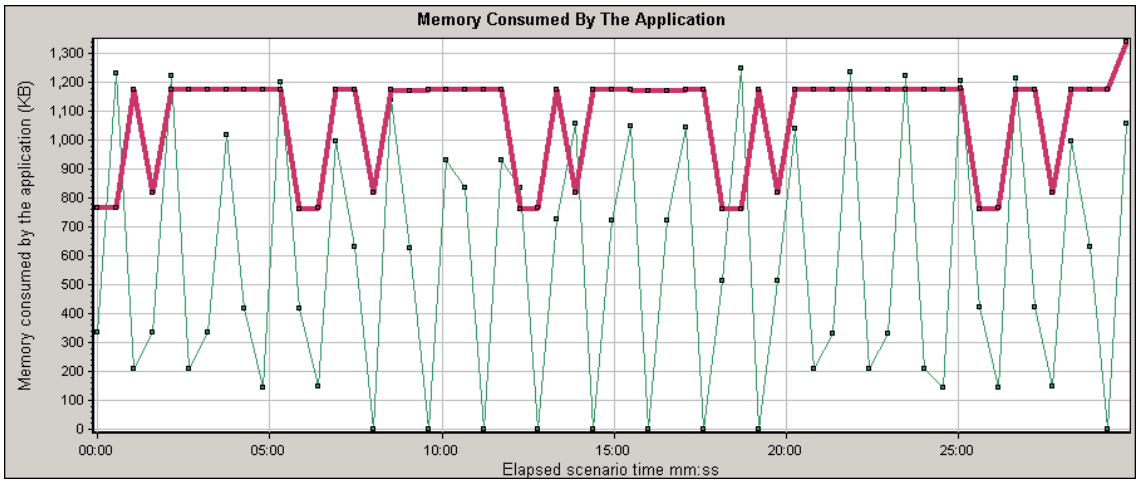
TruClient Memory Consumed by Application Graph

This graph displays the memory consumed by the application, as a function of time.

Purpose	Helps you evaluate the amount of memory used by the application.
X-axis	Elapsed time since the start of the scenario run.
Y-axis	The memory consumed by the application in KBs.

Example

In the following example, the memory consumption peaked to 1337 KBs at 30 minutes into the test, for one of the transactions.



Analysis Reports

Understanding Analysis Reports

Analysis Reports Overview

After running a load test scenario, you can view reports that summarize your system's performance. Analysis provides the following reporting tools:

- "Summary Report" on page 369
- "SLA Reports" on page 374
- "Transaction Analysis Report" on page 375
- "HTML Reports" on page 373

The Summary report provides general information about the scenario run. You can access the Summary report at any time from the Session Explorer.

The SLA report provides an overview of the defined SLAs (Service Level Agreements) with succeeded or failed status.

The Transaction Analysis report provides a detailed analysis of a specific transaction over a specific time period.

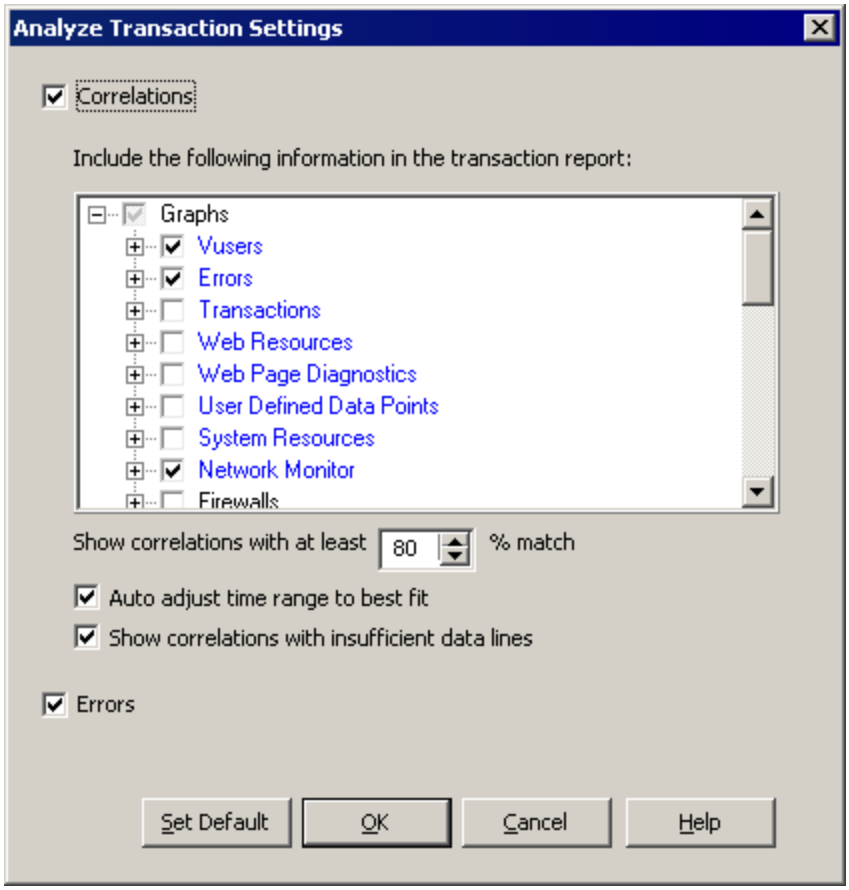
You can instruct Analysis to create an HTML report. The HTML report contains a page for each open graph, the Summary report, the SLA report, and the Transaction Analysis report.

Transaction reports provide performance information about the transactions defined within the Vuser scripts. These reports give you a statistical breakdown of your results and allow you to print and export the data.

> **Note:** SLA reports and Transaction Analysis reports are not available when generating Cross Result graphs. For more information on Cross Result graphs, see "Cross Result and Merged Graphs" on page 120.

Analyze Transaction Settings Dialog Box

This dialog box enables you to configure the Transaction Analysis Report to show correlations between the graph of the analyzed transaction and other graphs that you select.



To access	Use one of the following: • **Reports > Analyze Transaction > Settings** • **Tools > Options > Analyze Transaction Settings tab**

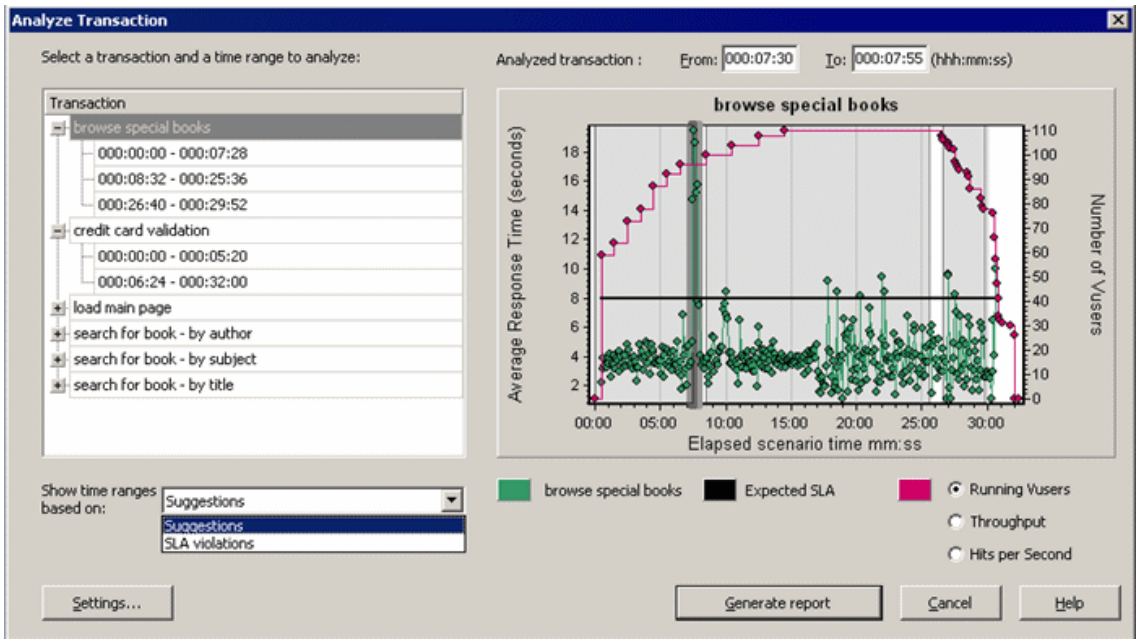
See also	"Analyze Transactions Dialog Box" below

User interface elements are described below:

UI Element	Description
Correlations	Defines which graphs you want Analysis to match to the graph of the transaction you selected. Graphs where data is available appear in blue.
Show correlations with at least x% match	The positive or negative percentage correlation between the graph of the analyzed transaction and the graphs selected above. You can change the percentage by entering a value in the box. The default is 20%.
Auto adjust time range to best fit	Analysis adjusts the selected time range to focus on the SLA violations within and around that time period. This option only applies when the Transaction Analysis report is generated directly from the Summary report (from the **X Worst transactions** or **Scenario behavior over time** sections).
Show correlations with insufficient data lines	Displays correlations where one of the measurements contains less than 15 units of granularity.
Errors	Displays errors in the Transaction Analysis Report if selected.

