HP LoadRunner

for the Windows operating systems

Software Version: 11.00

Controller User Guide

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Table of Contents

PART IV: WORKING WITH FIREWALLS

Welcome to LoadRunner Controller

Welcome to the *HP LoadRunner Controller User Guide*. This guide presents an overview of the HP LoadRunner testing process, and describes how to create and run HP LoadRunner scenarios using HP LoadRunner Controller in a Windows environment.

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

How This Guide Is Organized

This guide contains the following parts:

Part I Introducing HP LoadRunner

Introduces HP LoadRunner Controller, and describes how you use it for load testing.

Part II Designing Load Test Scenarios

Explains how to create a scenario for load testing.

Part III Running Load Test Scenarios

Explains how to run a scenario, and how to view the system's performance during the scenario.

Part IV Working with Firewalls

Explains how to use HP LoadRunner Controller in an environment that includes firewalls.

Part V Working with Diagnostics

Explains how to use LoadRunner's Diagnostics modules to identify and pinpoint performance problems in Siebel, Oracle, SAP, J2EE, and .NET environments.

Part VI Monitoring Load Test Scenarios

Explains how to monitor scenario execution using the LoadRunner online monitors.

Part VII Appendixes

Contains additional information about using LoadRunner.

Who Should Read This Guide

This guide is for the following users of HP LoadRunner:

- Performance Engineers
- Project Manager

This document assumes that you are moderately knowledgeable about enterprise application development and highly skilled in enterprise system and database administration.

Documentation Library Guides

The Documentation Library consists of the following guides and references, available online, in PDF format, or both. PDFs can be read and printed using Adobe Reader, which can be downloaded from the Adobe Web site *(*http://www.adobe.com*)*.

Using this Documentation Library explains how to use the Documentation Library and how it is organized.

Accessing the Documentation

You can access the documentation as follows:

- From the **Start** menu, click **Start** > **LoadRunner** > **Documentation** and select the relevant document.
- From the **Help** menu, click **Documentation Library** to open the merged help.

Getting Started Documentation

- **Readme.** Provides last-minute news and information about LoadRunner. You access the Readme from the **Start** menu.
- **HP LoadRunner Quick Start** provides a short, step-by-step overview and introduction to using LoadRunner. To access the Quick Start from the Start menu, click **Start** > **LoadRunner** > **Quick Start.**
- **HP LoadRunner Tutorial.** Self-paced printable guide, designed to lead you through the process of load testing and familiarize you with the LoadRunner testing environment. To access the tutorial from the Start menu, click **Start** > **LoadRunner** > **Tutorial.**

LoadRunner Guides

- **HP Virtual User Generator User Guide.** Describes how to create scripts using VuGen. The printed version consists of two volumes, Volume I - *Using VuGen* and Volume II - *Protocols*, while the online version is a single volume. When necessary, supplement this user guide with the online *HP LoadRunner Online Function Reference*.
- **HP LoadRunner Controller User Guide.** Describes how to create and run LoadRunner scenarios using the LoadRunner Controller in a Windows environment. Also describes how to set up the server monitor environment and configure LoadRunner monitors for monitoring data generated during a scenario.
- **HP LoadRunner Analysis User Guide.** Describes how to use the LoadRunner Analysis graphs and reports after running a scenario to analyze system performance.
- **HP LoadRunner Installation Guide.** Explains how to install LoadRunner and additional LoadRunner components, including LoadRunner samples.

LoadRunner References

- **LoadRunner Function Reference.** Gives you online access to all of LoadRunner's functions that you can use when creating Vuser scripts, including examples of how to use the functions.
- **Analysis API Reference.** This 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 access this reference from the Analysis Help menu.
- **Error Codes and Troubleshooting.** Provides clear explanations and troubleshooting tips for Controller connectivity and Web protocol errors. It also provides general troubleshooting tips for Winsock, SAPGUI, and Citrix protocols.

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Option	Description
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	**Show in Contents.** Displays the **Contents** tab in the navigation pane, and highlights the entry corresponding to the currently displayed page. This button is displayed only when the navigation pane is open.
	**Previous and Next.** Navigates to the previous or next page in the currently displayed guide.

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Using This Documentation Library	Located on the lower-left corner of each content page. Opens this section.
Glossary	Located on the lower-left corner of each content page. Opens a glossary containing definitions of terms and acronyms.

Topic Types

Note: This section applies to the LoadRunner Controller, VuGen, and Analysis User Guides only.

The content in the above mentioned LoadRunner guides is organized by topics. Three main topic types are in use: **Concepts**, **Tasks**, and **Reference**. The topic types are differentiated visually using icons.

Topic Type	Description	Usage
Concepts 	Background, descriptive, or conceptual information.	Learn general information about what a feature does.
Tasks 	**Instructional Tasks.** Step-by-step guidance to help you work with the application and accomplish your goals. Task steps can be with or without numbering: ➤ **Numbered steps.** Tasks that are performed by following each step in consecutive order. ➤ **Non-numbered steps.** A list of self-contained operations that you can perform in any order.	➤ Learn about the overall workflow of a task. ➤ Follow the steps listed in a numbered task to complete a task. ➤ Perform independent operations by completing steps in a non-numbered task.
	Use-case Scenario Tasks. Examples of how to perform a task for a specific situation.	Learn how a task could be performed in a realistic scenario.

Topic Type	Description	Usage
Reference 	**General Reference**. Detailed lists and explanations of reference-oriented material.	Look up a specific piece of reference information relevant to a particular context.
	User Interface Reference. Specialized reference topics that describe a particular user interface in detail. Selecting **Help on this page** from the Help menu in the product generally open the user interface topics.	Look up specific information about what to enter or how to use one or more specific user interface elements, such as a window, dialog box, or wizard.
Troubleshooting and Limitations 	**Troubleshooting and Limitations**. Specialized reference topics that describe commonly encountered problems and their solutions, and list limitations of a feature or product area.	Increase your awareness of important issues before working with a feature, or if you encounter usability problems in the software.

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Troubleshooting & Knowledge Base accesses the Troubleshooting page on the HP Software Support Web site where you can search the Self-solve knowledge base. Choose **Help** > **Troubleshooting & Knowledge Base**. The URL for this Web site is http://h20230.www2.hp.com/troubleshooting.jsp.

HP Software Support accesses the HP Software Support Web site. This site enables you to browse the Self-solve knowledge base. You can also post to and search user discussion forums, submit support requests, download patches and updated documentation, and more. Choose **Help** > **HP Software Support**. The URL for this Web site is www.hp.com/go/hpsoftwaresupport.

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Part I

Introducing HP LoadRunner

2

Understanding LoadRunner

This chapter includes:

Concepts

Reference

Concepts

Application Load Testing Overview

Modern system architectures are complex. While they provide an unprecedented degree of power and flexibility, these systems are difficult to test. Whereas single-user testing focuses primarily on functionality and the user interface of a system component, application testing focuses on performance and reliability of an entire system.

For example, a typical application testing scenario might depict 1000 users that log in simultaneously to a system on Monday morning. What is the response time of the system? Does the system crash? To be able to answer these questions, and more, a complete application performance testing solution must do the following:

- Test a system that combines a variety of software applications and hardware platforms
- Determine the suitability of a server for any given application
- Test the server before the necessary client software has been developed
- Emulate an environment where multiple clients interact with a single server application
- Test an application under the load of tens, hundreds, or even thousands of potential users

The HP LoadRunner Solution

Traditional or manual testing methods offer only a partial solution to load testing. For example, you can test an entire system manually by constructing an environment where many users work simultaneously on the system. Each user works at a single machine and submits input to the system. However, this manual testing method has the following drawbacks:

- It is expensive, requiring large amounts of both personnel and machinery

- It is complicated, especially coordinating and synchronizing multiple testers
- It involves a high degree of organization, especially to record and analyze results meaningfully
- The repeatability of the manual tests is limited

LoadRunner addresses the drawbacks of manual performance testing:

- LoadRunner reduces personnel requirements by replacing human users with virtual users or **Vusers**. These Vusers emulate the behavior of real users operating real applications.
- Because numerous Vusers can run on a single computer, LoadRunner reduces the amount of hardware required for testing.
- The HP LoadRunner Controller allows you to easily and effectively control all the Vusers from a single point of control.
- LoadRunner monitors the application performance online, enabling you to fine-tune your system during test execution.
- LoadRunner automatically records the performance of the application during a test. You can choose from a wide variety of graphs and reports to view the performance data.
- LoadRunner checks where performance delays occur: network or client delays, CPU performance, I/O delays, database locking, or other issues at the database server. LoadRunner monitors the network and server resources to help you improve performance.
- Because LoadRunner tests are fully automated, you can easily repeat them as often as you need.

HP LoadRunner Terminology

- **Scenario.** A scenario is a sequence of events that emulate the hypothetical actions of real users on your application.

- **Vusers.** In the scenario, LoadRunner replaces real users with **virtual users** or **Vusers**. While a workstation accommodates only a single human user, many Vusers can run concurrently on a single workstation. In fact, a scenario can contain tens, hundreds, or even thousands of Vusers.
- **Vuser Scripts.** The actions that a Vuser performs during the scenario are described in a Vuser script. When you run a scenario, each Vuser executes a **Vuser script**. The Vuser scripts include functions that measure and record the performance of your application's components.
- **Transactions.** To measure the performance of the server, you define **transactions**. A transaction represents an action or a set of actions that you are interested in measuring. You define transactions within your Vuser script by enclosing the appropriate sections of the script with **start** and **end** transaction statements. For example, you can define a transaction that measures the time it takes for the server to process a request to view the balance of an account and for the information to be displayed at the ATM.
- **Rendezvous points**. You insert **rendezvous points** into Vuser scripts to emulate heavy user load on the server. **Rendezvous points** instruct Vusers to wait during test execution for multiple Vusers to arrive at a certain point, so that they may simultaneously perform a task. For example, to emulate peak load on the bank server, you can insert a rendezvous point instructing 100 Vusers to deposit cash into their accounts at the same time.
- **Controller.** You use the **HP LoadRunner Controller** to manage and maintain your scenarios. Using the Controller, you control all the Vusers in a scenario from a single workstation.
- **Load Generator.** When you execute a scenario, the Controller distributes each Vuser in the scenario to a **load generator**. The load generator is the machine that executes the Vuser script, enabling the Vuser to emulate the actions of a human user.
- **Performance analysis.** Vuser scripts include functions that measure and record system performance during load-testing sessions. During a scenario run, you can monitor the network and server resources. Following a scenario run, you can view **performance analysis** data in reports and graphs.

The HP LoadRunner Testing Process - Overview

The following section provides a general overview of the HP LoadRunner testing process.

This section also includes:

1 Planning the Test

Successful load testing requires that you develop a thorough test plan. A clearly defined test plan will ensure that the LoadRunner scenarios that you develop will accomplish your load testing objectives. For more information, see "Planning Load Test Scenarios" on page 33.

2 Creating the Vuser Scripts

Vusers emulate human users interacting with your Web-based application. A Vuser script contains the actions that each Vuser performs during scenario execution.

In each Vuser script, you determine the tasks that will be:

- Performed by each Vuser
- Performed simultaneously by multiple Vusers
- Measured as transactions

For more information on creating Vuser scripts, see the *HP Virtual User Generator User Guide*.

3 Designing the Scenario

A scenario describes the events that occur during a testing session. A scenario includes a list of machines on which Vusers run, a list of scripts that the Vusers run, and a specified number of Vusers or Vuser groups that run during the scenario. When designing the scenario, you set the scenario configuration and scheduling which determines how all the load generators and Vusers behave while the scenario runs.

You design scenarios using the Controller. For information about LoadRunner scenarios, see "Designing Scenarios" on page 53.

4 Running the Scenario

You emulate user load on the server by instructing multiple Vusers to perform tasks simultaneously. While the scenario runs, LoadRunner measures and records the transactions that you defined in each Vuser script. You can set the level of load by increasing and decreasing the number of Vusers that perform tasks at the same time and you can also monitor your system's performance online. For more information, see "Running Scenarios" on page 247.

5 Monitoring the Scenario

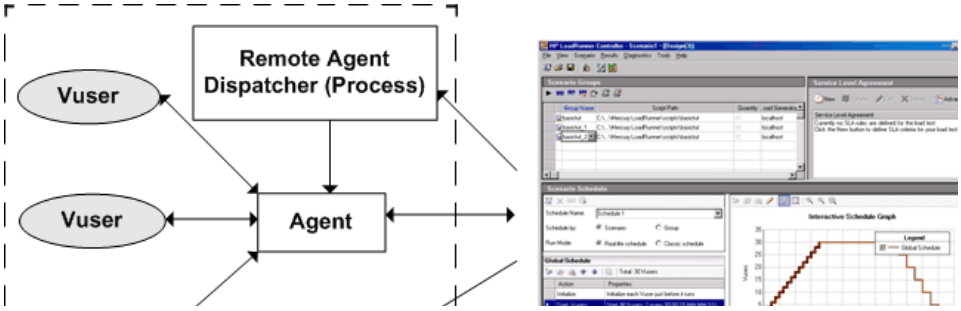
You configure the LoadRunner monitoring components to identify bottlenecks on the system and determine which element is causing performance degradation, for example, file locking, resource contention, and network overload. Use LoadRunner in conjunction with the new network and machine monitoring tools to create load and measure performance at different points in the system. For more information on monitoring, see "Working with LoadRunner Online Monitors" on page 441.

6 Analyzing Test Results

During scenario execution, LoadRunner records the performance of the application under different loads. You use LoadRunner's graphs and reports to analyze the application's performance. For more information about LoadRunner's reports and graphs, see the *HP LoadRunner Analysis User Guide*.

HP LoadRunner Vuser Technology

On each Windows load generator, you install the **Remote Agent Dispatcher (Process)** and a LoadRunner **Agent**.



- **Remote Agent Dispatcher.** The Remote Agent Dispatcher (Process) enables the Controller to start applications on the load generator.
- **Agent.** The LoadRunner Agent enables the Controller and the load generator to communicate with each other. When you run a scenario, the Controller instructs the Remote Agent Dispatcher (Process) to launch the LoadRunner agent. The agent receives instructions from the Controller to initialize, run, pause, and stop Vusers. At the same time, the agent also relays data on the status of the Vusers back to the Controller.

HP LoadRunner Vuser Types

There are two categories of Vusers:

Protocol Based Vusers

LoadRunner supports various types of Vusers using the most common protocols. Each type is designed to handle different aspects of today's system architectures. You can use the Vuser types in any combination in a scenario in order to create a comprehensive application test.

Vuser types are divided into several categories, indicating their use within common business environments. For example:

- **Application Deployment Solution** Vusers support the Citrix or Remote Desktop Protocol (RDP) protocols.
- **Client/Server** Vusers support database and socket communication protocols.
- **Distributed Components** Vusers support COM/DCOM and Microsoft .NET protocols.
- **E-business** Vusers support AJAX, AMF, HTTP/HTML, and Web Services protocols.
- **ERP/CRM** Vusers provide testing for Oracle NCA, SAP, and Siebel systems.
- **Java** Vusers support the Jacada, CORBA, RMI, and JMS protocols.

For a complete list of the available Vuser and protocol types, see Vuser Types in the *HP Virtual User Generator User Guide*.

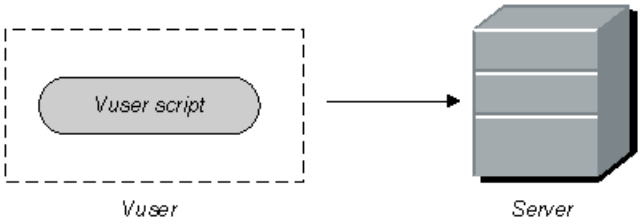
GUI Vusers

LoadRunner can integrate functional testing scripts in the form of *GUI Vuser scripts* into a load testing scenario. These GUI Vuser scripts are created using HP Functional Testing software - QuickTest Professional or WinRunner.

You can run only a single GUI Vuser on a Windows-based load generator. Use Citrix to run multiple GUI Vusers. For additional information on Windows-based GUI Vusers, see "Using QuickTest Scripts in LoadRunner" on page 329.

Vuser Technology

Vusers (except for GUI Vusers) generate load on a server by submitting input directly to the server. Vusers do not operate client applications—they access the server using LoadRunner API functions. These API functions emulate the input from an actual application.



Because Vusers are not reliant on client software, you can use Vusers to test server performance even before the client software has been developed. Further, since Vusers do not have a user interface, the amount of system resources required is minimal. This allows you to run large numbers of Vusers on a single workstation.

The following example illustrates the use of Vusers: Suppose that you have a Web-based database server that maintains your customer information. The information is accessed by numerous customer service personnel who are located throughout the country. The server receives the queries, processes the requests, and returns responses via the Web to field personnel.

You want to test the response times of the entire system when numerous service personnel simultaneously access the server. Using LoadRunner, you could create several hundred Vusers, each Vuser accessing the server database. The Vusers enable you to emulate and measure the performance of your database and Web servers under the load of many users.

You develop a Vuser script to define the actions of a Vuser. A Vuser script includes functions that control the script execution, specify the input that the Vuser submits to the server, and measure the server performance.

You develop Vuser scripts either by recording with HP Virtual User Generator (VuGen) or by using LoadRunner's Vuser script templates.

For the database server example above, you could create a Vuser script that performs the following actions:

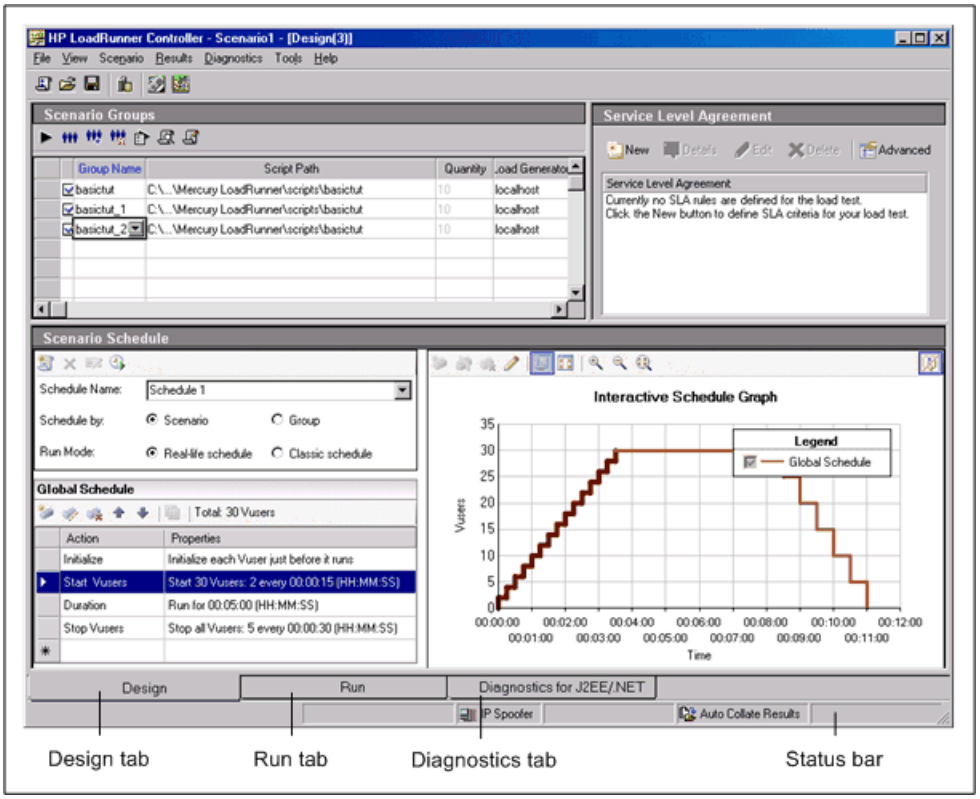
- Logs in to the Web application
- Connects to the database server
- Submits an SQL query
- Retrieves and processes the server response
- Disconnects from the server and the Web

You can create Vuser scripts on a Windows-based platform, or program them on a UNIX platform. For a list of the supported UNIX platforms, see the HP LoadRunner Readme file. For more information about Vusers, see the *HP Virtual User Generator User Guide*.

Reference

Controller Window

The Controller window enables you to design and run load test scenarios, and view Diagnostics for J2EE/.NET data.



To access	**Start** > **Program Files** > **LoadRunner** > **LoadRunner** > **Load Testing** tab > **Run Load Test** **Start** > **Program Files** > **LoadRunner** > **Applications** > **Controller**
Important information	By default, upon opening the Controller the New Scenario dialog box is displayed. To disable this option, clear the **Show at Startup** option. For details, see "New Scenario Dialog Box" on page 84.
Relevant tasks	➤ "How to Design a Goal-Oriented Scenario" on page 60 ➤ "How to Design a Manual Scenario" on page 62 ➤ "How to Run a Scenario" on page 249 ➤ "How to Set Up the Monitoring Environment – Workflow" on page 443

User interface elements are described below:

UI Elements (A-Z)	Description
	**New Scenario.** Opens New Scenario dialog box. For user interface details, see "New Scenario Dialog Box" on page 84.
	**Open Scenario.** Enables you to open an existing scenario.
	**Save Scenario.** Enables you to save the active scenario.
 (Goal-oriented scenario; Run view only)	**Edit scenario goal.** Opens the Edit Scenario Goal dialog box where you define goals for a goal-oriented scenario. For user interface details, see "Edit Scenario Goal Dialog Box" on page 78.
	**Load Generators.** Opens the Load Generators dialog box where you can add new load generators and view details about existing load generators. For user interface details, see "Load Generators Dialog Box" on page 124.

UI Elements (A-Z)	Description
 (Run view only)	**Initialize Vusers.** Initializes all Vusers (ar those that are still in the **Down** state) in a selected Vuser group. The group's status changes from **Down** to **Pending** to **Initializing** to **Ready**. If the group fails to initialize, the status changes to **Error**. By initializing all of the Vusers in a group before running them, you can ensure that they all begin executing the scenario at the same time.
 (Run view only)	**Run Vusers Until Complete.** Runs all Vusers in a selected Vuser group until completion. If you run a Vuser group in the **Down** or **Error** state, LoadRunner initializes and then runs the group. **Note:** You can instruct LoadRunner to randomly run only one Vuser in a Vuser group by right-clicking the group and selecting **Run one Vuser Until Complete**. A Vuser script log opens, displaying run-time information about the Vuser. For more information, see "Vuser Script Log" on page 287
 (Run view only)	**Gradual Stop.** Gradually stops a Vuser group in the Run state if you selected the **Wait for the current iteration to end before exiting** or **Wait for the current action to end before exiting** options in the Run-Time Settings tab of the Options dialog box.
 (Run view only)	**Stop Vusers.** Immediately stops all Vusers in selected Vuser groups from executing their scripts.
 (Run view only)	**Analyze Results.** Opens diagnostics results.
	**Invoke VuGen.** Invokes HP Virtual User Generator.
	**Invoke Analysis.** Invokes HP LoadRunner Analysis.

UI Elements (A-Z)	Description
Design tab	Enables you to design scenarios. For details, see "Design View User Interface" on page 72.
Diagnostics for J2EE/.NET tab	Enables you to view J2EE/.NET diagnostics data collected from a scenario run. For details, see the *HP Diagnostics User Guide*.
Run tab	Enables you to run and monitor scenario runs. For details, see "Run View User Interface" on page 270.
<Status bar>	Displays the following features of Controller (if enabled): ➤ Application Lifecycle Management Connection ➤ IP Spoofer ➤ Auto Collate Results ➤ Auto Load Analysis

Part II

Designing Load Test Scenarios

3

Planning Load Test Scenarios

This chapter includes:

Concepts

Tasks

Reference

Concepts

Load Test Planning Overview

As in any type of system testing, a well-defined test plan is the first essential step to successful testing. Planning your load testing helps you to:

➤ Build test scenarios that accurately emulate your working environment.

Load testing means testing your application under typical working conditions, and checking for system performance, reliability, capacity, and so forth.

Before running your load test, it is important to:

➤ Understand which resources are required for testing.

Application testing requires hardware, software, and human resources. Before you begin testing, you should know which resources are available and decide how to use them effectively.

➤ Define success criteria in measurable terms.

Focused testing goals and test criteria ensure successful testing. For example, it is not enough to define vague objectives like "Check server response time under heavy load." A more focused success criterion would be "Check that 50 customers can check their account balance simultaneously, and that the server response time will not exceed one minute."

Load Testing Objectives

Your test plan should be based on a clearly defined testing objective.

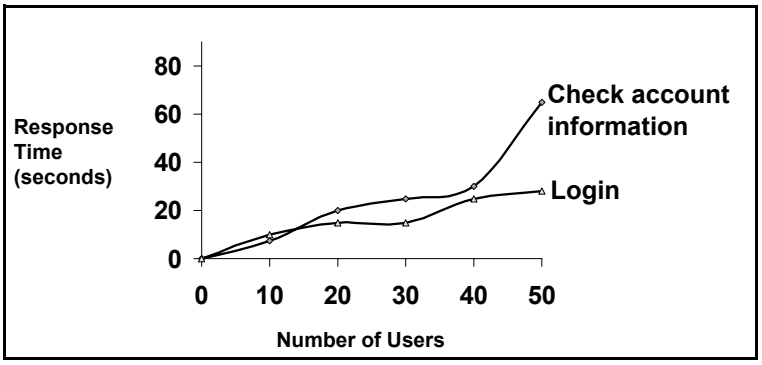
The following table presents common application testing objectives that LoadRunner helps you test, as described in Robert W. Buchanan, Jr's *The Art of Testing Network Systems* (John Wiley & Sons, Inc., 1996). More details on these objectives appear after the table.

Objective	Answers the Question
Measuring end-user response time	How long does it take to complete a business process?
Defining optimal hardware configuration	Which hardware configuration provides the best performance?
Checking reliability	How hard or long can the system work without errors or failures?
Checking hardware or software upgrades	How does the upgrade affect performance or reliability?
Evaluating new products	Which server hardware or software should you choose?
Measuring system capacity	How much load can the system handle without significant performance degradation?
Identifying bottlenecks	Which element is slowing down response time?

This section also includes:

Measuring End-User Response Time

Check how long it takes for the user to perform a business process and receive a response from the server. For example, suppose that you want to verify that while your system operates under normal load conditions, the end users receive responses to all requests within 20 seconds. The following graph presents a sample load vs. response time measurement for a banking application:



Defining Optimal Hardware Configuration

Check how various system configurations (memory, CPU speed, cache, adaptors, modems) affect performance. Once you understand the system architecture and have tested the application response time, you can measure the application response for different system configurations to determine which settings provide the desired performance levels.

For example, you could set up three different server configurations and run the same tests on each configuration to measure performance variations.

Checking Reliability

Determine the level of system stability under heavy or continuous work loads. You can use LoadRunner to create stress on the system: force the system to handle extended activity in a compressed time period to simulate the kind of activity a system would normally experience over a period of weeks or months.

Checking Hardware or Software Upgrades

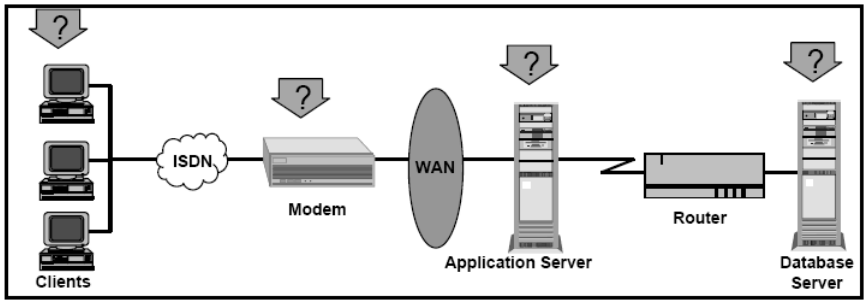
Perform regression testing to compare a new release of hardware or software to an older release. You can check how an upgrade affects response time (benchmark) and reliability. Application regression testing does not check new features of an upgrade; rather it checks that the new release is as efficient and reliable as the older release.

Evaluating New Products

You can run tests to evaluate individual products and subsystems during the planning and design stage of a product's life cycle. For example, you can choose the hardware for the server machine or the database package based on evaluation tests.

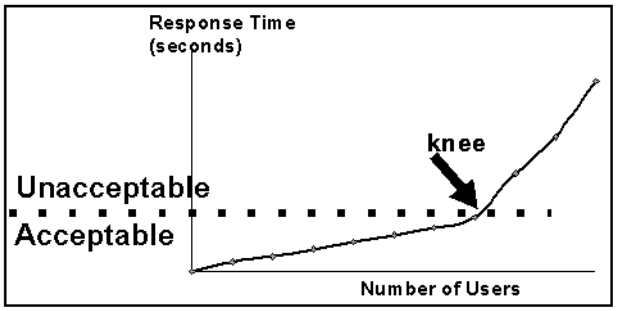
Identifying Bottlenecks

You configure the LoadRunner monitoring components to identify bottlenecks on the system and determine which element is causing performance degradation, for example, file locking, resource contention, and network overload. Use LoadRunner in conjunction with the new network and machine monitoring tools to create load and measure performance at different points in the system. For more information on monitoring, see "Monitoring Process Overview" on page 442.



Measuring System Capacity

Measure system capacity, and determine how much excess capacity the system can handle without performance degradation. To check capacity, you can compare performance versus load on the existing system, and determine where significant response-time degradation begins to occur. This is often called the “knee” of the response time curve.



Once you determine the current capacity, you can decide if resources need to be increased to support additional users.

Tasks

How to Plan a Load Test

This task describes how to plan a load test.

This task includes the following steps:

- "Analyze the application" on page 39
- "Define the load testing objectives" on page 39
- "Plan LoadRunner implementation" on page 39

1 Analyze the application

You should become thoroughly familiar with the hardware and software components, the system configuration, and the typical usage model. This analysis ensures that the testing environment you create using LoadRunner will accurately reflect the environment and configuration of the application under test. For task details, see "How to Analyze the Application" on page 40.

2 Define the load testing objectives

Before you begin testing, you should define exactly what you want to accomplish. For task details, see "How to Define the Load Test Objectives" on page 43.

3 Plan LoadRunner implementation

Decide how to use LoadRunner to achieve your testing goals. For task details, see "How to Plan the LoadRunner Implementation" on page 44.

How to Analyze the Application

This task describes how to analyze the application under test as part of the load test planning process. Each step in this task contains example information relating to an online banking system.

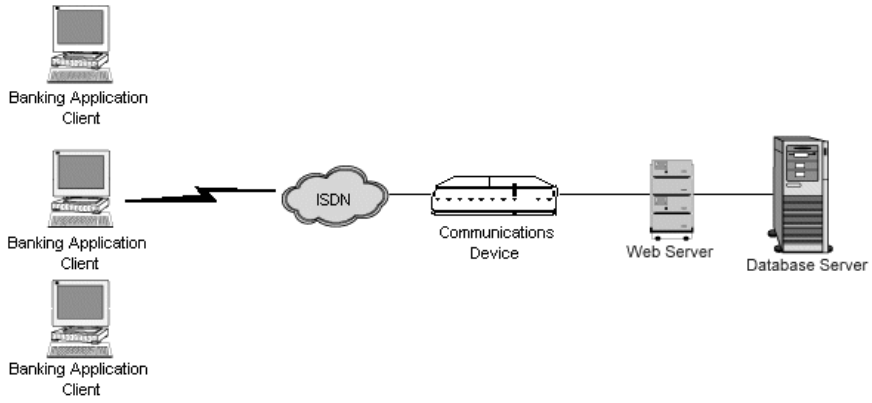
This task includes the following steps:

1 Identify system components

Draw a schematic diagram to illustrate the structure of the application. If possible, extract a schematic diagram from existing documentation. If the application under test is part of a larger network system, you should identify the component of the system to be tested. Make sure the diagram includes all system components, such as client machines, network, middleware, and servers.

Example

The following diagram illustrates an online banking system that is accessed by many Web users. The Web users each connect to the same database to transfer funds and check balances. The customers connect to the database server through the Web, using multiple browsers.



2 Describe the system configuration

Enhance the schematic diagram with more details. Describe each system component's configuration. You should be able to answer the following questions:

- How many users are anticipated to connect to the system?
- What is the application client's machine configuration (hardware, memory, operating system, software, development tool, and so forth)?
- What types of database and Web servers are used (hardware, database type, operating system, file server, and so forth)?
- How does the server communicate with the application client?
- What is the middleware configuration and application server between the front-end client and back-end server?
- What other network components may affect response time (modems and so forth)?
- What is the throughput of the communications devices? How many concurrent users can each device handle?

Example

The schematic diagram of the online banking system specified that there are multiple application clients accessing the system.

Front-End Client Configuration	
Anticipated number of application clients	50 concurrent application clients
Hardware / Memory	Pentium IV/ 1GB
Operating system & version	Windows 2003
Client browser	Internet Explorer 6.0 SP1

3 Analyze the usage mode

Define how the system is typically used, and decide which functions are important to test. Consider who uses the system, the number of each type of user, and each user's common tasks. In addition, consider any background load that might affect the system response time.

Example

Suppose 200 employees log on to the accounting system every morning, and the same office network has a constant background load of 50 users performing various word processing and printing tasks. You could create a LoadRunner scenario with 200 virtual users signing in to the accounting database, and check the server response time.

To check how background load affects the response time, you could run your scenario on a network where you also simulate the load of employees performing word processing and printing activities.

4 Examine task distribution

In addition to defining the common user tasks, examine the distribution of these tasks.

Example

Suppose the bank uses a central database to serve clients across many states and time zones. The 250 application clients are located in two different time zones, all connecting to the same Web server. There are 150 in Chicago and 100 in Detroit. Each begins their business day at 9:00 AM, but since they are in different time zones, there should never be more than 150 users signing in at any given time. You can analyze task distribution to determine when there is peak database activity, and which activities typically occur during **peak load** time.

How to Define the Load Test Objectives

This task describes how to define the load test objectives as part of the load test planning process.

This task includes the following steps:

- "Decide on general objectives" on page 43
- "State the objectives in measurable terms" on page 43
- "Decide when to test" on page 44

1 Decide on general objectives

For a list of suggested testing objectives, see "Examining Load Testing Objectives" on page 49.

2 State the objectives in measurable terms

Once you decide on your general load testing objectives, you should identify more focused goals by stating your objectives in measurable terms. To provide a baseline for evaluation, determine exactly what constitutes acceptable and unacceptable test results.

Example

General Objective. Product Evaluation: choose hardware for the Web server.

Focused Objective. Product Evaluation: run the same group of 300 virtual users on two different servers, HP and NEC. When all 300 users simultaneously browse the pages of your Web application, determine which hardware gives a better response time.

3 Decide when to test

Load testing is necessary throughout the product life cycle. The following table illustrates what types of tests are relevant for each phase of the product life cycle:

Planning and Design	Development	Deployment	Production	Evolution
Evaluate new products	Measure response time	Check reliability	Measure response time	Check HW or SW upgrades
Measure response time	Check optimal hardware configuration	Measure response time	Identify bottlenecks	Measure system capacity
	Check HW or SW upgrades	Measure system capacity		
	Check reliability			

How to Plan the LoadRunner Implementation

This task describes how to plan the LoadRunner implementation as part of the load test planning process.

This task includes the following steps:

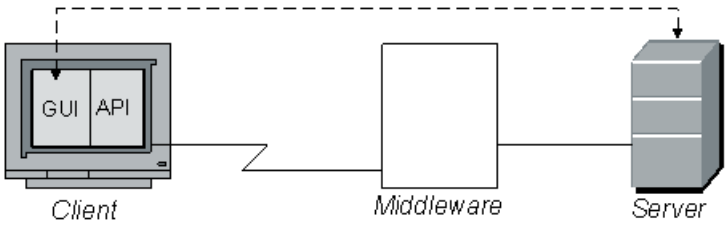
- "Define the scope of performance measurements" on page 45
- "Define Vuser activities" on page 47
- "Select Vusers" on page 47
- "Choose testing hardware/software" on page 48

1 Define the scope of performance measurements

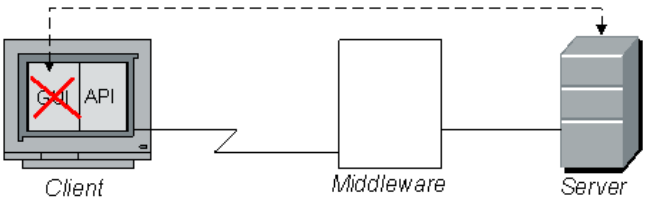
You can use LoadRunner to measure **response time** at different points in the application. Determine where to run the Vusers and which Vusers to run according to the test objectives:

➤ **Measuring end-to-end response time.** You can measure the response time that a typical user experiences by running a GUI Vuser at the front end. GUI Vusers emulate real users by submitting input to and receiving output from the client application.

You can run GUI Vusers at the front end to measure the response time across the entire network, including a terminal emulator or GUI front end, network, and server.

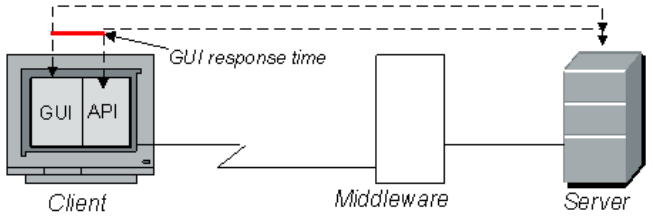


➤ **Measuring network and server response times.** You can measure network and server response time, excluding response time of the GUI front end, by running Vusers (not GUI) on the client machine. Vusers emulate client calls to the server without the user interface. When you run many Vusers from the client machine, you can measure how the load affects network and server response time.