Analyze Transactions Dialog Box

You use the Analyze Transaction dialog box to define the criteria that will be used to analyze the selected transaction in the Transaction Analysis Report. You can analyze a transaction even if you have not defined an SLA.



To access	**Reports > Analyze Transaction** **Summary Report > right-click menu > Add New Item > Analyze Transaction** **Toolbar >**  **Summary Report with no SLA > Statistics Summary section > Analyze Transaction tool link**
Note	Analysis data (for example, transactions) that has been excluded by the Summary Filter will not be available for analysis in the Transaction Analysis report.
See also	"Filtering and Sorting Graph Data" on page 103

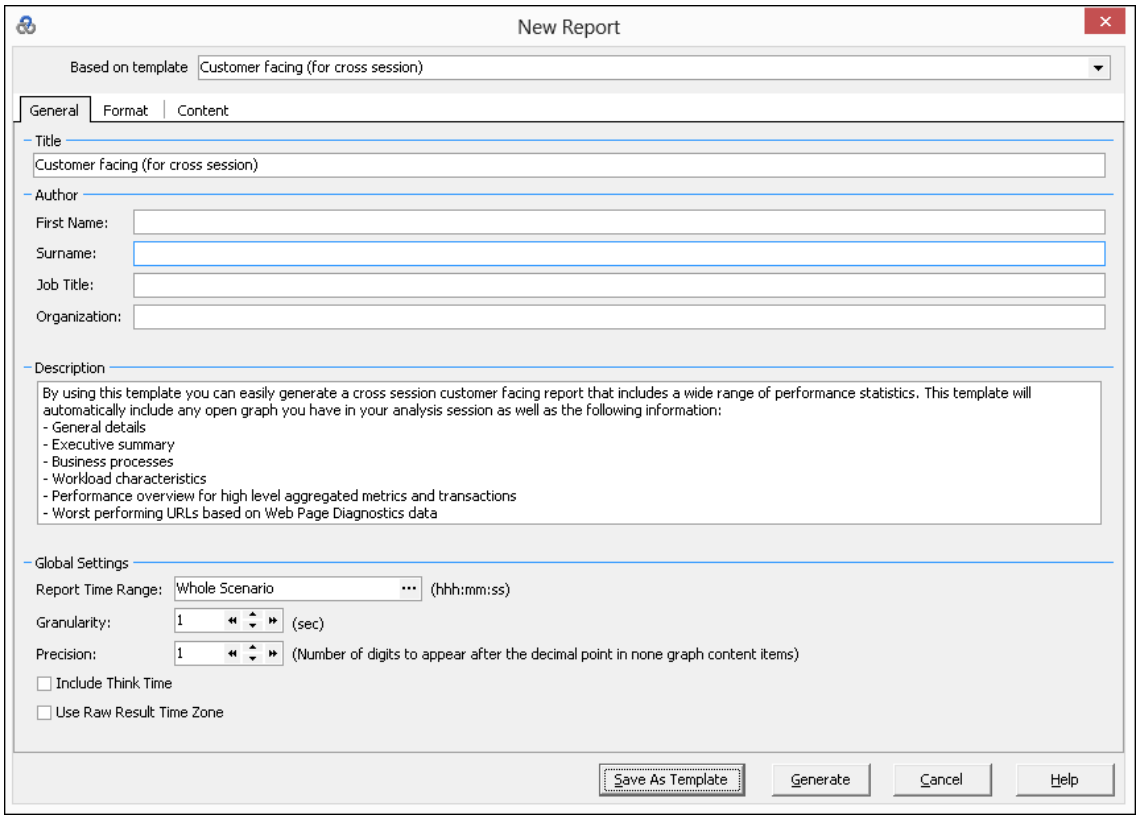
User interface elements are described below (unlabeled elements are shown in angle brackets):

UI Element	Description
Show time ranges based on box	Select one of the display options: • **Suggestions.** Lists all transactions and time ranges from the scenario run. • **SLA Violations.** Lists only those transactions and time ranges where the transaction exceeded the SLA. This option does not appear if there were no transactions that exceeded the SLA.
Transaction	Select the transaction to analyze from the Transaction tree.
<Time Range>	Select the time range to analyze in one of the following ways: • Select the time range from the Transaction tree.

UI Element	Description
	• Enter the time range in the **From** and **To** boxes above the graph. • Select the time range by dragging the bars on the graph.
<Display options>	Select one of the following: • **Running Vusers** • **Throughput** • **Hits per Second** The option you select is displayed on the graph and will appear on the snapshot of the graph that appears on the Transaction Analysis Report. Note that your choice only affects the display of the graph and not the calculation for correlations.
Settings	Click **Settings** to define the Analyze Transaction settings in the **Analyze Transaction Settings** dialog box. For more information, see "Analyze Transaction Settings Dialog Box" on page 357. **Note**: You can also define the Analyze Transaction settings in the **Analyze Transaction Settings** tab of the **Options** dialog box (**Tools > Options**).
Generate report	The Transaction Analysis Report opens. Once the report has been created, you can access it at any time from the Session Explorer.

New Report Dialog Box

This dialog box enables you to create a report based on the report template selected. You can adjust the report template settings to generate a report that corresponds to the required report layout.



To access	**Reports > New Report**
See also	"Report Templates Dialog Box" on the next page **Note:** This dialog box and the Report Templates dialog box utilize the same components.

User interface elements are described below:

UI Element	Description
Based on Template	The template upon which to build the report. After you select a template, the corresponding settings of the report template appear.
General tab	For user interface details, see "Report Templates - General Tab" on page 364.
Format tab	For user interface details, see "Report Templates - Format Tab" on page 365.
Content tab	For user interface details, see "Report Templates - Content Tab" on page 367.
Save As Template	Prompts you for a template name that will be added to the

UI Element	Description
	report template list.
Generate	Generates the report according to your settings.

Analysis Report Templates

Report Templates Overview

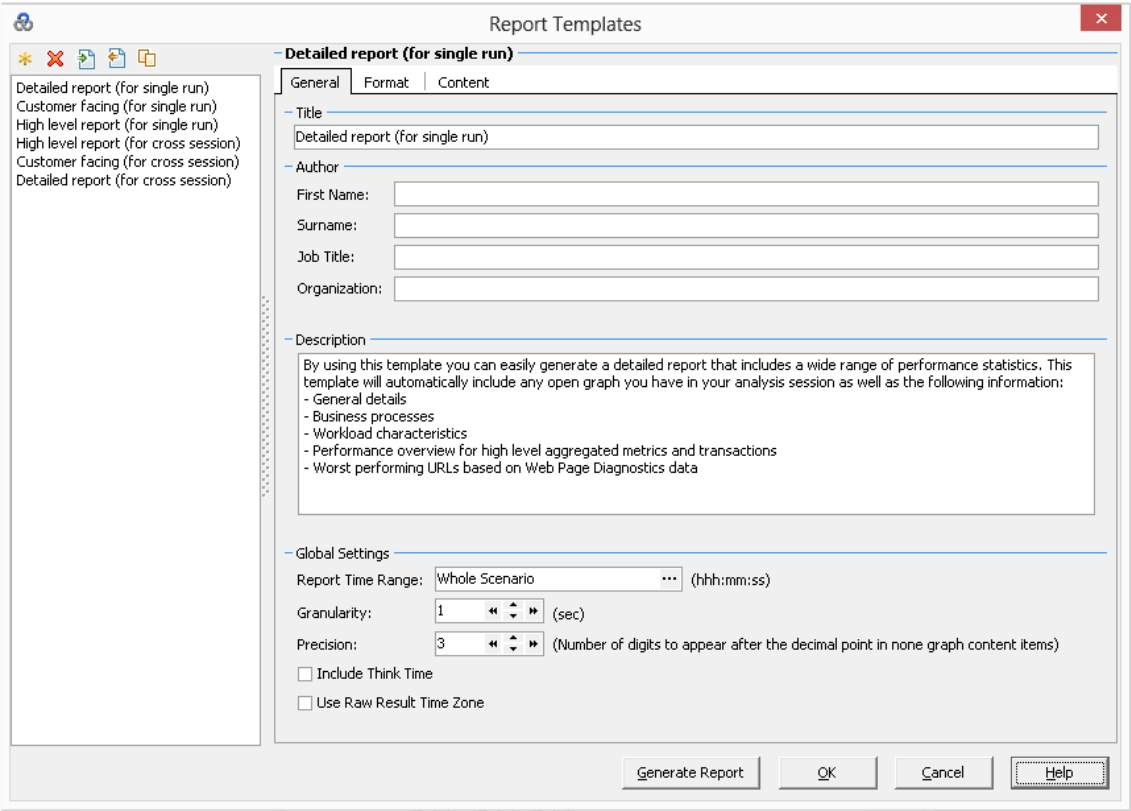
You can use Report Templates to create and customize templates which are used when generating reports. Report templates can be used across similar scenario runs and saves time and effort on recreating reports each time.

Using the Report Templates dialog box, you can record document details, define the format of the report, and select the content items to include in the report and configure each content item accordingly.

A list of report templates is displayed in the **Templates** dialog box, under **Rich Reports**. Select this option if you want to generate the report in the load run session in word, excel, HTML or PDF format. For more information on templates, see "Apply/Edit Template Dialog Box" on page 84.

Report Templates Dialog Box

This dialog box enables you to add, modify, import, export, or duplicate a report template.



To access	**Reports > Report Templates**
See also	• "Report Templates Overview" on the previous page • "New Report Dialog Box" on page 360 **Note:** This dialog box and the New Report dialog box utilize the same components.

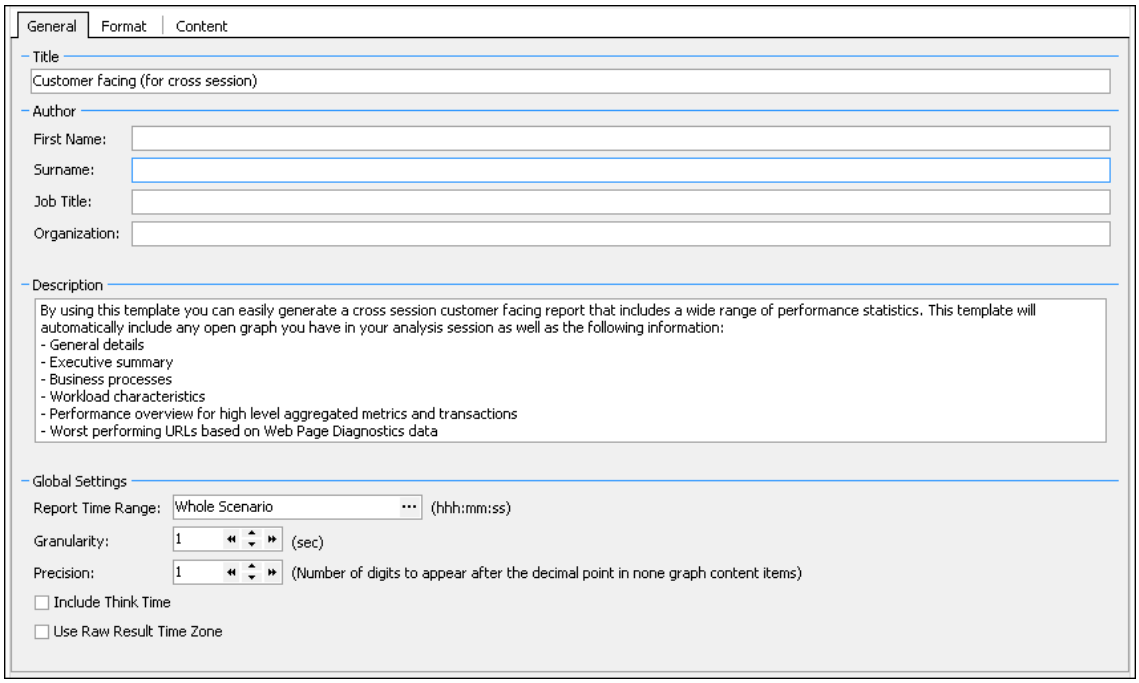
User interface elements are described below:

UI Element	Description
	New. Adds a new report template.
	Delete. Removes the selected template.
	Import. Imports a report template from an XML file.
	Export. Saves the selected template as an XML file.
	Duplicate. Creates a copy of the selected template.
General tab	For user interface details, see "Report Templates - General

UI Element	Description
	Tab" on the next page.
Format tab	For user interface details, see "Report Templates - Format Tab" on the next page.
Content tab	For user interface details, see "Report Templates - Content Tab" on page 367.
Generate Report button	Generates the report according to your settings.

Report Templates - General Tab

This tab enables you to record document details, such as title, author name and title and set global settings, such as Report Time Range and granularity.



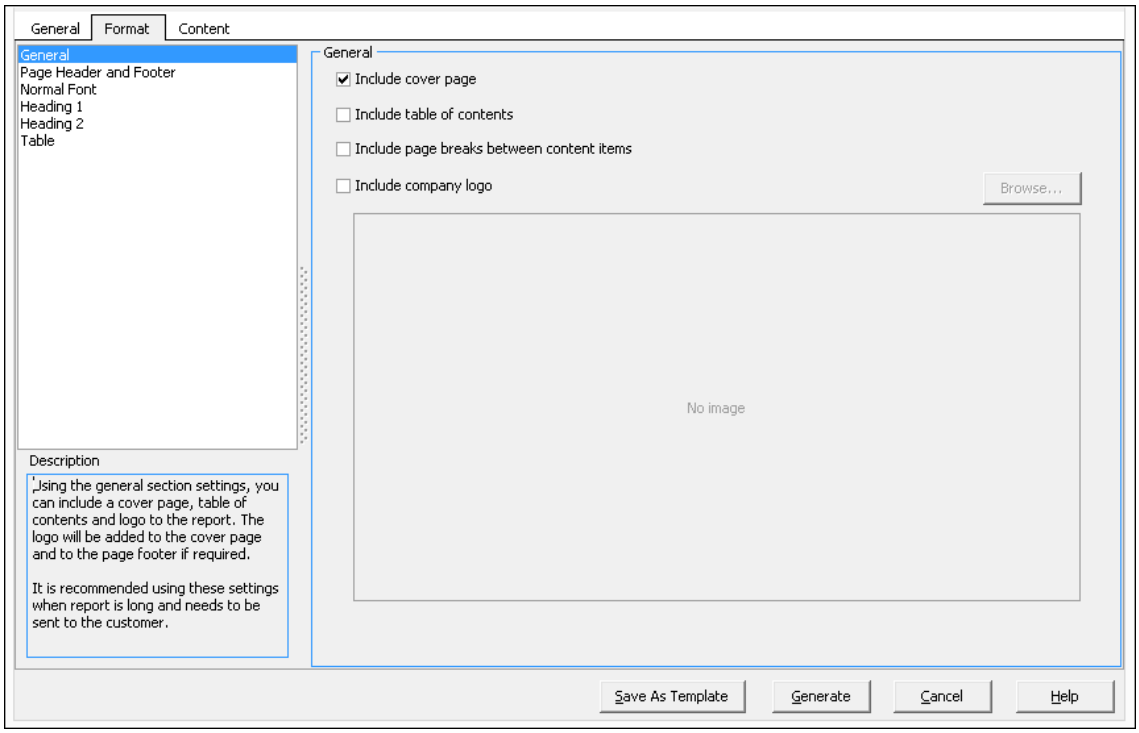
To Access	**Reports** > **New Report...** > **General** tab or **Reports** > **Report Templates...** > **General** tab
See also	• "Report Templates Overview" on page 362 • "New Report Dialog Box" on page 360 • "Report Templates Dialog Box" on page 362

User interface elements are described below:

UI Element	Description
Title	A description of the template.
First Name	The first name of the person to display on the report.
Surname	The last name of the person to display on the report.
Job title	The job title of the person to display on the report.
Organization	The name of the organization to display on the report.
Description	You can enter a description and include details of the report template.
Report Time Range	The default setting is Whole Scenario. Click ... to set the start and end time range of the scenario runtime to display on the report.
Granularity	Define granularity settings (in seconds).
Precision	The number of digits to appear after the decimal point in none graph content items.
Include Think Time	Include think time when processing the Analysis data. This data is then used when generating reports.
Use Raw Result Time Zone	When creating the report, use the time zone that was generated in the raw data results.