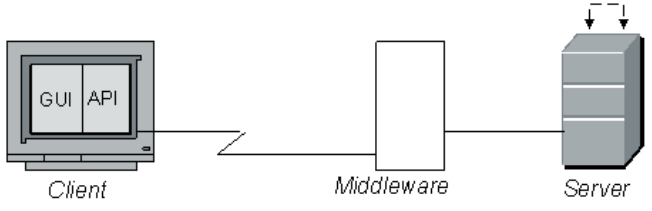


➤ **Measuring GUI response time.** You can determine how the client application interface affects response time by subtracting the previous two measurements:

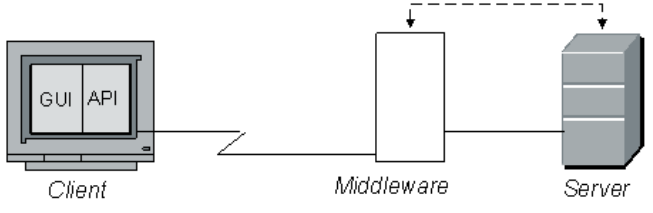
GUI response time = end-to-end - network and server



➤ **Measuring server response time.** You can measure the time it takes for the server to respond to a request without going across the network. When you run Vusers on a machine directly connected to the server, you can measure server performance.



➤ **Measuring middleware-to-server response time.** You can measure response time from the server to middleware if you have access to the middleware and its API. You can create Vusers with the middleware API and measure the middleware-server performance.



2 Define Vuser activities

Create Vuser scripts based on your analysis of Vuser types, their typical tasks, and your test objectives. Since Vusers emulate the actions of a typical end-user, the Vuser scripts should include the typical end-user tasks. For example, to emulate an online banking client, you should create a Vuser script that performs typical banking tasks. You would browse the pages that you normally visit to transfer funds or check balances.

You decide which tasks to measure based on your test objectives and define **transactions** for these tasks. Transactions measure the time that it takes for the server to respond to tasks submitted by Vusers (end-to-end time). For example, to check the response time of a bank Web server supplying an account balance, define a transaction for this task in the Vuser script.

In addition, you can emulate peak activity by using **rendezvous points** in your script. Rendezvous points instruct multiple Vusers to perform tasks at exactly the same time. For example, you can define a rendezvous to emulate 70 users simultaneously updating account information.

3 Select Vusers

Before you decide on the hardware configuration to use for testing, determine the number and type of Vusers required. To decide how many Vusers and which types to run, look at the typical usage model, combined with the testing objectives. Some general guidelines are:

- Use one or a few GUI users to emulate each type of typical user connection.
- Run multiple Vusers to generate the rest of the load for each user type.

For example, suppose that you have five kinds of users, each performing a different business process:

Usage Model	GUI	Other
100 customer service users in New York (LAN connection)	2	98
30 customers in Europe (dial-in ISDN connection)	2	28

Usage Model	GUI	Other
5 background batch processes	_	5
150 customers (terminal connection)	_	_
6 managers	2	4

4 Choose testing hardware/software

The hardware and software should be powerful and fast enough to emulate the required number of virtual users. Refer to the *HP LoadRunner Installation Guide* for specific hardware requirements.

To decide on the number of machines and correct configuration, consider the following:

- It is advisable to run HP LoadRunner Controller on a separate machine.
- Each GUI Vuser requires a separate Windows-based machine; several GUI Vusers can run on a single UNIX machine.
- Configuration of the test machine for GUI Vusers should be as similar as possible to the actual user's machine.

Note: The results file requires a few MB of disk space for a long scenario run with many transactions. The load generators also require a few MB of disk space for temporary files if there is no NFS. For more information about run-time file storage, see "Run-Time File Storage Locations" on page 213.

Reference

Examining Load Testing Objectives

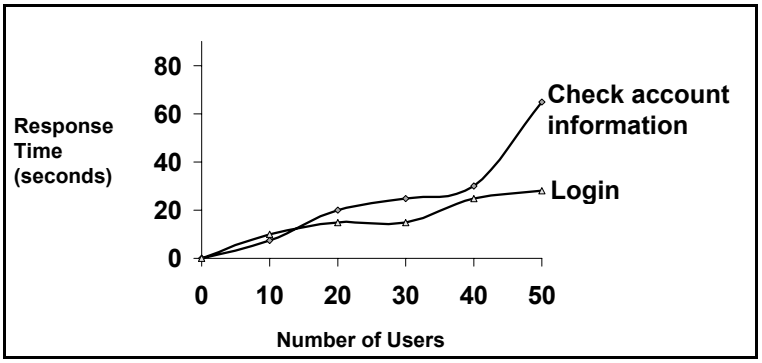
Your test plan should be based on a clearly defined testing objective. This section presents an overview of common testing objectives:

This section includes:

- Measuring End-User Response Time
- Defining Optimal Hardware Configuration
- Checking Reliability
- Checking Hardware or Software Upgrades
- Evaluating New Products
- Identifying Bottlenecks
- Measuring System Capacity

Measuring End-User Response Time

Check how long it takes for the user to perform a business process and receive a response from the server. For example, suppose that you want to verify that while your system operates under normal load conditions, the end users receive responses to all requests within 20 seconds. The following graph presents a sample load vs. response time measurement for a banking application:



Defining Optimal Hardware Configuration

Check how various system configurations (memory, CPU speed, cache, adaptors, modems) affect performance. Once you understand the system architecture and have tested the application response time, you can measure the application response for different system configurations to determine which settings provide the desired performance levels.

For example, you could set up three different server configurations and run the same tests on each configuration to measure performance variations.

Checking Reliability

Determine the level of system stability under heavy or continuous work loads. You can use LoadRunner to create stress on the system: force the system to handle extended activity in a compressed time period to simulate the kind of activity a system would normally experience over a period of weeks or months.

Checking Hardware or Software Upgrades

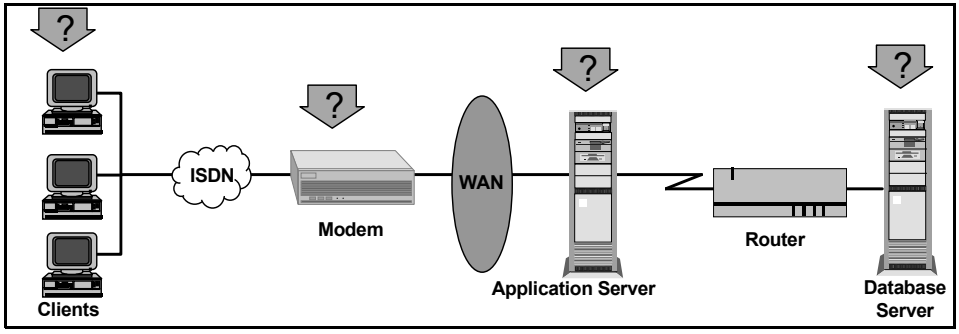
Perform regression testing to compare a new release of hardware or software to an older release. You can check how an upgrade affects response time (benchmark) and reliability. Application regression testing does not check new features of an upgrade; rather it checks that the new release is as efficient and reliable as the older release.

Evaluating New Products

You can run tests to evaluate individual products and subsystems during the planning and design stage of a product's life cycle. For example, you can choose the hardware for the server machine or the database package based on evaluation tests.

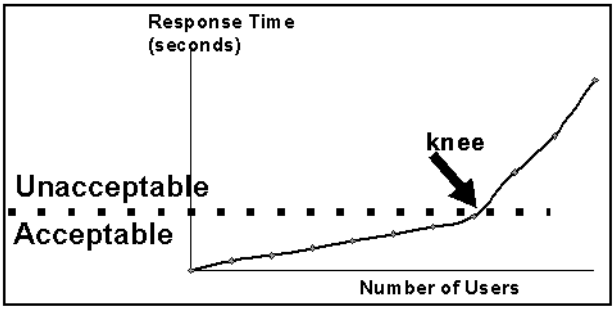
Identifying Bottlenecks

You can run tests that identify bottlenecks on the system and determine which element is causing performance degradation, for example, file locking, resource contention, and network overload. Use LoadRunner in conjunction with the new network and machine monitoring tools to create load and measure performance at different points in the system. For more information, see Part VI, "Monitoring a Scenario."



Measuring System Capacity

Measure system capacity, and determine how much excess capacity the system can handle without performance degradation. To check capacity, you can compare performance versus load on the existing system, and determine where significant response-time degradation begins to occur. This is often called the “knee” of the response time curve.



Once you determine the current capacity, you can decide if resources need to be increased to support additional users.

4

Designing Scenarios

This chapter includes:

Concepts

Tasks

Reference

Concepts

Load Test Scenarios Overview

To test your system with LoadRunner, you must create a **load test scenario**. A scenario defines the events that occur during each testing session. It defines and controls the number of users to emulate, the actions that they perform, and the machines on which they run their emulations.

Before you design a scenario, you should have a a well-defined test plan in mind. For more details, see "Planning Load Test Scenarios" on page 33.

You design scenarios in the Design tab of the Controller. After you design the scenario, LoadRunner saves the information in a scenario file (**.lrs**).

You can design the following types of scenarios:

- Manual Scenarios
- Goals Types for Goal-Oriented Scenarios

Manual Scenarios

You build a manual scenario by selecting scripts to run, assigning load generators on which to run the scripts, and distributing Vusers to run among the scripts.

You can design a manual scenario in one of the following modes:

- **Vuser group mode**. In this mode, each script you select for the scenario is assigned to a Vuser group. You assign a number of Vusers to each Vuser group that you create. You can instruct all Vusers in a group to run the same script on the same load generator, or you can assign different scripts and load generators to the various Vusers in a group.
- **Percentage mode.** In this mode, you define a total number of Vusers to be used in the scenario, and assign load generators and a percentage of the total number of Vusers to each script.

After you define which Vuser groups/scripts to run in the scenario, you select or build a **schedule** by which to run the scenario. For more information, see "Scheduling Manual Scenarios" on page 127.

You can also create **service level agreements (SLAs)** which are specific goals that you define for your load test scenario. When you run the scenario, LoadRunner gathers and stores performance-related data. When you analyze the run, Analysis compares this data against the SLAs and determines SLA statuses for the defined measurements. For more information, see "Service Level Agreements" on page 161.

Changing Scenario Modes

You can convert a scenario from the Vuser group mode to the percentage mode and vice versa.

The following table describes what happens to the scenario when converting from the one mode to the other:

Vuser group mode to percentage mode	➤ If a Vuser group contains multiple scripts, in percentage mode the scripts are listed one by one in the Scenario Scripts pane. ➤ In the percentage mode, all load generators are assigned to all Vuser scripts by default. If multiple load generators are assigned to a Vuser group, the Vusers assigned to the scripts in the percentage mode are distributed evenly among the load generators originally assigned to the group. If you defined group schedules for the Vuser groups, these settings will be lost. All profiles will contain schedule **by scenario** settings only. For details about scheduling scenarios, see "Scheduling Manual Scenarios" on page 127.
Percentage mode to Vuser group mode	➤ Each script is converted to a Vuser group. ➤ If you defined multiple load generators for a Vuser script, the Vuser group that is created when converting the scenario will also contain multiple load generators. ➤ If a schedule is defined for the scenario, all the schedule settings remain unchanged.

Note: You can convert from one scenario mode to another at any time. For details, see "How to Change the Scenario Mode (Manual Scenario)" on page 65.

Goals Types for Goal-Oriented Scenarios

In a goal-oriented scenario, you define the goals you want your test to achieve and LoadRunner automatically builds a scenario for you based on these goals.

You can define the following types of goals for a goal-oriented scenario:

- **Virtual Users**

  This goal tests if your application can run a specified number of Vusers simultaneously. Running this type of goal-oriented scenario is similar to running a manual scenario.

- **Pages per Minute/Hits per Second/Transactions per Second**

  These goals test the strength of your server. For each of these goal types, you specify a minimum-maximum range of Vusers for the scenario to run, and in the case of the Transactions per Second goal type, you also specify a transaction name.

Note:

- **Pages per Minute** and **Hits per Second** goals are for Web Vusers only.
- Hits per second relates to HTTP requests per second.

When you define one of these goal type, the Controller divides the target defined by the minimum number of Vusers specified, and determines the target number of hits/transactions per second or pages per minute that each Vuser should reach.

The Controller then begins loading the Vusers according to the load behavior settings you defined, as follows:

- If you selected to run the Vusers automatically, LoadRunner loads 50 Vusers in the first batch. If the maximum number of Vusers defined is less than 50, LoadRunner loads all of the Vusers simultaneously.
- If you chose to reach your target after a certain period of the scenario elapses, LoadRunner attempts to reach the defined target within this period of time. It determines the size of the first batch of Vusers based on the time limit you defined and the calculated target number of hits, transactions, or pages per Vuser.
- If you chose to reach your target by gradation (x number of pages/hits every x amount of time), LoadRunner calculates the target number of hits or pages per Vuser and determines the size of the first batch of Vusers accordingly. (Not relevant for the Transactions per Second goal type).

After running each batch of Vusers, LoadRunner evaluates whether the target for the batch was achieved. If the batch target was not reached, LoadRunner recalculates the target number of hits, transactions, or pages per Vuser, and readjusts the number of Vusers for the next batch to be able to achieve the defined goal. By default, a new batch of Vusers is released every two minutes.

If the goal has not been reached after the Controller has launched the maximum number of Vusers, LoadRunner attempts to reach the defined target once more by recalculating the target number of hits, transactions, or pages per Vuser, and running the maximum number of Vusers simultaneously.

A Pages per Minute or Hits/Transactions per Second goal-oriented scenario is assigned a **Failed** status if:

- The Controller has twice attempted to reach the goal using the maximum number of Vusers specified, and the goal could not be reached

- No pages per minute or hits/transactions per second were registered after the first batch of Vusers was run
- The number of pages per minute or hits/transactions per second did not increase after the Controller ran a certain number of Vuser batches
- All the Vusers that ran failed
- There were no available load generators for the type of Vusers you attempted to run

- **Transaction Response Time**

  This goal tests how many Vusers can be run simultaneously without exceeding a desired transaction response time. You specify the name of the transaction in your script that you want to test, and a minimum-maximum range of Vusers for LoadRunner to run. The transaction response time you specify should be a predefined threshold value.

  For example, if you do not want a customer to wait more than five seconds to log in to your e-commerce site, specify a maximum acceptable transaction response time of five seconds. Set the minimum and maximum number of Vusers to the minimum-maximum range of customers you want to be able to serve simultaneously.

  If the scenario does not reach the maximum transaction response time that you defined, your server is capable of responding within a reasonable period of time to the number of customers you want to be able to serve simultaneously. If the defined response time is reached after only a portion of the Vusers has been executed, or if you receive a message that the defined response time will be exceeded if the Controller uses the maximum number of Vusers defined, you should consider revamping your application and/or upgrading your server software and hardware.

Notes about Transactions per Second or Transaction Response Time goals:

- To achieve a Transactions per Second or Transaction Response Time goal, your script must contain transactions. For each of these goal types, you define the transaction in the script that you want to test.
- For a Transaction Response Time goal-oriented scenario to be effective, you must choose your transaction carefully, ensuring that it performs effective hits on the server.

Tasks

How to Design a Goal-Oriented Scenario

This task describes how to design a goal-oriented scenario. In this type of scenario, you define the goals you want your test to achieve and LoadRunner automatically builds a scenario for you based on these goals.

This task includes the following steps:

1 Prerequisites

- Before setting up the scenario, decide which goal you want the scenario to reach. For details on types of scenario goals, see "Goals Types for Goal-Oriented Scenarios" on page 56.
- Before you start designing the scenario, record the VuGen scripts that will run in the scenario. For details, see the *HP Virtual User Generator User Guide*.

2 Open a new goal-oriented scenario

a On the Controller toolbar, click the **New Scenario** button.

b In the New Scenario dialog box that opens, select **Goal-oriented Scenario**.

c Select scripts to run in the scenario. Select scripts in the **Available Scripts** box, and click **Add** to move them to the **Scripts in Scenario** box.

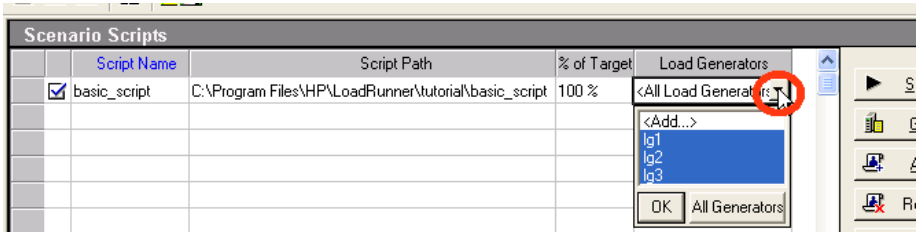
When you click **OK**, the Design tab opens and displays the new scenario.

3 Add load generators to the scenario

Click the **Load Generators** button. In the Load Generators dialog box that opens, click **Add** and enter the details of the load generator you are adding. For details about the Add Load Generator dialog box, see "Add Load Generator/Load Generator Information Dialog Box" on page 108.

4 Assign load generators to each script

In the Scenario Scripts pane, for each script, click the **Load Generators** column and select a load generator on which to run the script.



Note: By default, the script will run on all the load generators in the scenario.

---

5 Define a goal for the scenario

In the Scenario Goal pane, click the **Edit Scenario Goal** button. In the dialog box that opens, define the goal the scenario should reach. For details about filling in the scenario goal details, see "Edit Scenario Goal Dialog Box" on page 78.

6 Assign each script a percentage of the total scenario target

In the Scenario Scripts pane's **% of Target** column, enter the percentage of the total goal you want each script to reach during the scenario.

Note: Assign percentages to the scripts starting with the first script in the list and moving down the list.

---

7 Define service level agreements for the scenario - optional

You can define service level agreements (SLAs) to measure scenario goals over time intervals, or over a whole scenario run. When you later analyze the run using HP LoadRunner Analysis, this data is compared against the SLAs and SLA statuses are determined for the defined measurements. To define SLAs, see "How to Define Service Level Agreements" on page 164.

How to Design a Manual Scenario

This task describes how to design a manual scenario.

This task includes the following steps:

1 Prerequisites

- When designing a manual scenario, plan how you want to distribute the Vusers in the scenario. For more details, see "Manual Scenarios" on page 54.
- Before you start designing the scenario, record the VuGen scripts that will run in the scenario. For details, see the *HP Virtual User Generator User Guide*.

2 Open a scenario, or create a new one

a On the main Controller toolbar, click the **New Scenario** button.

b In the New Scenario dialog box, select **Manual Scenario**.

c (Optional) To distribute the Vusers by percentage, select the **Use the Percentage mode...** option.

Note: You can convert from one scenario mode to another at any time. For details, see "How to Change the Scenario Mode (Manual Scenario)" on page 65.

---

d (Optional) Select scripts to participate in the scenario. If you do not select the scripts here, you can select them in the step.

When you click **OK**, the scenario opens in the Design tab.

3 Add load generators to the scenario

Click the **Load Generators** button. In the Load Generators dialog box that opens, click **Add** and enter the details of the load generator you are adding. For details about adding load generators, see "Add Load Generator/Load Generator Information Dialog Box" on page 108.

4 Add Vuser groups/scripts to the scenario

Vuser Group Mode: In the Scenario Groups pane, create Vuser groups to participate in the scenario. To create a group:

a Click the **Add Group** button.

b In the Add Group dialog box:

- ➤ Give the group a name and assign a number of Vusers to the group.
- ➤ Select a load generator on which to run the Vusers.
- ➤ Select a Vuser script.

Percentage Mode: In Scenario Scripts pane, add groups to participate in the scenario as follows:

a Click the **Add Group** button and select a Vuser script from the list.

b In the Scenario Scripts pane's **Load Generator** column, select load generators on which to run the scripts.

Note: By default, the script will run on all the load generators in the scenario.

---

c When you have selected all the scripts for the scenario, in the Scenario Scripts pane's **%** column assign a percentage of the total number of Vusers to each script. Assign percentages to the scripts starting with the first script in the table and moving down the list.

Note: The total number of Vusers for the scenario is defined in the scenario schedule. See below.

---

5 Define a schedule for the scenario

Define a schedule by which to run the Vusers in the scenario. For details, see "How to Define a Schedule for the Scenario - Workflow" on page 132.

6 Define service level agreements for the scenario - optional

You can define service level agreements (SLAs) to measure scenario goals over time intervals, or over a whole scenario run. When you later analyze the run using HP LoadRunner Analysis, this data is compared against the SLAs and SLA statuses are determined for the defined measurements. To define SLAs, see "How to Define Service Level Agreements" on page 164.

How to Change the Scenario Mode (Manual Scenario)

This task describes how to change a manual scenario from Vuser group mode to percentage mode, and vice versa.

For details about the scenario modes and the effects of changing from one to another, see "Manual Scenarios" on page 54.

- To convert the scenario from Vuser group mode to percentage mode, select **Scenario** > **Convert Scenario to the Percentage Mode**.
- To convert the scenario from percentage mode to Vuser group mode, select **Scenario** > **Convert Scenario to the Vuser Group Mode**.

Note: By default, every time you convert from one mode to another, a message appears warning you that scenario and schedule settings may change. To show/hide this warning message, select **Scenario** > **Show Convert Scenario Mode Warning**.

How to View/Modify Scripts in the Scenario

This section describes how to view and modify scripts used in your load test scenario.

You view/modify the details of the scripts in the Group Information dialog box (see "Group Information Dialog Box" on page 81) or in the Script Information dialog box (see "Script Information Dialog Box" on page 94).

View script details

You can view the details of a script by right-clicking the script in the Scenario Groups/Scripts pane and selecting **Details**.

In the Group/Script Information dialog box that opens, you can:

➤ View details about the script, including:

Note: If you do not see some of the details listed below, click **More**.

  ➤ Script path
  ➤ Command line options (see "Specify command line options" on page 68)
  ➤ Rendezvous points included in the script (see "View rendezvous points included in the script" on page 69)
  ➤ Vusers associated with the script (see "View Vusers associated with the script" on page 69)
  ➤ Files associated with the script (see "View files associated with the script" on page 69)

➤ Open the script in VuGen by clicking the **View Script** button (see "View/Edit a script in VuGen" on page 68)

➤ View the script's run-time settings by clicking the **Run-Time Settings** button (see "Modify a script's run-time settings" on page 67 and "Modify multiple scripts' run-time settings" on page 67).

Modify a script's run-time settings

➤ To view or modify a script's run-time settings, in the Scenario Groups/Scripts pane right-click the script and select **Run-Time Settings**.

➤ To view or modify run-time settings of a script associated with a particular Vuser, in the Vusers dialog box (Scenario Groups pane > **Vusers**) right-click the Vuser and select **Run-Time Settings**.

Modifying the run-time settings for one Vuser in a group modifies the run-time settings for all the Vusers in that group that are using the same script.

➤ To modify run-time settings for multiple scripts, see "Modify multiple scripts' run-time settings" below).

Note:

➤ For details about specific run-time settings, see the *HP Virtual User Generator User Guide*.

➤ When you modify the run-time settings from the Controller, LoadRunner runs the script using the modified settings.

Modify multiple scripts' run-time settings

This section describes how to modify run-time settings of multiple scripts or of a Vuser group that includes multiple scripts.

1 In the Scenario Groups/Scripts pane select multiple scripts or the Vuser group that includes multiple scripts.

2 Right-click the selection and select **Run-Time Settings**.

3 In the Multiple Run-Time Settings Mode dialog box that opens:

➤ To modify run-time settings for all of the scripts simultaneously, click **Shared RTS**.

➤ To modify run-time settings per script, click **Individual RTS**.

For user interface details, see "Multiple Run-Time Settings Mode Dialog Box" on page 83.

Note:

➤ For details about specific run-time settings, see the *HP Virtual User Generator User Guide*.

➤ When you modify the run-time settings from the Controller, LoadRunner runs the script using the modified settings.

View/Edit a script in VuGen

To view/edit a script included in your scenario, right-click the script and select **View Script**. The script opens in VuGen. For more information on editing scripts, see the *HP Virtual User Generator User Guide*.

Specify command line options

You can specify command line options to use when running a script.

1 In the Scenario Groups/Scripts pane, right-click the script and select **Details**.

2 In the Group/Script Information dialog box that opens, if **Command line** is not displayed near the bottom, click **More**.

3 Enter a command in the command line, for example: -x value -y value.

For information about passing command line argument values to a script, see the *HP Virtual User Generator User Guide*.

View rendezvous points included in the script

1 In the Scenario Groups/Scripts pane, right-click the script and select **Details**.

2 In the Group/Script Information dialog box, if the **Rendezvous** tab is not displayed near the bottom, click **More**.

If there are rendezvous points included in the script, they are displayed in the Rendezvous tab. For details about rendezvous points, see "Rendezvous Points Overview" on page 314.

View Vusers associated with the script

1 In the Scenario Groups/Scripts pane, right-click the script and select **Details**.

2 In the Group/Script Information dialog box, if the **Vusers** tab is not displayed near the bottom, click **More**.

The Vusers tab displays the Vusers associated with the script.

View files associated with the script

1 In the Scenario Groups/Scripts pane, right-click the script and select **Details**.

2 In the Group/Script Information dialog box, if the **Files** tab is not displayed near the bottom, click **More**.

By default, the Files tab lists all the files in the script's directory (only after your script has been added to the script list). These files include the configuration settings file, the init, run, and end portions of the script, the parameterization definitions file, and the **.usr** file. To add a file to the list, click **Add**.

Example

To run Visual C++ Vusers on a remote load generator, you must add the **.dll** of the Vuser to the list of files.

You can delete the files that you add, but not the other files listed.

Reference

Relative Paths for Scripts

You can specify a relative location for a script in your scenario. The location can be relative to the current scenario directory, or relative to the LoadRunner installation directory.

When you run a scenario, the script is automatically copied from this relative location to a temporary directory on the load generator running the script. This enables the load generator to access the script locally instead of over a network.

To specify a path relative to the current scenario director, type either of the following notations at the start of the script path:

Notation	Description
.\	Indicates that the path is relative to the location of the scenario directory
..\	Indicates that the path is relative to the location of the parent directory of the scenario directory

For example, if the current scenario is located at F:\scenarios, to specify that the script, **user1**, is located in F:\scenarios\scripts, you could type:

```
.\scripts\user1
```

To specify a path relative to the LoadRunner installation directory, type a percent sign (%) at the beginning of the script path. For example, if the LoadRunner installation directory is located at F:\LoadRunner, to specify that the script, **user1**, is located in F:\LoadRunner\scripts, you could type:

```
%\scripts\user1
```

Note: When specifying a relative path, you can include standard DOS notation (.\ and ..\) inside the path, as shown in the following example: M:\LR\my_tests\..\..\test.usr.

Vuser Statuses

The following table describes the possible statuses of Vusers before, during, and after a scenario run.

Status	Description
Down	The Vuser is down.
Pending	The Vuser is ready to be initialized and is waiting for an available load generator, or is transferring files to the load generator. The Vuser will run when the conditions set in its scheduling attributes are met.
Initializing	The Vuser is being initialized on the remote machine.
Ready	The Vuser already performed the init section of the script and is ready to run.
Running	The Vuser is running. The Vuser script is being executed on a load generator.
Rendezvous	The Vuser has arrived at the rendezvous point and is waiting to be released by LoadRunner.
Done.Passed	The Vuser has finished running. The script passed.
Done.Failed	The Vuser has finished running. The script failed.
Error	A problem occurred with the Vuser. Check the Status field on the Vuser dialog box or the output window for a complete explanation of the error.
Gradual Exiting	The Vuser is completing the iteration or action it is running (as defined in **Tools** > **Options** > **Run-Time Settings**) before exiting.

Status	Description
Exiting	The Vuser has finished running or has been stopped, and is now exiting.
Stopped	The Vuser stopped when the Stop command was invoked.

Design View User Interface

This section includes (in alphabetical order):

Add Group Dialog Box

This dialog box enables you to add Vuser groups to participate in a scenario.

To access	Manual scenario > **Design** tab > **Scenario Groups/Scripts** pane > **Add Group**
Important information	While a scenario is running, you can add Vuser groups to the scenario and enable them. However, if you add a Vuser group after all the Vusers in the scenario have started running, the new group will not run in the scenario.
Relevant tasks	"How to Design a Manual Scenario" on page 62

User interface elements are described below:

UI Elements (A-Z)	Description
Browse...	Enables you to add Vuser scripts to the list of scripts. **Note:** To add a VB Vuser script, select the **.usr** file.
Record...	Opens VuGen where you can record a Vuser script. For more information on recording Vuser scripts, see the *HP Virtual User Generator User Guide*.
Group Name	The name of the Vuser group. When you select a script the Vuser group is automatically given the same name as the script. You can modify the group name. **Note:** The name is limited to a maximum of 55 characters.
Load Generator Name	The load generator assigned to the Vuser group. To add a load generator to this list, select **Add** from the list. For user interface details, see "Add Load Generator/ Load Generator Information Dialog Box" on page 108.

UI Elements (A-Z)	Description
Select Script	Lists the available scripts that have been added to the scenario. When you select a script, its name and path are displayed above the list. To display the scripts with their full paths, right-click the list area and select **Show Paths**. **Note:** If a script uses Unique file parameterization, running more than one Vuser group with that script in the same scenario may cause unexpected scenario results. For more information about Unique file parameterization, see the *HP Virtual User Generator User Guide*.
Vuser Quantity	The number of Vusers to add to the group.

Add Script Dialog Box

This dialog box enables you to add Vuser scripts to a scenario.

To access	Use one of the following: ➤ All scenarios: **Design** tab > Right-click in **Scenario Scripts** pane > **Add Script** ➤ Goal-oriented scenario: **Design** tab > **Scenario Scripts** pane > **Add Script** ➤ Manual scenario (percentage mode): **Design** tab > **Add Group** 
Important information	While a scenario is running, you can add scripts to the scenario and enable them. However, if you add a script after all the Vusers in the scenario have started running, the added script will not run in the scenario.
Relevant tasks	➤ "How to Design a Manual Scenario" on page 62 ➤ "How to Design a Goal-Oriented Scenario" on page 60

User interface elements are described below:

UI Elements (A-Z)	Description
	Enables you to add Vuser scripts to the list of scripts. **Note:** To add a VB Vuser script, select the **.usr** file.
	Opens VuGen where you can record a Vuser script. For more information on recording Vuser scripts, see the *HP Virtual User Generator User Guide*.
Select Script	Lists the scripts available for the scenario. When you select a script, its name and path are displayed above the list. To display the scripts with their full paths, right-click the list area and select **Show Paths**.

Add Vusers Dialog Box

This dialog box enables you to add Vusers to a Vuser group.

To access	➤ **Design** tab > **Scenario Groups** pane > **Vusers**  > **Add Vusers**
Important information	➤ Relevant for manual scenarios in Vuser group mode only. ➤ Available when a group is selected in the Scenario Groups pane.
See also	"Run/Stop Vusers Dialog Box" on page 279

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

UI Elements (A-Z)	Description
	Enables you to add Vuser scripts to the list of scripts. **Note:** To add a VB Vuser script, select the **.usr** file.
	Opens VuGen where you can record a Vuser script. For more information on recording Vuser scripts, see the *HP Virtual User Generator User Guide*.
	Opens the Run-Time Settings dialog box, where you can edit the script's run-time settings. When you modify the run-time settings from the Controller, LoadRunner runs the script using the modified settings.
	Opens the Parameter list in VuGen where you can create, view, modify, and delete script parameters. For details, see the *HP Virtual User Generator User Guide*.
Group Name	The name of the group to which to add Vusers.
Load Generator Name	The load generator assigned to the Vuser group. To add a load generator to this list, select **Add** from the list. For user interface details, see "Add Load Generator/ Load Generator Information Dialog Box" on page 108.
Quantity to add	The number of Vusers to add to the Vuser group.
Select Script	Lists the scripts available for the scenario. When you select a script, its name and path are displayed above the list. To display the scripts with their full paths, right-click the list area and select **Show Paths**.

Design Tab

The Design tab enables you to design load test scenarios.

To access	**Design** tab
Relevant tasks	➤ "How to Design a Manual Scenario" on page 62 ➤ "How to Design a Goal-Oriented Scenario" on page 60 ➤ "How to Define a Schedule for the Scenario - Workflow" on page 132 ➤ "How to Define Service Level Agreements" on page 164 ➤ "How to Change the Scenario Mode (Manual Scenario)" on page 65 ➤ "How to View/Modify Scripts in the Scenario" on page 65

User interface elements are described below:

UI Elements (A-Z)	Description
Scenario Goal pane (Goal-oriented scenario)	In goal-oriented scenarios, displays information regarding the scenario goal. For user interface details, see "Scenario Goal Pane" on page 86.
Scenario Groups pane (Manual scenario in Vuser Group mode)	Displays the Vuser groups created for the scenario. For user interface details, see "Scenario Groups/Scripts Pane - Manual Scenarios" on page 88.
Scenario Scheduler pane (Manual scenario)	Displays the scenario schedule. For user interface details, see "Scenario Schedule Pane" on page 149.

UI Elements (A-Z)	Description
Scenario Scripts pane	Displays the Vuser scripts selected for the scenario. For user interface details: ➤ See "Scenario Groups/Scripts Pane - Manual Scenarios" on page 88 ➤ See "Scenario Scripts Pane - Goal-Oriented Scenarios" on page 91
Service Level Agreement pane	Lists the service level agreements defined for the scenario. For user interface details, see "Service Level Agreement Pane" on page 173.

Edit Scenario Goal Dialog Box

This dialog box enables you to set goals for your scenario.

To access	Goal-oriented scenario > **Design** tab > **Scenario Goal** pane > **Edit Scenario Goal**
Important information	➤ Available for goal-oriented scenarios only. ➤ When you run a goal-oriented scenario, the goal you defined is displayed in the appropriate graph, along with the scenario results. This enables you to compare the results with your target goal.
Relevant tasks	"How to Design a Goal-Oriented Scenario" on page 60

User interface elements are described below:

UI Elements (A-Z)	Description
Rename	Enables you to rename the selected goal profile.
Delete	Enables you to delete the selected goal profile.

UI Elements (A-Z)	Description
New	Enables you to define a new goal profile.
Scenario Start Time...	Opens the Scenario Start dialog box where you can set the scenario start time as follows: ➤ **Without delay.** As soon as the Start Scenario command is issued. ➤ **With a delay of HH:MM:SS.** The specified time after the Start Scenario command is issued. ➤ **At HH:MM:SS on <date>.** At a specified time on a specified date.
Define Scenario Goal	The scenario goal: ➤ **Goal Type.** The type of goal. For more details, see "Goals Types for Goal-Oriented Scenarios" on page 56. ➤ **Transaction Name.** (When goal type is **Transactions per second/Transaction Response Time**) The static script transaction for your scenario to test, or the name of an automatic/dynamic script transaction that you have recorded. ➤ **Reach Goal of <value> <goal type>.** The desired goal limits. ➤ **Using a minimum of <value> and a maximum of <value> Vusers.** The minimum and maximum number of Vusers to use in the scenario.
Do not change recorded think time	If selected, LoadRunner runs the scenario using the think time recorded in the script. **Note:** If you select this option, you may need to increase the number of Vusers in your scenario in order to reach your target.
Goal Profile Name	The goal profile name.

UI Elements (A-Z)	Description
Load Behavior tab	Enables you to specify how and when the Controller should reach the target. **Ramp Up.** How the Vusers should start running. ➤ **Automatic.** The Controller starts running the default number of Vusers in a batch, that is, 50 Vusers every two minutes. If the maximum number of Vusers defined is less than 50, then it runs all the Vusers. ➤ **Reach target X after.** The amount of scenario time after which Controller should reach the target. ➤ **Step up by.** How rate at which the Controller should reach the target (x number of Vusers/hits/pages every x amount of time). (Not available for the Transactions per Second and Transaction Response Time goal types.)
Load Preview graph	A graphical representation of the goal and load behavior defined for the scenario.
Scenario Settings tab	Enables you to specify the actions to take when the target is reached, or if the target is not reached: ➤ **Run Time**. The amount of time (in hours, minutes, and seconds) to run the scenario after the target has been reached. ➤ **If target cannot be reached.** The action to be taken if the target cannot be reached. ➤ **Receive Notification.** If selected, the Controller sends an error message indicating that the target could not be reached.

Group Information Dialog Box

This dialog box displays details about the selected Vuser group, and enables you to modify the group's settings.

To access	Manual Scenario > **Design** tab > **Scenario Groups** pane > **Details**
Important information	➤ Relevant for manual scenarios in Vuser group mode only. ➤ Available when a group is selected in the Scenario Groups pane.
Relevant Tasks	➤ "How to Design a Manual Scenario" on page 62 ➤ "How to View/Modify Scripts in the Scenario" on page 65

User interface elements are described below:

UI Elements (A-Z)	Description
Refresh	Updates script settings as follows: ➤ **Script.** If a script was modified during a scenario run, updates the script details in the scenario. ➤ **Run-Time Settings.** If you modified a script's run-time settings from the Controller, restores the initial run-time settings.
View Script...	Opens VuGen where you can view and edit the script. For more information on editing scripts, see the *HP Virtual User Generator User Guide*.
Run-Time Settings...	Opens the Run-Time Settings dialog box, where you can edit the Vuser script's run-time settings. When you modify the run-time settings from the Controller, LoadRunner runs the script using the modified settings. To restore the initial settings previously set using VuGen, click the **Refresh** button and select **Run-Time Settings**.