Report Templates - Format Tab

This tab enables you to define the format of report template.



To access	**Reports** > **New Report...** > **Format** tab or **Reports** > **Report Templates...** > **Format** tab
See also	• "Report Templates Overview" on page 362 • "New Report Dialog Box" on page 360 • "Report Templates Dialog Box" on page 362

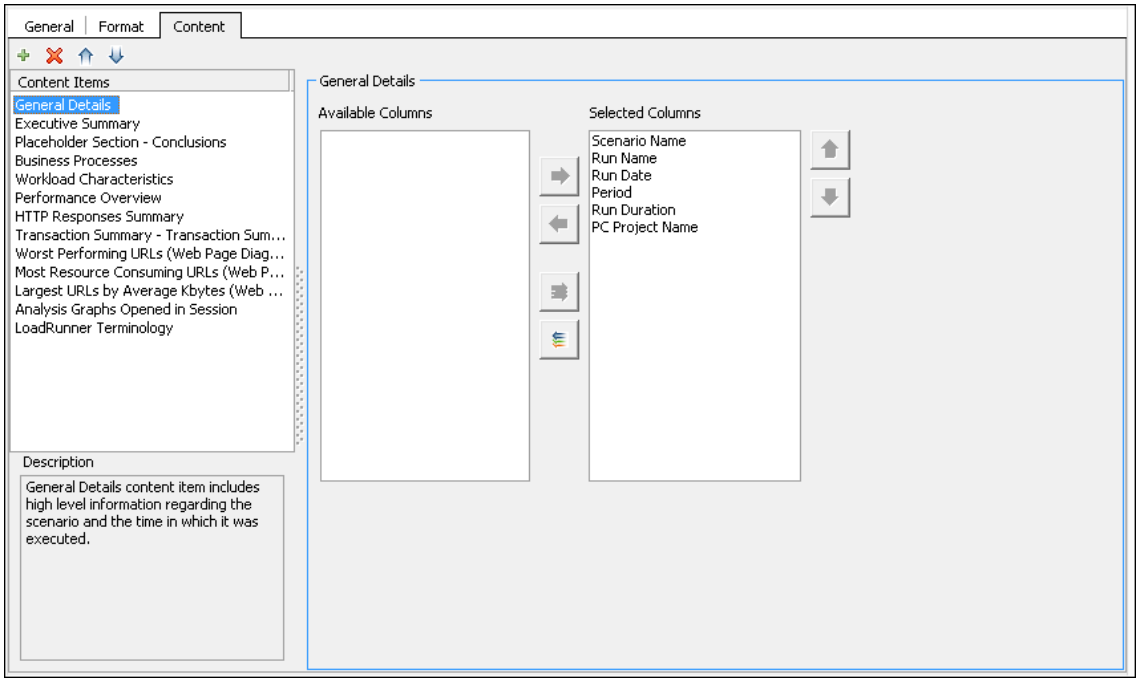
User interface elements are described below:

UI Element	Description
General	General options such as: • include a cover page • include table of contents • include company logo
Page Header and Footer	Header and footer options: • Font type, size and color • Bold, italicize, or underline • Right, center or left align • You can add tags, such as date, name or organization.

UI Element	Description
	• You can include required details such as page count, date, name, and so forth on the left, center or right column.
Normal Font	The type of font to use in the report template.
Heading 1/2	The style for your headings.
Table	Table format options: • Font type, size and color • Background color • Bold, italicize, or underline • Right, center or left align

Report Templates - Content Tab

This tab enables you to select the content items to include in the report and configure each item accordingly.



To access	**Reports** > **New Report...** > **Content** tab or **Reports** > **Report Templates...** > **Content** tab

See also	• "Report Templates Overview" on page 362 • "New Report Dialog Box" on page 360 • "Report Templates Dialog Box" on page 362

User interface elements are described below:

UI Element	Description
	Add Content. Opens the **Add Content Items** pane. Select one or more items from the grid and click **OK**.
	Delete Content. Removes the selected items from the Content Items pane.
	Reorder. Reorders the content items, determining how they will be shown in the report.
Contents Item pane	A list of the content items to be included in the report. • To add more items, click the Add Content button. • To learn about a content item, select it and view the information in the Description pane beneath it.
<Configuration pane>	Settings for the selected content item. The components and tabs in this pane vary, based on the selected content item. • **Parameters tab.** Settings such as integer values for percentiles or number of elements. • **Columns tab.** Allows you to select the columns to include in the report. To include a column, make sure it appears in the **Selected Columns** pane. • **Filter tab.** Allows you to enter criteria for including a specific range of a measurement. • **Text area.** A rich text box for enter free text, such as in a Placeholder Section or an Executive Summary. **Tip:** For the **Performance Summary** content item, you can retrieve different information about transactions such as the total number of passed or failed transactions. The item, **Weighted Average of Transaction Response time**is calculated based on the following formula: *Round (Sum of Average value in transaction response time / Sum of transactions)*. For example if you have three transactions with the response times of 0.005, 0.004, and 0.003, the weighted Average of Transaction Response Time is Round((0.005 + 0.004 + 0.003)/3) = 0.004
Generate	Generates the report according to your settings.

UI Element	Description
Report	

Analysis Report Types

Summary Report Overview

The Summary report provides general information about load test scenario execution. This report is always available from the Session Explorer or as a tab in the Analysis window.

The Summary report lists statistics about the scenario run and provides links to the following graphs: Running Vusers, Throughput, Hits Per Second, HTTP Responses per Second, Transaction Summary, and Average Transaction Response Time.

The appearance of the Summary report and the information displayed, will vary depending on whether an SLA (Service Level Agreement) was defined.

An SLA defines goals for the scenario. LoadRunner measures these goals during the scenario run, and analyzes them in the Summary report. For more information on defining an SLA, see "SLA Reports" on page 374

A Summary report is also provided for Cross Result graphs. For more information about Cross Result graphs, see "Cross Result Graphs Overview" on page 120.

> **Note:** You can save the Summary reports to an Excel file by selecting **View > Export Summary to Excel** or by clicking the **Export Summary to Excel** button on the toolbar.

Summary Report

The Summary report provides general information about load test scenario execution. It lists statistics about the scenario run and provides links to the following graphs: Running Vusers, Throughput, Hits Per Second, HTTP Responses per Second, Transaction Summary, and Average Transaction Response Time.

To access	**Session Explorer > Reports > Summary Report**
Important information	The Summary report for SAP Diagnostics, J2EE /.NET Diagnostics, and Siebel Diagnostics provides a usage chart that links to and displays each individual transaction's Web, application, and database layers, and provides the total usage time for each transaction.
Relevant tasks	You can save the Summary reports to an Excel file by selecting **View > Export Summary to Excel** or by clicking on the toolbar.