UI Elements (A-Z)	Description
Command Line	The command line options to use when running the script. **Example:** -x value -y value. For information about passing command line argument values to a script, see the *HP Virtual User Generator User Guide*.
Files tab	Displays all files used by the script, including the configuration settings file, the init, run, and end portions of the script, the parameterization definitions file, and the **.usr** file. ➤ To exclude a file from the list, clear the check box adjacent to it. ➤ To add a file or directory used by the script, click the **Add** button. **Note:** To run Visual C++ Vusers on a remote load generator, you must add the **.dll** of the Vuser to this list. ➤ You can delete the files that you add, but not the other files listed.
Group Name	The name of the Vuser group. To modify, type a new name in the **Group Name** box. The name is limited to a maximum of 55 characters.
Load Generator Name	The load generator assigned to the Vuser group. To add a load generator to this list, select **Add** from the list. For user interface details, see "Add Load Generator/ Load Generator Information Dialog Box" on page 108.
Rendezvous tab	Displays the rendezvous points defined for the selected script.
Script	The name, path, and type of the Vuser script selected for the Vuser group.
Vusers tab	Displays all Vusers associated with the selected script.

Multiple Run-Time Settings Mode Dialog Box

This dialog box enables you to select the mode for modifying run-time settings of multiple selected scripts.

To access	Use one of the following: ➤ In the Scenario Groups/Scripts pane, right-click a multiple selection of scripts, and select **Run-Time Settings** ➤ Right-click a Vuser group that includes multiple scripts and select **Run-Time Settings**
Important information	➤ If one of the selected scripts does not support shared run-time settings, then you will only have the option of modifying each script's individual run-time settings (**Individual RTS**). ➤ **Shared RTS** mode is disabled for GUI or Astra LoadTest Vusers. ➤ Some run-time settings cannot be modified in **Shared RTS** mode. These settings will not appear in the Run-Time Settings window. To modify them, open the run-time settings for each individual script. The following nodes will not appear in Shared RTS mode: ➤ **Run Logic** node - for protocols which support the **Run Logic** node, the **Iterations** box appears in the **Pacing** node ➤ **Additional Attributes** node ➤ **Internet Protocol:ContentCheck** node ➤ **Java Environment Settings:Classpath** node ➤ Nodes with tables in the format **Property, Value** for the protocols: Citrix ICA, Oracle NCA, and WAP For example: **Oracle NCA:Client Emulation** node
Relevant tasks	"Modify multiple scripts' run-time settings" on page 67

User interface elements are described below:

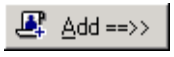
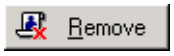
UI Elements (A-Z)	Description
Individual RTS	Opens a separate Run-Time Settings dialog box (one at a time) for each selected script. In this mode, you modify each script's settings individually.
Shared RTS	Opens the Run-Time Settings Shared Mode dialog box containing all of the run-time settings in blank mode. In this mode, any settings that are change are applied to all selected scripts. All other run-time settings remain unchanged. See **Important information** above.

New Scenario Dialog Box

This dialog box enables you to create a new scenario and select Vuser scripts to run in the scenario.

To access	Controller toolbar > **New Scenario** 
Important information	Before you create a scenario, you should have a good idea as to the type of scenario you want to create. See "Load Test Scenarios Overview" on page 54.
Relevant tasks	➤ "How to Design a Manual Scenario" on page 62 ➤ "How to Design a Goal-Oriented Scenario" on page 60

User interface elements are described below:

UI Elements (A-Z)	Description
	Moves the script selected in the **Available Scripts** box to the **Scripts in Scenario** box.
	Removes the selected script from the **Scripts in Scenario** box.

UI Elements (A-Z)	Description
	Enables you to add scripts to the list of available scripts. **Note:** To add a VB Vuser script, select the **.usr** file.
	Opens VuGen where you can record a Vuser script. For more information on recording Vuser scripts, see the *HP Virtual User Generator User Guide*.
	Opens the Connection to HP ALM dialog box, where you can connect to Application Lifecycle Management to download scripts.
Select Scenario Type	Select the type of scenario to create. For details, see "Load Test Scenarios Overview" on page 54. ➤ **Manual Scenario.** You manually build the scenario creating Vuser groups and specifying the script, load generators, and the number of Vusers to include in each Vuser group. ➤ **Use the Percentage mode...** You define the total number of Vusers to be used in the scenario and assign a percentage of the total number of Vusers to each Vuser script. **Note:** You can convert from one scenario mode to another at any time. For details, see "How to Change the Scenario Mode (Manual Scenario)" on page 65. ➤ **Goal-Oriented Scenario.** You define the goals you want your test to achieve, and LoadRunner automatically builds a scenario for you, based on these goals.

UI Elements (A-Z)	Description
Select the scripts you would like to use in your scenario	(Optional) Select the scripts to use in the scenario. ➤ **Available Scripts.** Lists the fifty most recently used scripts. ➤ **Scripts in Scenario.** Lists the scripts selected for the scenario. Click **Add**/**Remove** to move selected scripts between the two lists. **Note:** You can change the maximum number of scripts displayed in the **Available Scripts** box by modifying the following registry key: **HKEY_CURRENT_USER\Software\Mercury Interactive\RecentScripts\max_num_of_scripts**
Show at startup	When selected, the New Scenario dialog box is displayed upon opening the Controller. **Note:** This option can also be enabled/disabled from the Controller's View menu. Select **View > Show New Scenario Dialog.**

Scenario Goal Pane

This pane displays the goals defined for the scenario.

To access	Goal-oriented scenario > **Design** tab
Important information	➤ Available for goal-oriented scenarios only. ➤ The goal profiles include the type of goal, the minimum and maximum number of Vusers that should be used in the scenario, the duration of the scenario, and the load behavior.
Relevant tasks	"How to Design a Goal-Oriented Scenario" on page 60

User interface elements are described below:

UI Elements (A-Z)	Description
	Opens the Edit Scenario Goal dialog box, where you set the goals for the scenario. See "Edit Scenario Goal Dialog Box" on page 78.
Goal	The defined goal, including the type of goal and the expected target.
Goal Profile Name	The name of the goal profile.
Load Behavior	How and when the Controller should reach the defined goal.
Load Preview graph	A graphical representation of the goal and load behavior defined for the scenario.
Max Number of Vusers	The maximum number of Vuser to run in the scenario.
Min Number of Vusers	The minimum number of Vuser to run in the scenario.
Scenario Duration	The amount of time the scenario should continue running after reaching the defined goal.

Scenario Groups/Scripts Pane - Manual Scenarios

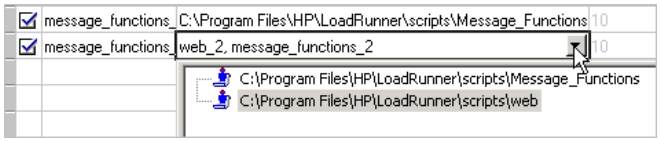
This pane displays the Vuser groups/scripts that were added to the scenario.

To access	Manual Scenario > **Design** tab
Important information	➤ **Vuser group mode:** The Design tab displays the **Scenario Groups** pane where you can define Vuser groups to run Vuser scripts in a scenario. It lists all Vuser groups, together with their paths, as well as the load generators and number of Vusers assigned to each group. ➤ **Percentage mode:** The Design tab displays the **Scenario Scripts** pane where you can define Vuser scripts to run in a scenario. It lists all Vuser scripts, their paths, and the load generators and percentage of the total number of Vusers assigned to each script. **Note:** You can change from one scenario mode to another at any time. For details, see "How to Change the Scenario Mode (Manual Scenario)" on page 65.
Relevant tasks	➤ "How to Design a Manual Scenario" on page 62 ➤ "How to Change the Scenario Mode (Manual Scenario)" on page 65
See also	"Load Test Scenarios Overview" on page 54

User interface elements are described below:

UI Elements (A-Z)	Description
	**Start Scenario.** Starts running the scenario.
	**Virtual Users.** Opens the Vusers dialog box where you can define properties for individual Vusers within the Vuser groups you have defined. To each Vuser you can assign a different Vuser script and/or load generator. For user interface details, see "Vusers Dialog Box" on page 98.

UI Elements (A-Z)	Description
	**Add Group.** ➤ **Vuser group mode:** Opens the Add Group dialog box where you create Vuser groups for the scenario. See "Add Group Dialog Box" on page 73. ➤ **Percentage mode:** Opens the Add Script dialog box where you select Vuser scripts for the scenario. See "Add Script Dialog Box" on page 74.
	**Remove Group.** Deletes the selected Vuser group/script.
	Opens the Run-Time Settings dialog box, where you can edit the Vuser script's run-time settings. **Notes:** ➤ When you modify the run-time settings from the Controller, LoadRunner runs the script using the modified settings. To restore the initial settings previously set using VuGen, click the **Refresh** button and select **Run-Time Settings**. ➤ If run-time settings for a script were not defined in VuGen, the Controller displays its own default settings for Log and Think Time. Default VuGen settings are displayed for all other nodes.
	**Details.** Opens the Group/Script Information dialog box where you can view and modify the Vuser group/script's settings. For details, see "Group Information Dialog Box" on page 81 or "Script Information Dialog Box" on page 94 where respectively.
	**View Script.** Opens the script in VuGen where you can view and edit the Vuser script. For more information on editing scripts, see the *HP Virtual User Generator User Guide*.

UI Elements (A-Z)	Description
<Groups/Scripts table>	Displays the following information about the Vuser groups/scripts selected for the scenario: ➤  . Indicates that the Vuser group/script is participating in the scenario. ➤ **Group/Script Name.** The name of the Vuser group/ script. ➤ **Script Path.** The path of the Vuser script. In Vuser group mode, if the Vuser group includes more than one script, the scripts' names are listed. Clicking the cell's drop down arrow displays the scripts' full paths.  If you want to access the script from a location that is relative to the current scenario directory, you can replace the actual path with the relative path. For details, see "Relative Paths for Scripts" on page 70. ➤ **Quantity.** (Vuser group mode) The number of Vusers assigned to the Vuser group. This column is read-only when the defining a real-world schedule (default schedule). In this case, the quantity of Vusers is defined when designing the scenario schedule. ➤ **%.** (Percentage mode) The percentage of Vusers assigned to run the Vuser script. If you modify the percentage assigned to one group, the percentages assigned to the other scripts change to create a total of 100% for all of the Vuser scripts. **Note:** Modify percentages to the scripts starting with the first script in the list and moving down the list.

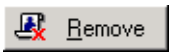
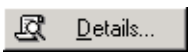
UI Elements (A-Z)	Description
<Groups/Scripts table> (continued)	➤ **Load Generators.** The load generators assigned to the Vuser group/script. If you select multiple load generators for a group/script, the Vusers assigned to the Vuser group/script are distributed evenly among the load generators. **Default value (in percentage mode)**: All Load Generators **Note:** To add a load generator to this list, select **Add** from the list. For more details, see "Add Load Generator/Load Generator Information Dialog Box" on page 108.
<Right-click menu>	➤ **Auto Sort.** When adding a Vuser group/script, automatically sorts the table according to the defined sort. ➤ **Sort Groups/Scripts.** Enables you to sort the table by Vuser group/script name, script path, quantity/percentage of Vusers, or load generator. To sort the table in ascending/descending order, click the relevant table heading.

Scenario Scripts Pane - Goal-Oriented Scenarios

This pane lists the Vuser scripts selected for the goal-oriented scenario.

To access	Goal-oriented scenario > **Design** tab
Relevant tasks	"How to Design a Goal-Oriented Scenario" on page 60
See also	"Load Test Scenarios Overview" on page 54

User interface elements are described below:

UI Elements (A-Z)	Description
	Starts running the scenario.
	Opens the Load Generators dialog box where you can add new load generators and view details about existing load generators. See "Load Generators Dialog Box" on page 124.
	Opens the Add Script dialog box where you can select Vuser scripts to add to the scenario. See "Add Script Dialog Box" on page 74.
	Deletes the selected Vuser script.
	Opens the Run-Time Settings dialog box, where you can edit the Vuser script's run-time settings. **Notes:** ➤ When you modify the run-time settings from the Controller, LoadRunner runs the script using the modified settings. ➤ If run-time settings for a script were not defined in VuGen, the Controller displays its own default settings for Log and Think Time. Default VuGen settings are displayed for all other nodes.
	Opens the Script Information dialog box where you can view the Vuser script's settings. See "Script Information Dialog Box" on page 94.
	Opens the script in VuGen where you can view and edit the Vuser script. For more information on editing scripts, see the *HP Virtual User Generator User Guide*.

UI Elements (A-Z)	Description
<Right-click menu>	➤ **Auto Sort.** When adding a script, automatically sorts the table according to the defined sort. ➤ **Sort Scripts.** Enables you to sort the table by Vuser script name, script path, percentage of Vusers, or load generator. To sort the table in ascending/descending order, click the relevant table heading.
<Scripts table>	Displays the following information about the Vuser scripts selected for the scenario: ➤  . Indicates that the script is participating in the scenario. ➤ **Script Name.** The name of the Vuser script. ➤ **Script Path.** The path of the Vuser script. If you want to access the script from a location that is relative to the current scenario directory, you can replace the actual path with the relative path. For details, see "Relative Paths for Scripts" on page 70. ➤ **% of Target.** The percentage of the overall target number of Vusers, pages per minute, hits per second, transactions per second, or transaction response time that is automatically distributed to each Vuser script. ➤ **Load Generators.** The load generators assigned to the script. If you select multiple load generators for a script, the Vusers assigned to the script are distributed evenly among the load generators. **Default value**: All Load Generators **Note:** To add a load generator to this list, select **Add** from the list. For more details, see "Add Load Generator/Load Generator Information Dialog Box" on page 108.

Script Information Dialog Box

This dialog box displays details about the selected Vuser group, and enables you to modify the group's settings.

To access	**Design** tab > **Scenario Scripts** pane > **Details**
Important information	Available when a script is selected in the Scenario Scripts pane. Relevant to: ➤ Manual scenarios in percentage mode ➤ Goal-oriented scenarios
Relevant tasks	➤ "How to View/Modify Scripts in the Scenario" on page 65

User interface elements are described below:

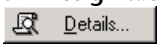
UI Elements (A-Z)	Description
Refresh	Updates script settings as follows: ➤ **Script.** If the script was modified during a scenario run, updates the script details in the scenario. ➤ **Run-Time Settings.** If you modified the run-time settings from the Controller, restores the initial run-time settings.
View Script...	Opens VuGen where you can view and edit the script. For more information on editing scripts, see the *HP Virtual User Generator User Guide*. **Note:** If you use VuGen to make changes to a script while the Controller is running, click **Refresh** and select **Script** to update the script details in the scenario.

UI Elements (A-Z)	Description
	Opens the Run-Time Settings dialog box, where you can edit the Vuser script's run-time settings. **Notes:** ➤ When you modify the run-time settings from the Controller, LoadRunner runs the script using the modified settings. To restore the initial settings previously set using VuGen, click the **Refresh** button and select **Run-Time Settings**. ➤ If run-time settings for a script were not defined in VuGen, the Controller displays its own default settings for Log and Think Time. Default VuGen settings are displayed for all other nodes.
Command Line	The command line options to use when running the script. **Example:** -x value -y value. For information about passing command line argument values to a script, see the *HP Virtual User Generator User Guide*.
Files tab	Displays all files used by the script, including the configuration settings file, the init, run, and end portions of the script, the parameterization definitions file, and the **.usr** file. ➤ To exclude a file from the list, clear the check box adjacent to it. ➤ To add a file or directory used by the script, click the **Add** button. **Note:** To run Visual C++ Vusers on a remote load generator, you must add the **.dll** of the Vuser to this list. ➤ You can delete the files that you add, but not the other files listed.
Rendezvous tab	Displays the rendezvous points defined for the selected script.

UI Elements (A-Z)	Description
Script	The name, path, and type of the selected Vuser script.
Vusers tab	Displays all Vusers associated with the selected script.

Vuser Information Dialog Box

This dialog box displays details about a specific Vuser in a group, and lets you modify the load generator and script settings for the Vuser.

To access	Use one of the following: ➤ Manual scenario > **Design** tab > **Scenario Groups** pane > **Vusers**  >  ➤ In Vusers dialog box, double-click Vuser.
Relevant tasks	➤ "How to View/Modify Scripts in the Scenario" on page 65 ➤ "How to Run a Scenario" on page 249

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

UI Elements (A-Z)	Description
	Enables you to add Vuser scripts to the list of scripts. **Note:** To add a VB Vuser script, select the **.usr** file.
	Opens VuGen where you can record a Vuser script. For more information on recording Vuser scripts, see the *HP Virtual User Generator User Guide*.

UI Elements (A-Z)	Description
	Opens the Run-Time Settings dialog box, where you can edit the Vuser script's run-time settings. **Notes:** ➤ Modifying the run-time settings for one Vuser modifies the run-time settings for all the Vusers in the group that are using the same script. ➤ When you modify the run-time settings from the Controller, LoadRunner runs the script using the modified settings. ➤ If run-time settings for a script were not defined in VuGen, the Controller displays its own default settings for Log and Think Time. Default VuGen settings are displayed for all other nodes.
	Opens the Parameter list in VuGen where you can create, view, modify, and delete Vuser script parameters. For details, see the *HP Virtual User Generator User Guide*.
Group Name	The name of the group to which the selected Vuser belongs.
Load Generator Name	The load generator assigned to the Vuser's Vuser group. To add a load generator to this list, select **Add** from the list. For user interface details, see "Add Load Generator/ Load Generator Information Dialog Box" on page 108.
Select Script	Lists the available scripts that have been added to the scenario. When you select a script, its name and path are displayed above the list. To display the scripts with their full paths, right-click the list area and select **Show Paths**.
Vuser Name	The name of the selected Vuser.

Vusers Dialog Box

This dialog box displays the status of the Vusers in the selected Vuser group.

To access	Manual scenario > **Design** tab > **Scenario Groups** pane > **Vusers**
Relevant tasks	➤ "How to Run a Scenario" on page 249 ➤ "Control Vusers During a Scenario Run - Use-Case Scenario" on page 252

User interface elements are described below:

UI Elements (A-Z)	Description
	Show the Selected Vusers. Opens a Run-Time Viewer for each selected Vuser.
	Hide the Selected Vusers. Closes the Run-Time Viewers that were opened.
	Show Vuser Log. Displays a log containing run-time information about the Vuser that is refreshed, by default, every 1000 milliseconds. For more information, see "Vuser Script Log" on page 287.
	Hide Vuser Log. Closes the Vuser log.
Run	Starts running the selected Vuser.
Gradual Stop	Instructs the Controller to complete the current iteration or action before stopping the Vuser. **Note:** This option is only available when the Vuser is in the **Run** state, and if you selected the **Wait for the current iteration to end before exiting** or **Wait for the current action to end before exiting** option in the Run-Time Settings tab of the Options dialog box.
Stop	Stops running the selected Vuser **immediately**.

UI Elements (A-Z)	Description
	Resets the status of the Vuser to **Down**.
	Opens the Vuser Information dialog box, where you can view details about the selected Vuser.
	Opens the Add Vusers dialog box where you can add more Vusers to the Vuser group.
<Filter by script>	Filters the Vusers table by the selected script.
<Filter by status>	Filters the Vusers table by the selected Vuser status. For details, see "Vuser Statuses" on page 71.
<Right-click menu>	➤ **Filter Vusers.** Enables you filter the Vuser list by Vuser status. ➤ **Renumber.** Renumbers the list of Vusers in sequential order, starting from 1. ➤ **Sort Vusers.** Enables you to sort the table by a selected column. To sort the table in ascending/descending order, click the relevant table heading.
<Vusers table>	Displays the following information about the Vusers: ➤ **ID.** The Vuser's ID number ➤ **Status.** The Vuser's status. For details, see "Vuser Statuses" on page 71. ➤ **Script.** The script run by the Vuser. ➤ **Load Generator.** The load generator on which the Vuser is running. ➤ **Elapsed Time.** Amount of time that has elapsed in the scenario since the Vuser began running.

5

Load Generators

This chapter includes:

Concepts

Tasks

Reference

Concepts

Load Generators Overview

Load generators are the machines that run the Vuser scripts in your scenario.

When you add a load generators to the list of load generators in the Controller, you define its attributes. You can modify these attributes at any time.

You can enable load generators to take part in the scenario, and then indicate which specific load generators will run Vuser scripts in the scenario. If an enabled load generator is unavailable for a particular scenario run, you can exclude it temporarily instead of removing it entirely from your list of load generators. You can also disable load generators to isolate a specific machine to test its performance.

To set attributes for a specific load generator, see "Add Load Generator/Load Generator Information Dialog Box" on page 108.

To set global settings for all the load generators participating in the scenario, see "Options Dialog Box" on page 221.

Load Balancing

Load balancing evenly distributes the load generated by Vusers among the requested load generators, ensuring an accurate load test.

When a Windows load generator's CPU usage becomes overloaded, the Controller stops loading Vusers on the overloaded load generator, and automatically distributes them among load generators taking part in the scenario. Only where there are no other load generators in the scenario does the Controller stop loading Vusers.

You can monitor the status of a machine's CPU usage using the icons in the Load Generators dialog box (see "Load Generators Dialog Box" on page 124). When the CPU usage of a load generator becomes problematic, the icon to the left of the load generator name contains a yellow bar. When the machine becomes overloaded, the icon contains a red bar.

Note: Load balancing is only available in manual scenarios in the percentage mode and in goal-oriented scenarios.

Tasks

How to Connect to a UNIX Load Generator Without Using RSH

This task describes how to connect to a UNIX load generator without using RSH.

1 On the UNIX load generator, make sure that the agent daemon (m_agent_daemon) is running. If not, launch it by running the following command from <**load generator installation directory**>/**bin**:

```
m_daemon_setup -install
```

If successful, you will receive the following message:

```
m_agent_daemon <process ID>
```

The agent now keeps running, even if the user is logged off. It only stops running if you run the command explained below, or if you reboot the machine.

Note: If you look at the log file **m_agent_daemon[xxx].log** in the temp directory, you may see communication errors, even if the installation succeeded. These messages appear because the LoadRunner agent always tries to open Port #443 (because any agent can be an MI Listener, and the MI Listener always listens to this port), and in UNIX machines, this port cannot be opened by any user except for the root user. However, this does not interfere with using this agent for the load generator.

---

2 In the Controller, in the **Load Generator Information** dialog box > **UNIX Environment** tab, select the **Don't use RSH** option. Connect as usual.

For details, see "Load Generator Configuration > UNIX Environment Tab" on page 118.

To stop the agent daemon:

➤ Run the following command from the **<LR_root>/bin** directory:

```
m_daemon_setup -remove
```

This stops the m_agent_daemon. If successful, you receive the following message:

```
m_agent_daemon is down.
```

How to Add Load Generators to a Scenario

The following steps describe how to add load generators to a scenario.

Note: When you add a load generator, it remains in the **Down** state until it is connected.

For details about the Load Generator configuration tabs, see "Add Load Generator/Load Generator Information Dialog Box" on page 108.

To add a load generator:

1 Open the scenario.

➤ Click to open a new scenario.

➤ Click to open an existing scenario.

The scenario is displayed in the Design tab.

2 Click the **Load Generators** button.

3 Click **Add**, and enter the details of the load generator.

4 (Optional) Click **More** to display the configuration tabs and configure other load generator's details.

How to Modify Load Generator Details

The following steps describe how to edit load generator settings.

5 Open the scenario. The scenario is displayed in the Design tab.

6 Click the **Load Generators** button.

7 Select the load generator, and click **Details**.

8 Modify the details displayed in the configuration tabs. For details, see "Load Generator Configuration Tabs" on page 109.

How to Connect/Disconnect a Load Generator

This task describes how to connect or disconnect a load generator.

9 On the **Controller** toolbar, click **Load Generators**.

10 Select the load generator in the list and click **Connect/Disconnect**.

Reference

UNIX Environment Variables

To work with a load generator in a UNIX environment, your UNIX startup configuration file needs to include specific environment variables. To set the environment variables, users need to add the **env.csh** script to their startup configuration file.

UNIX Users	Startup Configuration File
C shell	.cshrc
Bourne and Korn shell	.profile

Add the following line in the startup configuration file:

```
source <load generator installation directory>/env.csh
```

For example:

```
source /opt/HP/HP_LoadGenerator/env.csh
```

Load Generators - User Interface

This section includes:

➤ Load Generator Configuration > Terminal Services Tab on page 116
➤ Load Generator Configuration > UNIX Environment Tab on page 118
➤ Load Generator Configuration > Vuser Limits Tab on page 121
➤ Load Generator Configuration > Vuser Status Tab on page 122
➤ Load Generator Configuration > WAN Emulation Tab on page 123
➤ Load Generators Dialog Box on page 124

Add Load Generator/Load Generator Information Dialog Box

These dialog boxes enable you to add load generators, and view and edit information about a load generator respectively.

To access	Controller toolbar >  ➤ **Add New Load Generator dialog box:** Click **Add** ➤ **Load Generator Information dialog box:** Select a load generator and click **Details**
Important information	After adding a load generator, it appears in the Load Generators list with a **Down** status.
Relevant tasks	"How to Add Load Generators to a Scenario" on page 105 "How to Modify Load Generator Details" on page 106
See also	"Load Generators Overview" on page 102

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

UI Elements (A-Z)	Description
 (Add New Load Generator dialog box only)	**More/Less.** Shows/hides the tabs where you configure the load generator's details. See "Load Generator Configuration Tabs" below.

UI Elements (A-Z)	Description
Enable load generator to take part in the scenario	When selected, enables the load generator to participate in the scenario. When cleared, the load generator is disabled. This is useful in the following cases: ➤ If an enabled load generator is unavailable for a particular scenario run, you can exclude it temporarily instead of removing it entirely from your list of load generators. ➤ You can disable load generators to isolate a specific machine to test its performance.
Name	The name of the load generator.
Platform	The platform on which the load generator is installed.
Temporary directory	The location, on the load generator, where the Controller can store temporary files. **Default:** If left empty, during a scenario run LoadRunner stores temporary files on the load generator in a temporary directory specified by the load generator's TEMP or TMP environment variables.

Load Generator Configuration Tabs

UI Elements (A-Z)	Description
Connection Log tab (Load Generator Information dialog box only)	Displays the standard output and standard errors generated as the Controller connects to the selected UNIX load generator. You can change the command that the Controller sends to the remote bridge in order to connect to the load generator. See "Load Generator Configuration > Connection Log Tab" on page 111. **Note:** Available in Expert mode only
Run-Time File Storage tab	Enables you to specify the result directory for the performance data that LoadRunner gathers from each load generator during a scenario. See "Load Generator Configuration > Run-Time File Storage Tab" on page 112.

UI Elements (A-Z)	Description
Run-Time Quota tab	Enables you to specify a maximum number of Vuser types that the load generator should initialize or stop simultaneously. See "Load Generator Configuration > Run-Time Quota Tab" on page 113.
Security tab	Enables monitoring or running Vusers over a firewall. See "Load Generator Configuration > Security Tab" on page 114.
Status tab	**Status.** Displays details about the status of the load generator. See "Load Generator Configuration > Status Tab" on page 116.
Terminal Services tab	The Terminal Services Manager which enables you to distribute Vusers running in your load testing scenario on terminal servers. See "Load Generator Configuration > Terminal Services Tab" on page 116.
UNIX Environment tab	Enables you to configure the login parameters and shell type for each UNIX load generator. See "Load Generator Configuration > UNIX Environment Tab" on page 118.
Vuser Limits tab (Add New Load Generator dialog box only)	Enables you to modify the maximum number of GUI, RTE, and other Vusers that the load generator can run. See "Load Generator Configuration > Vuser Limits Tab" on page 121.
Vuser Status tab (Load Generator Information dialog box only)	Displays the status of all the Vusers connected to the load generator. See "Load Generator Configuration > Vuser Status Tab" on page 122.
WAN Emulation tab	Enables WAN Emulation on your scenario. See "Load Generator Configuration > WAN Emulation Tab" on page 123.

Load Generator Configuration > Connection Log Tab

This tab displays the standard output and standard errors generated as the Controller connects to the selected UNIX load generator and enables you change the command that the Controller sends to the remote bridge in order to connect to the load generator.

To access	Controller toolbar >  > **Details**
Important information	This tab is displayed only when the Controller is in Expert mode.
Relevant tasks	➤ "How to Add Load Generators to a Scenario" on page 105 ➤ "How to Modify Load Generator Details" on page 106
See also	➤ "Load Generators Overview" on page 102 ➤ "Expert Mode" on page 212

User interface elements are described below:

UI Elements (A-Z)	Description
Bridge cmd	The command sent by the Controller to the remote bridge in order to connect the UNIX load generator. **Note:** This command replaces the default bridge command sent by the Controller.
Rsh standard errors	Displays rsh standard errors as the Controller connects to the selected UNIX load generator.
Rsh standard output	Displays rsh standard output as the Controller connects to the selected UNIX load generator.

Load Generator Configuration > Run-Time File Storage Tab

This tab enables you to specify the results directory for the performance data that LoadRunner gathers from this load generator during a scenario run.

To access	Controller toolbar >  > **Add** or **Details**
Important information	➤ The directory specified here stores the result files gathered on the selected load generator. A global results directory for all load generators is specified in the **Tools** > **Options** dialog box. For details, see "Options > Run-Time File Storage Tab" on page 231. **Note:** If the settings specified here differ to the global load generator settings, the settings specified here take preference for this particular load generator. ➤ If the load generator is **localhost**, then LoadRunner stores the scripts and results on a shared network drive, and the options on this tab are all disabled. ➤ If you are monitoring over a firewall, the settings in this tab are not relevant.
Relevant tasks	➤ "How to Add Load Generators to a Scenario" on page 105 ➤ "How to Modify Load Generator Details" on page 106
See also	➤ "Run-Time File Storage Locations" on page 213 ➤ "Options > Run-Time File Storage Tab" on page 231

User interface elements are described below:

UI Elements (A-Z)	Description
Scripts and results stored	Select where to store the results of the scenario run and/or Vuser scripts gathered from the selected load generator during a scenario run: ➤ **As defined in Tools > Options > Run-Time File Storage.** Stores the results as specified in the global settings. ➤ **In temporary directory on <load generator name>.** Instructs the Controller to save the run-time files on a hard drive of the load generator machine. ➤ **On a shared network drive.** Instructs the Controller to save the scenario results and/or the Vuser scripts on a shared network drive. A shared network drive is a drive to which the Controller and all the load generators in the scenario have read and write permissions.

Load Generator Configuration > Run-Time Quota Tab

This tab enables you to specify a maximum number of Vuser types that the load generator should initialize or stop simultaneously, so as to reduce load on the load generator.

To access	Controller toolbar >  > **Add** or **Details**
Important Information	The settings specified here are relevant for the selected load generator. You can set run-time quotas for all load generators in a scenario from the **Tools > Options > Run-Time Settings** tab. For details on setting global run-time quotas, see "Options > Run-Time Settings Tab" on page 232 **Note:** If the settings specified here differ to the global load generator settings, the settings specified here take preference for this particular load generator.

Relevant tasks	➤ "How to Add Load Generators to a Scenario" on page 105 ➤ "How to Modify Load Generator Details" on page 106
See also	➤ "Options > Run-Time Settings Tab" on page 232

User interface elements are described below:

UI Elements (A-Z)	Description
Defaults	Resets values to their defaults.
Vuser Quota	➤ **Number of Vusers that may be initialized at one time - <current load generator>.** The maximum number of Vusers that the current load generator can initialize simultaneously. **Default:** 50 **Maximum value:** 999 ➤ **Limit the number of users that may be stopped at one time to.** The maximum number of Vusers that the current load generator can stop simultaneously. **Default:** 50

Load Generator Configuration > Security Tab

Enables monitoring or running Vusers over a firewall.

To access	Controller toolbar >  > **Add** or **Details**

Important information	➤ If the load generator is connected, you cannot change values in the Security tab. To disconnect a load generator, select the load generator in the Load Generators dialog box and click **Disconnect**. The load generator status changes to **Down**, and you can change the settings. ➤ If the load generator is **localhost**, this tab is disabled.
Relevant tasks	➤ "How to Add Load Generators to a Scenario" on page 105 ➤ "How to Modify Load Generator Details" on page 106

User interface elements are described below:

UI Elements (A-Z)	Description
Enable firewall	Enables LoadRunner to monitor or run Vusers over a firewall. **Note:** If this option is selected, the **Temporary directory** box in the load generator's details area (at the top of the dialog box) is disabled and if a location was defined, it is erased.
Enable SSL Support	Enables an encrypted connection between the Controller and load generator.
Firewall Settings	➤ **Enable running Vusers over Firewall.** Enables LoadRunner to run Vusers on a load generator outside the firewall. ➤ **Enable Monitoring over Firewall.** Enables LoadRunner to monitor the load generator over a firewall. ➤ **MI Listener.** The name of the MI Listener that the load generator uses to communicate over the firewall.

Load Generator Configuration > Status Tab

This tab displays details about the status of the load generator.

To access	Controller toolbar >  > **Details**
Relevant tasks	"How to Modify Load Generator Details" on page 106

User interface elements are described below:

UI Elements (A-Z)	Description
Details	Error and other run-time information about the selected load generator.
Load Generator Status	The status of the load generator.

Load Generator Configuration > Terminal Services Tab

This tab displays the Terminal Services Manager which enables you to distribute Vusers running in your load testing scenario on terminal servers.

To access	Controller toolbar >  > **Add** or **Details**
Important information	This feature is not supported if the load generator is located over a firewall.
Relevant tasks	➤ "How to Add Load Generators to a Scenario" on page 105 ➤ "How to Modify Load Generator Details" on page 106
See also	"Terminal Services Overview" on page 194

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

UI Elements (A-Z)	Description
Defaults	Resets values to their defaults.
<**Connection Options**>	➤ **Connect to existing Terminal Services Sessions.** Enables connection to existing (open) terminal sessions. **Note:** If you select this option, you must open a terminal client session manually for each terminal that you want to run Vusers on during the scenario. ➤ **Create new Terminal Services Sessions.** Enables the Controller to open and close terminal sessions automatically using a **user name**, **password**, and **domain** for the Terminal Services session. ➤ **Show Terminal Services clients on the Controller machine.** Enables interaction with new Terminal Services sessions using the RDP client.
Enable Terminal Services Manager	Enables the Controller to manage load automatically using terminal sessions on the load generator. **Note:** When enabled, you can see the load generator's name only, without adding any extra references. **Example:** If you need to use three load generator sessions, **my_machine**, **my_machine:1**, and **my_machine:2**, then in the load generator list, you need only insert the load generator, **my_machine**, and enable the Terminal Services Manager for three terminals (**Number of terminals = 3** - see below). If not enabled, you need to insert each of the three terminals as separate load generators: **my_machine**, **my_machine:1**, and **my_machine:2**.

UI Elements (A-Z)	Description
Maximum number of Vusers per terminal	The maximum number of Vusers that you want to run in a terminal session. This depends on the Vuser type used in the script. **Default:** 50 **Example:** For GUI Vusers, the maximum is **one** Vuser for each terminal session.
Number of terminals	The number of terminals you want to use in your scenario. You must open a terminal client session for each terminal on which you want to run Vusers during the scenario. **Default:** 2

Load Generator Configuration > UNIX Environment Tab

This tab enables you to configure the login parameters and shell type for each UNIX load generator.

To access	Controller toolbar >  > **Add** or **Details**
Important information	➤ This tab is not available for a load generator running Vusers or monitoring over a firewall. ➤ Editable only when the load generator is on a UNIX platform.
Relevant tasks	➤ "How to Add Load Generators to a Scenario" on page 105 ➤ "How to Modify Load Generator Details" on page 106 ➤ "How to Connect to a UNIX Load Generator Without Using RSH" on page 104

User interface elements are described below:

UI Elements (A-Z)	Description
Login as	The user's credentials for logging in to the UNIX environment: ➤ **Name.** If the load generator is UNIX-based, set the login information for the load generator. **Default:** LoadRunner uses your Windows user name for the UNIX login. That is, if your Windows login is **lrunner**, the Controller logs in to the load generator as lrunner. To log in to a UNIX-based load generator using a different login name, select **Name** and specify the desired UNIX login name. Using this option, you can log in to the Windows Controller as **bill** and connect to the UNIX load generator as **mike**. However, you should make sure that mike allows bill to log in using his name. This can be done by adding the line "**+ bill**" at the beginning of mike's .rhosts file. ➤ **Use lower case for login names.** Instructs LoadRunner to use lower case names during login to avoid case-sensitive issues with the UNIX operation system. **Local User.** (Expert mode only) UNIX load generators that use the rsh shell to establish a connection as the current Windows user (due to security considerations). To "mislead" rsh and log in as a user other than the current Windows login, select **Local user** and specify the desired UNIX login name. Because modifying the local user name is a security breach for rsh, this option should be used only when you encounter a problem connecting to the remote machine.

UI Elements (A-Z)	Description
Shell Settings	The UNIX shell settings for the remote UNIX load generator. **Default:** The Controller connects remotely to the UNIX load generator using rsh (remote shell). ➤ **Don't use RSH.** Connects to the remote load generator without using RSH. In this case, you need to activate the agent daemon on the load generator manually. **Note:** If you do want to connect using RSH, clear this check box, make sure that RSH is enabled on the load generator, and make sure that the agent daemon is not already running on the load generator. If the agent daemon is running, stop it by running the following command from the **<LR_root>/bin** directory: m_daemon_setup -remove ➤ **Default shell.** The default shell on the UNIX load generator: **csh** (C Shell—the default), **bsh** (Bourne Shell), or **ksh** (Korn Shell). To work with the load generator, your UNIX startup configuration file needs to include specific environment variables. For details, see "UNIX Environment Variables" on page 107. ➤ **Initialization command.** Command line options for LoadRunner to use when logging in to a UNIX system. This initialization command runs as soon as the shell opens. **Example:** You could select **ksh** and use the following initialization command: source .profile;

Load Generator Configuration > Vuser Limits Tab

This tab enables you to modify the maximum number of GUI, RTE, and other Vusers that the load generator can run.

To access	Controller toolbar >  > **Add** or **Details**
Relevant tasks	➤ "How to Add Load Generators to a Scenario" on page 105 ➤ "How to Modify Load Generator Details" on page 106

User interface elements are described below:

UI Elements (A-Z)	Description
Defaults	Resets values to their defaults.
Available Types	The types of Vusers the load generator should run. The types of vusers are: ➤ **GUI-WinRunner** ➤ **RTE** ➤ **Other Vusers**
Maximum Active	The maximum number of each type of Vuser that the load generator should run. **Defaults:** ➤ GUI-WinRunner: 1 ➤ RTE: 1000 ➤ Other Vusers: 5000 **Note:** The maximum number of active Vusers that you specify must not exceed the number of Vusers that you are licensed to run. To check your Vuser licensing limitations, in the LoadRunner launcher window (**Start** > **Programs** > **LoadRunner** > **LoadRunner**), select **Configuration** > **LoadRunner License**.

Load Generator Configuration > Vuser Status Tab

This tab enables you to view the status of all the Vusers connected to the load generator.

To access	Controller toolbar >  > **Add** or **Details**
Important information	This tab is visible only when the load generator is connected.
Relevant tasks	➤ "How to Add Load Generators to a Scenario" on page 105 ➤ "How to Modify Load Generator Details" on page 106
See also	Chapter 10, "Configuring WAN Emulation Settings"

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

UI Elements (A-Z)	Description
<Vuser Status>	The status of the Vusers: ➤ **Pending.** Vusers are waiting to initialize. ➤ **Initializing.** Vusers are in the initialization state. ➤ **Active.** Vusers are actively running in the scenario.
GUI/WinRunner	The number of GUI/WinRunner Vusers that are in the **Pending**, **Initializing**, and **Active** states.
Other Vusers	The number of Vusers—other than GUI/WinRunner and RTE Vusers—that are in the **Pending**, **Initializing**, and **Active** states.
RTE	The number of RTE Vusers that are in the **Pending**, **Initializing**, and **Active** states.
Totals	The total number of Vusers that are in the **Pending**, **Initializing**, and **Active** states.

Load Generator Configuration > WAN Emulation Tab

This tab enables WAN Emulation on your scenario.

To access	Controller toolbar >  > **Add** or **Details**
Important information	➤ To enable the WAN Emulator, the load generator must be disconnected. If the load generator is connected, select it in the Load Generators dialog box and click **Disconnect**. The load generator status changes to **Down**. ➤ This tab is disabled if: ➤ The load generator is running on a UNIX platform ➤ The WAN Emulation third party software is not installed ➤ The load generator is also the Controller
Relevant tasks	➤ "How to Integrate WAN Emulation Into Your Scenario" on page 204 ➤ "How to Add Load Generators to a Scenario" on page 105 ➤ "How to Modify Load Generator Details" on page 106
See also	Chapter 10, "Configuring WAN Emulation Settings"

User interface elements are described below:

UI Elements (A-Z)	Description
WAN Emulation settings.	Opens the third party software WAN Emulation Settings dialog box. For detailed information on configuring WAN Emulation using this dialog box, see the relevant third party software documentation. For information on some typical network emulation settings, see "Typical Network Emulation Settings" on page 200. **Note:** If several load generators are being configured to emulate a specific location, make sure that each load generator is configured with the same settings.
Auto Monitoring User Details	If you are connecting to the load generator remotely, but do not have the necessary permissions to retrieve third party monitors, you can retrieve these monitors with additional credentials that do have the necessary permissions. If you have these additional credentials, enter them in the **User Name** and **Password** boxes.
Emulated Location	The name of the emulated location. For details, see "Emulated Locations Overview" on page 201.
Enable WAN Emulation on Load Generator	Enables the WAN Emulator on the load generator.

Load Generators Dialog Box

This dialog box enables you to manage the load generators defined for the scenario.

To access	Controller toolbar > 

Relevant tasks	"How to Add Load Generators to a Scenario" on page 105 "How to Modify Load Generator Details" on page 106
See also	"Load Generators Overview" on page 102 "Load Balancing" on page 102

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

UI Elements (A-Z)	Description
	Opens the Add New Load Generator dialog box where you define a new load generator. See "Add Load Generator/Load Generator Information Dialog Box" on page 108. **Note:** When you add a load generator, its status is set to **Down** until it is connected.
	➤ **Connect.** Instructs the Controller to connect the load generator for the scenario. The status of the load generator changes from **Down** to **Ready**. ➤ **Disconnect.** When the load generator is connected, the button automatically changes to **Disconnect**. When clicked, the status of the load generator changes to **Down**.
	Removes the load generator from the list. The load generator can be removed when it is disconnected only.
	Opens the Load Generator Information dialog box where you can view and modify information about the load generator selected in the list. See "Add Load Generator/ Load Generator Information Dialog Box" on page 108.
	Instructs the Controller to disable or enable the load generator. When a load generator is disabled, its **Name**, **Status**, **Platform**, and **Details** appear in gray.
	Attempts to reset a failed connection.

UI Elements (A-Z)	Description
<Icons>	The Controller monitors a Windows load generator's CPU usage and automatically stops loading Vusers on a load generator when it becomes overloaded. You can monitor the status of a machine's CPU usage as follows:  The load generator is ready.  There is a problem with the CPU usage of the load generator.  The load generator is overloaded.
<Load Generator table>	Displays the following information: ➤ **Name.** The name of the load generator. ➤ **Status.** The status of the load generator: ➤ **Ready.** The load generator is connected. ➤ **Connecting.** The load generator is in the process of connecting. ➤ **Active.** The load generator is running Vusers. ➤ **Down.** The load generator is not connected. ➤ **Failed.** A connection with the load generator could not be established. ➤ **Platform.** The type of platform on which the load generator is running. ➤ **Details.** If the connection fails, displays details about why it failed.
<Right-click menu>	➤ **Filter Hosts.** Enables you filter the load generator list by status. ➤ **Load Default List.** Loads the default list of load generators. ➤ **Save List As Default.** Saves the current list of load generators as the default list. ➤ **Sort Hosts.** Enables you to sort the Load Generator table by a selected column. To sort the table in ascending/descending order, click the relevant table heading.

6

Scheduling Manual Scenarios

This chapter includes:

Concepts

Tasks

Reference

Concepts

Scheduling Manual Scenarios Overview

An important factor in the creation of a manual scenario is developing a test that accurately portrays user load behavior—the type of load and the timing of the load.

After you create a scenario, you schedule the scenario to start running at a specified time. You can limit the execution duration of the scenario or of a Vuser group within the scenario.

You can also stipulate how many Vusers to start and stop running within a certain time frame. You can specify whether LoadRunner should start or stop running all Vusers in a scenario simultaneously, or only a certain number of Vusers within a specified amount of time.

Note: Rendezvous points in a Vuser script interfere with a scheduled scenario run. If your script contains rendezvous points, your scenario will not run as scheduled. For details on rendezvous points, see "Rendezvous Points" on page 313.

Scheduling by Scenario or Group

After you have designed a manual scenario, you can schedule the participating Vuser groups/scripts to run as part of a scenario schedule.

You can schedule all the groups/scripts to run together on one schedule, or you can define a separate schedule for each Vuser group.

For details about manual scenario modes, see "Manual Scenarios" on page 54.

Scheduling By Scenario

When you schedule **by scenario**, LoadRunner runs all the Vuser groups participating in the scenario simultaneously. That is, the schedule defined for running the scenario is applied to all the Vuser groups concurrently, and LoadRunner applies each action proportionately to all the Vusers groups.

For example, take a scenario that includes 3 participating Vuser groups as follows:

Group Name	Number of Vusers
Group1	10
Group2	20
Group3	30
Total	**60**

When scheduling by scenario, if the schedule instructs LoadRunner to load 30 Vusers when it starts running, LoadRunner loads a proportional number of Vusers from each group as follows:

Group Name	Number of Vusers
Group1	5
Group2	10
Group3	15
Total	**30**

Note: The same principle applies when viewing the scenario in percentage mode.

Scheduling By Vuser Group

Note: For scenarios in Vuser group mode only.

When you schedule **by Vuser group**, each Vuser group participating in the scenario runs on its own separate schedule. That is, for each Vuser group, you can specify when to start running the Vuser group, how many Vusers in the group to start and stop running within specified time intervals, and how long the group should continue running.

 Schedule Run Modes

You can schedule a scenario to run according to the run-time settings defined in the Vuser groups, or you can let the groups run over and over again until the scenario schedule instructs them to stop running.

You can schedule a scenario to run in one of the following modes:

- **Real-world schedule.** (Default) The scenario runs according to a user-defined group of actions that simulate a real-world schedule of events. Vuser groups run according to the iterations defined in their run-time settings, but you can define how many Vusers to run at a time, how long Vusers should continue to run, and how many Vusers to stop running at a time.
- **Basic schedule.** All enabled Vuser groups run together on one schedule, each according to its own run-time settings. You can schedule how many Vusers to start running at a time, and how long they should run before stopping.

Note: You can change the default run mode in the **Tools** > **Options** > **Execution** tab.

The following table illustrates how the given schedule types run in real-world vs basic run mode:

Schedule by	Run Mode	
	Real-world	Basic
Scenario	All participating Vuser groups run together on one schedule. The scenario runs according to a user-defined group of actions that emulate a true-to-life schedule of events. You can schedule how many Vusers to start running at a time, how long to run the Vusers, and how many Vusers to stop running at a time.	All participating Vuser groups run together on one schedule, each according to its own run-time settings. You can schedule the Vusers to start and stop running simultaneously or gradually, and you can specify how long they should run before stopping.
Group (Not applicable when viewing scenario in Percentage mode)	Each participating Vuser group runs according to its own defined schedule that emulates a true-to-life schedule of events for that Vuser group. You can schedule when to start running the Vuser group, how many Vusers to run at a time, how long to run the Vusers, and how many Vusers to stop running at a time.	Each participating Vuser group runs according to its own schedule, each according to its own run-time settings. For each Vuser group, you can schedule how many Vusers in the group to start and stop running simultaneously or gradually, and you can specify how long they should run before stopping.

Tasks

How to Define a Schedule for the Scenario - Workflow

This task describes how to define a schedule for a scenario.

This task includes the following steps:

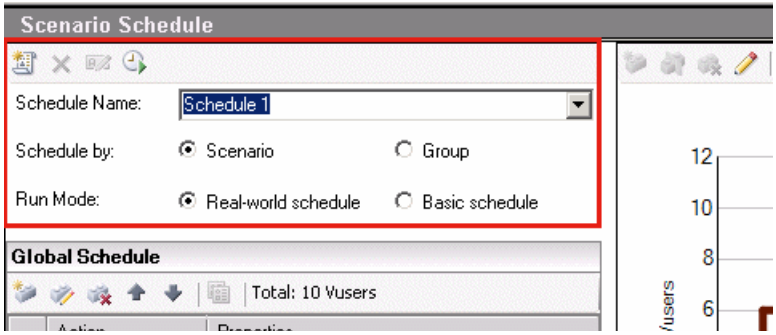
1 Prerequisite

Make sure that a scenario is open, or create a new one, and that scripts have been selected for the scenario.

For more details, see "How to Design a Manual Scenario" on page 62.

2 Define the schedule

In the Scenario Schedule pane, select a schedule from the list, or define a new schedule by clicking **New Schedule**.



Define the schedule in the definition area as follows:

a (Optional) To rename the schedule, type a new name in the **Schedule Name** box and click **Save New Name**.

b Select the type of schedule: **Scenario** or **Group**. For details, see "Scheduling by Scenario or Group" on page 128.

c Select a run mode: **Real-world** or **Basic**. For details, see "Schedule Run Modes" on page 130.

Note: The default run mode for all schedules is **Real-world**. You can change the default to **Basic** in the **Tools** > **Options** > **Execution** tab.

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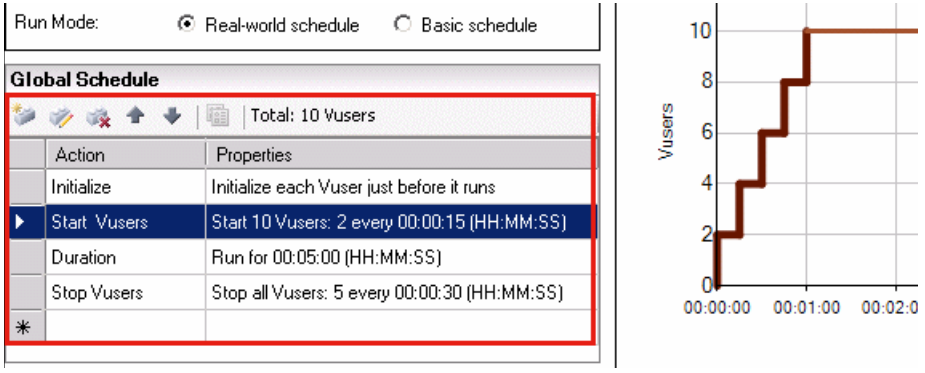
3 Define actions for the schedule

The Actions Grid displays the default actions that correspond to the type of schedule you selected in step 2 above.



For schedule action details, see "Schedule Actions" on page 142.

➤ For details about how to add actions, see "How to Add Actions to the Scenario Schedule" on page 136.

➤ For details about how to edit actions, see "How to Edit Schedule Actions" on page 139.

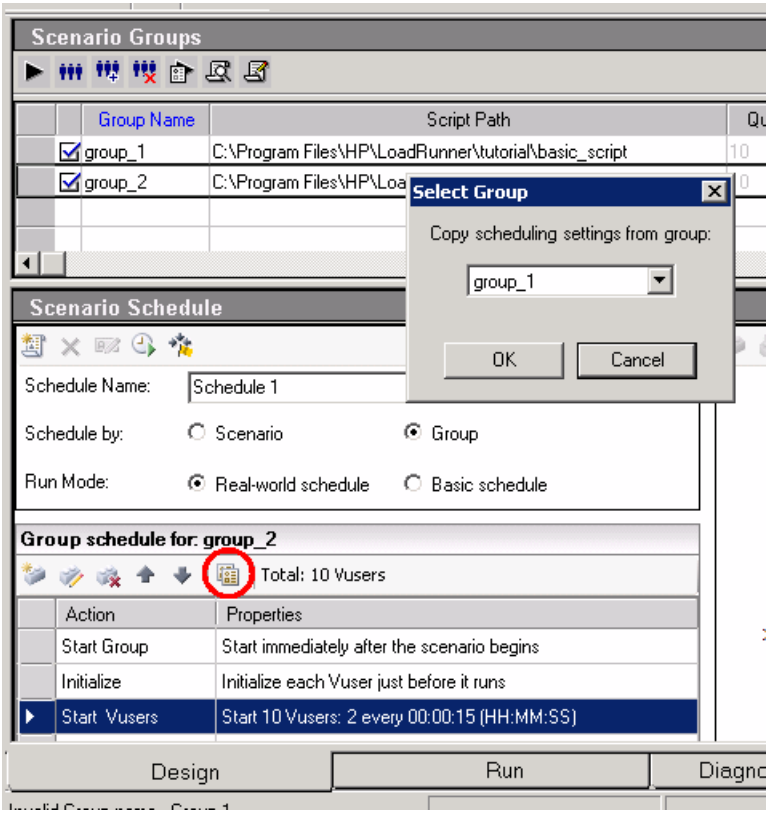
4 Vuser group schedules only: Copy a group's schedule settings to other groups - optional

When scheduling by Vuser group, you can copy a Vuser group's schedule settings to other Vuser groups.

Note: Schedule settings copied include the schedule run mode (basic or real-world) and the set of schedule actions.

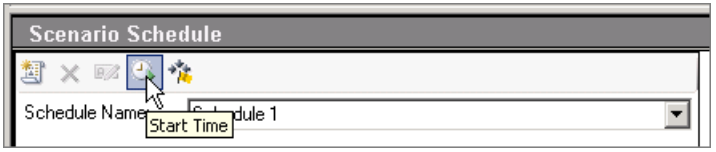
Example:

To copy group_1's schedule settings to group_2, select **group_2** in the Scenario Groups pane, click **Copy Schedule Settings From**, and select **group_1**.



5 Schedule a start time for the scenario - optional

In the Schedule Definition area, click the **Start Time** button and select when to start running the scenario.



How to Add Actions to the Scenario Schedule

Note: You can add actions to a **real-world schedule** only.

Add an action to the schedule from the Actions grid

1 In the Action grid do one of the following:

- ➤ To insert an action after a specific action, select the action and click **Add Action After**.
- ➤ To add an action after the last action, double-click the last row in the Actions grid—marked by an asterisk (*).

2 In the Add Action dialog box, define the new action. For schedule action details, see "Schedule Actions" on page 142.

3 Click **Apply**.

4 To add another action while in the Add Action dialog box, click **Add Another Action** and repeat steps 2 through 3.

Add an action from the schedule graph

You can add **Start Vusers**, **Duration**, and **Stop Vusers** actions from the graph by splitting an action into two actions, or appending a new action after the last action in the graph.

To add an action by splitting an action in two:

1 Make sure that the graph is in Edit mode.

2 Select the line that represents the action that you want to split.

Tip: Selecting the action in the Actions grid highlights the corresponding line in the graph.

3 Click the **Split Action** button. The selected line splits in two. In the Actions grid, the original action splits into two equivalent actions, each representing half of the original action. For example:

- Splitting a Duration action of 5 minutes results in two Duration actions of 2.5 minutes each.
- Splitting a Start Vusers action that starts 20 Vusers results in two Start Vusers actions, each starting 10 Vusers.

4 (Optional) Edit each of the actions. For details, see "How to Edit Schedule Actions" on page 139.

To append an action after the last action:

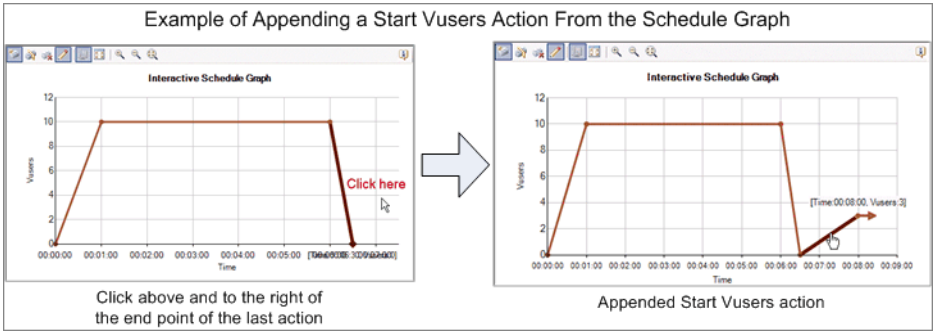
1 Make sure that the graph is in Edit mode.

2 In the graph toolbar, click **New Action**.

3 Append new actions as follows:

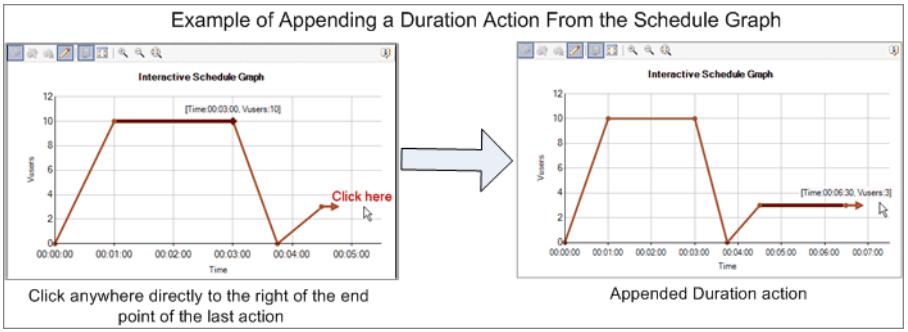
- **Start Vusers action.** Click the graph anywhere **above and to the right of** the endpoint of the last line of the graph.

  For example:



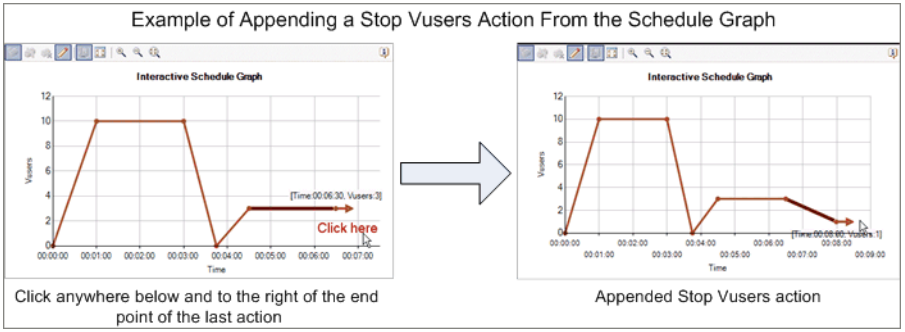
- **Duration action.** Click the graph anywhere **directly to the right of** the endpoint of the last line of the graph.

For example:



➤ **Stop Vusers action.** Click the graph anywhere **below and to the right of** the endpoint of the last line of the graph.

For example:



4 Edit the actions. For details, see "How to Edit Schedule Actions" on page 139.

How to Edit Schedule Actions

This task describes how to edit schedule actions, both in the Actions grid and from the schedule graph.

This task includes the following steps:

➤ "Edit an action from the Actions grid" on page 139

➤ "Edit an action from the schedule graph" on page 139

Edit an action from the Actions grid

Double-click the action (or select it), click **Edit Action**, and edit the action as desired.

You can also edit other actions before closing the Edit Action dialog box. Click **Previous** or **Next** to navigate between the actions.

Edit an action from the schedule graph

You can edit **real-world schedules** from the graph: you can edit Start Vusers, Stop Vusers, and Duration actions. When you edit actions from the graph, the action's details in the Actions grid are updated accordingly.

To edit an action from the graph, do one of the following:

➤ Double-click the line in the graph representing the action you want to edit. Edit the action in the Edit Action dialog box that opens. Click **Previous** or **Next** to edit other actions.

➤ Make sure that the graph is in Edit mode, select the line in the graph, and drag it as follows:

Action	Modification
Start Vusers	To change **the number of Vusers** to start running: ➤ To start more Vusers, drag the diamond-shaped endpoint upwards. ➤ To start fewer Vusers, drag the diamond-shaped endpoint downwards.
Start Vusers	To change **the time interval between starting Vusers**: ➤ To increase the time interval, drag the diamond-shaped endpoint to the right. ➤ To decrease the time interval, drag the diamond-shaped endpoint to the left. **Note:** A vertical line indicates that the Vusers start running simultaneously.
Duration	➤ To increase the duration between scheduled actions, drag the diamond-shaped endpoint to the right. ➤ To decrease the duration between scheduled actions, drag the diamond-shaped endpoint to the left.
Stop Vusers	To change **the number of Vusers** to stop running: ➤ To stop fewer Vusers, drag the diamond-shaped endpoint upwards. ➤ To stop more Vusers, drag the diamond-shaped endpoint downwards.
Stop Vusers	To change **the time interval between stopping Vusers**: ➤ To increase the time interval, drag the diamond-shaped endpoint to the right. ➤ To decrease the time interval, drag the diamond-shaped endpoint to the left. **Note:** A vertical line indicates that the Vusers stop running simultaneously.

Tip: To fine-tune any of the details of the selected action line, use the arrow keys on your keyboard, or edit the action in the Actions grid.

Reference

Schedule Actions

A scenario schedule contains a series of actions that instruct the scenario when to start running a Vuser group, how to initialize Vusers, when to start and stop running Vusers, and how long to run an action.

The following sections describe the available schedule actions.

- "Start Group" on page 142
- "Initialize" on page 143
- "Start Vusers" on page 144
- "Duration" on page 145
- "Stop Vusers" on page 146

Start Group

The Start Group action defines when to start running a Vuser group.

Options	Description
Start immediately after the scenario begins (Default)	LoadRunner starts running the Vuser group as soon as the scenario starts running.
Start <00:00:00> **(HH:MM:SS) after the scenario begins**	After the scenario starts running, LoadRunner waits the specified time (in hours, minutes, and seconds) before it starts running the Vuser group.
Start when group <group name> finishes	LoadRunner starts running the Vuser group immediately after the Vuser group specified in this option has finished running.

Note:

- The Start Group action is available for **group schedules only**, and always appears as each group's first schedule action.
- The Start Group action is always followed by the **Initialize** action.
- The Start Group action cannot be deleted.

Initialize

The Initialize action instructs LoadRunner to prepare the Vusers so that they are in the Ready state and can run.

Options	Description
Initialize all Vusers simultaneously	LoadRunner initializes all the Vusers together before running them.
Initialize XX **Vusers every** <00:00:00> **(HH:MM:SS)**	LoadRunner initializes the specified number of Vusers gradually, according to the specified time interval (in hours, minutes, and seconds), before running them.
Initialize each Vuser just before it runs (Default)	LoadRunner initializes each Vuser just before it starts running. **Note:** This option is not available for group schedules when the **Wait for all groups to initialize** option is selected. For details, see page 158.

Note:

- The Initialize action appears in the Actions grid for all schedule types.
- The Initialize action cannot be deleted.

Start Vusers

The Start Vusers action instructs LoadRunner to start running Vusers.

Options	Description
Start XX **Vusers: Simultaneously** (Default)	LoadRunner runs the specified number of Vusers simultaneously.
Start XX **Vusers:** YY **Vusers every** <00:00:00> **(HH:MM:SS)**	LoadRunner runs the specified number of Vusers (XX) gradually. That is, LoadRunner runs YY Vusers, and waits the specified time (in hours, minutes, and seconds) before running another YY Vusers.

Note:

- LoadRunner starts running Vusers only when they have reached the Ready state.
- In a basic schedule, LoadRunner always runs **all** the Vusers, whether simultaneously or gradually. In a real-world schedule, you can select how many Vusers to start running.
- While a scenario is running, you can add Vuser groups/scripts to participate in the scenario. When starting the Vusers gradually, if you add a Vuser group to the scenario after all the original Vusers have already started running, the new group starts running immediately.

Duration

The Duration action instructs LoadRunner to continue running the scenario in the current state, for the specified amount of time.

Options	Description
Run until completion	The scenario runs until all the Vusers have finished running. **Note:** In real-world schedules, this option is available after the **first** Start Vusers action only, and if selected, causes all subsequent actions to be deleted.
Run for XX **days and** <00:00:00> **(HH:MM:SS)**	The scenario runs in its current state for the specified amount of time (in days, hours, minutes, and seconds) before continuing with the next action. **Default:** 5 minutes. **Note:** In a real-world schedule, if you select this option, and this Duration action is not followed by any other action, the scenario continues to run indefinitely.
Run indefinitely (Basic schedule only)	The scenario runs indefinitely.

Stop Vusers

The Stop Vusers action instructs LoadRunner to stop running Vusers.

Options	Description
Stop XX **Vusers: Simultaneously** (Default)	LoadRunner stops running the specified number of Vusers at once.
Stop XX **Vuser:** YY **Vusers every** <00:00:00> **(HH:MM:SS)**	LoadRunner stops running the specified number of Vusers gradually. That is, LoadRunner stops YY Vusers, and waits the specified time (in hours, minutes, and seconds) before stopping another YY Vusers, until all XX Vusers have stopped running.

Scheduler User Interface

This section includes (in alphabetical order):

- Add Action Dialog Box on page 147
- Edit Action Dialog Box on page 148
- Scenario Schedule Pane on page 149

Add Action Dialog Box

This dialog box enables you to add actions to a real-world scenario schedule to simulate a more true-to-life schedule by which to run your scenario.

To access	In the **Design** tab > **Scenario Schedule** pane > **Actions** grid, do one of the following: ➤ Double-click the last row in the Actions grid—marked by an asterisk (*). ➤ In the Actions grid, select the action after which you want to add a new action, and click **Add Action After**  .
Important information	➤ Available for **real-world schedules only**. ➤ You can add Start Vusers, Duration, and Stop Vusers actions only.
Relevant tasks	"How to Define a Schedule for the Scenario - Workflow" on page 132
See also	➤ "Actions Grid" on page 150 ➤ "Schedule Actions" on page 142

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

UI Elements (A-Z)	Description
Add Another Action	Resets the Add Action dialog box so that you can add another action. Available only after clicking **Apply** when adding an action.
Apply	Adds the defined action to the Actions grid. Leaves the Add Action dialog box open, **in edit mode**, so that you can make changes to the action you added or add another action.

UI Elements (A-Z)	Description
<Action details area>	The details of the new action. For details about the schedule actions, see "Schedule Actions" on page 142.
Action type	The type of action to add.

Edit Action Dialog Box

This dialog box enables you to edit schedule actions.

To access	Use one of the following: ➤ Double click an action in the Actions grid or in the interactive graph. ➤ **Design** tab > **Scenario Schedule** pane > Actions grid/ Schedule graph > **Edit Action** 
Important information	➤ In the Actions grid, you can edit all actions. ➤ In the interactive graph, you can edit Start/Stop Vusers and Duration actions only.
Relevant tasks	➤ "How to Define a Schedule for the Scenario - Workflow" on page 132 ➤ "How to Edit Schedule Actions" on page 139
See also	➤ "Actions Grid" on page 150 ➤ "Schedule Actions" on page 142 ➤ "Interactive Schedule Graph" on page 154

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

UI Elements (A-Z)	Description
< Previous Next >	Displays the details of the previous/next action in the Actions grid.
<Action details area>	Displays the current details of the selected action.
Action type	Displays the type of action selected.

Scenario Schedule Pane

This pane enables you to define a schedule for running your scenario.

To access	Manual scenario > **Design** tab
Relevant tasks	"How to Define a Schedule for the Scenario - Workflow" on page 132
See also	➤ "Scheduling Manual Scenarios Overview" on page 128 ➤ "Scheduling by Scenario or Group" on page 128 ➤ "Schedule Run Modes" on page 130

User interface elements are described below:

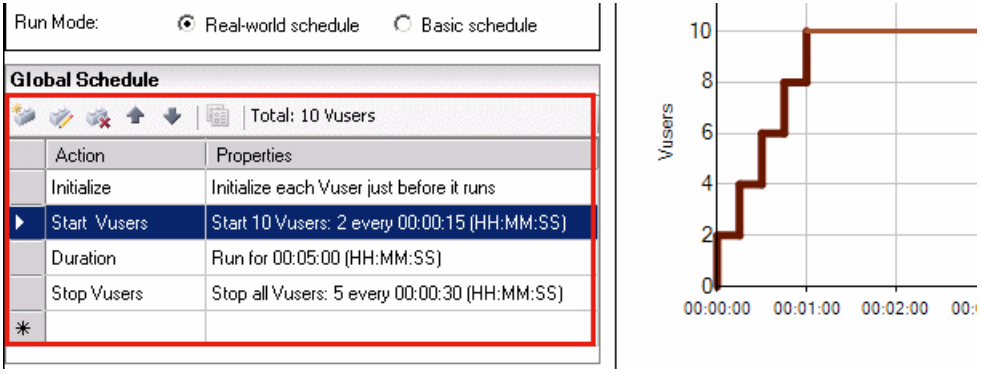
UI Elements (A-Z)	Description
Actions grid	Displays a list of scenario's schedule actions. See "Actions Grid" on page 150.

UI Elements (A-Z)	Description
Interactive schedule graph	Displays a graphical representation of the scenario schedule. The lines in the graph correspond to the actions defined in the Actions grid. See "Interactive Schedule Graph" on page 154.
Schedule definition area	Displays the selected schedule's details. See "Schedule Definition Area" on page 157.

Actions Grid

You define the actions for a schedule in this area. You can add, modify, and delete actions. These actions include starting Vuser groups (in group schedules) and initializing, starting, and stopping Vusers. You can also define how long each action should continue.

When creating group schedules, you can copy group schedule settings from one Vuser group to another.

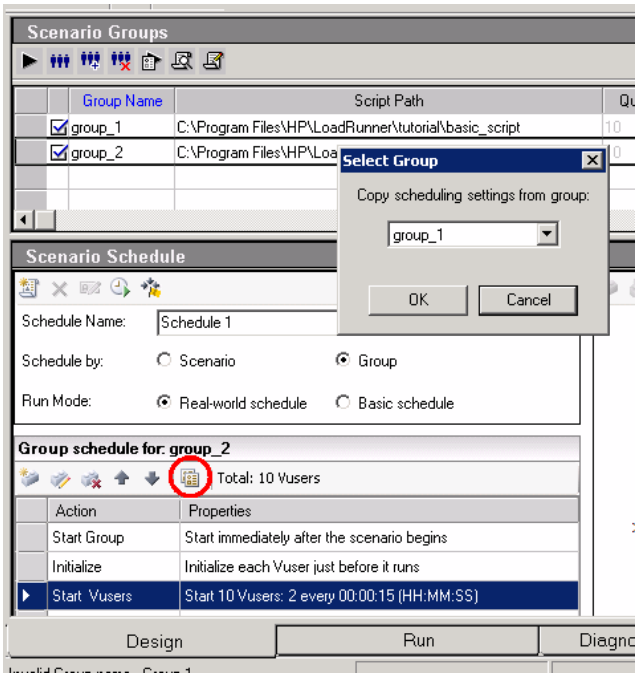


To access	Manual scenario > **Design** tab > **Scenario Schedule** pane

Relevant tasks	➤ "How to Define a Schedule for the Scenario - Workflow" on page 132 ➤ "How to Add Actions to the Scenario Schedule" on page 136 ➤ "How to Edit Schedule Actions" on page 139
See also	➤ Parent Topic: "Scenario Schedule Pane" on page 149 ➤ "Schedule Actions" on page 142 ➤ "Interactive Schedule Graph" on page 154

User interface elements are described below:

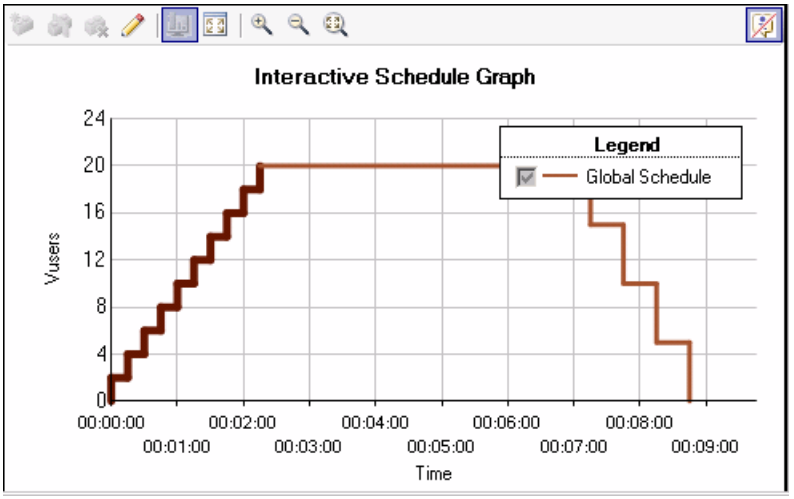
UI Elements (A-Z)	Description
 (Real-world schedule only)	**Add Action After.** Opens the Add Action dialog box where you can define new actions. For details, see "Add Action Dialog Box" on page 147. **Note:** The new action is added **after** the action selected in the Actions grid.
	**Edit Action**. Opens the Edit Action dialog box where you can edit the schedule actions. For details, see "Edit Action Dialog Box" on page 148.
	**Delete Action.** Deletes the selected action.
	**Move Action Up**. Moves the selected action up the grid.
	**Move Action Down**. Moves the selected action down the grid.

UI Elements (A-Z)	Description
 (Vuser group schedules only)	**Copy Schedule Settings From.** Enables copying group schedule settings from one Vuser group to another in the Scenario Groups pane. **Note:** Schedule settings copied include the schedule run mode (basic or real-world) and the set of schedule actions. **Example:** To copy group_1's schedule settings to group_2, select **group_2** in the Scenario Groups pane. Then click this button, and select **group_1**. 

UI Elements (A-Z)	Description
Total: 20 Vusers	Displays the total number of Vusers scheduled to run in the scenario. **Note:** ➤ This is editable in basic schedules, when the scenario is in percentage mode only. ➤ When the scenario is in Vuser group mode and you are defining a basic schedule, this value is updated when you modify the quantity of Vusers in the Vuser groups. For details, see "Add Vusers Dialog Box" on page 75. ➤ In real-world schedules, the total number of Vusers is the sum of all the Vusers defined in the Start Vusers actions.
	**Apply.** When you modify the **Total: <#> Vusers** field, applies the specified total number of Vusers proportionately to the Vuser groups. (Percentages are visible in the **%** column of the Scenario Scripts pane.) **Note:** Appears only when **Total: <#> Vusers** is modified.