See also	The Summary reports for the various diagnostics environments are discussed in detail in the following sections: "SAP Diagnostics Summary Report" on page 350 J2EE & .NET Diagnostics Graphs Summary Report "Siebel Diagnostics Graphs Summary Report" on page 321

Summary Report with No SLA

User interface elements are described below:

UI Element	Description
Scenario Details	Shows the basic details of the load test scenario being analyzed.
Statistics Summary	This section shows a breakdown of the transaction statistics and also provides links to the following: • The SLA configuration wizard. For more information on defining an SLA, see "SLA Reports" on page 374 • The Analyze Transaction tool. For more information on analyzing transactions, see "Analyze Transactions Dialog Box" on page 358
Transaction Summary	This section displays a table containing the load test scenario's diagnostics data. Included in this data is a percentile column (x Percent). This column indicates the maximum response time for that percentage of transactions performed during the run. **Note**: You can change the value in the percentile column in one of the following ways: • Open the Options dialog box (**Tools > Options**). Click the **General** tab and in the Summary Report section enter the desired percentile in the Transaction Percentile box. • Select **View > Summary** Filter or click on the toolbar. The Analysis Summary Filter dialog box opens. In the Additional Settings area enter desired percentile.
HTTP Responses Summary	This section shows the number of HTTP status codes returned from the Web server during the load test scenario, grouped by status code. **Note**: There are additional Diagnostics sections that may appear at the end of the Summary report, depending on the configuration of your system.

Summary Report with SLA

User interface elements are described below:

UI Element	Description
Scenario details	This section shows the basic details of the load test scenario being analyzed.
Statistics Summary	This section shows a breakdown of the transaction statistics.
X Worst Transactions	The X Worst Transactions table shows the worst transactions in terms of how often the transactions exceeded the SLA boundary during the run, and by how much. Click here to see an example of the 5 Worst transactions section of the summary report. **Note**: You choose how many transactions are displayed in this table in the Summary Report section on the General tab of the options dialog box. Open the dialog box (**Tools** > **Options**) and enter the number of transactions to display. The default is **5**. You expand a transaction to get more information. When expanded, the following information appears for each transaction: **Failure Ratio** • The percentage of time intervals where the transaction exceeded the SLA. You can see this graphically in the Scenario Behavior Over Time section below. **Failure Value** • The average percentage by which the transaction exceeded the SLA over the whole run. **Avg exceeding ratio** • The average percentage by which the transaction exceeded the SLA over a specific time interval. For example, in the first time interval in the screenshot above, the figure is 4.25%. This means that during that time interval, the transaction may have exceeded the SLA boundary several times, each time by a different percentage margin, the average percentage being 4.25%. **Max exceeding ratio** • The highest percentage by which the transaction exceeded the SLA over a specific time interval. For example, using the same time interval as above, the transaction may have exceeded the SLA several times, each time by a different percentage margin. The highest percentage being 7.39% Analysis allows you to analyze a specific transaction in more detail. You open the Analyze Transaction tool from this section by clicking the **Analyze Transaction** button. For more information on Transaction Analysis Reports, see "Analyze Transactions Dialog Box" on page 358.

UI Element	Description
Scenario Behavior Over Time	This section shows how each transaction performed in terms of the SLA over time intervals. The green squares show time intervals where the transaction performed within the SLA boundary. Red squares show time intervals where the transaction failed and gray squares show where no relevant SLA was defined. **Note:** The time intervals displayed in the **Scenario Behavior Over Time** section may vary for each interval. The time interval set in the tracking period of the SLA is only the minimum time interval that will be displayed. It is only the display that varies. The SLA is still determined over the time interval you choose in the **Advanced Settings** section. Analysis allows you to analyze a specific transaction in more detail. You open the Analyze Transaction tool from the **Scenario Behavior Over Time** section in one of the following ways: • Select the transaction to analyze from the list and enter the time interval in the **From** and **To** boxes. Then click **Analyze Transaction**. • Drag the mouse over the desired transaction and time range to analyze. Then click **Analyze Transaction**. For more information on Transaction Analysis Reports, see "Analyze Transactions Dialog Box" on page 358.
Transaction Summary	This section displays a table containing the load test scenario's diagnostics data. Included in this data is a percentile column (x Percent). This column indicates the maximum response time for that percentage of transactions performed during the run. For example, in the table below, the value in the 88 Percent column for **browse special books** is 8.072. This means that the response time for 88% of the **browse special books** transactions was less that 8.072 seconds. Click here to see an example of a Transaction Summary. **Note:** You can change the value in the percentile column in the Summary Report section of the General tab of the Options dialog box. Open the dialog box (**Tools > Options**) and enter the desired percentage. Alternatively, you can also change the value in the Summary Filter (**View > Summary Filter**) .
HTTP Responses Summary	This section shows the number of HTTP status codes returned from the Web server during the load test scenario, grouped by status code. **Note:** There are additional Diagnostics sections that may appear at the end of the Summary report, depending on the configuration of your system.

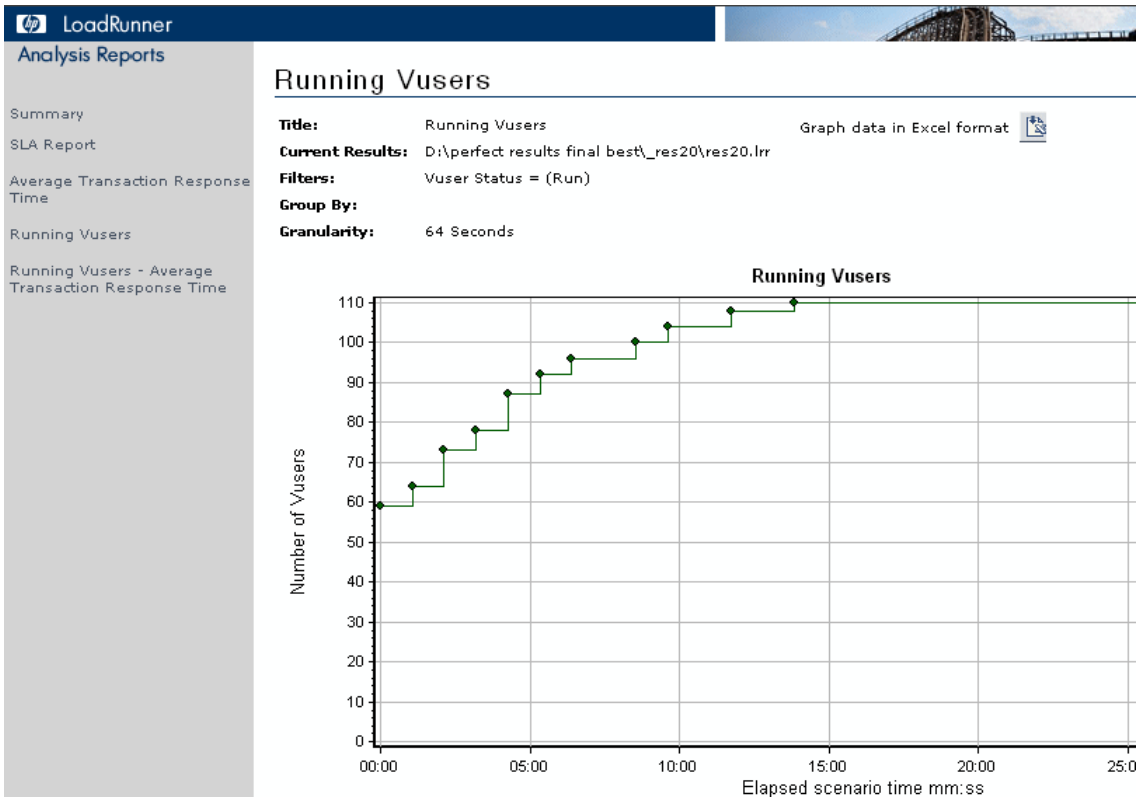
Summary reports for Cross Result Graphs

User interface elements are described below:

UI Element	Description
<graphs>	Displays summary information for the scenarios that you are comparing. The information is displayed in a way that enables you to compare data from the different scenarios. Includes the same type of information as the regular Summary report except for the following: • SLA information • Diagnostics information • Scenario behavior over time

HTML Reports

Analysis enables you to create HTML reports for your load test scenario run. It creates a separate page for each one of the open graphs and reports.



To access	Use one of the following: • **Reports > HTML Report**

	• **Toolbar >**
Relevant tasks	• Open all graphs that you want to include in the report. • Specify a path and file name for the HTML report and click **Save**. Analysis saves a Summary report which has the same name as the file in the selected folder. The rest of the graphs are saved in a folder with the same name as the Summary report's file name. When you create an HTML report, Analysis opens your default browser and displays the Summary report. • To copy the HTML reports to another location, be sure to copy the filename and the folder with the same name. For example, if you named your HTML report `test1`, copy `test1.html` and the folder `test1` to the desired location

User interface elements are described below:

UI Element	Description
<Graphs> menu left frame	Click the graph link to view an HTML report for that graph.
	You can view an Excel file containing the graph data, by clicking the **Graph data in Excel format** button on the relevant graph page.

SLA Reports

An SLA (Service Level Agreement) defines goals for the load test scenario. LoadRunner measures these goals during the scenario run and analyzes them in the Summary report. The SLA Report shows the succeeded or failed status of all SLAs that were defined for the scenario run.

> **Note:** Analysis data (for example, transactions) that has been excluded by the Summary Filter will not be available for analysis in the SLA report.

To access	You create the SLA Report in one of the following ways**:** **Reports > Analyze SLA** **Right-click the Summary pane > Add New Item > Analyze SLA** **Summary Report >**
Relevant tasks	"Defining Service Level Agreements " on page 51

User interface elements are described below:

UI Element	Description
Display of SLA statuses	**SLA Status per goal definition** • Where the SLA was defined over the whole run, the report displays a single SLA status for each goal definition. **SLA status for each transaction per time interval** • Where the SLA was defined per time interval within the run, the report displays the status of the SLA for each transaction per time interval. The green squares show time intervals where the transaction performed within the SLA boundary. Red squares where the transaction failed and gray squares show where no relevant SLA was defined. **SLA goal definitions** • Where the SLA was defined per time interval within the run, a further section appears detailing the goal definitions for the SLA.

Transaction Analysis Report

This report enables you to individually examine each of the transactions from the load test scenario run.

To access	**Reports > Analyze Transaction > Generate Report button**

User interface elements are described below:

UI Element	Description
Observations	This section shows both positive and negative correlations between the graph of the transaction being analyzed, and other graphs based on the settings you chose in the Analyze Transaction Dialog Box. When two graphs are correlated, it means that their behavior matches each other by a certain percentage. To view the correlating graph, select one of the results and then click the View Graph icon at the bottom of the section. The graph comparison opens. You can return to the Transaction Analysis Report from the graph comparison at anytime by clicking the Back to <transaction name> icon on the toolbar. **Note**: The correlations are automatically calculated according to a default ratio of 20%. You can adjust this ratio by clicking the arrows next to the percentage. Then click **Recalculate**.
Errors	This section is divided into two sub-sections. • **Application Under Test errors.** Shows errors that occurred during the transaction

UI Element	Description
	that were direct results of Vuser activity. • **All errors.** Shows Application Under Test errors as well as errors that were not related to Vuser activity, and which affected your system and not the application under test.
Observation Settings	This section displays a summary of the settings that were selected in the Advanced Settings section of the Analyze Transaction dialog box.
Graph	The Graph section displays a snapshot of selected transaction and time range for analysis merged with the display option you selected (Running Vusers, Throughput, or Hits per Second). Note that it is only a snapshot and can not be manipulated like normal graphs.

Importing Data

What do you want to do?

- Import data
- Define a custom file format

See also:

- Supported file types
- Import Data dialog box

Import Data Tool Overview

The LoadRunner Analysis Import Data tool enables you to import and integrate non-HP data into a LoadRunner Analysis session. After the import procedure, you can view the data files as graphs within the session, using all the capabilities of the Analysis tool.

Suppose an NT Performance Monitor runs on a server and measures its behavior. Following a LoadRunner scenario on the server, you can retrieve the results of the Performance Monitor, and integrate the data into LoadRunner's results. This enables you to correlate trends and relationships between the two sets of data: LoadRunner's and the Performance Monitor's.

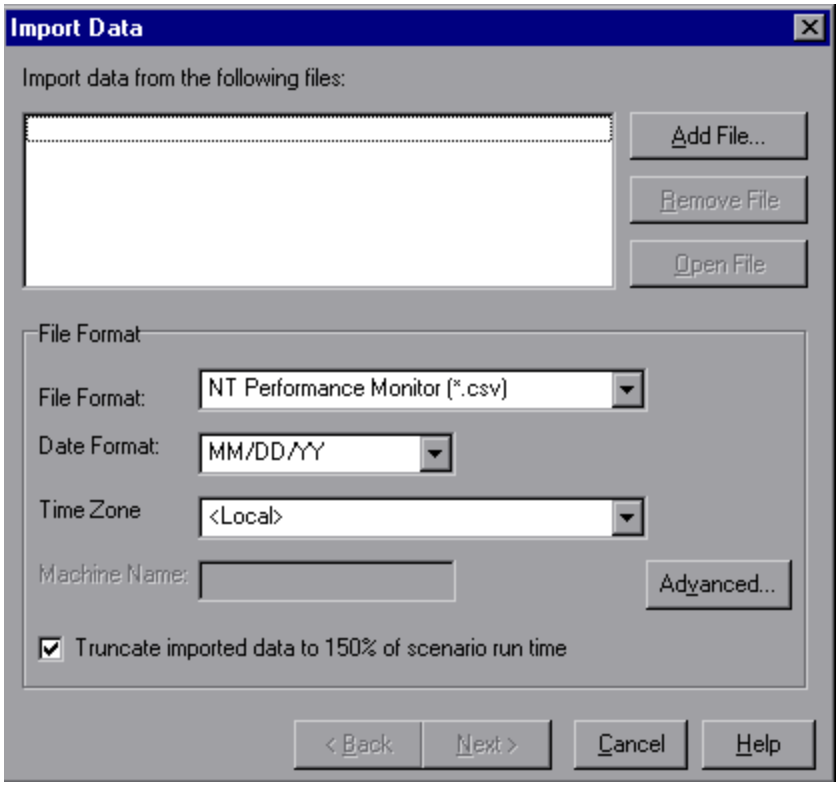
In this case, the results of the NT Performance Monitor are saved as a **.csv** file. You launch the Import Data tool, direct it to the **.csv** file, and specify its format. LoadRunner reads the file and integrates the results into its own Analysis session.

For a list of data formats that are supported, see "Supported File Types" on page 378. To define your own custom data files, see "How to Define Custom File Formats" on page 378.

How to Use the Import Data Tool

This task describes how to import data files to integrate into your analysis session.

1. Choose **Tools > External Monitors > Import Data**. The Import Data dialog box opens.



2. Select the format of the external data file from the **File format** list box.
3. Click **Add File**. In the **Select File to Import** dialog box that opens, the **Files of type** list box shows the type chosen in step 2.
4. Set other file format options, as described in "Import Data Dialog Box" on page 383. You must enter a machine name.
5. To specify character separators and symbols, click **Advanced**. For more information, see "Advanced Settings Dialog Box (Import Data Dialog Box)" on page 380.
6. Click **Next**. The Import Data dialog box opens.
7. Select the type of monitor that generated the external data file. If your monitor type does not exist, you can add it, as described in How to Customize Monitor Types for Import.

   When opening a new graph, you will see your monitor added to the list of available graphs under this particular category. (See "Open a New Graph Dialog Box" on page 125.)

8. Click **Finish**. LoadRunner Analysis imports the data file or files, and refreshes all graphs currently displayed in the session.

> **Note:** When importing data into a scenario with two or more cross results, the imported data will be integrated into the last set of results listed in the **File > Cross with Result** dialog box. For more information, see "How to Generate Merged Graphs" on page 124.

How to Define Custom File Formats

This task describes how to define a custom format, if the file format of your import file is not supported.

If the file format of your import file is not supported, you can define a custom format.

1. Choose **Tools > External Monitors > Import Data**. The Import Data dialog box opens.
2. From the **File Format** list, select **<Custom File Format>**. The Enter New Format Name dialog box opens.
3. Enter a name for the new format (in this case, `my_monitor_format`).
4. Click **OK**. The Define External Format dialog box opens.
5. Specify the mandatory and optional data, as described in "Define External Format Dialog Box" on page 381.
6. Click **Save**.

Supported File Types

The following file types are supported:

NT Performance Monitor (.csv)

The default file type of the NT Performance monitor, in comma separated value (CSV) format.