Interactive Schedule Graph

This graph provides a graphical representation of the scenario's schedule. From the graph, you can watch the progress of the schedule during a scenario run.



To access	Manual scenario > **Design** tab > **Scenario Schedule** pane
Important information	Only **real-world** schedules can be modified from the interactive schedule graph. You can modify Start Vusers, Duration, and Stop Vusers actions. To modify a **basic** schedule, you must edit the actions in the Actions grid itself.
Relevant tasks	➤ "How to Define a Schedule for the Scenario - Workflow" on page 132 ➤ "How to Add Actions to the Scenario Schedule" on page 136 ➤ "How to Edit Schedule Actions" on page 139
See also	➤ Parent Topic: "Scenario Schedule Pane" on page 149 ➤ "Schedule Actions" on page 142 ➤ "Actions Grid" on page 150

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

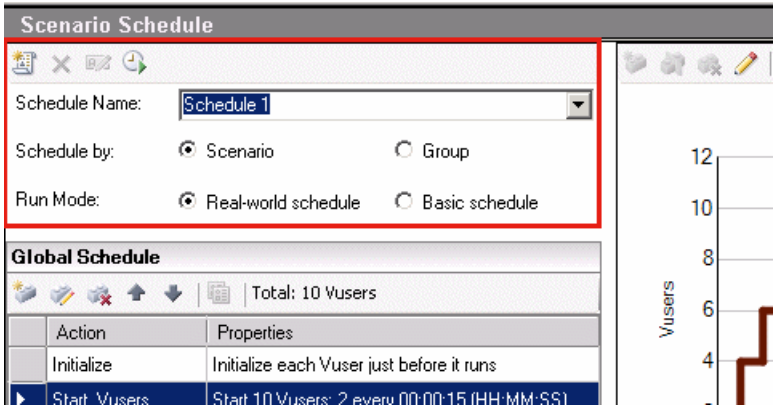
UI Elements (A-Z)	Description
 (Real-world schedule only)	**New Action.** Appends a new action after the last action in the graph. Append new actions as follows: ➤ **Start Vusers**. Click the graph anywhere **to the right of and above** the endpoint of the last line of the graph. ➤ **Duration**. Click the graph anywhere **to the right of** the the endpoint of last line of the graph. ➤ **Stop Vusers**. Click the graph anywhere **to the right of and below** the endpoint of the last line of the graph. **Note:** Available when the graph is in Edit mode only. (See **Edit/View Mode**  below.)
 (Real-world schedule only)	**Split Action**. Splits a selected line in the graph in two. The original action in the Actions grid is split into two equivalent actions, each representing half of the original action. **Examples:** ➤ Splitting a Duration action of 5 minutes results in two Duration actions of 2.5 minutes each. ➤ Splitting a Start Vusers action that starts 20 Vusers results in two Start Vusers actions, each starting 10 Vusers. **Note:** Available when the graph is in Edit mode only. (See **Edit/View Mode**  below.)
 (Real-world schedule only)	**Delete Action.** Deletes a selected action. **Note:** Available when the graph is in Edit mode only. (See **Edit/View Mode**  below.)
 (Real-world schedule only)	**Edit/View Mode.** Switches the graph display between Edit mode and View mode.

UI Elements (A-Z)	Description
	**Pause.** Pauses the schedule during the scenario run. When the schedule is paused, the red vertical line that indicates the schedule's progress freezes. **Note:** Available only when the scenario is running.
	**Resume.** Resumes a paused schedule. When the schedule resumes running, the red vertical line continues moving across the graph, indicating the schedule's progress. **Note:** Available only when the scenario is running.
	**Show Selected Group.** Displays only the group selected in the Scenario Groups pane. **Note:** Available for group schedules only.
	**Show All Groups.** Displays all Vuser groups participating in the scenario. **Note:** Available for group schedules only.
	**Open Full View.** Opens the graph in its own window. **Note:** All the options available in the Schedule pane's interactive graph are also available in the full-view graph window.
	**Zoom In.** Zooms into the x-axis of the graph— that is, spreads the graph out to view shorter time intervals.
	**Zoom Out.** Zoom out of the x-axis of the graph— that is, displays longer time intervals.
	**Zoom Reset.** Reverts to the default time intervals displayed on the x-axis.
	**Hide Legend.** Hides the graph legend.
	**Show Legend.** Shows the graph legend.

UI Elements (A-Z)	Description
<End points>	When an action (line) in the graph is selected, two endpoints are displayed: ➤ **Dot.** Starting point of the line. ➤ **Diamond.** The endpoint of a selected line. Can be dragged to edit an action. For details, see "How to Edit Schedule Actions" on page 139. **Note:** To fine-tune any of the details of the selected action line, use the arrow keys on your keyboard.
<Schedule progress indicator>	A red vertical line that slides across the schedule graph while the schedule is running. **Note:** The schedule may run a few seconds ahead of the scenario run.
<Time scroll bar>	Appears if, when zooming into the graph, the graph spreads out wider than the graph area.

Schedule Definition Area

This area displays the selected schedule's details.



To access	Manual scenario > **Design** tab > **Scenario Schedule** pane
Relevant tasks	"How to Define a Schedule for the Scenario - Workflow" on page 132
See also	➤ Parent Topic: "Scenario Schedule Pane" on page 149 ➤ "Scheduling by Scenario or Group" on page 128 ➤ "Schedule Run Modes" on page 130

User interface elements are described below:

UI Elements (A-Z)	Description
	**New Schedule.** Creates a new schedule.
	**Delete Schedule.** Deletes the selected schedule.
	**Save New Name.** Saves a new name given to the schedule. **Note:** Enabled when you start typing the new name.
	**Start Time.** Opens the Scenario Start Time dialog box. You can schedule the scenario to start running: ➤ **Without delay.** As soon as the Start Scenario command is issued. ➤ **With a delay of HH:MM:SS.** The specified time after the Start Scenario command was issued. ➤ **At HH:MM:SS on <date>.** At a specified time on the specified date.
 (Group schedule only)	**Wait for all groups to finish initialization.** When this option is selected, all of the Vusers in all of the Vuser groups finish initializing before any of them start running. **Note:** When this option is selected, **Initialize each Vuser just before it runs** is not available. For details about the **Initialize** action, see "Initialize" on page 143.

UI Elements (A-Z)	Description
Run Mode	The mode according to which the schedule will run: ➤ **Real-world schedule.** A schedule designed according to a true-to-life series of events. ➤ **Basic schedule.** A schedule according to which all the Vusers start running, run for a given duration, and then all stop running. For details, see "Schedule Run Modes" on page 130. **Default value:** Real-world. **Note:** To change the default, select **Tools** > **Options** > **Execution** tab.
Schedule by	The schedule type: ➤ **Scenario.** Runs all participating Vuser Groups together on the same schedule. ➤ **Group.** Each Vuser group runs on its own schedule. For details, see "Scheduling by Scenario or Group" on page 128.
Schedule Name	The name given to the schedule.

7

Service Level Agreements

This chapter includes:

Concepts

Tasks

Reference

Concepts

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: ➤ **Average Transaction Response Time** ➤ **Errors per Second**
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: ➤ **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.

To define SLAs in the Controller, see "How to Define Service Level Agreements" on page 164.

For details about defining SLAs in Analysis and viewing SLA information in Analysis reports, see the *HP LoadRunner Analysis User Guide*.

Tracking Period

When you define an SLAs 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" on page 171.

Tasks

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 162.

See also the *HP LoadRunner Analysis User Guide*.

Tip: For a use-case scenario related to this task, see "How to Define Service Level Agreements - Use-Case Scenario" on page 166.

This task includes the following steps:

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 174.

a Select a measurement for the SLA.

b If you are defining an SLA for Average Transaction Response Time, 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 page 166.

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 **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 page 163.

For user interface details, see "Advanced Options Dialog Box" on page 171.

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.

For more information, see the *HP LoadRunner Analysis User Guide*.

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.

This scenario includes the following steps:

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

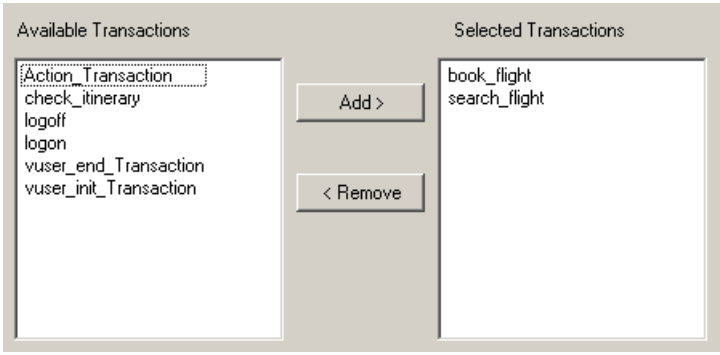
In the Service Level Agreement pane, click **New** to open the Service Level Agreement wizard.

3 Select the measurement for the SLA

On the Select a Measurement page, under **SLA status determined at time intervals over a timeline,** select **Average Transaction Response Time**.

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.

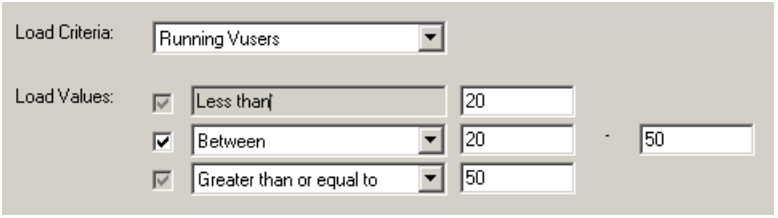
In this case, to see the effect that various quantities of Vusers running on the system has on the average transaction response time of each transaction, in the **Load Criteria** box, select **Running Vusers**.

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 163.

For user interface details, see "Advanced Options Dialog Box" on page 171.

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.

For more information, see the *HP LoadRunner Analysis User Guide*.

Reference

Service Level Agreements User Interface

This section includes (in alphabetical order):

Advanced Options Dialog Box

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

To access	**Design** tab > **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 164 ➤ "How to Define Service Level Agreements - Use-Case Scenario" on page 166
See also	"Service Level Agreements Overview" on page 162

User interface elements are described below:

UI Elements (A-Z)	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 = 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

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

To access	**Design** tab > **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 162

Service Level Agreement Pane

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

To access	**Design** tab
Relevant Tasks	➤ "How to Design a Goal-Oriented Scenario" on page 60 ➤ "How to Design a Manual Scenario" on page 62 ➤ "How to Define Service Level Agreements" on page 164 ➤ "How to Define Service Level Agreements - Use-Case Scenario" on page 166
See also	"Service Level Agreements Overview" on page 162

User interface elements are described below:

UI Elements (A-Z)	Description
	Starts the Service Level Agreement wizard where you can define new goals for the load test scenario.
	Opens the Goal Details dialog box which displays a summary of the details of the selected SLA.
	Opens the Service Level Agreement wizard where you can modify the goals defined in the SLA.
	Deletes the selected SLA.
	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 163. For user interface details, see "Advanced Options Dialog Box" on page 171.
Service Level Agreement list	Lists the SLAs defined for the scenario.

Service Level Agreement Wizard

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

To access	**Design** tab > **Service Level Agreement** pane > 
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 Design a Goal-Oriented Scenario" on page 60 ➤ "How to Design a Manual Scenario" on page 62 ➤ "How to Define Service Level Agreements" on page 164 ➤ "How to Define Service Level Agreements - Use-Case Scenario" on page 166
Wizard map - Goal measured per time interval	The Service Level Agreement Wizard contains: **Welcome** > Select a Measurement Page > (Select Transactions Page) > Set Load Criteria Page > Set Threshold Values Page (Goal Per Time Interval)
Wizard map - Goal measured over whole scenario run	The Service Level Agreement Wizard contains: **Welcome** > Select a Measurement Page > Set Threshold Values Page (Goal Per Whole Run)
See also	"Service Level Agreements Overview" on page 162

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 page 174. ➤ 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 contains: **Welcome** > **Select a Measurement Page** > (Select Transactions Page) > Set Load Criteria Page > Set Threshold Values Page (Goal Per Time Interval)
Wizard map - Goal measured over whole scenario run	The Service Level Agreement Wizard contains: **Welcome** > **Select a Measurement Page** > Set Threshold Values Page (Goal Per Whole Run)
See also	"Service Level Agreements Overview" on page 162

User interface elements are described below:

UI Elements (A-Z)	Description
SLA status determined over the whole run	Evaluates a single SLA status for the whole scenario run. Select one of the following measurements: ➤ **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 163.

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 174. ➤ This page is displayed only creating an SLA for Average Transaction Response Time. ➤ In order to define an SLA for Average Transaction Response Time, 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 contains: **Welcome** > Select a Measurement Page > (**Select Transactions Page**) > Set Load Criteria Page > Set Threshold Values Page (Goal Per Time Interval)
See also	"Service Level Agreements Overview" on page 162

User interface elements are described below:

UI Elements (A-Z)	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 174. ➤ 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 contains: **Welcome** > Select a Measurement Page > (Select Transactions Page) > **Set Load Criteria Page** > Set Threshold Values Page (Goal Per Time Interval)
See also	"Service Level Agreements Overview" on page 162

User interface elements are described below:

UI Elements (A-Z)	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 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 174. ➤ If you defined load criteria in the Set Load Criteria Page, 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.
Wizard map - Goal measured per time interval	The Service Level Agreement Wizard contains: **Welcome** > Select a Measurement Page > (Select Transactions Page) > Set Load Criteria Page > **Set Threshold Values Page (Goal Per Time Interval)**
See also	"Service Level Agreements Overview" on page 162

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

UI Elements (A-Z)	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 174.
Wizard map - Goal measured over whole scenario run	The Service Level Agreement Wizard contains: **Welcome** > Select a Measurement Page > **Set Threshold Values Page (Goal Per Whole Run)**
See also	"Service Level Agreements Overview" on page 162

User interface elements are described below:

UI Elements (A-Z)	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.

8

Multiple IP Addresses

This chapter includes:

Concepts

Tasks

Reference

Concepts

Multiple IP Addresses Overview

Application servers and network devices use IP addresses to identify clients. The application server often caches information about clients coming from the same machine. Network routers try to cache source and destination information to optimize throughput. If many users have the same IP address, both the server and the routers try to optimize. Since Vusers on the same load generator have the same IP address, server and router optimizations do not reflect real-life situations.

LoadRunner's Multiple IP Address feature enables Vusers running on a single load generator to be identified by many IP addresses. The server and router recognize the Vusers as coming from different load generators and as a result, the testing environment is more realistic.

This feature can be implemented on Windows and UNIX platforms, and applies to the following protocols:

Client/Server	DNS, Windows Sockets
Custom	Javascript Vuser, VB Vuser, VB Script Vuser
E-business	FTP, Palm, SOAP, Web (HTTP/HTML), Web Services, WinSock\Web Dual Protocol
ERP/CRM	Oracle NCA, Oracle Web Applications 11i, PeopleSoft Enterprise, SAP-Web, Siebel-Web
Legacy	RTE
Mailing Services	Internet Messaging (IMAP), POP3, SMTP
Streaming Data	Real
Wireless	i-Mode, VoiceXML, WAP

Tasks

How to Add IP Addresses to a Load Generator

The following steps describe how to add IP addresses to a load generator.

This task includes the following steps:

- "Run the IP Wizard on the load generator" on page 185
- "Update the server's routing table with the new addresses" on page 186
- "Enable the Multiple IP Addresses feature from the Controller." on page 187

1 Run the IP Wizard on the load generator

- **Windows:** LoadRunner includes an IP Wizard program that you run on Windows load generators to create multiple IP addresses. You add new IP addresses to a machine once and use the addresses for all scenarios.

  Run the IP Wizard on the load generator to add a specified number of IP addresses.

  For details, see "IP Wizard" on page 190.

  After running the wizard, restart the load generator machine.

- **UNIX:** Manually configure the new IP addresses for UNIX load generators. For details, see "How to Configuring Multiple IP Addresses on UNIX" on page 187.

2 Update the server's routing table with the new addresses

Once the client machine has new IP addresses, the server needs the addresses in its routing table, so that it can recognize the route back to the client. If the server and client share the same netmask, IP class, and network, the server's routing table does not require modification.

Note: If there is a router between the client and server machines, the server needs to recognize the path via the router. Make sure to add the following to the server routing table: route from the Web server to the router, and routes from the router to all of the IP addresses on the load generator.

Update the Web server routing table as follows:

a Edit the batch file that appears in the IP Wizard Summary screen. An example **.bat** file is shown below.

```
REM This is a bat file to add IP addresses to the routing table of a
server
REM Replace [CLIENT_IP] with the IP of this machine that the server
already recognizes
REM This script should be executed on the server machine

route ADD 192.168.1.50 MASK 255.255.255.255 [CLIENT_IP] METRIC 1
route ADD 192.168.1.51 MASK 255.255.255.255 [CLIENT_IP] METRIC 1
route ADD 192.168.1.52 MASK 255.255.255.255 [CLIENT_IP] METRIC 1
route ADD 192.168.1.53 MASK 255.255.255.255 [CLIENT_IP] METRIC 1
route ADD 192.168.1.54 MASK 255.255.255.255 [CLIENT_IP] METRIC 1
```

b For each occurrence of **[CLIENT_IP],** insert your IP address instead.

c Run the batch file on the server machine.

3 Enable the Multiple IP Addresses feature from the Controller.

Once you define multiple IP addresses, you set an option to tell the Controller to use this feature.

a In the Controller Design view, select **Scenario** > **Enable IP Spoofer**.

Note: You must select this option before connecting to a load generator.

---

b In the Controller's **Tools** > **Options** > **General** tab (Expert mode only), specify how the Controller should allocate the IP addresses: per process or per thread. For details, see "Options > General Tab" on page 226.

How to Configuring Multiple IP Addresses on UNIX

The following sections describe how to manually configure multiple IP addresses on UNIX load generators.

HP 11.0 or higher

To define multiple IP addresses for a single Ethernet card, you need IP Aliasing compiled into the kernel. To do this, use the **ifconfig** command:

```
/sbin/ifconfig lan1:0 x.x.x.x netmask 255.255.x.x up
```

Substitute the new IP address for x.x.x.x, and insert the correct information for the subnet mask. Place this command in the **rc.local** file so that it executes upon boot.

IBM AIX

To define multiple IP addresses for a single Ethernet card, you need IP Aliasing compiled into the kernel. To do this, use the **ifconfig** command:

```
/usr/sbin/ifconfig [int] [ip address] alias netmask [mask]
```

For example, if you want to add IP address 10.0.0.1 to the main interface, you need to run, as root, the following:

```
/usr/sbin/ifconfig ne0 10.0.0.1 alias netmask 255.255.255.0
```

To execute this line upon boot, create a standard script in the appropriate run level (**/etc/rc.d/rc#.d**).

Linux

To define multiple IP addresses for a single Ethernet card, you need IP Aliasing compiled into the kernel. To do this, use the **ifconfig** command:

```
/sbin/ifconfig eth0:0 x.x.x.x netmask 255.255.x.x up
```

Substitute the new IP address for x.x.x.x, and insert the correct information for subnet mask. Place this command in the **rc.local** file so that it executes upon boot.

Solaris 2.5, 2.6, 7.0, 8.0

To configure the hme0 device to support more than one IP address:

1 Create entries in **/etc/hosts** for each hostname on your physical machine:

```
128.195.10.31  myhost
128.195.10.46  myhost2
128.195.10.78  myhost3
```

Create **/etc/hostname.hme0:n** files that contain the hostname for the virtual host **n**.

Note: hostname.hme0:0 is the same as **hostname.hme0**.

```
/etc/hostname.hme0   (Contains name myhost)
/etc/hostname.hme0:1 (Contains name myhost2)
/etc/hostname.hme0:2 (Contains name myhost3)
```

The above changes will cause the virtual hosts to be configured at boot time.

2 You can also directly enable or modify logical hosts' configuration by running **ifconfig** directly on one of the logical hosts, using the **hme0:n** naming scheme:

```
% ifconfig hme0:1 up
% ifconfig hme0:1 129.153.76.72
% ifconfig hme0:1 down
```

To verify the current configuration, use **ifconfig –a**.

Reference

IP Wizard

This wizard enables you to create and save new IP addresses on Windows machines.

To access	**Start > Program Files > LoadRunner > Tools > IP Wizard**
Important information	This wizard resides on each load generator. It enables you to create and save new IP addresses on Windows machines. The new addresses can be a range of addresses defined by the Internet Assignment Numbers Authority. They are for internal use only, and cannot connect to the Internet. This range of addresses is the default used by the IP Wizard.
Relevant tasks	"How to Add IP Addresses to a Load Generator" on page 185

IP Wizard Welcome - Step 1 of 3

User interface elements are described below:

UI Elements (A-Z)	Description
Create new settings	Enables you to define new IP settings on the load generator.
Load previous settings from file	Enables you to use an existing file with IP address settings.
Restore Original Settings	Restores original settings.

IP Wizard - Step 2 of 3 - Optional

User interface elements are described below:

UI Elements (A-Z)	Description
<Web Server Address box>	If you have more than one network card, enables you to choose the card to use for IP addresses. This step enables the IP Wizard to check the server's routing table to see if it requires updating after new IP addresses are added to the load generator.

IP Wizard - Step 3 of 3 - Optional

User interface elements are described below:

UI Elements (A-Z)	Description
	Opens the Add dialog box where you can add a new IP address. ➤ **Private Address Spaces.** Classes that represents the correct submask for the machine's IP addresses. ➤ **From IP.** Adds IP addresses starting with this number. ➤ **Submask.** IP addresses include two components, a **netid** and **hostid**. The submask determines where the netid portion of the address stops and where the hostid begins. ➤ **Number to add.** The number of IP addresses to add. ➤ **Verify that new IP addresses are not already in use.** Instructs the IP Wizard to check the new addresses. The IP Wizard adds only the addresses that are not already in use.
	Removes a selected IP Address
IP Address	The IP addresses on the load generator machine.

UI Elements (A-Z)	Description
Subnet Mask	The submasks of the IP addresses on the load generator machine.
Number of IPs added	The number of IP addresses added to the load generator machine.

IP Wizard - Summary

User interface elements are described below:

UI Elements (A-Z)	Description
<Summary area>	Displays a summary of the operations performed by the IP Wizard. Take note of the location of the batch file (**.bat**). This is used to update the routing table, if necessary. See "Update the server's routing table with the new addresses" on page 186.
Reboot now to update routing tables	If you updated the routing table, rebooting initializes the Windows device drivers with the new addresses.

9

Configuring Terminal Services Settings

This chapter includes:

Concepts

Tasks

Concepts

Terminal Services Overview

You can use LoadRunner's Terminal Services Manager to remotely manage multiple load generators running in your load testing scenario on a terminal server. In addition, you can use a terminal server to overcome the limitation of being able to run only a single GUI Vuser on a Windows-based load generator. By opening a terminal server session for each GUI Vuser, you can run multiple GUI Vusers on the same application.

A terminal server client can have multiple terminal sessions running simultaneously. Using LoadRunner's Terminal Services Manager, you can select the number of terminals to be used in your scenario (provided that you have sufficient terminal sessions running), and the maximum number of Vusers that can be run per terminal. The Terminal Services Manager then evenly distributes the number of virtual users among the client sessions.

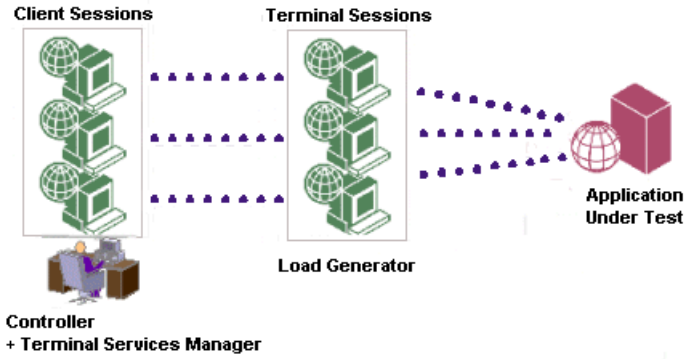
Note: This feature is not supported if the Controller and the load generators connect over a firewall. To configure terminal services on a load generator over a firewall, see "How to Configure Terminal Sessions Over a Firewall" on page 197.

About Terminal Services

Terminal services allows centralized management of computing resources for each client connected to the server, and provides each user with their own working environment. Using a terminal server client, you can operate in a server-based computing environment from a remote machine. The terminal server transmits applications over the network and displays them via terminal emulation software. Each user logs on and sees only his individual session, which is managed transparently by the server's operating system independent of any other client session.

Note: Only users with administrator privileges can connect from the Controller to a local load generator via a terminal services session.

The following diagram illustrates how the LoadRunner components work together during a terminal session.



Tasks

How to Use the Terminal Services Manager

This task describes how to set up and use LoadRunner's Terminal Services Manager.

This task includes the following steps:

1 Prerequisite

Make sure that a load generator has been installed on the terminal services machine. For more information, see the *HP LoadRunner Installation Guide*.

2 Set up the LoadRunner agent on the load generator

Perform the following steps:

a Select **Start** > **Programs** > **LoadRunner** > **Advanced Settings** > **Agent Configuration**, or run **<LR>\launch_service\bin\AgentConfig.exe** to open the Agent Configuration dialog box.

b Select **Enable Terminal Services**, and click **OK**.

c Restart the LoadRunner Agent as a process by double-clicking the shortcut on the desktop, or from **Start** > **Programs** > **LoadRunner** > **LoadRunner Agent Process**. You need to run the LoadRunner Agent as a process for each terminal session that you are running.

Note: For more information about the LoadRunner Agent, see "Working with the LoadRunner Agent" on page 524.

3 Launch a terminal client session

Be aware of the following:

- You must open a Terminal Client session for each terminal that you want to run Vusers on during the scenario.
- If you are connecting to an existing Terminal Services session, you need to open a Terminal Client session, log in to the session, and run the LoadRunner Agent as a process.

4 Distribute Vusers on the terminal server

In the Terminal Services Tab of the Load Generator Information dialog box, Select **Enable Terminal Services Manager** and enter information about the terminals and Vusers that you want to use. For more information, see "Load Generator Configuration > Terminal Services Tab" on page 116.

How to Configure Terminal Sessions Over a Firewall

This task describes how to configure a terminal sessions on a load generator that is located over a firewall. You configure the terminal sessions as independent virtual load generators. Each virtual load generator must have its own logical name.

This task includes the following steps:

- "Prerequisite" on page 198
- "Configure the terminal sessions as independent load generators" on page 198

1 Prerequisite

If the LoadRunner Agent is not running as a process, select **Start** > **Programs** > **LoadRunner** > **LoadRunner Agent Process** to run it as a process.

2 Configure the terminal sessions as independent load generators

Perform the following steps:

a Select **Start** > **Programs** > **LoadRunner** > **Advanced Settings** > **Agent Configuration** to open the Agent Configuration dialog box.

b Select **Enable Firewall Agent** and **Enable Terminal Services**.

c Click **Settings** to open the Agent Configuration Over Firewall Settings dialog box.

d In the Local Machine Key field, enter a logical virtual load generator name, for example, machine_ofw.

e Click **OK**.

f Create one or more terminal sessions on the load generator console machine.

Keep in mind the following:

- For each terminal session, run the agent configuration as above. For each session, specify a different Local Machine Key name, for example, machine_ofw_1, machine _ofw_2, etc.
- If you stop the agent on a terminal session, you must reconfigure the settings for that particular session before restarting the agent.
- When selecting the load generator for the scenario in the Controller, select the local machine key for each individual virtual load generator used.

10

Configuring WAN Emulation Settings

This chapter includes:

Concepts

Tasks

Reference

Concepts

WAN Emulation Overview

HP LoadRunner is integrated with 3rd party software that enables you to accurately test point-to-point performance of WAN-deployed products under real-world network conditions. By installing this WAN emulation software on your load generator, you can introduce highly probable WAN effects such as latency, packet loss, and link settings. As a result of this, your scenario performs the test in a more realistic environment that better represents the actual deployment of your application.

You can create more meaningful results by configuring several load generators with the same unique set of WAN effects, and by giving each set a unique location name, for example, London. When viewing scenario results in Analysis, you can group metrics from different load generators according to their location names. For information on grouping metrics according to an emulated location name, see the section that deals with applying filter and sort criteria to graphs in the *HP LoadRunner Analysis User Guide*.

Typical Network Emulation Settings

The WAN Emulator allows you to emulate probable WAN effects over your network, thereby creating a more realistic scenario. The most typical effects which you can configure are:

Latency

The **Latency** value you define represents the time, in milliseconds, that it takes an IP packet to cross the WAN. This is usually affected by geographical distance, the available bandwidth, the network load on the route between the two ends, and whether this is a terrestrial link or not.

Packet Loss

The **Packet Loss** value you define represents the chance of losing IP packets while data travels through a WAN. Packets can get lost due to link faults or due to extreme network load.

Bandwidth

The **Bandwidth** value you define represents your network's capacity to transfer data over the WAN.

Emulated Locations Overview

To receive more meaningful results, you can configure your WAN Emulation to emulate conditions unique to specific geographic locations. For example, London and New York.

To view the results for location individually in Analysis, you can group the results of the scenario by the emulated location name. In other words, for any graph in Analysis, all the results of the 'New York based' load generators can be grouped together, as can all the results of the 'London based' load generators, and so on.

Note: In cases where you have to configure more than one load generator per location, make sure that each load generator designated for a specific location is configured with the same settings.

For information on grouping Analysis graph data by emulated location name, see the section that deals with applying filter and sort criteria to graphs in the *HP Analysis User Guide*.

Viewing WAN Emulation Monitors

The WAN Emulation starts and stops automatically as you start and stop the scenario. WAN Emulation monitors are assigned automatically when the scenario run starts and WAN metrics are automatically collected during the scenario run. You can view the WAN metrics during the scenario run in the Windows Resources monitor.

If a load generator is connected over a firewall, you must add the monitors manually using the Monitor Over Firewall component. For more information, see "Monitors Over a Firewall" on page 353

Excluding Machines from WAN Emulation

In some situations, you may need to exclude certain machines from the WAN Emulation, for example, a software update server. This means that you set the WAN Emulator to refrain from affecting traffic from a load generator to the specified machines. When a machine is excluded from the WAN Emulation, network traffic to that machine does not suffer any WAN effects and will not be included in the WAN Emulation results.

During a scenario run, machines, that if emulated, may affect the results of the actual scenario (for example, the Controller) must be excluded. Accordingly, the following machines are excluded by default:

- The Controller or the MI Listener and proxy server.
- The Diagnostics Commander server.

In addition to the machines which are excluded by default, the integrated 3rd party software may provide an interface for excluding additional machines from the WAN Emulation. For a list of some examples of when you may want to exclude additional machines, see "Additional Reasons to Exclude Machines" below.

Note: The option to exclude machines from the WAN Emulation might not be available. To check for the availability of this option, consult the relevant 3rd party software documentation.

Additional Reasons to Exclude Machines

Examples of situations where you should exclude machines from an emulated WAN include:

- In a Multiprotocol scenario that includes a Web server and a database server; where information from the database server is not required as a part of the load test. In such a case, you would exclude the database server.
- You may want to exclude all deployment and software upgrade servers.
- Where a user runs and stores scripts on a shared network drive.

Tasks

How to Integrate WAN Emulation Into Your Scenario

This task describes how to run a scenario using WAN Emulation and view the WAN metrics in Analysis.

This task includes the following steps:

1 Prerequisite

Make sure that the relevant 3rd party components are installed on the load generator machines.

Note that in addition to the load generators, you may be required to install the WAN Emulator on additional LoadRunner components. For more information, see the relevant WAN emulation software installation documentation.

2 Determine emulated locations and define the WAN Emulation settings for each load generator

---

Note: For concept details about emulated locations, see "Emulated Locations Overview" on page 201.

On the main Controller toolbar, click the **Load Generator** button to open the Load Generator Information dialog box. Select the desired load generator, then click **Details**.

On the WAN Emulation tab:

- In the **Emulated Location** box, determine which locations you would like to emulate in your scenario.
- Click **WAN Emulation Settings** to open the third party software WAN Emulation setting dialog box. For detailed information on configuring WAN Emulation using this dialog box, see the relevant third party software documentation. If several load generators are being configured to emulate a specific location, make sure that each load generator is configured with the same settings.

For user interface details, see "Load Generator Configuration > WAN Emulation Tab" on page 123.

3 View WAN metrics in HP LoadRunner Analysis

The WAN Emulation starts and stops automatically as you start and stop the scenario. WAN metrics are automatically collected during the scenario run.

You can view all the WAN metrics in the Windows Resources monitor, as well as in Analysis using all of the available analysis tools, including the option to group metrics by emulated location, and to correlate data such as response time with WAN metrics. For more information, see the *HP LoadRunner Analysis User Guide*.

Reference

WAN Emulation Best Practices

We recommend the following when running a scenario with WAN Emulation:

- Once the scenario has started, check that WAN Emulation is running in one of the following ways:
  - Check for a confirmation message in the notification messages of the Output window. The message should contain the following text:

    ```
    WAN Emulation started on host <host name> with the following configuration <config>
    ```

  - Ping the load generator from your machine and check that the latency and packet loss behavior is as defined. Your machine must not be excluded from WAN Emulation to do this.
- If you kill the **LR_Bridge.exe** or **magentproc.exe** processes on a load generator to stop a load test, manually stop the WAN Emulation as well.

Limitations

- Selecting either **Use bandwidth**, or **Use custom bandwidth** in the **Network: Speed Simulation** node in the Run Time Settings, may interfere with the WAN Emulation settings and could lead to unexpected behavior. For more information on Run Time Settings, refer to the *HP Virtual User Generator User Guide*.
- There is no backward compatibility between the current LoadRunner/ WAN Emulation integration and any previous integrations.
- The integrated WAN emulation software may not comply with accepted Internationalization (I18N) conventions.
- The WAN emulation software may consume large amounts of memory, since the technology delays traffic and captures traffic for later analysis. To verify that the load generator machine has sufficient memory, compare the load generator memory consumption with and without the emulation.
- WAN emulation software integration may not be available on the Unix platform.

Part III

Running Load Test Scenarios

11

Configuring Scenario Options

This chapter includes:

Concepts

Tasks

Reference

Concepts

Configuring Scenario Options Overview

Before you run a scenario, you can configure both the load generator and Vuser behavior for the scenario. Although the default settings correspond to most environments, LoadRunner allows you to modify the settings to customize the scenario behavior. The settings apply to all future scenario runs and generally need to be set only once.

You configure these settings from the **Tools** > **Options** dialog box. Settings related to load generator behavior apply to all the load generators in a scenario.

Note: You can configure settings for an individual load generator that override the global settings for that particular load generator. For details, see "How to Modify Load Generator Details" on page 106.

Global scenario configuration settings are unrelated to the Vuser run-time settings. Run-time settings apply to individual Vusers or scripts and contain information about logging, think time, and the network, the number of iterations, and the browser. For information on setting run-time settings, see the *HP Virtual User Generator User Guide*.

Expert Mode

Expert mode is intended to provide support personnel with access to system information. When you work in the Expert mode, the Controller dialog boxes contain additional options for fine tuning the Controller operation.

To activate the Expert mode, select **Tools** > **Expert Mode.**

To deactivate Expert mode, select **Tools** and clear the **Expert Mode** option.

Run-Time File Storage Locations

When you run a scenario, by default the run-time files are stored **locally on each load generator** (the machine running the Vuser script). The default location of the files is in the temporary directory specified by the load generator's environment variables (on Windows, **TEMP** or **TMP**, and on UNIX, **$TMPDIR** or **$TMP**). If no environment variable is defined, the files are saved to the **/tmp** directory.

Alternatively, you can store the run-time files on **a shared network**. A shared network drive is a drive to which the Controller and all the load generators in the scenario have read and write permission. If you select to save run-time files on a shared network drive, you may need to perform path translation. Path translation ensures that the specified results directory is recognized by the remote load generator. For details about path translation see "Path Translation" on page 214.

You select where to store run-time files in the **Tools > Options > Run-Time File Storage** tab. For details, see "Options > Run-Time File Storage Tab" on page 231.

The primary run-time files are as follows:

Run-Time File Type	Description
Vuser Script files	When you run a Vuser, the Controller sends a copy of the associated Vuser script to the load generator. The script is stored in the load generator's temporary run-time directory. If you specify that all Vusers access their Vuser scripts directly at some shared location, no transfer of script files occurs at run time. This method often necessitates path translation. For details, see "Path Translation" on page 214. This method may be useful in either of the following situations: ➤ The file transfer facility does not work. ➤ The Vuser script files are large and therefore take a long time to transfer. Remember that Vuser script files are transferred only once during a scenario.
Result files	While you run a scenario, the participating Vusers write their results to the temporary run-time file directory. After scenario execution, these result files are collated or consolidated—results from all of the load generators are transferred to the results directory. After collating the results, the temporary run-time directory is deleted. For user interface details, see "Options > Run-Time File Storage Tab" on page 231.