For example:

```
Reported on \\WINTER
Date: 03/06/15
Time: 10:06:01 AM
Data: Current Activity
Interval: 1.000 seconds
,,% Privileged Time,% Processor Time,% User Time,
,,0,0,0,
,,,,,,
,,Processor,Processor,Processor,
Date,Time,\\WINTER,\\WINTER,
03/06/15,10:06:00 AM , 0.998, 1.174, 0.000,
```

```
03/06/15,10:06:00 AM , 0.000, 0.275, 0,000,
```

Windows Performance Monitor (.csv)

The default file type for the Windows 2000, 2008 server, Windows 7, etc. performance monitor, in CSV format.

For example:

```
"(PDH-CSV 4.0) (Pacific Daylight Time)(420)","\\RD00155D558700\Processor(_Total)\% Processor Ti
"08/20/2013 05:22:41.874"," "," "," ","2047","7"," "," "," "," ","69914624","182","3018522624",
"08/20/2013 05:22:42.890","74.602361878754735","0.35896005815043219","0.010768598563407998","20
"08/20/2013 05:22:43.874","65.150399964314005","0.29737678878451379","0.008921497609135613 9","2
"08/20/2013 05:22:44.874","77.868144239632059","0.44066983913977048","0.013220095174193116","20
"08/20/2013 05:22:45.874","91.975051843634304","0.086916361570483838","0.002607490847114 5149","
"08/20/2013 05:22:46.874","97.872272338246731","0","0","1984","9","46.948343841937636","32246.6
```

Standard Comma Separated File (.csv)

This file type has the following format:

date, time, measurement_1,measurement_2, ...

where fields are comma separated and first row contains column titles.

The following example from a standard CSV file shows 3 measurements: an interrupt rate, a file IO rate and a CPU usage. The first row shows an interrupt rate of 1122.19, an IO rate of 4.18, and a CPU busy percentage of 1.59:

```
date, time, interrupt rate, File IO rate, CPU busy percent
03/06/15,10:06:01,1122.19,4.18,1.59
03/06/15,10:06:01,1123.7,6.43,1.42
```

Master-Detail Comma Separated File (.csv)

This file type is identical to Standard Comma Separated Files except for an additional **Master** column which specifies that row's particular breakdown of a more general measurement. For example, a Standard CSV file may contain data points of a machine's total CPU usage at a given moment:

Date,Time,CPU_Usage

However, if the total CPU usage can be further broken up into CPU time per-process, then a Master-Detail CSV file can be created with an extra column **ProcessName**, containing the name of a process.

Each row contains the measurement of a specific process's CPU usage only. The format will be the following:

Date,Time,ProcessName,CPU_Usage

as in the following example:

```
date, time, process name, CPU used, elapsed time used
03/06/15,10:06:01,edaSend,0.1,47981.36
03/06/15,10:06:01,PDS,0,47981.17
```

Microsoft Excel File (.xls)

Created by the Microsoft Excel application. The first row contains column titles. (.xlxs format is not supported.)

	A	B	C	D	E
1	date	time	interrupt rate	File IO rate	CPU busy percent
2	3/6/2015	10:06:01	1122.19	4.18	1.59
3	3/6/2015	10:06:01	1123.7	6.43	1.42
4	3/6/2015	10:12:01	1103.62	5.33	1.17
5	3/6/2015	10:14:01	1118.89	12.18	2.37
6	3/6/2015	10:15:01	1116.89	19.85	3.87
7	3/6/2015	10:16:01	1128.12	19.9	4.15
8	3/6/2015	10:06:01	1151.98	20.82	4.25

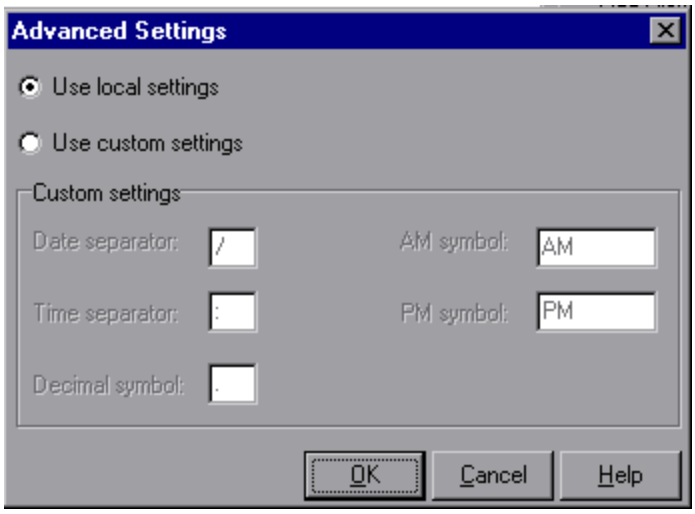
Master-Detail Microsoft Excel file (.xls)

Created by Microsoft's Excel application. The first row contains column titles. It contains an extra **Master** column. (.xlxs format is not supported.)

	A	B	C	D	E
1	date	time	process name	CPU used	elapsed time used
2	3/6/2015	10:06:01	edaSend	0.1	47981.36
3	3/7/2015	11:06:01	PDS	0	47981.17

Advanced Settings Dialog Box (Import Data Dialog Box)

This dialog box enables you to define the data format of the imported file to settings other than of the regional configuration.



To access	**Tools > External Monitors > Import Data > Advanced**

User interface elements are described below:

UI Element	Description
Use local settings	Keep default settings of the regional configuration. Disables the **Custom Settings** area of the dialog box.
Use custom settings	Define your own settings. Enables the **Custom Settings** area of the dialog box. • **Date Separator.** Enter a custom symbol, for example, the slash (`/') character in 11/10/02 • **Time Separator.** Enter a custom symbol, for example, the colon `:' character in 9:54:19 • **Decimal symbol.** Enter a custom symbol, for example, the `.' character in the number 2.5 • **AM symbol.** Enter a custom symbol for the hours between midnight and noon. • **PM symbol.** Enter a custom symbol for the hours between noon and midnight.

Define External Format Dialog Box

This dialog box enables you to define a new file format for external data files not supported by Analysis.

The Define External Format dialog box is divided into mandatory and optional information.

To access	**Tools > External Monitors > Import data > File Format > <Custom File Format>**
Relevant tasks	"How to Define Custom File Formats" on page 378

Mandatory tab

User interface elements are described below:

UI Element	Description
Date Column Number	Enter the column that contains the date. If there is a master column (see "Supported File Types" on page 378), specify its number.
Time Column Number	Enter the column that contains the time.
Use Master Column	Select this if the data file contains a master column. A master column specifies the row's particular breakdown of a more general measurement.
File Extension	Enter the file suffix.
Field Separator	Enter the character that separates a field in a row from its neighbor. To select a field separator character, click **Browse** and select a character from the define Field Separator dialog box.

Optional tab

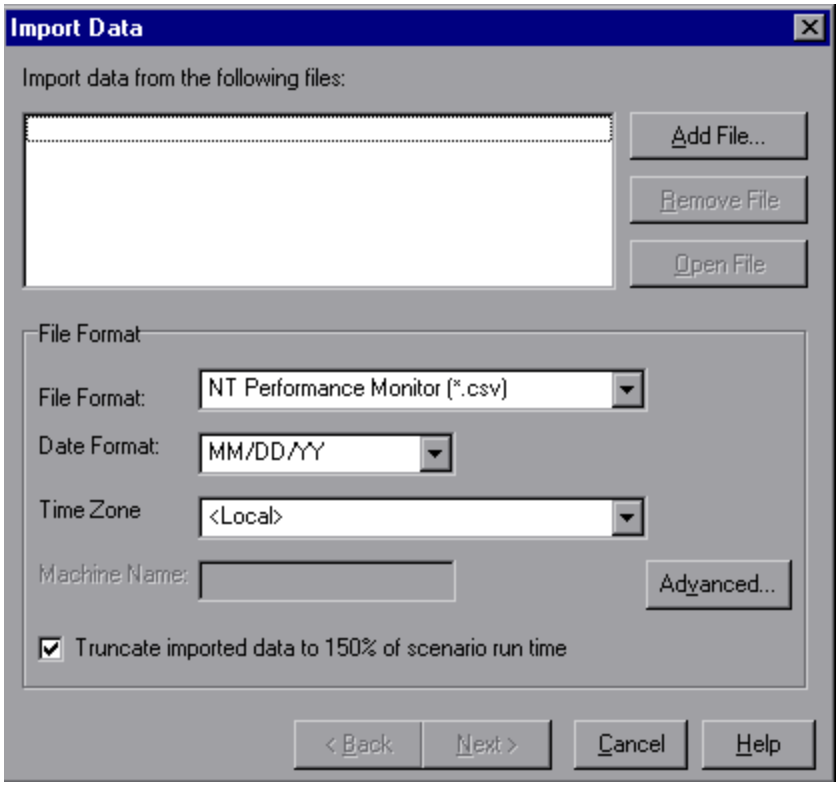
User interface elements are described below:

UI Element	Description
Date Format	Specify the format of the date in the imported data file. For example, for European dates with a 4 digit year, choose **DD/MM/YYYY**.
Time Zone	Select the time zone where the external data file was recorded. LoadRunner Analysis aligns the times in the file with local time zone settings to match LoadRunner results. (LoadRunner does not alter the file itself).
Machine Name	Specify the machine name the monitor runs on. This associates the machine name with the measurement.
Exclude Columns	Indicate which columns are to be excluded from the data import, such as columns containing descriptive comments. When there is more than one column to be excluded, specify the columns in a comma-separated list. For example, 1,3,8.
Convert file from UNIX	Monitors often run on UNIX machines. Check this option to convert data files to Windows format. A carriage return (Ascii character 13) is appended to all line feed

UI Element	Description
to DOS format	characters (Ascii character 10) in the UNIX file.
Skip the first [] lines	Specify the number of lines at the start of the file to ignore before reading in data. Typically, the first few lines in a file contain headings and sub-headings.

Import Data Dialog Box

This dialog box enables you to import and integrate non-HP data files into Analysis session.



To access	**Tools > External Monitors > Import Data**

User interface elements are described below (unlabeled elements are shown in angle brackets):

UI Element	Description
Import data from the following files	Displays the files that you selected for import.
Add file	Select an external data file to import. A dialog box opens to enable you to select files.

UI Element	Description
Remove file	Delete an external data file from the list.
Open File	Open an external data file using the associated application.
File Format	Set the file format options. • **File Format**. Choose the format of the external data file. For an explanation of available formats, see "Supported File Types" on page 378. • **Date Format.** Specify the format of the date in the imported data file. For example, for European dates with a 4 digit year, choose **DD/MM/YYYY**.
Time Zone	Select the time zone where the external data file was recorded. LoadRunner Analysis compensates for the various international time zones and aligns the times in the file with local time zone settings in order to match LoadRunner results. If the times in the imported file are erroneous by a constant offset, you can synchronize the time.
<Synchronize with scenario start time>	Time Zone also contains the option **<Synchronize with scenario start time>**. Choose this to align the earliest measurement found in the data file to the start time of the LoadRunner scenario.
Machine Name	Specify the machine name the monitor runs on. This associates the machine name with the measurement. For example, a file IO rate on the machine `fender` will be named `File IO Rate:fender`. This enables you to apply Graph settings by the machine name. For more information, see "Filtering and Sorting Graph Data" on page 103.
Advanced	For more information, see "Advanced Settings Dialog Box (Import Data Dialog Box)" on page 380.
Truncate imported data to 150% of scenario runtime	In certain cases, the external monitor may have collected data over a time period that was larger than the actual load test. This option deletes data that was collected while the load test was not running, limiting the data collection period to 150% of the load testing period.

Troubleshooting and Limitations for Analysis

This section contains troubleshooting and limitations for Analysis.

General

- If the behavior of Analysis is unpredictable and unexpected messages appear, this might be a result of UAC Virtualization having been enabled for Analysis. You can disable UAC Virtualization on the **Analysis.exe** process in the Windows Task Manager.
- Analysis API works only on x86 platforms. If you are using Visual Studio, define the platform as x86 in the project options.
- When analyzing results from a load test in which the Web Vusers accesses the AUT through a proxy server, the **Time to First Buffer Breakdown** graph shows only zero values for Network Time and Server Time. This is because the "time to first buffer" metric is turned off when working behind a proxy, and the time values can only be calculated to the proxy server.
- Load results that contain transactions with the '@' or ',' characters may conflict with existing transactions. This is because Analysis attempts to replace those characters with the '_', and if this results in a transaction name conflict, an error will occur.
  Workaround: Avoid using the '@' and ',' characters in transaction names.
- The following Analysis default settings have been modified: **Include Think Time** is disabled and **Display summary while generating complete data** is enabled.
- When exporting Analysis reports to MS Word, the content load may affect the table format within the document. The recommended format is RTF.
- If the results take a long time to load, make sure that the **Use cached file to store data** option in **Tools > Options > General** tab is disabled. You should only enable this for very large result files. For details, see "General Tab (Options Dialog Box)" on page 30.

Graphs

- When the Analysis results consists of a large number of similar measurements, you may experience spikes in graphs, or an *Out of memory* message.
  Workaround: For 64-bit Windows, make sure that you have 4 GB or more memory. F or 32-bit Windows, Select **Start > Run**, and type msconfig. In the **Boot** tab, click **Advanced Options**. Select **Maximum memory** and set it to the maximum value.
- After running a Language Pack, the Analysis data generated from the sample session (in the <LR Installation>\tutorial folder) is displayed in English and filtering cannot be applied.
  Workaround: Regenerate the graphs.
- The Transaction Response Time (Percentile) graph may show inaccurate results.
  Workaround: Follow these steps:
  a. Close the Analysis application.
  b. Open the **C:\Program Files (x86)\HP\LoadRunner\bin\dat\percentile.def** file
  c. In the **[Graph Definition]** section, set BasicTableName to an empty string:
     [Graph Definitions]

BasicTableName=

d. Open Analysis again and view the graph.

ALM Integration

- When trying to save an Analysis session to the ALM repository with CAC on IIS, you may encounter an error message indicating that the session cannot be saved and that the connection is unavailable..
  Workaround: Increase the size of the **uploadReadAHeadSize** parameter to 16 MB or higher, and restart IIS. You can use the command line: `C:\Windows\System32\inetsrv\appcmd.exe set config "Default Web Site" -section:system.webServer/ServerRuntime /uploadReadAheadSize:16777216 /commit:apphost`
- After running a Language Pack, the Analysis data generated from the sample session (in the <LR Installation>\tutorial folder) is displayed in English and filtering cannot be applied.
  Workaround: Regenerate the graphs.

Microsoft SQL Server

- If you are using your own policy in an MS SQL server, you may need to add your own account to the Analysis database template (in the <LR Installation>\bin\dat folder).
- Analysis may fail to load results created through an MS SQL database, if the decimal separator on the Analysis machine is different from the decimal separator on the MS SQL Server machine (common on non-English operating systems).
  Workaround: Change the decimal separator on Analysis machine to be the same as the MS SQL Server machine.
- Filtering of transactions for MS Access and SQL queries is limited to 100 transactions.
- If you are using Microsoft SQL Server 2000, you need to either migrate Analysis data, or upgrade to Microsoft SQL Server 2005. The following tasks describe how to migrate and upgrade.

To migrate legacy Analysis data to a SQL 2005 server:

1. From the SQL Server Management Studio, using Object Explorer, connect to an instance of SQL Server Database Engine.
2. Expand Databases, right-click Analysis database, select Tasks\Copy Database.
3. Follow the instructions in the wizard.

To upgrade SQL 2000 to SQL 2005:

1. Uninstall SQL 2000.
2. Install SQL 2005.
3. Restore Analysis data from backup. (http://msdn.microsoft.com/en-us/library/ms177429 (SQL.90).aspx)

Analysis API Reference

The HP LoadRunner Analysis API set can be used for unattended creating of an Analysis session or for custom extraction of data from the results of a test run under the Controller.

You can only view this help from a machine with LoadRunner. Go to **Start > All Programs > HP Software > HP LoadRunner > Documentation > Analysis API Reference**. In icon-based desktops, such as Windows 8, search for **API** and select **Analysis API Reference** from the results.

> **Note:** The Analysis API is only supported for 32-bit environments. If you use Visual Studio to develop your script, make sure to define x86 as the platform in the project options.

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Let us know how we can improve your experience with the User Guide.

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