Path Translation

Path translation might be required when storing scripts and run-time data results from a scenario on a shared network drive (**Tools** > **Options** > **Run-Time File Storage** tab).

Path translation is a mechanism used by LoadRunner to convert a remote path name for the Controller so that all participating machines recognize the same network drive.

Example 1

The scenario runs on a Windows-based machine and includes multiple Vusers running on both Windows-based and UNIX load generators. One remote load generator may map the network drive as F, while another load generator maps the same drive as H. In a complex situation such as this, you need to ensure that all participating load generators recognize the same network drive.

Example 2

The Scenario Groups/Scripts pane in the Design view contains a list of all the Vuser scripts associated with a scenario, and their locations. A script's location (path) is always based on the Controller machine's mapping of that location. If a load generator maps to the script's path using a different name, path translation is required.

For example, assume that the scenario is running on a Windows-based machine named **pc2**, and that a Vuser script is located on a network drive. The Controller machine maps the network drive as **m:\lr_tests**. If the remote load generator hosting the Vusers also maps the path as **m:\lr_tests**, no translation is necessary. However, if the remote machine maps the path as another drive or path, for example **r:\lr_tests**, you must translate the path to enable the load generator to recognize the script location.

Note: If the Controller and load generator machines are all Windows machines, consider using the **Universal Naming Convention** method instead of manually adding path translation information. On Windows machines, you can tell the Controller to convert all paths to UNC, in which case all the machines are able to recognize the path without requiring path translation. An example of UNC format is \\machine_a\results.

Tasks

How to Configure Scenario Options

The following sections describe how to configure options that will be relevant for all your scenarios. You configure these options in the Options dialog box (**Tools** > **Options**).

This task includes the following steps:

Configure timeout options

Select **Tools** > **Options** > **Timeout** tab and specify timeout values for commands related to the load generator. For user interface details, see "Options > Timeout Tab" on page 235.

If the command is not executed successfully within the timeout period, the load generator status changes to **Error**.

Configure Vuser run-time settings

Select **Tools** > **Options** > **Run-Time Settings** tab. You can specify:

- The Vuser quota for a scenario
- How to stop running Vusers

➤ Whether to use a seed number for random sequencing

For user interface details, see "Options > Run-Time Settings Tab" on page 232.

Configure general scenario options for Expert mode

Select **Tools** > **Options** > **General** tab to specify the following general scenario settings that apply when in Expert mode:

➤ Specify the directory for data table storage

➤ Disable collation of log files after a scenario run. For details, see "How to Collate Scenario Run Results" on page 324.

➤ Enable multiple IP address allocation. For details, see "Multiple IP Addresses" on page 183.

For user interface details, see "Options > General Tab" on page 226.

Configure the default schedule run mode

Select **Tools** > **Options** > **Execution** tab. Under **Default Scheduler** select a default run mode. For user interface details, see "Options > Execution Tab" on page 225.

For details about schedule run modes, see "Schedule Run Modes" on page 130.

Define a command to run after scenario results are collated

Select **Tools** > **Options** > **Execution** tab. Under **Post Collate Command**, enter a command to run after collating scenario results. For user interface details, see "Options > Execution Tab" on page 225.

For more details about collating run results, see "How to Collate Scenario Run Results" on page 324.

Configure global run-time file storage options

Select **Tools** > **Options** > **Run-Time File Storage** tab, and specify where LoadRunner should save and store scenario run-time files collected on remote load generators:

➤ On the load generator

➤ On a shared network drive

For user interface details, see "Options > Run-Time File Storage Tab" on page 231.

Note:

➤ LoadRunner applies these settings to all the load generators participating in a scenario. You can change the settings for individual load generators as described in "How to Modify Load Generator Details" on page 106.

➤ Storing the files on a shared network drive is not recommended as it increases network traffic and necessitates path translation. For details about path translation, see "Path Translation" on page 214.

Configure monitoring options

Select **Tools** > **Options** > **Monitors** tab, and configure the online monitoring settings. For user interface details, see "Options > Monitors Tab" on page 227.

Configure debug information options (Expert mode only)

Select **Tools** > **Options** > **Debug Information** tab, and determine the extent of the trace to be performed during a scenario run. For user interface details, see "Options > Debug Information Tab" on page 223.

Configure output display options (Expert mode only)

Select **Tools** > **Options** > **Output** tab, and configure how to display running Vusers on the Controller machine. For user interface details, see "Options > Output Tab" on page 229.

Reference

Path Translation Table

To translate a path from one Windows-based computer to another, or between Windows-based and UNIX machines, you create an entry in the **Path Translation table**. This table contains a list of paths translated into formats that can be recognized by different machines.

Each line of the Path Translation table has the following format:

```
<controller_host> <controller_path> <remote_path> [<remote_host>]
```

where:

- **controller_host** is the name or type of the machine that is running the Controller.

  The value of **controller_host** can be:

  - **<hostname>.** The name of the machine running the Controller, for example, LOADPC1
  - **win.** The Controller is running on a Windows-based computer
  - **unix.** The Controller is running on a UNIX machine
  - **all.** The Controller is running on a Windows-based or a UNIX machine

- **controller_path** is the path of a specific directory—as recognized by the Controller. For example, if the directory **scripts** is located on the network drive **r**—as mapped by the Controller—type the path r:\scripts in the **controller_path** field.
- **remote_path** is the path of a specific directory—as recognized by the remote machine. For example, if the directory **scripts** is located on the network drive **n**—as mapped by the remote load generator—type the path n:\scripts in the **remote_path** field.

If a Vuser on the remote UNIX load generator recognizes the above path as /m/tests, you would type this path in the **remote_path** field.

- **remote_host** is the name or type of the remote load generator. For example, if all the remote machines are UNIX workstations, you could type unix in the **remote_host** field. The options for the **remote_host** field are the same as the options for the **controller_host** field, listed above. The **remote_host** parameter is optional.

Examples

The examples below show the use of the Path Translation table for a Windows-based Controller called Merlin.

- **Example 1:** Vusers are running on a Windows 2003 machine, Oasis. Merlin maps the network drive as f:, while Oasis maps it as g:\loadtest.

```
merlin          f:\             g:\loadtest\        Oasis
```

- **Example 2:** Vusers are running on a UNIX machine, Ultra. Ultra maps the networks drive as /u/tests/load.

```
merlin          f:\             /u/tests/load/      Ultra
```

- **Example 3:** The mapping of the network drive by the remote load generator Jaguar, is identical to the Controller's mapping, so no translation is required. This line can be excluded from the Path Translation table.

```
merlin          n:\             n:\                 Jaguar
```

- **Example 4:** All Windows-based Vuser load generators map the network drive as m:\loadtest.

```
merlin          I:\mnt\                 m:\loadtest\    win
```

Configuring Scenario Options User Interface

This section includes (in alphabetical order):

Options Dialog Box

This dialog box enables you to configure scenario options.

To access	**Tools > Options**
Important information	The settings configured in this dialog box: ➤ Generally need to be set only once ➤ Apply to all future scenarios ➤ Apply globally to all the load generators in a scenario. **Note:** You can change the settings for individual load generators (see "How to Modify Load Generator Details" on page 106). Individual load generator settings override global scenario settings.
Relevant tasks	"How to Configure Scenario Options" on page 216

User interface elements are described below:

UI Elements (A-Z)	Description
Debug Information tab (Expert mode only)	Enables you to determine the extent of the trace to be performed during a scenario run. For details, see "Options > Debug Information Tab" on page 223.
Execution tab	Enables you to configure the following miscellaneous scenario settings: ➤ The default schedule run mode for a new scenario ➤ The command to run after collating scenario results For details, see "Options > Execution Tab" on page 225.
General tab (Expert mode only)	Enables you to specify global settings for data table storage, log file collation, and multiple IP address allocation. For details, see "Options > General Tab" on page 226.
Monitors tab	Enables you to configure the online monitoring settings. For details, see "Options > Monitors Tab" on page 227.
Output tab (Expert mode only)	Enables you to configure how running Vusers are displayed on the Controller machine. For details, see "Options > Output Tab" on page 229.
Path Translation Table tab	Enables you to perform path translation when storing result and script files stored on a shared network drive. For details, see "Options > Path Translation Tab" on page 230.
Run-Time File Storage tab	Enables you to specify where LoadRunner should save and store the run-time files. **Default value:** On the current Vuser machine For details, see "Options > Run-Time File Storage Tab" on page 231

UI Elements (A-Z)	Description
Run-Time Settings tab	Enables you to specify scenario run-time settings. For details, see "Options > Run-Time Settings Tab" on page 232.
Timeout tab	Enables you to specify timeout values for certain commands related to the load generator. For details, see "Options > Timeout Tab" on page 235.

Options > Debug Information Tab

This tab enables you to configure the settings to determine the extent of the trace to be performed during a scenario run.

To access	**Tools** > **Options** > **Debug Information** tab
Important Information	➤ This tab is available only when the Controller is operating in the Expert mode. ➤ The debug information is written to the Output window.
Relevant tasks	"How to Configure Scenario Options" on page 216
See also	"Output Window" on page 271

User interface elements are described below:

UI Elements (A-Z)	Description
Defaults	Sets the default debug information settings.
Keep temporary files	The LoadRunner Agent and Controller create temporary files that collect information such as the parameter file sent to the Vuser, the output compilation file, and the configuration file. The Agent files are saved in **brr** folders in the **TMP** or **TEMP** directory of the Agent machine. The Controller files are saved in **lrr** folders in the **TMP** or **TEMP** directory of the Controller machine. At the end of the scenario, all these files are automatically deleted. When selected, this option instructs the Agent and Controller not to delete these files so that you can use them for debugging.
Trace Flags	For debugging purposes, you can configure the type of trace performed by LoadRunner during the scenario run. Select the appropriate options to enable the detailed trace. The available trace flags are: ➤ **General** ➤ **File Transfer** ➤ **Incoming Communication** ➤ **Outgoing Communication** The trace information appears in the log file located in the specified Agent log directory. **Note:** Select only the flags relating to your problem. For example, if you encounter specific problems with the transfer of files, select the **File Transfer** flag.

Options > Execution Tab

This tab enables you to configure miscellaneous scenario execution settings.

To access	**Tools** > **Options** > **Execution** tab
Relevant tasks	"How to Configure Scenario Options" on page 216
See also	➤ "Schedule Run Modes" on page 130

User interface elements are described below:

UI Elements (A-Z)	Description
Default Scheduler	Enables you to set the default schedule run mode for new scenarios. ➤ **Real-world schedule.** Runs the scenario according to a real-world set of events ➤ **Basic schedule.** Runs a basic schedule, starting the Vuser, running the for a given amount of time, and stopping them. For more details, see "Schedule Run Modes" on page 130).
Post Collate Command	Enables you to define a command that the Controller will run directly after it collates the results of a scenario run. **Example:** You can define a command to run a customer application that runs the Analysis API to extract data. **Note:** In the command, you can use the keyword, **%ResultDir%**, to refer to the scenario's results directory. (This keyword is not case sensitive.)

Options > General Tab

This tab enables you to specify global settings for data table storage, log file collation, and multiple IP address allocation.

To access	**Tools** > **Options** > **General** tab
Important Information	This tab is available only when the Controller is operating in Expert mode.
Relevant tasks	➤ "How to Configure Scenario Options" on page 216 ➤ "How to Add IP Addresses to a Load Generator" on page 185

User interface elements are described below:

UI Elements (A-Z)	Description
Data tables global directory	The network location for data tables used as a source for parameter values. **Note:** This setting is only required for scripts created with earlier versions of LoadRunner.
Do not collate log files	LoadRunner collates only result files, and not log files.
Multiple IP address mode	Allocates IP addresses when the multiple IP address option is enabled (**Scenario** > **Enable IP Spoofer**). The Controller can allocate an IP address per process or per thread. Allocation per thread results in a more varied range of IP addresses in a scenario. **Note:** If the IP Spoofer is not enabled, this option is not available.

Options > Monitors Tab

In this tab you can enable the Transaction monitor, configure the behavior of the transaction data, and set the data sampling rate, error handling, debugging, and frequency settings for the online monitors.

To access	**Tools** > **Options** > **Monitors** tab
Relevant tasks	"How to Configure Scenario Options" on page 216
See also	"How to Set Up the Monitoring Environment – Workflow" on page 443

User interface elements are described below:

UI Elements (A-Z)	Description
Defaults	Sets the default timeout values.
Debug	If **Display debug messages** is selected, debug-related messages are sent to the Output window. For the Network monitor the messages are sent according to the specified debug level (1 - 9).
Error Handling	Controls the way in which LoadRunner issues error messages: ➤ **Send errors to the Output window.** ➤ **Pop-up an error message box.**
Send (Expert mode only)	➤ **Summary.** Sends a summary of the collected data back to the Controller. Use this option if the speed at which the data is transferred is significant to you. ➤ **Raw Data.** Sends all of the data in raw form back to the Controller. Sending the data in raw form saves time because the data does not need to be processed. However, since all of the data is being transferred to the Controller, it may cause more network traffic.

UI Elements (A-Z)	Description
Transaction Data	Configures the behavior of data for the Transaction, Data Point, and Web Resource online graphs. ➤ **Enable Transaction Monitor.** Enables the online Vuser Transaction monitor to start monitoring transactions at the start of a scenario. ➤ **Frequency.** The frequency, in seconds, at which the online monitor samples the data to produce the Transaction, Data Point, and Web Resource online graphs. For a small scenario, use a lower frequency, for example, **1**. For a large scenario, use a higher frequency, for example, **3 - 5**. The higher the frequency, the less network traffic there will be. The data is averaged for the frequency period defined, and only one value is sent to the Controller. **Default value:** 5 seconds For information on enabling and disabling the Transaction monitor and Web Page Diagnostics, see "Run-Time and Transaction Monitoring" on page 471. **Note:** ➤ Disabling this option conserves resources. ➤ You cannot modify these settings during scenario execution; you must stop the scenario before disabling the monitor or changing its frequency.

UI Elements (A-Z)	Description
Server Resource Monitors	Configures the behavior of the Server Resource monitors. ➤ **Data Sampling Rate.** The sampling rate is the period of time (in seconds) between consecutive samples. Enter the rate at which LoadRunner samples the scenario for monitoring data. If you increase the sampling rate, the data is monitored less frequently. This setting applies to all graphs. **Default value:** 3 seconds **Note:** ➤ This data sampling rate is applied to all server monitors that are subsequently activated. It is not applied to server monitors that have already been activated. To apply the new data sampling rate to activated server monitors, save your scenario and reopen it. ➤ Each monitor has a different minimum sampling rate. If the default sampling rate or the rate set here is less than a monitor's minimum sampling rate, the monitor will sample data at intervals of its minimum sampling rate. For example, the minimum sampling rate for the Oracle Monitor is 10 seconds. If the sampling rate is set here at less than 10 seconds, the Oracle Monitor will continue to monitor data at 10 second intervals.

 Options > Output Tab

This tab enables you to configure how to display running Vusers on the Controller machine.

To access	**Tools** > **Options** > **Output** tab
Important information	This tab is available only when the Controller is operating in Expert mode.

Relevant tasks	"How to Configure Scenario Options" on page 216
See also	"Output Window" on page 271

User interface elements are described below:

UI Elements (A-Z)	Description
Defaults	Sets the default output options.
Configuration of the "Show Vuser" operation	Specifies how to handle the Vuser logs: ➤ **Max. simultaneously displayed.** The maximum number of Vuser logs that may be displayed simultaneously, as well as the maximum number of active UNIX, GUI, RTE, or Web Vusers that the Controller should display by opening up Run-Time Viewers on your machine. **Default value:** 10 ➤ **Refresh timeout (milliseconds).** How often the Vuser log should be refreshed. **Default value:** Every 1000 milliseconds
Delete Output window messages upon Reset	When selected, clears all messages in the Output window when you reset a scenario.

Options > Path Translation Tab

This tab enables you to perform path translation when storing result and script files on a shared network drive.

To access	**Tools** > **Options** > **Path Translation** tab
Relevant tasks	"How to Configure Scenario Options" on page 216
See also	➤ "Run-Time File Storage Locations" on page 213 ➤ "Path Translation" on page 214

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

UI Elements (A-Z)	Description
<Path Translation table>	Displays a list of paths translated into formats that can be recognized by different machines. You can insert comments by typing the # symbol at the start of a line in the table. For details, see "Path Translation Table" on page 219.
Convert to UNC	When selected, LoadRunner ignores the path translation table and converts all paths to the Universal Naming Convention. **Note:** This option can be used only when the Controller and load generator machines are all Windows-based machines.
Mode	The read/write permissions for the **ppath.mnt** file which contains the path translation table.
Path	The path to the **ppath.mnt** file which contains the path translation table.

Options > Run-Time File Storage Tab

This tab enables you to specify where LoadRunner should save run-time files.

To access	**Tools > Options > Run-Time File Storage** tab
Important information	The run-time file storage options described below apply to all the load generators in a scenario. To change the settings for an individual load generators see "Load Generator Configuration > Run-Time File Storage Tab" on page 112.
Relevant tasks	➤ "How to Configure Scenario Options" on page 216 ➤ "How to Prepare a Scenario to Run" on page 238
See also	"Run-Time File Storage Locations" on page 213

User interface elements are described below:

UI Elements (A-Z)	Description
Scripts and results stored	Select one of the following options: ➤ **On the current Vuser machine.** Saves the run-time files on the load generator that is running the Vuser script. **Note:** If you select this option, you must collate the results before you can perform any analysis. You can wait for LoadRunner to collate the results when you launch HP LoadRunner Analysis, or you can collate results by choosing **Results** > **Collate Results**. Alternatively, select **Results** > **Auto Collate Results** to automatically collate the results at the end of each scenario run. ➤ **On a shared network drive.** Saves the scenario results and/or the Vuser scripts on a shared network drive. A shared network drive is a drive to which the Controller and all the load generators in the scenario have read and write permission. **Note:** If you select this option, you may need to perform path translation. Path translation ensures that the specified results directory is recognized by the remote load generator. For information about path translation, see "Path Translation" on page 214.

Options > Run-Time Settings Tab

This tab enables you to specify scenario run-time settings relating to Vuser quotas, stopping Vusers, and the seed for random sequences.

To access	**Tools** > **Options** > **Run-Time Settings** tab
Relevant tasks	➤ "How to Configure Scenario Options" on page 216 ➤ "How to Prepare a Scenario to Run" on page 238

User interface elements are described below:

UI Elements (A-Z)	Description
Defaults	Sets the default run-time setting values.
Use random sequence with seed	Allows LoadRunner to use a seed number for random sequencing. Each seed value represents one sequence of random values used for test execution. Whenever you use this seed value, the same sequence of values is assigned to the Vusers in the scenario. This setting applies to parameterized Vuser scripts using the **Random** method for assigning values from a data file. It also affects the random percentage of recorded think time (see information on the Run-Time Settings dialog box in the *HP Virtual User Generator User Guide*). Enable this option if you discover a problem when running the test and want to repeat the test using the same sequence of random values. **Default:** 0

UI Elements (A-Z)	Description
Vuser Quota	To prevent your system from overloading, you can set quotas for Vuser activity. The Vuser quotas apply to Vusers on all load generators. ➤ **Number of Vusers that may be initialized at one time - all load generators.** The maximum number of Vusers the load generator can initialize at a time (when an Initialize command is sent). **Default:** 999
When stopping Vusers	Controls how Vusers stop running when the **Stop** button is clicked. ➤ **Wait for the current iteration to end before stopping.** (Default) The Vuser completes the iteration it is running before stopping. The Vusers move to the **Gradual Exiting** status and exit the scenario gradually. ➤ **Wait for the current action to end before stopping.** The Vuser completes the action it is running before stopping. The Vusers move to the **Gradual Exiting** status and exit the scenario gradually. ➤ **Stop immediately.** The Vusers stop running immediately. The Vusers move to the **Exiting** status and exit the scenario immediately.

Options > Timeout Tab

This tab enables you to specify timeout values for certain commands related to the load generator.

To access	**Tools** > **Options** > **Timeout** tab
Important information	LoadRunner enables you to set the timeout interval for commands and Vuser elapsed time. The command timeouts are the maximum time limits for various LoadRunner commands. When a command is issued by the Controller, you set a maximum time for the load generator or Vuser to execute the command. If it does not complete the command within the timeout interval, the Controller issues an error message **Note:** LoadRunner recognizes the fact that the number of active Vusers influences the timeout values. For example, 1000 Vusers trying to initialize will take much longer than 10 Vusers. LoadRunner adds an internal value, based on the number of active Vusers, to the specified timeout value.
Relevant tasks	"How to Configure Scenario Options" on page 216

User interface elements are described below:

UI Elements (A-Z)	**Description**
Defaults	Sets the default timeout values.
Command Timeout (seconds)	If **Enable timeout checks** is selected, this area defines how LoadRunner should monitor the status of load generators and Vusers after a command is issued by the Controller. If the load generator or Vuser does not complete the command within the timeout interval you specified, the Controller issues an error message. If **Enable timeout checks** is not selected, LoadRunner waits an unlimited time for the load generators to connect and disconnect, and for the Initialize, Run, Pause, and Stop commands to be executed.

UI Elements (A-Z)	Description
Command Timeout: Load Generator	➤ **Connect.** The time limit that LoadRunner waits to connect to any load generator. If a connection is not successful within this time, the status of the load generator changes to **Failed**. **Default value:** 120 seconds. ➤ **Disconnect.** The time limit that LoadRunner waits to disconnect from any load generator. If a disconnection is not successful within this time, the status of the load generator changes to **Failed**. **Default value:** 120 seconds.
Command Timeout: Vuser	➤ **Init.** The timeout value for the Initialize command. **Default value:** 180 seconds. ➤ **Run.** The timeout value for the Run command. **Default value:** 120 seconds. ➤ **Pause.** The timeout value for the Pause command. **Default value:** 120 seconds. ➤ **Stop.** The timeout value for the Stop command. **Default value:** 120 seconds.
Update Vuser elapsed time every	The frequency at which LoadRunner updates the value displayed in the **Elapsed Time** column in the Vusers dialog box. **Default value:** 4 seconds. **Example:** If you select a Vuser and click the **Initialize** button, LoadRunner checks whether the Vuser reaches the **READY** state within 180 seconds (the default **Init** timeout period); if it does not, the Controller issues a message indicating that the **Init** command timed out.

12

Before Running Your Scenario

This chapter includes:

Tasks

Reference

Tasks

How to Prepare a Scenario to Run

This task describes steps to take before you start running your scenario.

For details on designing the scenario, see "Designing Scenarios" on page 53.

This task includes the following steps:

Specify result file name and location

Select **Results** > **Results Settings**.

1 Enter a descriptive name for the result file.

This is especially useful for cross results analysis, in which LoadRunner superimposes the results of several scenario runs in a single graph and lets you compare the results of multiple scenario runs. Giving each run a descriptive name enables you to distinguish between the results of the multiple runs displayed later in the analysis graph.

2 Enter the full path to the directory where the result file will be stored. This depends on the run-time file storage options configured.

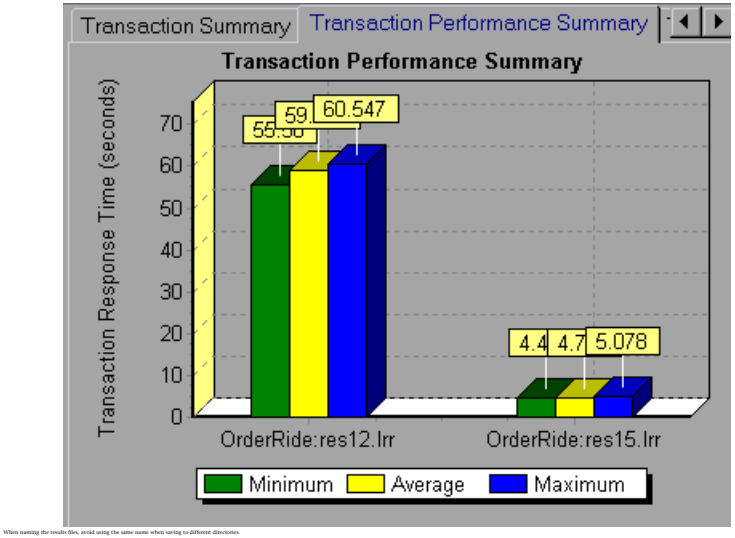
For details on setting **global** run-time file storage options, see "Options > Run-Time File Storage Tab" on page 231. To set run-time file storage options for an **individual** load generator, see "Load Generator Configuration > Run-Time File Storage Tab" on page 112.

- ➤ If you are using the default file storage setting (local machine), specify a directory in which to store all of the collated results after the scenario run.
- ➤ If you specified a shared network drive as the file storage method, specify the directory to which Vuser groups should write during scenario execution.

3 Select the appropriate options for subsequent scenario runs.

Note:

➤ When comparing the results of scenario runs in Analysis, the graph displays all the result sets by name. For example, the image below displays the superimposed results sets of two scenario runs, **res12**, and **res15**.



When naming the results files, avoid using the same name when saving to different directories.

➤ You can use HP's Web-based test management program, HP Application Lifecycle Management, to store results to a project. For information, see "Managing Scenarios Using Application Lifecycle Management" on page 337.

Specify Scenario Run-Time Settings

You can instruct LoadRunner to allow an individual Vuser or the Vusers in a group to complete the iterations they are running before stopping, to complete the actions they are running before stopping, or to stop running immediately. For details, see "Options > Run-Time Settings Tab" on page 232.

Set up the monitoring environment - optional

LoadRunner enables you to view data generated during the scenario run using the online monitors. Before the run, specify the server machines that the Controller should monitor during the scenario run.

For details, see "How to Set Up the Monitoring Environment – Workflow" on page 443.

Delete diagnostics log files from servers

- **Siebel Diagnostics:** Delete Siebel Diagnostics logs (*.sarm files) from all servers involved in the load test.
- **Siebel DB Diagnostics:** Delete log files from all servers involved in the load test.
- **Oracle 11i Diagnostics:** Delete trace log files from all servers involved in the load test.

Enable Automatic Result Collation - optional

If you are using the default file storage setting—local machine— (see "Specify result file name and location" above), prior to running the scenario you can enable auto-collation. As soon as the scenario run is complete, LoadRunner automatically collates the results from all the load generators and diagnostics mediators/servers.

Note: Alternatively, you can collate the results manually after the scenario run is complete. For details, see "How to Collate Scenario Run Results" on page 324.

To enable automatic collation, select **Results** > **Auto Collate Results**. When this feature is enabled, **Auto Collate Results** is displayed in the status bar.

If you are working in Expert mode, you can disable the collation of the log files. Select **Tools** > **Options** > **General tab** > **Do not collate log files.**

To set a post-collation command, select **Tools** > **Options** > **Execution** tab, and enter the command in the **Post Collate Command** box. For details, see "Options > Execution Tab" on page 225.

Enable Auto Load Analysis- optional

To invoke HP LoadRunner Analysis as soon as the scenario is finished running, select **Results** > **Auto Load Analysis**. When this is enabled, **Auto Load Analysis** is displayed in the status bar.

Schedule scenario - Optional

Define a schedule for the scenario. For details, see "How to Define a Schedule for the Scenario - Workflow" on page 132.

Provide scenario summary information - optional

Select **Scenario** > **Summary Information**, and enter the scenario's summary information.

For details, see "How to Define a Schedule for the Scenario - Workflow" on page 132.

Set up the scenario to run GUI Vusers - optional

If you have integrated a QuickTest script into the scenario:

- Ensure that QuickTest is closed before running the scenario.
- In the Run-Time Settings for script dialog box, only the **General** categories and sub-categories (**General**, **Iterations**, **Miscellaneous**, **Think Time**) are relevant for QuickTest and WinRunner tests. The **Replay** options are not relevant.

Note: You can run only one GUI Vuser concurrently per machine.

Reference

Scenario Pre-Run Configuration User Interface

This section includes (in alphabetical order):

Set Results Directory Dialog Box

This dialog box enables you to set the location in which the Controller saves scenario run results.

To access	Results > Results Settings
Important information	If you have an open connection to an HP ALM project, the Controller saves the results to a test set. You can also save the results directly to disk using the standard file system.
Relevant tasks	"How to Prepare a Scenario to Run" on page 238

User interface elements are described below:

UI Elements (A-Z)	Description
Automatically create a results directory for each scenario execution	Instructs LoadRunner to create a unique results directory for each scenario run. By default, the result names are **res1**, **res2**, **res3**, and so on.
Automatically overwrite existing results directory without prompting for confirmation	Instructs LoadRunner to automatically overwrite previous result sets, without prompting the user.

UI Elements (A-Z)	Description
Directory	Specify a location in the file system where the Controller will save the results file. The Controller creates a subdirectory in the results directory. All results are saved within this subdirectory.
File System (only when connected to HP ALM).	Displays the default LoadRunner directory path.
HP ALM (only when connected to HP ALM)	Enables you to save the results to a Application Lifecycle Management test set.
Results Name.	Specify a name for the run results. LoadRunner allows you to give descriptive names to each result set. This is especially useful for cross results analysis, in which LoadRunner superimposes the results of several scenario runs in a single Analysis graph and lets you compare the results of multiple scenario runs. The descriptive graph names enable you to distinguish between the results of the multiple runs.
Results Path	Displays the location for the results as specified in **Results Name** and **Directory**. Avoid using the same name with different paths. Only the names appear on the Analysis graphs. If the result names are identical it will be difficult to distinguish between the runs.

Summary Information Dialog Box

This dialog box enables you to provide a detailed description of the scenario.

To access	**Scenario** > **Summary Information**
Relevant tasks	"How to Prepare a Scenario to Run" on page 238

User interface elements are described below:

UI Elements (A-Z)	Description
Author	The name of the scenario's author
Description	A description of the scenario
Scenario Path	The name and location of the scenario definition file (.lrs)
Subject	A subject name or short title for the scenario

13

Running Scenarios

This chapter includes:

Concepts

Tasks

Reference

Concepts

Running Scenarios Overview

After planning, designing and scheduling your scenario, you run it to create load on your application and to test its performance.

Start of run

When you instruct LoadRunner to begin the scenario run, the Controller checks the scenario configuration information, invokes the applications that were selected to run with the scenario, and then distributes each Vuser script to its designated load generator. When the Vusers are ready, they start running their scripts.

As the scenario starts, in the Scenario Groups pane you can watch Vusers gradually start running.

During run

During the scenario run, you can see a synopsis of the running scenario in the Scenario Status pane. You can also drill down to see which Vuser actions are causing the application problems.

The Controller's online graphs display performance data collected by the monitors. You use this information to isolate potential problem areas in your system.

End of run

The scenario ends when all the Vusers have completed their scripts, when the duration runs out, or when you terminate it.

At the conclusion of the test run, the Scenario Status pane shows the **Down** status. This indicates that the Vusers have stopped running.

Tasks

How to Run a Scenario

This task describes how to run a scenario.

This task includes the following steps:

1 Prerequisite

Open an existing scenario, or design a new one.

- To design a manual scenario, see "How to Design a Manual Scenario" on page 62.
- To design a goal-oriented scenario, see "How to Design a Goal-Oriented Scenario" on page 60.

2 Prepare to run the scenario

Before you run the scenario, specify a location for the scenario results and other run-time related settings. For details, see "How to Prepare a Scenario to Run" on page 238.

3 Run the scenario

In the Run tab, click the **Start Scenario** button to begin running the scenario. The scenario runs according to its defined schedule.

4 Manually control the behavior, addition, and stopping of Vusers during the scenario run - optional

You can do the following during the scenario run:

Note: For a use-case scenario that explains the differences between the following options, see "Control Vusers During a Scenario Run - Use-Case Scenario" on page 252.

- **Control the behavior of Vuser groups.** You can initialize, run, and stop Vuser groups during the scenario run.

  To initialize, run, or stop an entire Vuser group, select the group in the Scenario Groups pane, and click the desired button on the main Controller toolbar:

  - **Initialize Vusers.** 
  - **Run Vusers.** 
  - **Stop Vusers immediately.** 
  - **Stop Vusers gradually.** 

- **Run or stop individual Vusers.** You can run or stop specific Vusers within a Vuser group. For user interface details, see "Vusers Dialog Box" on page 98.
- **Initialize/Run additional Vusers, or stop currently running Vusers.** You can manually control the addition of new Vusers to a running scenario, as well as stop running Vusers. For user interface details, see "Run/Stop Vusers Dialog Box" on page 279.

5 View a log containing run-time information about each running Vuser - Optional

For user interface details, see "Vuser Script Log" on page 287.

6 Release Vusers from a rendezvous before the Controller releases them - Optional

For more information, see "Rendezvous Points" on page 313.

7 Log execution notes during the scenario run - Optional

The Controller provides you with a dialog box in which you can log comments while a scenario is running. To open the dialog box select **Scenario** > **Execution Notes**. The notes are automatically saved by clicking **OK** to close the dialog box.

8 Monitor the scenario - optional

During the scenario run, you can view data collected by the online monitors using the online monitor graphs. If you did not set up the monitors before you started the run, you can do so during the run. The data collected by the monitors can be viewed using the LoadRunner online graphs.

- For details about setting up the online monitors, see "How to Set Up the Monitoring Environment – Workflow" on page 443.
- For details about viewing the monitor graphs, see "Online Monitor Graphs" on page 289.

9 Collate run results

If you are using the default file storage setting—local machine, when the scenario run is complete, the run results must be collated or consolidated in preparation for result analysis. If LoadRunner is not set up to collate the results automatically upon completion of the run, you need to collate the results manually after the run.

Select **Results** > **Collate Results** > **Collate Results**. For details, see "How to Collate Scenario Run Results" on page 324.

For details about result collation, see "Collating Run Data" on page 322.

Control Vusers During a Scenario Run - Use-Case Scenario

This use-case scenario describes how to override defined schedules and manually control the behavior, addition, and stopping of Vusers during a scenario run.

Note: For a task related to this scenario, see "How to Run a Scenario" on page 249.

David Smith is a load tester at NewSoft Company, currently using LoadRunner to test a new product in preparation for its upcoming release.

His load test contains three Vuser groups, **Script_A**, **Script_B**, and **Script_C**. Each group has been assigned **ten** Vusers and been given the same schedule definitions, that is, to start **two** Vusers every **ten** seconds, and to stop **two** Vusers every **ten** seconds.

If David were to leave these schedules as defined, the start and stop actions in the scenario groups pane would look as follows:

Start

Group Name	Down	Pending	Init	Ready	Run	Rendez	Passed	Failed	Error	Gradual Exiting	Exiting	Stopped
3	15	0	0	0	15	0	0	0	0	0	0	0
Script_A	5				5							
Script_B	5				5							
Script_C	5				5							

Stop

Group Name	Down	Pending	Init	Ready	Run	Rendez	Passed	Failed	Error	Gradual Exiting	Exiting	Stopped
3	0	0	0	0	15	0	0	0	0	3	0	12
Script_A					5					1		4
Script_B					5					1		4
Script_C					5					1		4

The following table shows the options available to David should he wish to override these defined schedules and manually manipulate the way the Vusers start or stop:

Note: All the following use-case scenario options refer back to the scenario explained above.

Control Vusers Option	Use-Case Scenario
Manipulate an entire Vuser group. **Example:** Run or stop all the Vusers in a group simultaneously.	"Initialize, Run, or Stop Vuser Groups - Use-Case Scenario" on page 254
Run/Stop individual Vusers, or add new Vusers. **Example 1:** Run/Stop a single Vuser currently in the **down/run** state. **Example 2:** (Vuser Group mode) Add a specified number of Vusers to a group without initializing or running them.	"Run/Stop Individual Vusers, or Add New Vusers - Use-Case Scenario" on page 256
Initialize/Run/Stop any number of Vusers within a group.	"Initialize/Run Additional Vusers or Stop Running Vusers - Use-Case Scenario" on page 260

Initialize, Run, or Stop Vuser Groups - Use-Case Scenario

This use-case scenario describes how David can manipulate the behavior of the Vuser groups during the scenario run, irrespective of their defined schedules. The examples will show how he can initialize, run, and stop all the Vusers in a Vuser group simultaneously.

Initialize a Vuser group

If David wants to initialize all the Vusers in **Script_C** simultaneously, he selects the script in the Scenario Groups pane and clicks the Initialize Vusers button on the Controller toolbar. All Vusers that are still in the **Down** state are immediately initialized (in this case, only five). Their status changes from **Down** to **Pending** to **Initializing** to **Ready**. They then run according to their defined schedules.

Group Name	Down	Pending	Init	Ready	Run	Rendez	Passed	Failed	Error	Gradual Exiting	Exiting	Stopped
3	10	0	0	5	15	0	0	0	0	0	0	0
Script_A	5				5							
Script_B	5				5							
Script_C				5	5							

Note: Only Vusers that are in the **Down** state can be initialized. Vusers that have been initialized already are unaffected.

Run a Vuser group

If David wants to run all the Vusers in **Script_C** simultaneously, he selects the script in the Scenario Groups pane and clicks the **Run Vusers** button on the Controller toolbar. All Vusers in the group that have not yet started running move to the **Run** state and begin executing their scripts.

Group Name	Down	Pending	Init	Ready	Run	Rendez	Passed	Failed	Error	Gradual Exiting	Exiting	Stopped
3	10	0	0	0	20	0	0	0	0	0	0	0
Script_A	5				5							
Script_B	5				5							
Script_C					10							

Stop a Vuser Group

If David wants to stop all the Vusers in **Script_C** from running, he has two options:

➤ **To stop them immediately**

He selects the script in the Scenario Groups pane and clicks the **Stop Vusers** button on the Controller toolbar. All Vusers that have been initialized, or are already running, stop executing their scripts immediately and move directly to the **Stopped** state.

Group Name	Down	Pending	Init	Ready	Run	Rendez	Passed	Failed	Error	Gradual Exiting	Exiting	Stopped
3	0	0	0	0	10	0	0	0	0	2	0	18
Script_A					5					1		4
Script_B					5					1		4
Script_C												10

➤ **To stop them gradually**

He selects the script in the Scenario Groups pane and clicks the **Gradual Stop** button on the Controller toolbar. All Vusers that have been initialized, or are already running, move to the **Gradual Exiting** state and then exit the scenario gradually as per their defined schedules.

Group Name	Down	Pending	Init	Ready	Run	Rendez	Passed	Failed	Error	Gradual Exiting	Exiting	Stopped
3	0	0	0	0	10	0	0	0	0	8	0	12
Script_A					5					1		4
Script_B					5					1		4
Script_C										6		4

Note: The group can only be stopped gradually if **Wait for the current iteration to end before exiting** or **Wait for the current action to end before exiting** have been selected in the Run-Time Setting tab of the Options dialog box. For more information, see "Options > Run-Time Settings Tab" on page 232.

Run/Stop Individual Vusers, or Add New Vusers - Use-Case Scenario

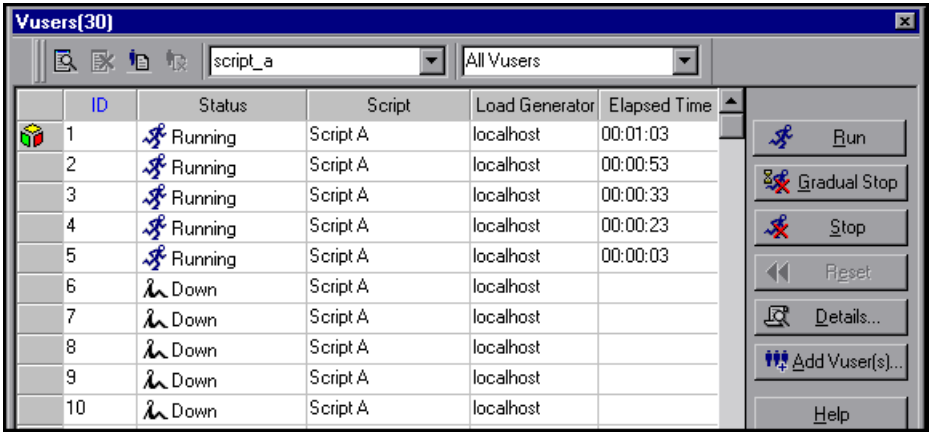
This use-case scenario describes how David can manipulate the behavior of individual Vusers during the scenario run, irrespective of their defined schedules. The examples will show how he can run or stop individual Vusers, as well as how he can add new Vusers to the scenario.

Note: The examples presented in this section demonstrate options in the Vusers dialog box. Not all information relevant for working with this dialog box necessarily appears here. For full information about working with the Vusers dialog box, see "Vusers Dialog Box" on page 98.

Run an individual Vuser

If David wants to immediately run an additional Vuser from **Script_A**, in the Run tab, he clicks **Vusers** to open the Vusers dialog box.

By selecting **script_a**, and **All Vusers** in the filter options at the top of the dialog box, the table displays a list of all the Vusers in **Script_A**, and indicates that five are currently running, and that five are still down.



David then selects Vuser number 6 (or any Vuser in the **Down** state that he wishes to run), and clicks **Run**.

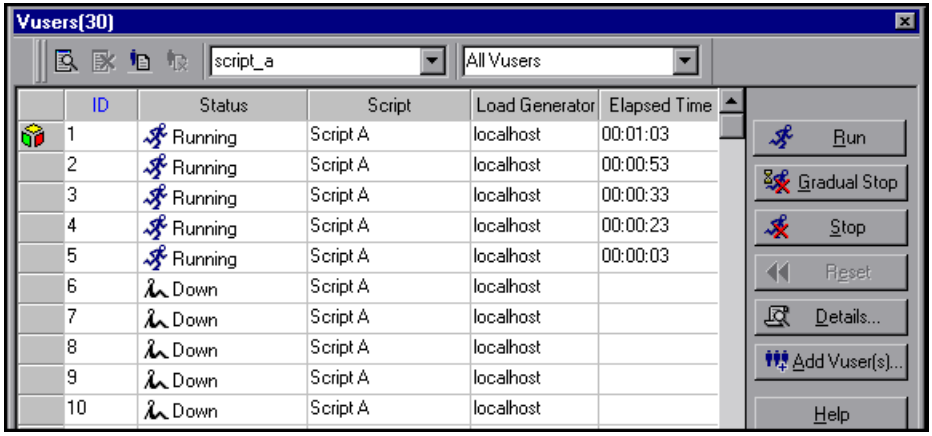
That Vuser is immediately initialized and moved to the **Run** state.

Group Name	Down	Pending	Init	Ready	Run	Rende
3	14	0	0	0	16	0
Script_A	4				6	
Script_B	5				5	
Script_C	5				5	

Stop an individual Vuser

If David wants to stop one of the running Vusers in **Script_A**, in the Run tab, he clicks **Vusers** to open the Vusers dialog box.

By selecting **script_a**, and **All Vusers** in the filter options at the top of the dialog box, the table displays a list of all the Vusers in **Script_A**, and indicates that five are currently running, and that five are still down.



He then selects Vuser number 1 (or any running Vuser that he wishes to stop), and then selects one of the stopping options:

➤ **Stop the Vuser gradually.** David clicks **Gradual Stop**, and the Vuser immediately moves from the **Run** state to the **Gradual Exiting** state, where it completes its current iteration or action before stopping.

Group Name	Down	Pending	Init	Ready	Run	Rendez	Passed	Failed	Error	Gradual Exiting	Exiting	Stopped
3	15	0	0	0	14	0	0	0	0	1	0	0
Script_A	5				4					1		
Script_B	5				5							
Script_C	5				5							

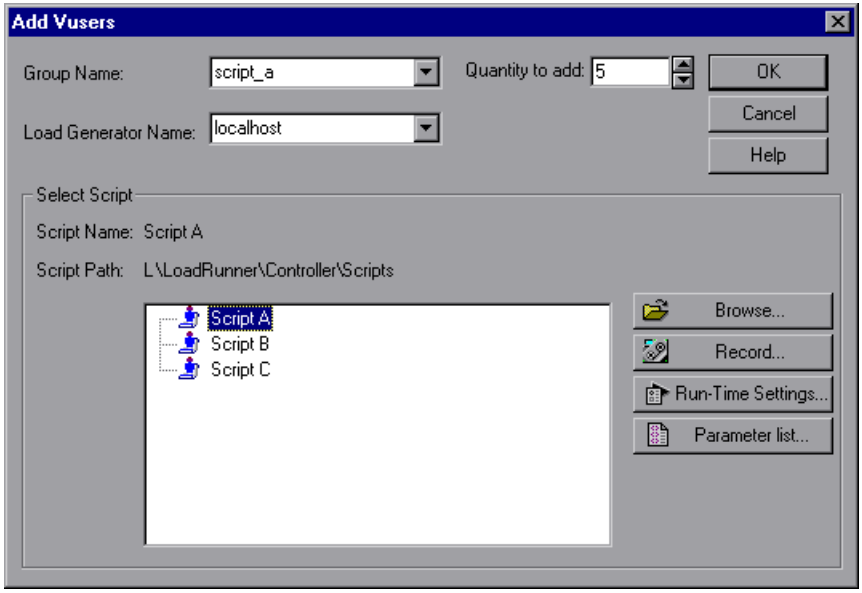
➤ **Stop the Vuser immediately.** David clicks **Stop**, and the Vuser immediately stops running and moves to the **Stopped** state.

Group Name	Down	Pending	Init	Ready	Run	Rendez	Passed	Failed	Error	Gradual Exiting	Exiting	Stopped
3	15	0	0	0	14	0	0	0	0	0	0	1
Script_A	5				4							1
Script_B	5				5							
Script_C	5				5							

Add new Vusers (Vuser Group mode only)

If David is working in Vuser Group mode, he can add new Vusers to a group without initializing them, as follows:

In the Run tab, he clicks **Vusers** to open the Vusers dialog box, then he clicks **Add Vusers** to open the Add Vusers dialog box.



He then enters the following information (as shown in the image above):

- **Group Name.** script_a
- **Quantity to add.** 5
- **Load Generator Name.** localhost (or any load generator on which the group is running Vusers).
- **Select Script.** Script_A

These settings instruct LoadRunner to add five Vusers to **Script_A**, and that the additional Vusers should run Script_A when they run.

Note: For full information on how to work with the Add Vusers dialog box, see "Add Vusers Dialog Box" on page 75.

He clicks **OK**. Five Vusers are added to **Script_A** in the down state, from where they run according to the group's defined schedules.

Group Name	Down	Pending	Init	Ready	Run	Rende
3	16	0	2	0	12	0
Script_A	10				5	
Script_B	5				5	
Script_C	5				5	

Initialize/Run Additional Vusers or Stop Running Vusers - Use-Case Scenario

This use-case scenario describes how David can manipulate the behavior of Vusers during a scenario run, irrespective of their defined schedules. The examples will show how he can initialize or run specified numbers of additional Vusers, or stop specified numbers of running Vusers.

Note: The examples presented in this section demonstrate options in the **Run/Stop Vusers** dialog box. Not all information relevant for working with this dialog box necessarily appears here. For full information about working with the **Run/Stop Vusers** dialog box, see "Run/Stop Vusers Dialog Box" on page 279.

Initialize/Run additional Vusers in Vuser group mode

The following procedure shows how David can initialize and run additional Vusers when he is working in Vuser Group mode:

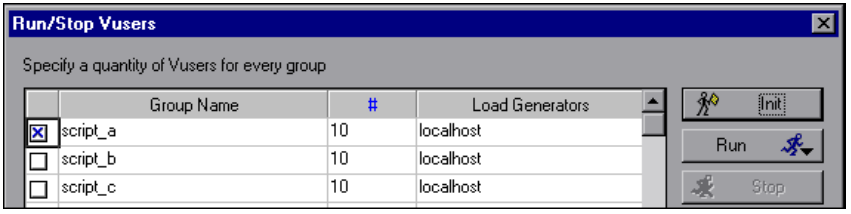
Note: The options to initialize or run additional Vusers can be done as two separate actions, with no connection to each other. They are being shown here together as a single workflow for demonstrative purposes only.

---

1 Initialize additional Vusers

If he wants to initialize **ten** Vusers in **Script_A** immediately, and not wait for them to initialize as per their defined schedules, in the Run tab, he clicks **Run/Stop Vusers** to open the Run/Stop Vusers dialog box.

In the dialog box, he makes sure that only the check box by **script_a** is selected, and he enters **10** in the # (number) column.



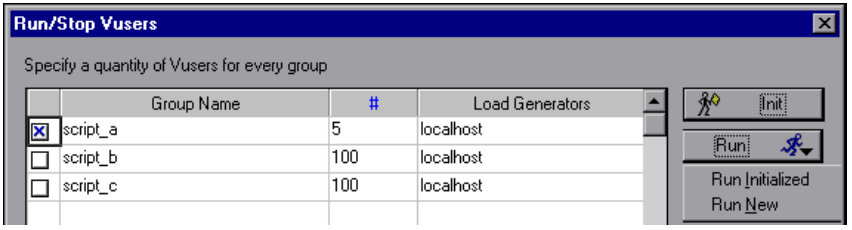
To initialize these Vusers, he clicks **Initialize**. Ten Vusers are immediately initialized and move to the **Ready** state. From there, they run according to their defined schedules.

Group Name	Down	Pending	Init	Ready	Run	Rendez	Passed	Failed	Error	Gradual Exiting	Exiting	Stopped
3	10	0	0	10	15	0	0	0	0	0	0	0
Script_A				10	5							
Script_B	5				5							
Script_C	5				5							

Note: The additional initialized Vusers are taken from the Vusers that are in the **Down** state. If David initializes a greater number of Vusers than there are in the **Down** state, then all of them will be initialized. In the example above, there were five Vusers in the **Down** state. All of them have been initialized, while an additional five have been created.

2 Run additional Vusers

If David then wants to run five additional Vusers in **Script_A** immediately, and not wait for them to run as per their defined schedules, in the Run/Stop Vusers dialog box, he makes sure that only the check box by **script_a** is selected, and he enters **5** in the # (number) column.



He then has the following two options for how to run these additional Vusers:

➤ **Run initialized Vusers.** He can run five Vusers from those he initialized in the previous step. To do this, he clicks the arrow on the **Run** button and selects **Run Initialized**. Five Vusers immediately move from the **Ready** state to the **Run** State.

Group Name	Down	Pending	Init	Ready	Run	Rendez	Passed	Failed	Error	Gradual Exiting	Exiting	Stop
3	10	0	0	5	20	0	0	0	0	0	0	0
Script_A				5	10							
Script_B	5				5							
Script_C	5				5							

➤ **Run new Vusers.** He can create and run five new Vusers, with no effect on those he initialized in the previous step. To do this, he clicks the arrow on the **Run** button and selects **Run New**. Five Vusers are immediately created and move directly to the **Run** state.

Group Name	Down	Pending	Init	Ready	Run	Rendez	Passed	Failed	Error	Gradual Exiting	Exiting	Stop
3	10	0	0	10	20	0	0	0	0	0	0	0
Script_A				10	10							
Script_B	5				5							
Script_C	5				5							

Note: If there were still vusers in the **Down** state, the new Vusers would be taken from them.

Initialize/Run additional Vusers in Percentage mode

The following procedure shows how David can initialize and run additional Vusers when he is working in Percentage mode:

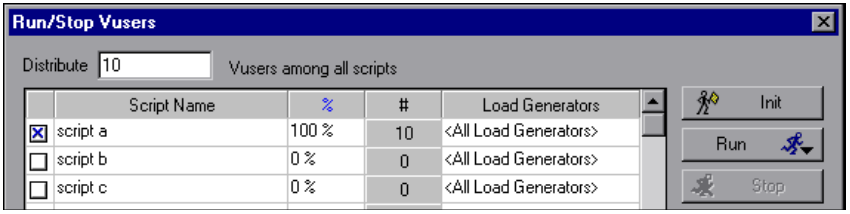
Note: The options to initialize or run additional Vusers can be done as two separate actions, with no connection to each other. They are being shown here together as a single workflow for demonstrative purposes only.

---

1 Initialize new Vusers

If he wants to initialize ten Vusers in **Script_A** immediately, and not wait for them to initialize as per their defined schedules, in the Run tab, he clicks **Run/Stop Vusers** to open the Run/Stop Vusers dialog box.

In the dialog box, he makes sure that only the check box by **script_a** is selected, and he enters **10** in the **Distribute X Vusers among all the scripts** box. It is also important that the percentage values for **Script_B** and **Script_C** are set to **0%**. See the note below for a detailed explanation why.



Note: When a check box is deselected, no Vusers are distributed to that script. However, the amount of Vusers that *would* have been assigned to it are not redistributed to the scripts that remain selected, unless you specify **0%** in the percentage column.

For example, in our use-case scenario, when David enters **10** in the **Distribute X Vusers among all the scripts** box, LoadRunner automatically distributes these Vusers as equally as possible among the available scripts, that is:

- **script_a**. 4 Vusers
- **script_b**. 3 Vusers
- **script_c**. 3 Vusers

However, should David wish to distribute all **10** Vusers to **script_a**, it is not sufficient to simply deselect **script_b** and **script_c**. This only ensures that no Vusers are added to these scripts, but it *does not* change the original Vuser distribution.

In other words, should David complete the step now, the four Vusers that are assigned to **script_a** will be added, while the three each assigned to **script_b** and **script_c** will not, though they will still appear under the **#** (number) column. To distribute these six Vusers to **script_a** instead, David must first change the **%** (percentage) columns for these scripts to **0%**.

He then clicks **Initialize**. Ten Vusers are immediately initialized and move to the **Ready** state. From there, they run according to their defined Scheduler settings.

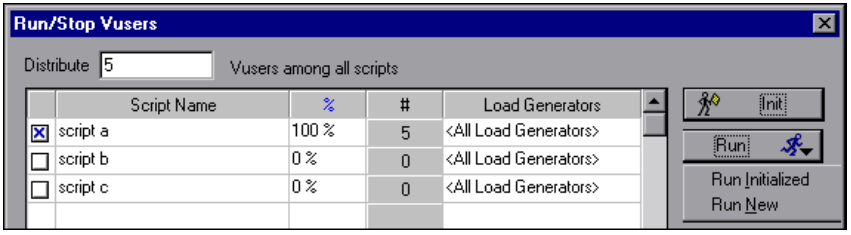
Group Name	Down	Pending	Init	Ready	Run	Rendez	Passed	Failed	Error	Gradual Exiting	Exiting	Stopped
3	10	0	0	10	15	0	0	0	0	0	0	0
Script_A				10	5							
Script_B	5				5							
Script_C	5				5							

Note: The additional initialized Vusers are taken from the Vusers that are in the **Down** state. If you initialize a greater number of Vusers than there are in the **Down** state, then all of them will be initialized. In the example above, there were five Vusers in the **Down** state. All of them have been initialized, while an additional five have been created.

---

2 Run additional Vusers

If David then wants to run five additional Vusers in **Script_A** immediately, and not wait for them to run as per their defined schedules, in the Run/Stop Vusers dialog box, he makes sure that only the check box by **script_a** is selected, and he enters **5** in the **Distribute X Vusers among all the scripts** box at the top of the dialog box. It is also important that the percentage values for **Script_B** and **Script_C** are set to **0%**. See the note in the step above for a detailed explanation why.



He then has the following two options for how to actually run these additional Vusers:

➤ **Run initialized Vusers.** He can run five Vusers from those he initialized in the previous step. To do this, he clicks the arrow on the **Run** button and selects **Run Initialized**. Five Vusers immediately move from the **Ready** state to the **Run** State.

Group Name	Down	Pending	Init	Ready	Run	Rendez	Passed	Failed	Error	Gradual Exiting	Exiting	Stop
3	10	0	0	5	20	0	0	0	0	0	0	0
Script_A				5	10							
Script_B	5				5							
Script_C	5				5							

➤ **Run new Vusers.** He can create and run five new Vusers, with no effect on those he initialized in the previous step. To do this, he clicks the arrow on the **Run** button and selects **Run New**. Five Vusers are immediately created and move directly to the **Run** state.

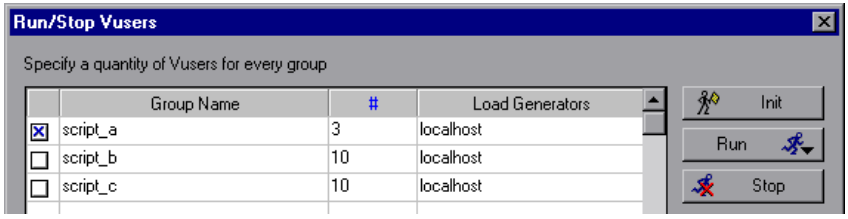
Group Name	Down	Pending	Init	Ready	Run	Rendez	Passed	Failed	Error	Gradual Exiting	Exiting	Stop
3	10	0	0	10	20	0	0	0	0	0	0	0
Script_A				10	10							
Script_B	5				5							
Script_C	5				5							

Note: If there were still vusers in the **Down** state, the new Vusers would be taken from them.

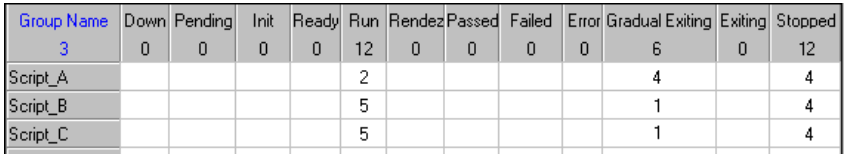
Stop running Vusers in Vuser group mode

If David wants to stop **three** of the **five** running Vusers in **Script_A**, and not wait for them to stop as per their defined schedules, in the Run tab, he clicks **Run/Stop Vusers** to open the Run/Stop Vusers dialog box.

In the dialog box, he makes sure that only the check box by **script_a** is selected, and he enters **3** in the **#** (number) column.



He then clicks **Stop**. Three of the running Vusers in **Script_A** move from the **Run** state to the **Gradual Exiting** state.

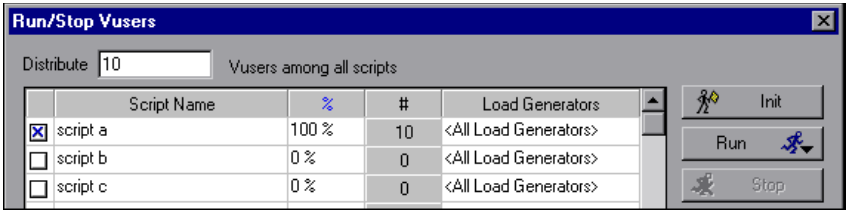


Group Name	Down	Pending	Init	Ready	Run	Rendez	Passed	Failed	Error	Gradual Exiting	Exiting	Stopped
3	0	0	0	0	12	0	0	0	0	6	0	12
Script_A					2					4		4
Script_B					5					1		4
Script_C					5					1		4

Stop running Vusers in Percentage mode

If David wants to stop **three** of the **five** running Vusers in **Script_A**, and not wait for them to stop as per their defined schedules, in the Run tab, he clicks **Run/Stop Vusers** to open the Run/Stop Vusers dialog box.

In the dialog box, he makes sure that only the check box by **script_a** is selected, and he enters **3** in the **Distribute X Vusers among all the scripts** box. It is also important that the percentage values for **Script_B** and **Script_C** are set to **0%**. See the note below for a detailed explanation why.



Note: When a check box is deselected, no Vusers are distributed to that script. However, the amount of Vusers that *would* have been assigned to it are not redistributed to the scripts that remain selected, unless you specify **0%** in the percentage column.

For example, in our use-case scenario, when David enters **3** in the **Distribute X Vusers among all the scripts** box, LoadRunner automatically distributes these Vusers as equally as possible among the available scripts, that is:

- **script_a**. 1Vuser
- **script_b**. 1Vuser
- **script_c**. 1Vuser

However, should David wish to distribute all **3** Vusers to **script_a**, it is not sufficient to simply deselect **script_b** and **script_c**. This only ensures that no Vusers are added to these scripts, but it *does not* change the original Vuser distribution.

In other words, should David complete the step now, the single Vuser that is assigned to **script_a** will be stopped, while the one each assigned to **script_b** and **script_c** will not, though they will still appear under the **#** (number) column. To distribute these two Vusers to **script_a** instead, David must first change the **%** (percentage) columns for these scripts to **0%**.

He then clicks **Stop**. Three of the running Vusers in **Script_A** move from the **Run** state to the **Gradual Exiting** state.

Group Name	Down	Pending	Init	Ready	Run	Rendez	Passed	Failed	Error	Gradual Exiting	Exiting	Stopped
3	0	0	0	0	12	0	0	0	0	6	0	12
Script_A					2					4		4
Script_B					5					1		4
Script_C					5					1		4

Reference

Run View User Interface

This section includes (in alphabetical order):

Execution Notes Dialog Box

This page dialog box enables you to log comments while a scenario is running.

To access	Select **Scenario** > **Execution Notes**
Relevant tasks	"How to Run a Scenario" on page 249
Important Information	Only enabled while the scenario is running.

User interface elements are described below:

UI Element	Description
<note writing area>	Enter your notes in this area.

Output 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	Use one of the following: ➤ **Run** tab > **Scenario Status** pane > **Errors** >  ➤ Select **View** > **Show Output**
Important information	➤ LoadRunner clears the messages in the Output window at the start of each scenario execution. If you reset a scenario, messages remain in the Output window unless you instruct LoadRunner to delete messages from the window upon reset. For more information, see "Options > Output Tab" on page 229. ➤ The Summary tab is displayed by default when you open this window.
Relevant tasks	➤ "How to Run a Scenario" on page 249 ➤ "Configure output display options (Expert mode only)" on page 218

User interface elements are described below:

UI Elements (A-Z)	Description
Filtered Tab	See "Filtered Tab" on page 274
Summary Tab	See "Summary Tab" on page 271

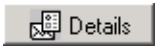
Summary Tab

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

To access	**Output** window > **Summary** tab
Important Information	You can drill down further on any information displayed in blue.

Parent topic	"Output Window" on page 271
See also	"Filtered Tab" on page 274

User interface elements are described below:

UI Elements (A-Z)	Description
	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.** 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.

UI Elements (A-Z)	Description
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
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 223. ➤ **Errors.** Usually indicate that the script failed. ➤ **Notifications.** Provides run-time information, such as message sent using **lr_output_message**. ➤ **Warnings.** Indicates that the Vuser encountered a problem, but the scenario continued to run.
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	**Output** window > **Summary** tab. Click the blue link on the column about which you wish to view more information.
Important information	The tab is appears when you click on a blue link in the Summary tab.
Parent topic	"Output Window" on page 271
See also	"Summary Tab" on page 271

User interface elements are described below:

UI Elements (A-Z)	Description
	**Previous/Next View.** Enables you to move between the various drill down levels.
	Displays the full text of the selected output message in the Detailed Message Text area at the bottom of the Output window.
	**Export the view.** Saves the output to a specified file.
	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.

UI Elements (A-Z)	Description
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 ➤
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.
Vuser	The Vuser that generated the message.

UI Elements (A-Z)	Description
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.
# Diff Texts	

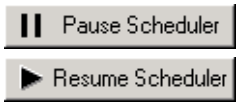
Run Tab

The Run tab enables you to run and monitor scenarios.

To access	**Run** tab
Relevant tasks	➤ "How to Run a Scenario" on page 249 ➤ "Control Vusers During a Scenario Run - Use-Case Scenario" on page 252

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

UI Elements (A-Z)	Description
	Instructs the Controller to initialize the Vusers and distribute them to their designated load generators, where they begin running their Vuser scripts. **Notes:** ➤ The Controller begins running the scenario according to the start time defined in the scenario schedule. ➤ We do not recommend changing the Time/Date and Time Zone settings on the Controller and load generators during the load test run.
	Terminates the scenario. The behavior depends on your selection in the **Tools** > **Options** > **Run-Time Settings** tab: ➤ If you selected **Stop immediately,** all Vusers in the scenario move to the **Exiting** status. ➤ If you selected **Wait for the current iteration to end before exiting,** or **Wait for the current action to end before exiting**, the button text changes to **Stop Now** and the Vusers status changes to **Gradual Exiting**. To stop the Vusers immediately, click **Stop Now**. For more information about the Run-Time Settings options, see "Options > Run-Time Settings Tab" on page 232.
	Resets all Vuser groups to the **Down** status.
	Opens the Vusers dialog box, where you can view the status of each of the Vusers in a Vuser group.
	Opens the Run/Stop Vusers dialog box, where you can activate additional Vusers.

UI Elements (A-Z)	Description
	Pauses or resumes the scenario schedule.
<Graph Legend>	Displays statistics for the selected graph. For more information, see "Online Monitor Graphs" on page 289.
<Graph Viewing Pane>	Displays the graphs that are listed in the **Available Graphs** pane. For more information, see "Online Monitor Graphs" on page 289. **Default:** Displays four graphs
Available Graphs	Displays the available online monitor graphs. For more information, see "Online Monitor Graphs" on page 289.
Scenario Groups pane	Displays each Vuser group and it's current status. For more information. see "Scenario Groups Pane" on page 282.
Scenario Status pane	Displays a synopsis of the running scenario. For more information, see "Scenario Status Pane" on page 285.

Run/Stop Vusers Dialog Box

This dialog box enables you to manually control the addition of new Vusers to a running scenario, as well as to stop running vusers.

To access	Run tab > Scenario Groups pane > Run/Stop Vusers...
Important information	➤ The dialog box differs depending on which mode you are working in. ➤ **Vuser group mode.** You specify the number of new Vusers to be added to each Vuser group, as well as the load generators on which these additional Vusers will run. ➤ **Percentage mode.** You specify the percentage of Vusers to be added to each script, as well as the load generators on which these additional Vusers will run. ➤ When you add Vusers to a running scenario or Vuser group, the current scheduler settings are automatically applied to all new Vusers. For example, if the scenario or Vuser group has a set duration of five minutes, all Vusers that are subsequently added run only for the remaining part of that time period. Vusers that are added to a scenario or Vuser group which has finished running, are not affected by schedule settings and run according to the scenario run-time settings.
Relevant tasks	➤ "How to Run a Scenario" on page 249 ➤ "Control Vusers During a Scenario Run - Use-Case Scenario" on page 252

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

UI Elements (A-Z)	Description
	Distributes the added Vusers to their designated load generators so that they are ready to execute their scripts. The Controller first initializes the Vusers in your scenario that have not yet run and then adds additional Vusers, as required, to reach the defined quantity.
	➤ **Run Initialized.** Runs the Vusers in the scenario that have already been initialized. ➤ **Note:** You cannot run more Vusers than are currently initialized using this option. ➤ **Run New.** Runs the number of Vusers you specified. The Controller first runs the Vusers in your scenario that have not yet been run and then adds additional Vusers, as required, to reach the defined quantity.
	Stops the Vusers that are running. The Controller stops the Vusers according to the settings you defined in the Run-Time Settings tab. For more information, see "Options > Run-Time Settings Tab" on page 232.

UI Elements (A-Z)	Description
<check box>	Selects the Vuser groups/scripts you add Vusers to. **Notes:** ➤ To disable a Vuser group/script, clear the check box to the left of the group/script name. A group/script automatically appear disabled if it is disabled in the Design view. ➤ When you disable a Vuser group (Vuser Group mode), no Vusers are added to the group. ➤ When you disable a script (Percentage mode), no Vusers are distributed to the script, and the unused percentage of the Vusers are not distributed among the remaining scripts, unless you define a zero percent value for the disabled script. **Example:** If you have three scripts, **A**, **B**, and **C**, and you enter **10** in the **Distribute X Vusers among all the scripts** box, LoadRunner automatically distributes these Vusers as equally as possible among the scripts, that is: ➤ **A.** 4 Vusers ➤ **B.** 3 Vusers ➤ **C.** 3 Vusers However, if you want LoadRunner to distribute *all* 10 Vusers to **A**, it is not sufficient to simply deselect **B** and **C**. This only ensures that no Vusers are added to these scripts, but it *does not* change the original Vuser distribution. In other words, if you were to finish the step now, the four Vusers that are assigned to **A** *would* be added to the script, while the three each assigned to **B** and **C** *would not*, though they would still appear under the **#** (number) column. To distribute these **six** Vusers to **A** instead, you must first change the **%** (percentage) columns **B** and **C** to **0%**.
% (Percentage mode)	Enter the percentage of Vusers to be distributed to each Vuser script.
#	Indicates the number of Vusers distributed to each script.

UI Elements (A-Z)	Description
Distribute x Vusers among the checked scripts (Percentage mode)	Enter the number of Vusers to be distributed. The Vusers will be distributed according to the values you entered in the percentage (%) column.
Load Generators	The load generators assigned to the Vuser group/script. If you select multiple load generators for a group/script, the Vusers assigned to the Vuser group/script are distributed evenly among the load generators. **Default value (in Percentage mode):** All Load Generators **Note:** To add a load generator to the list, select **Add** from the list. For more details see "Add Load Generator/Load Generator Information Dialog Box" on page 108.

Scenario Groups Pane

This pane enables you to monitor the actions of all the Vusers and Vuser groups in the scenario.

To access	**Run** tab
Relevant tasks	➤ "How to Run a Scenario" on page 249 ➤ "Control Vusers During a Scenario Run - Use-Case Scenario" on page 252

User interface elements are described below:

UI Elements (A-Z)	Description
<Right-click menu>	Additional actions available only via the right-click menu: ➤ **Reset IDs.** Resets the IDs of the Vusers in the group. ➤ **Run Vusers Until Complete.** Runs the selected Vusers until complete. If you run Vusers in the **Down** or **Error** state, the Controller initializes and then runs the Vusers. ➤ **Run One Vuser Until Complete.** Instructs the Controller to run a randomly selected Vuser in the Vuser group, until it completes running. The Vuser Log opens, displaying run-time information about the Vuser. For more information, see "Vuser Script Log" on page 287. ➤ **Pause Vusers.** Temporarily pauses running the Vusers group. The status of the Vuser group changes from **Running** to **Paused**. Note that pausing a Vuser group affects its transaction response time. ➤ **Enable.** Enables the Vuser group to participate in the scenario. ➤ **Disable.** Disables the Vuser group so that it no longer participates in the scenario. ➤ **Show Vusers.** Opens a Run-Time Viewer for each Vuser in the group which displays the vuser executing its script. ➤ **Hide Vusers.** Closes open Run-Time Viewers. ➤ **Show Vuser Log.** Opens a script log containing run-time information for each Vuser in the group. The Vuser script log is refreshed, by default, every 1000 milliseconds. ➤ **Hide Vuser Log.** Closes the Vuser script logs. ➤ **Sort By Name.** Sorts the groups alphabetically, by name.
Done/Failed	The number of Vusers that have finished running and the script failed.

UI Elements (A-Z)	Description
Done/Passed	The number of Vusers that have finished running and the script passed.
Down	The number of Vusers that have stopped running.
Error	The number of Vusers that encountered problems. Check the Status field on the Vuser dialog box or the output window for a complete explanation of the error.
Exiting	The number of Vusers that have finished running or have been stopped, and are now exiting.
Gradual Exiting	The number of Vusers that are completing their iterations or actions before exiting. (as defined in **Tools** > **Options** > **Run-Time Settings**)
Initializing	The number of Vusers that are being initialized on the remote machine.
Pending	The number of Vusers that are ready to be initialized and are waiting for an available load generator, or are transferring files to the load generator.
Ready	The number of Vusers that have already performed the init section of the script and are ready to run.
Rendezvous	The number of Vusers that have arrived at the rendezvous and are waiting to be released by the Controller.
Running	The number of Vusers that are running, and the Vuser script is being executed on a load generator.
Stopped	The Vuser stopped when the Stop command was invoked.

Scenario Status Pane

This pane displays a synopsis of the running scenario.

To access:	**Run** tab
Important Information	To detach the Scenario Status pane from the Run tab, click the detach pane button in the upper right corner.
Relevant tasks	"How to Run a Scenario" on page 249

User interface elements are described below:

UI Elements (A-Z)	Description
Elapsed Time	Indicates how much time has elapsed since the scenario started running.
Errors	Indicates the number of Vusers with errors. To display the errors, click the **Show Snapshot** button to display the Output Window. For more information, see "Output Window" on page 271.
Hits/Second	Indicates how many hits (HTTP requests) there have been to the Web site being tested per second that each Vuser has been running.
Passed/Failed Transactions	Indicates how many transactions have been executed successfully or unsuccessfully. For more information, see "Transactions Dialog Box" on page 286.
Running Vusers	Indicates the number of Vusers that are currently running.
Scenario Status	Indicates whether the scenario is **Running** or **Down**.

Transactions Dialog Box

This dialog box indicates how many transactions have been executed successfully or unsuccessfully.

To access	**Run** tab > **Scenario Status** pane. Click the Show Snapshot button by Passed/Failed Transactions.
Important information	VuGen automatically defines each **Init**, **Action**, and **End** unit as a transaction. In addition, you can insert a static transaction in your script using the Start Transaction and End Transaction functions. For details, see the *HP Virtual User Generator User Guide*.
Relevant tasks	"How to Run a Scenario" on page 249
See also	"Scenario Status Pane" on page 285

User interface elements are described below:

UI Elements (A-Z)	Description
Failed	The number of times the transaction failed.
Name	The names of the individual transactions in a script.
Passed	The number of times the transaction passed.
Stopped	The number of times the transaction stopped.
TPS	The number of times per second the transaction has run.

Vuser Script Log

This page enables you to view run-time information about each running Vuser.

To access	Manual scenario > **Run** tab > **Scenario Groups** pane > **Vusers**  . In the Vusers dialog box select the Vuser whose log you want to view and click **Show Vuser Log**  .
Important information	➤ If you disabled the logging feature in the Run-Time Settings **Log** node, the Vuser script log will contain output only if your script contains the **lr_output_message** or **lr_message** function. ➤ If you selected the **Send messages only when an error occurs** option in the **Log** node, the Vuser script log will contain output only if there are script errors.
Relevant tasks	"How to Run a Scenario" on page 249

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

UI Elements	Description
 	**Show Text/Tree View.** Displays the run-time information in text/tree format. To revert to the previous view, click the button again.
	**Display.** Displays a snapshot of the Web page where an error occurred, when the error is highlighted in the Vuser log. **Note:** To view a snapshot of the Web page where an error occurred, you must select the **Activate snapshot on error** option in the **General** node of the Run-Time Settings dialog box before running the scenario.
	**Find Text.** Enables you to search for text in the Vuser log.

UI Elements	Description
	**Expand/Collapse Node.** Expands the node so that you can view additional run-time information details about the Vuser. To revert to the collapsed tree view, click the button again.
<message icons>	The following icons may can appear in the script log: ➤ **Action.** Displays the name and description of an action. ➤ **End iteration.** Indicates the end of an iteration. ➤ **Errors.** Indicates that the Vuser encountered a problem, but test execution continued. Displays the error code and a description of the error. ➤ **Notifications.** Provides action information. ➤ **Start/End Transaction.** Indicates the start or end of a transaction. ➤ **Start iteration.** Indicates the start of an iteration. ➤ **Start User Script.** Indicates the start of the Vuser script.
<Right-click options>	➤ **Copy.** Enables you to copy selected text from the Vuser log. ➤ **Copy path from status bar.** Enables you to copy the path of the Vuser log.
Refresh (every 1000 milliseconds)	When selected, instructs LoadRunner to refresh the run-time information displayed every 1000 milliseconds. **Note:** For information on how to change the default refresh settings, see "Options > Output Tab" on page 229.

14

Online Monitor Graphs

This chapter includes:

Concepts

Tasks

Reference

Concepts

Online Monitor Graphs Overview

You can view the data collected by the online monitors using the online monitor graphs.

About Online Monitor Graphs

Online monitor graphs display performance measurements for those resources being monitored during scenario run. Each measurement is represented on the graph by a colored line. Information about the measurements is listed in the legend below the graph. The legend displays the measurements for the selected graph only.

For details about selecting monitor graphs and customizing the graph display area, see "How to Display Online Monitor Graphs" on page 291.

For details about customizing graph layout and measurements, see "How to Customize Online Graph and Measurement Settings" on page 293.

Viewing Monitor Data Offline

After monitoring resources during a scenario run, you can view a graph of the data that was gathered using HP LoadRunner Analysis. Analysis processes the data from the scenario run results files, and generates a graph for each measurement that was monitored.

For details about working with Analysis at the end of the scenario run, see the *HP LoadRunner Analysis User Guide*.

Tasks

How to Display Online Monitor Graphs

This task describes how to open other monitor graphs and customize the graph display area.

This task includes the following steps:

1 Prerequisites

To see data in the online monitor graphs, the relevant monitoring environments must be configured. For details, see "How to Set Up the Monitoring Environment – Workflow" on page 443.

2 Open a monitor graph

By default, LoadRunner displays the following graphs in the graph display area:

- **Running Vusers**
- **Transaction Response Time**
- **Hits per Second**
- **Windows Resources**

You can open other graphs., one at a time, as follows:

Method 1

a Select **Monitors** > **Online Graphs** > **Open a New Graph**, or right-click a graph and select **Open a New Graph**.

b In the Open a New Graph dialog box, click the "+" in the left pane to expand the category nodes, and select a graph. You can view a description of the selected graph in the **Graph Description** box.

c Click **Open Graph**, or drag the selected graph into the right pane of the Run view.

Method 2

In the graph tree on the left of the Run tab, click the "+" to expand the category nodes. Double-click a graph or, alternatively, select it and drag it to the graph display area on the right.

Note: If the graph tree is not displayed, select **View** > **Show Available Graphs**. To hide the graph tree view, select **View** > **Hide Available Graphs**.

---

3 Customize the graph display area - Optional

By default, LoadRunner displays four graphs in the graph display area.

To change the number of graphs displayed, right-click a graph in the graph display area and select **View Graphs** (or select **View** > **View Graphs**).

Do one of the following:

➤ Select the number of graphs to display from the options given

➤ Select **Custom Number** and enter a number of graphs to display.

➤ To display only one graph, double-click the graph displayed in the graph display area. To return to the previous view, double-click the graph again.

How to Customize Online Graph and Measurement Settings

This task describes ways to customize online graphs and graph measurements.

➤ "Configure the graph settings" on page 293

➤ "Configure the measurement settings" on page 293

Configure the graph settings

You can customize:

➤ The type of graph display

➤ What to display on the x-axis and y-axis.

You can apply these settings to all graphs, or to a specific graph only.

To configure the graph settings, in the Run tab, select **Monitors** > **Online Graphs** > **Configure**, (or right-click a graph and select **Configure**).

For user interface details, see "Graph Configuration Dialog Box" on page 298 .

Configure the measurement settings

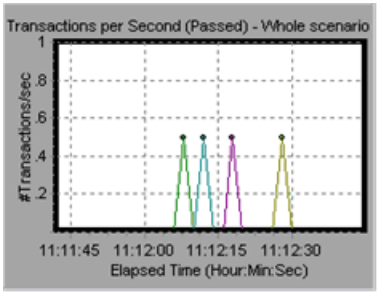
You can customize the appearance and scale of measurements in a graph, and select whether they should be displayed in the graph or hidden from the graph.

In the Run tab, right-click a measurement in the graph or legend, and select **Configure**.

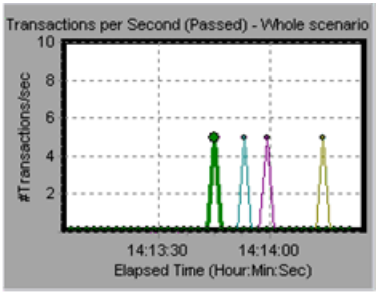
For user interface details, see "Measurement Configuration Dialog Box" on page 301 .

Example: Measurement Scale

In the following example, the same graph is displayed with a scale of 1 and 10:



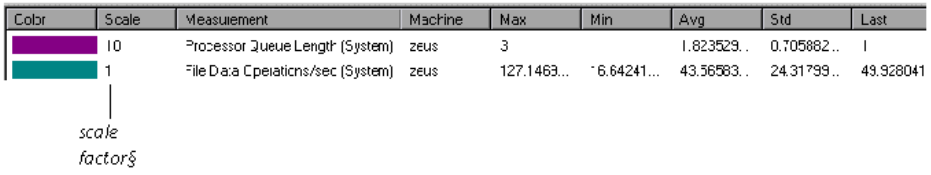
Scale =1



Scale = 10

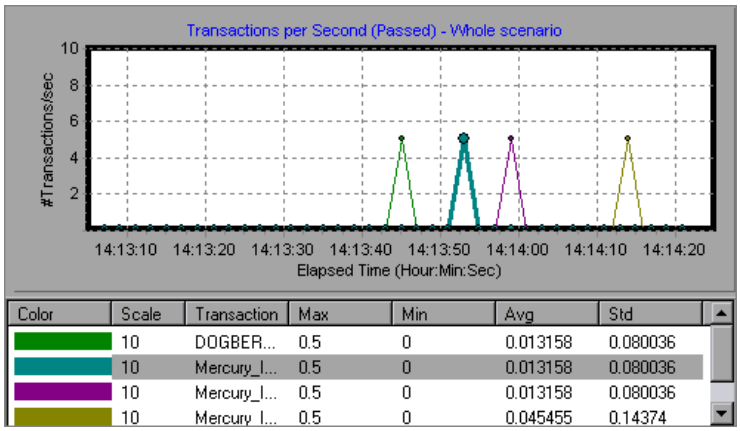
The actual graph values range from 0-1, as shown in the left graph. You can view the information more accurately using a larger scale for the display, as shown in the right graph. However, to obtain the actual values, you need to divide the displayed value by the scale. In the example above, the highest value shown in the graph is 5. Since the scale is 10, the actual value is 0.5.

The legend below the graph indicates the scale factor.

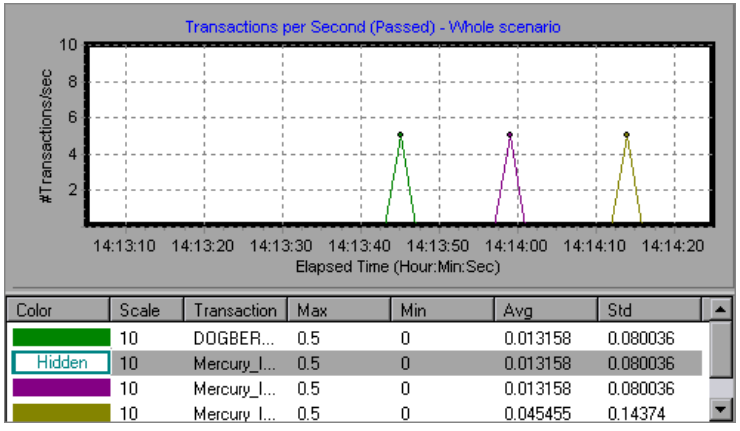


Example: Shown/Hidden Measurements

In the following example, the first image displays a line for each of the four measurements. In the second image, the second measurement listed in the legend is hidden in the graph:



Color	Scale	Transaction	Max	Min	Avg	Std
	10	DOGBER...	0.5	0	0.013158	0.080036
	10	Mercury_l...	0.5	0	0.013158	0.080036
	10	Mercury_l...	0.5	0	0.013158	0.080036
	10	Mercury_l...	0.5	0	0.045455	0.14374



Color	Scale	Transaction	Max	Min	Avg	Std
	10	DOGBER...	0.5	0	0.013158	0.080036
Hidden	10	Mercury_l...	0.5	0	0.013158	0.080036
	10	Mercury_l...	0.5	0	0.013158	0.080036
	10	Mercury_l...	0.5	0	0.045455	0.14374

How to Manage Online Graphs

The following sections describe ways to work with the online monitor graphs.

➤ "Freeze graphs" on page 296

➤ "Overlay graphs" on page 296

➤ "Export graphs to HTML" on page 296

Freeze graphs

You can pause a specific graph during a scenario run. Select the graph and select **Monitors** > **Online Graph** > **Freeze,** or right-click the graph and select **Freeze**. To resume, repeat the above action. When resumed, the graph displays the data for the paused period as well.

Overlay graphs

You can merge or overlay the results of two graphs from the same scenario into a single graph. This enables you to compare several different measurements at once.

In the Run tab, right-click one of the online graphs you want to overlay, and select Overlay Graphs.

Note: The x-axis of both graphs must be the same measurement.

For details, see "Overlay Graphs Dialog Box" on page 304.

Export graphs to HTML

You can export graphs displayed on the Run tab to HTML format for offline viewing at a later stage. When you export to HTML, the legend is also displayed with the graph.

You can export a single graph or all graphs in the online monitor display.

To export a single graph:

a Right-click the graph and select **Export to HTML.**

b Specify a path and filename for the exported graph/report.

To export all the displayed graph:

a Select **Monitors** > **Export Online Graphs to HTML**.

b Specify a path and filename for the exported graphs/reports.

Reference

Online Monitor Graphs User Interface

This section includes (in alphabetical order):

Graph Configuration Dialog Box

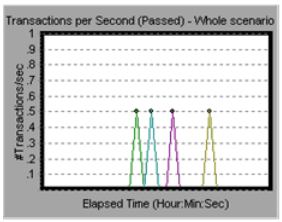
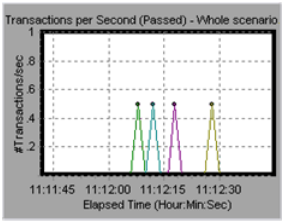
This dialog box enables you to customize the online graph settings.

To access	Use one of the following: ➤ Select **Monitors** > **Online Graphs** > **Configure**. ➤ Right-click a graph and select **Configure**.
Important information	You can apply these settings to all graphs, or to a specific graph only.
Relevant tasks	"How to Customize Online Graph and Measurement Settings" on page 293

User interface elements are described below:

UI Elements (A-Z)	Description
Apply to all graphs	Applies the dialog box settings to all graphs.
Apply to selected graph	Applies the dialog box settings to the selected graph.

UI Elements (A-Z)	Description
Bar Values Type	If the **Bar** display type is selected, determines the type of value that will be displayed in the bar graph: **Average**, **Last Value**, **Minimum**, **Maximum**.
Display Type	The type of graph displayed: line graph or bar graph. By default, each graph is displayed as a line graph. **Note:** For the Network Delay graph, if you right-click the graph and select **View Segments**, you can view the network segments of the graph as an area graph or a pie graph.
Graph Time	Indicates the scale for a graph's x-axis when it is time-based. A graph can show 60 to 3600 seconds of activity. To see the graph in greater detail, decrease the graph time. To view the performance over a longer period of time, increase the graph time. The available graph times are: **Whole Scenario**, **60**, **180**, **600**, and **3600** seconds.
Network Delay View	Available for the Network Delay Time graph only: ➤ **SubPaths**. Displays the delay measurements from the source machine to each of the nodes along the network path. ➤ **DNS name.** Displays the DNS names of the measurements displayed in the legend.
Refresh Rate	The interval at which the graph is refreshed with new data. By default, the graph is refreshed every five seconds. If you increase the refresh rate, the data is refreshed less frequently. **Note:** In a large load test, it is recommended to use a refresh rate of three to five seconds. This enables you to avoid problems with CPU resource usage.

UI Elements (A-Z)	Description
Time	Specifies how the graph displays the time (in seconds) on the x-axis: ➤ **Don't Show.** Instructs LoadRunner not to display values for the x-axis. ➤ **Clock Time.** Displays the absolute time, based on the system clock. ➤ **Relative to Scenario Start.** Displays the time relative to the beginning of the scenario. **Note:** If no step is running, clock time is displayed. **Example:** In the left image below the time is not displayed on the x-axis. In the right image, the time is displayed.  *Don't Show*  *Clock Time*
Y-Axis Scale	Displays graphs using the selected y-axis scale: ➤ **Automatic.** Displays the default y-axis values. ➤ **Maximum Y-Axis Value.** The maximum value for the y-axis. ➤ **Minimum Y-Axis Value.** The minimum value for the y-axis.

Measurement Configuration Dialog Box

This dialog box enables you to configure settings for measurements in a graph. You can:

- Change line colors
- Configure a measurement's scaling
- Show/hide measurements
- View descriptions of the measurements

To access	In the Run tab, right-click a measurement in the graph or legend, and select **Configure.**
Relevant tasks	"How to Customize Online Graph and Measurement Settings" on page 293

User interface elements are described below:

UI Elements (A-Z)	Description
Configuration tab	➤ **Color.** The color assigned to the selected measurement. ➤ **Scale.** The relationship between the y-axis and the graph's actual value. ➤ **Autoscale.** Automatically scales the measurement by calculating the best ratio for displaying the graph. For some graphs, this option is not available. **Default value:** Autoscale **Example:** A scale of **1** indicates that the measurement's value is the value of the y-axis. If you select a scale of **10**, you must multiply the y-axis value by 10 to obtain the true value of the measurement. ➤ **Show / Hide.** The resource selected in the legend is shown/hidden in the graph. By default, all resource measurements are shown in the graph. To show only a selected measurement, right-click the measurement, and select **Show Only Selected**. **Note:** Alternatively right-click a measurement in the graph legend and select **Show/Hide**.
Description tab	Information about the measurement: ➤ **Machine.** Displays the name of the machine whose resources are being monitored. **Note:** Displayed only when a machine's resources are being monitored. ➤ **Description.** Displays a description of the selected measurement. **Note:** Also accessible by right-clicking a measurement in the legend and selecting **Description**.
Machine	The name of the machine whose resources are being monitored. **Note:** Displayed only when a machine's resources are being monitored.

UI Elements (A-Z)	Description
Measurement	The name of the selected measurement.
Network Type	Appears only when monitoring a network path.

Open a New Graph Dialog Box

This dialog box enables you to open a new graph.

To access	Use one of the following: ➤ **Run** tab > **Monitors** > **Online Graphs** > **Open a New Graph** ➤ Right-click a graph and select **Open a New Graph**.
Important information	The graph selected in the graph display area will be replaced by the added graph.
Relevant tasks	"How to Display Online Monitor Graphs" on page 291

User interface elements are described below:

UI Elements (A-Z)	Description
Open Graph	Opens the selected graph and displays it in the graph tree view.
Display only graphs containing data	Select this option to view only those graphs that contain data. To view the entire list of online monitor graphs (even those that do not contain data), clear this option.
Graph Description	Displays a description of the selected graph
Select Graph box	Lists the online monitor graphs by category. To expand a category node, click the "+" . **Tip:** Graph names displayed in blue contain data. **Note:** You can select only one graph at a time.

Overlay Graphs Dialog Box

This dialog box enables you to merge or overlay the results of two graphs from the same scenario into a single graph. The merging enables you to compare several different measurements at once.

For example, you can make an overlaid graph that displays the Web Throughput and Hits per Second as a function of the elapsed time.

To access	In the Run tab, right-click one of the online graphs you want to overlay, and select **Overlay Graphs**.
Important information	➤ In order to overlay graphs, the x-axis of both graphs must be the same measurement. ➤ When you overlay the contents of two graphs that share a common x-axis, the left y-axis on the overlaid graph shows the current graph's values. The right y-axis shows the values of the graph that was overlaid.
Relevant tasks	"How to Manage Online Graphs" on page 296

User interface elements are described below:

UI Elements (A-Z)	Description
Current Graph	The name of the current graph.
Select graph to overlay with	The name of the graph to be merged with the current graph. **Note:** The drop-down list displays only the active graphs that have a common x-axis with the current graph.
Title of overlaid graph	The title given to the overlaid graph.

Available Graphs Tree

The Available Graphs Tree displays the online monitor graphs.

Tip: Graph names displayed in blue contain data.

To select measurements to monitor in a particular graph, see the monitor configuration instructions for each specific monitor. For details, see "How to Set Up the Monitoring Environment – Workflow" on page 443.

Graph	Description
Running Vusers	Provides information about the status of the Vusers running in the current scenario on all load generators. The graph shows the number of running Vusers, while the information in the legend indicates the number of Vusers in each state.
User-Defined Data Points	Displays the real-time 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).
Error Statistics	Provides details about the number of errors that accrue during each second of the scenario run. The errors are grouped by error source—for example, the location in the script or the load generator name.
Vusers with Errors	Provides details about the number of Vusers that generate errors during scenario execution. The errors are grouped by error source.
Transaction Response Time	Shows the average response time of transactions in seconds (y-axis) as a function of the elapsed time in the scenario (x-axis).
Transaction Per Second (Passed)	Shows the number of successful transactions performed per second (y-axis) as a function of the elapsed time in the scenario (x-axis).

Graph	Description
Transaction Per Second (Failed, Stopped)	Shows the number of failed and stopped transactions per second (y-axis) as a function of the elapsed time in the scenario (x-axis).
Total Transactions Per Second (Passed)	Shows the total number of completed, successful transactions per second (y-axis) as a function of the elapsed time in the scenario (x-axis).
Hits Per Second	Shows the number of hits (HTTP requests) to the Web server (y-axis) as a function of the elapsed time in the scenario (x-axis). You can compare this graph to the Transaction Response Time graph to see how the number of hits affects transaction performance.
Throughput	Shows the amount of throughput on the Web server (y-axis) during each second of the scenario run (x-axis). Throughput is measured in bytes and represents the amount of data that the Vusers received from the server at any given second. You can compare this graph to the Transaction Response Time graph to see how the throughput affects transaction performance.
HTTP Responses per Second	Shows the number of HTTP status codes—which indicate the status of HTTP requests, for example, “the request was successful,” “the page was not found”—(y-axis) returned from the Web server during each second of the scenario run (x-axis), grouped by status code. You can group the results shown in this graph by script (using the "Group By" function) to locate scripts which generated error codes.
Pages Downloaded per Second	Shows the number of Web pages (y-axis) downloaded from the server during each second of the scenario run (x-axis). This graph helps you evaluate the amount of load Vusers generate, in terms of the number of pages downloaded.

Graph	Description
Retries per Second	Shows the number of attempted Web server connections (y-axis) as a function of the elapsed time in the scenario x-axis). A server connection is retried when the initial connection was unauthorized, when proxy authentication is required, when the initial connection was closed by the server, when the initial connection to the server could not be made, or when the server was initially unable to resolve the load generator's IP address.
Connections	Shows the number of open TCP/IP connections (y-axis) at each point in time of the scenario (x-axis). One HTML page may cause the browser to open several connections, when links on the page go to different Web addresses. Two connections are opened for each Web server.
Connections per Second	Shows the number of new TCP/IP connections (y-axis) opened and the number of connections that are shut down each second of the scenario (x-axis).
SSLs per Second	Shows the number of new and reused SSL Connections (y-axis) opened in each second of the scenario (x-axis). An SSL connection is opened by the browser after a TCP/IP connection has been opened to a secure server.
Windows Resources	Shows the NT and Windows 2000 resources measured during the scenario. The NT and Windows 2000 measurements correspond to the built-in counters available from the Windows Performance Monitor.
UNIX Resources	Shows the UNIX resources measured during the scenario. The UNIX 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.

Graph	Description
Server Resources	Shows the resources (CPU, disk space, memory, or services) used on remote Unix servers measured during the scenario. This helps you determine the impact of Vuser load on the various system resources. The x-axis represents the elapsed time. The y-axis represents the resource usage.
SNMP Resources	Shows statistics for machines running an SNMP agent, using the Simple Network Management Protocol (SNMP). The x-axis represents the elapsed time. The y-axis represents the resource usage.
SiteScope	Displays statistics about the resource usage on the SiteScope machine during the scenario run. The x-axis represents the elapsed time. The y-axis represents the resource usage.
Network Delay Time	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 scenario time.
CheckPoint FireWall-1	Shows statistics on Check Point's Firewall server as a function of the elapsed scenario time. The x-axis represents the time that has elapsed since the start of the scenario run. The y-axis represents the resource usage.
Apache	Displays statistics about the resource usage on the Apache server during the scenario run.The x-axis represents the time that has elapsed since the start of the scenario run. The y-axis represents the resource usage.
Microsoft IIS	Shows server statistics as a function of the elapsed scenario time. The x-axis represents the time that has elapsed since the start of the scenario run. The y-axis represents the resource usage.

Graph	Description
Microsoft Active Server Pages	Displays statistics about the resource usage on the ASP server during the scenario run. The x-axis represents the time that has elapsed since the start of the scenario run. The y-axis represents the resource usage.
WebLogic (SNMP)	Displays statistics about the resource usage on the WebLogic (SNMP) server (version 6.0 and earlier) during the scenario run. The x-axis represents the time that has elapsed since the start of the scenario run. The y-axis represents the resource usage.
DB2	Shows the resource usage on the DB2 database server machine as a function of the elapsed scenario time. The x-axis represents the time that has elapsed since the start of the scenario run. The y-axis represents the resource usage.
Oracle	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.
SQL Server	Shows the standard Windows resources on the SQL server machine. The x-axis represents the time that has elapsed since the start of the scenario run. The y-axis represents the resource usage.
RealPlayer Client	Shows statistics on the RealPlayer client machine as a function of the elapsed scenario time. The x-axis represents the time that has elapsed since the start of the scenario run. The y-axis represents the resource usage.
Media Player Client	Shows statistics on the Windows Media Player client machine as a function of the elapsed scenario time. The x-axis represents the time that has elapsed since the start of the scenario run. The y-axis represents the resource usage.

Graph	Description
SAPGUI	Shows the resource usage of a SAP R/3 system server as a function of the elapsed scenario time. The x-axis represents the time that has elapsed since the start of the scenario run. The y-axis represents the resource usage.
Siebel Server Manager	Shows the resource usage of your Siebel Server Manager server as a function of the elapsed scenario time.
PeopleSoft (Tuxedo)	Shows the resource usage of your Tuxedo server as a function of the elapsed scenario time.
J2EE	Shows the resource usage of Java 2 Platform, Enterprise Edition (J2EE) objects as a function of the elapsed scenario time. The x-axis represents the time that has elapsed since the start of the scenario run. The y-axis represents the resource usage.
Microsoft COM+	A series of graphs that provide performance information for COM+ interfaces and methods as a function of the elapsed scenario time.
Citrix MetaFrame XP	Citrix MetaFrame is an Application Deployment solution which delivers applications across networks. The Citrix MetaFrame Resource Monitor is an Application Deployment Solution monitor, which provides performance information for the Citrix MetaFrame servers. The Citrix MetaFrame XP graph displays statistics about resource usage on the Citrix server during the scenario run.
Tuxedo	Provides information about the server, load generator, workstation handler, and queue in a Tuxedo system.
IBM WebSphere MQ	Shows the resource usage of IBM WebSphere MQ Server channel and queue performance counters as a function of the elapsed scenario time.
Network Client	Shows statistics for FTP, POP3, SMTP, IMAP, and DNS Vusers on the network client machine as a function of the elapsed scenario time.

15

Rendezvous Points

This chapter includes:

Concepts

Tasks

Reference

Concepts

Rendezvous Points Overview

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.

Suppose you want to measure how a Web-based banking system performs when ten Vusers simultaneously check account information. To emulate the required user load on the server, you instruct all the Vusers to check account information at exactly the same time.

You ensure that multiple Vusers act simultaneously by creating a rendezvous point. When a Vuser arrives at the rendezvous point, it is held there by the Controller. You then set a **rendezvous policy** according to which the Controller releases the Vusers from the rendezvous point either when the required number of Vusers arrives, or when a specified amount of time has passed.

You define rendezvous points in the Vuser script. For information about inserting rendezvous points into Vuser scripts, see the *HP Virtual User Generator User Guide*.

Using the Controller, you can influence the level of server load by selecting:

- which of the rendezvous points will be active during the scenario
- how many Vusers will take part in each rendezvous

For example, to test a bank server, you could create a scenario that contains two rendezvous points. The first rendezvous ensures that 1000 Vusers simultaneously deposit cash. The second rendezvous ensures that another 1000 Vusers simultaneously withdraw cash. If you want to measure how the server performs when only 500 Vusers deposit cash, you can deactivate the **withdraw** rendezvous, and instruct 500 Vusers to participate in the **deposit** rendezvous only.

Tasks

How to Set Up a Rendezvous in a Scenario

This task describes set up rendezvous points and policies in a scenario.

This task includes the following steps:

1 Prerequisites

To set up a rendezvous in the scenario, your scenario must include Vuser scripts that have rendezvous points inserted in them. For information about inserting rendezvous points into Vuser scripts, see the *HP Virtual User Generator User Guide*.

When you add a Vuser group or script to the scenario, LoadRunner scans the included scripts for the names of the rendezvous points and adds them to the list of rendezvous points. You can the list of all the rendezvous points in your scenario by selecting **Scenario** > **Rendezvous**.

Note: In goal-oriented scenarios, a script's rendezvous points are disabled.

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2 Set the level of emulated user load

Select the rendezvous points to take part in the scenario, and the number of Vusers to participate in each rendezvous. For user interface details, see "Rendezvous Information Dialog Box" on page 317.

You can temporarily disable a rendezvous and exclude it from the scenario. You can disable a rendezvous point for all Vusers in a scenario, or you can temporarily disable specific Vusers from participating in the rendezvous.

By disabling and enabling a rendezvous, you influence the level of server load.

3 Set the attributes for the rendezvous policy - Optional

In the Rendezvous Information dialog box, for each rendezvous:

a Select the rendezvous, and click the **Policy** button.

b In the Policy dialog box, set the **policy** attributes as follows:

- **Release.** How many Vusers will be released from a rendezvous at a time.
- **Timeout.** How long the Controller waits before releasing Vusers from a rendezvous.

For user interface details, see "Rendezvous Information Dialog Box" on page 317.

Reference

Rendezvous User Interface

This section includes (in alphabetical order):

➤ Rendezvous Information Dialog Box on page 317

Rendezvous Information Dialog Box

This dialog box enables you to view and modify the attributes of each rendezvous point in the scenario. It displays general information about the rendezvous point: which script is associated with the rendezvous, and release history.

To access	Manual scenario > **Design** tab > **Scenario** > **Rendezvous**
Important information	Available only if one of the Vuser scripts participating in the scenario contains a rendezvous point.
Relevant tasks	"How to Set Up a Rendezvous in a Scenario" on page 315

User interface elements are described below:

UI Elements (A-Z)	Description
	Disables the rendezvous, excluding it from the scenario, thereby influencing the level of server load.
	Enables a disabled rendezvous point.

UI Elements (A-Z)	Description
Policy...	Opens the Policy dialog box, where you can set the number Vusers to be released from a rendezvous at a time, as well as the amount of time the Controller waits before releasing Vusers from a rendezvous. ➤ **Release when X% of all Vusers arrive at the rendezvous.** Releases the Vusers only when the specified percentage of all Vusers arrives at the rendezvous point. **Note:** This option interferes with the scheduling of your scenario. If you select this option, your scenario will not run as scheduled. ➤ **Release when X% of all running Vusers arrive at the rendezvous.** Releases the Vusers only when the specified percentage of all Vusers running in the scenario arrives at the rendezvous point. ➤ **Release when X Vusers arrive at the rendezvous.** Releases the Vusers only when the specified number arrives at the rendezvous point. ➤ **Timeout between Vusers.** The timeout value (in seconds). After each Vuser arrives at the rendezvous point, LoadRunner waits up to the maximum timeout period specified for the next Vuser to arrive. If the next Vuser does not arrive within the timeout period, the Controller releases all the Vusers from the rendezvous. Each time a new Vuser arrives, the timer is reset to zero. You set a timeout for each rendezvous point. **Default value:** 30 seconds
Disable VUser	Disables a Vuser from taking part in the rendezvous.
Enable VUser	Enables a Vuser to take part in the rendezvous.
Reset	Resets the Status Information, removing the information currently displayed.

UI Elements (A-Z)	Description
	While a scenario is running, enables you to manually release Vusers from a rendezvous before the Controller releases them. Use this option if you want the scenario to continue running even though all the Vusers did not reach the rendezvous.
Rendezvous	The names of the rendezvous points in the scenario.
Scripts	The Vuser scripts that are associated with the rendezvous points.
Status Information	During and after a scenario, displays: ➤ **Current Status.** The number of Vusers that arrived at the rendezvous point out of the total number of Vusers assigned to the rendezvous. ➤ **Time.** The time at which the Vusers at the rendezvous point were released. ➤ **Reason.** The reason the Vusers at the rendezvous point were released. The possible reasons are **Timeout** or **Arrived**.
Vusers	The Vusers associated with the rendezvous points.

16

After the Scenario Run

This chapter includes:

Concepts

Tasks

Reference

Concepts

Post Scenario Run Procedures - Overview

After the scenario runs you analyze the results using HP LoadRunner Analysis. If the run results are stored locally on each participating load generator, they need to be gathered into one location so that they can be processed for analysis. Diagnostics results on the mediators and severs must also be gathered. This process is known as **data collation**.

For details about collating run results and diagnostics data, see "Collating Run Data" on page 322.

For details about analyzing the scenario run, see the *HP LoadRunner Analysis User Guide*.

Collating Run Data

When you run a scenario, by default all the run data is stored locally on each load generator. After scenario execution, the results must be collated—that is, the results from all of the load generators must be gathered and transferred to the results directory–before any analysis data can be generated.

In addition, data from the diagnostics servers or mediators must be collated as well.

You can set LoadRunner to collate the run data automatically, as soon as the run is complete. Alternatively, you can collate the run data manually after the run. This way, you can save and close a scenario and collate the data after reopening the scenario in the Controller.

The data that is collated include the result, diagnostics, and log files. After LoadRunner has successfully collated the data, these files are deleted from the load generators and diagnostics mediators from which they were gathered.

Note: In Expert mode, you can disable the collation of the log file collation (see "Configure general scenario options for Expert mode" on page 217).

For details on how to collate run data, see "How to Collate Scenario Run Results" on page 324.

Tasks

How to Collate Scenario Run Results

This task describes how to collate results after a scenario run.

Note:

- Data collation includes result, diagnostics, and log files. If you are working in Expert mode, you can disable the collation of the log files. Before collating the results, select **Tools** > **Options** > **General tab** > **Do not collate log files.**
- You can set a command to run when collation is complete. Select **Tools** > **Options** > **Execution** tab, and enter the command in the **Post Collate Command** box.

To collate results automatically:

Select **Results** > **Auto Collate Results.**

To collate results manually:

Select **Results** > **Collate Results** > **Collate Results.**

To stop the collation process:

In the Collate Results dialog box, click **Stop.**

To resume the collation process:

If you stopped the collation process, to resume select **Results** > **Collate Results** > **Continue stopped collation**.

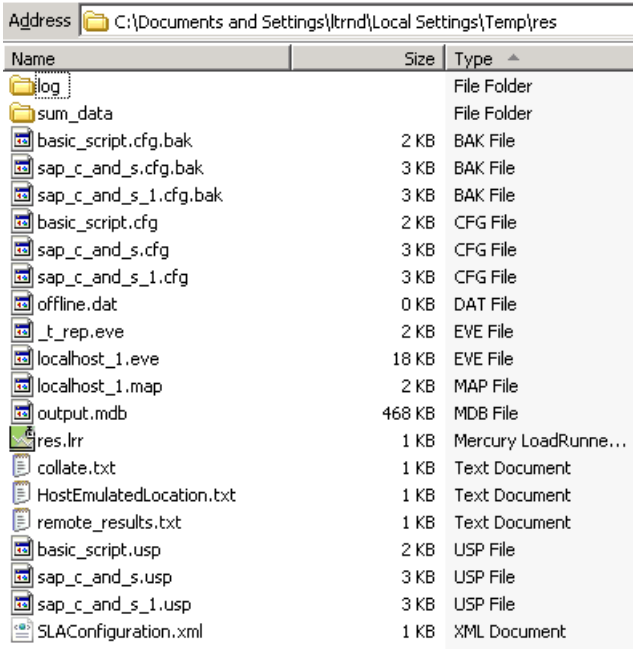
If collation fails due to a lack of disk space:

To recollate, select **Results** > **Collate Results** > **Recollate**. LoadRunner attempts to collate the results again, without compressing the **.eve** file.

Reference

Results Directory File Structure

Before you run a scenario, you specify where the run results should be stored. LoadRunner saves all the data it gathers during the run to the specified directory. A typical results directory has the following structure:



The content of the results directory are described in the following table:

Directory/File	Description
log directory	Contains output information generated during replay for each Vuser
sum_data directory	Contains the graph summary data (**.dat**) files.
***_bd directories**	Contain diagnostics breakdown information.

Directory/File	Description
***.cfg files**	Contain a listing of the script's run-time settings as defined in VuGen (think time, iterations, log, Web, and so on). The results directory contains a .cfg file for each script.
***.def files**	Definition files for graphs that describe the online and other custom monitors.
***.usp files**	Contain the script's run logic, including how the actions sections run. The results directory contains a .usp file for each script.
_t_rep.eve	Contains Vuser and rendezvous information.
<Controller>.eve	Contains information from the Controller host.
<Load_Generator>.eve.gzl files	The <load generator>.eve files contain information from the load generators in the scenario. These files are zipped and saved to the results directory in .gzl format.
<Load_Generator>.map	Maps transactions and data points on the load generator to IDs.
<results_name> directory	Contains the scenario run results.
<results_name>.lrr	Contains information about the scenario run, such as the name, duration, scripts included, and so on.
collate.txt	Contains the file paths of the result files, and collation status information.
collateLog.txt	Contains the status (succeeded, failed) of result, diagnostics, and log file collation from each load generator.
HostEmulatedLocation.txt	Contains the emulated locations defined for WAN Emulation.
offline.dat	Contains sample monitor information.
output.mdb	The database created by the Controller. Stores all the output messages reported during the scenario run.

Directory/File	Description
remote_results.txt	Contains the file paths for the host event files
SLAConfiguration.xml	Contains SLA definition information for the scenario.

When you generate analysis graphs and reports, the Analysis engine copies all of the scenario result files (**.eve** and **.lrr**) to a database. After the database is created, Analysis works directly with the database and does not use the result files.

Collating Results User Interface

This section includes:

➤ Collate Results Dialog Box on page 327

Collate Results Dialog Box

This dialog box enables you to view the progress of result collation after a scenario run.

To access	➤ **Results** > **Collate Results** > **Collate Results** ➤ If **Auto Collate Results** is activated, this dialog box opens automatically when LoadRunner starts collating the run results after a scenario run.
Relevant tasks	➤ "How to Collate Scenario Run Results" on page 324 ➤ "Enable Automatic Result Collation - optional" on page 241

User interface elements are described below:

UI Elements (A-Z)	Description
	Stops collating the results.
Close automatically	Select to automatically close the Collate Results dialog box after collation is completed.
General Status	The collation status and file size of the Event, Diagnostics, and Log files. **Note:** The file size shown is before compression.
Progress Details	The status (succeeded, failed) of result, diagnostics, and log file collation from each load generator or mediator. This information is stored in the **collateLog.txt** file.

17

Using QuickTest Scripts in LoadRunner

This chapter includes:

Concepts

Tasks

Concepts

Using QuickTest Scripts in LoadRunner Overview

HP Functional Testing software (QuickTest) enables you to create complex tests that examine the full spectrum of your application's functionality.

LoadRunner can integrate QuickTest scripts into a load testing scenario in the form of GUI Vuser scripts. These scripts, that have already been designed and debugged in QuickTest can be used as the basis of your load test.

The main advantages of running QuickTest scripts in LoadRunner are:

- To check how your application's functionality is affected by heavy load
- To measure the response time that a typical user experiences on the client side while your application is under load (end-to-end response time)

For example, you can add QuickTest scripts to specific points in a LoadRunner scenario to confirm that the application's functionality is not affected by the extra load at those sensitive points.

Another advantage of using a GUI Vuser script as part of your LoadRunner scenario is that the GUI Vuser script runs on your screen during the scenario, enabling you to watch the actual steps executed by the Vuser in real time.

About GUI Vuser Scripts

GUI Vusers enable you to measure and monitor end-to-end user response times while your client/server system is under load. A GUI Vuser emulates the complete environment of a human user.

For example, a human user sits at a machine, operates applications using the keyboard and the mouse, and reads information on the machine's monitor. Similarly, a GUI Vuser runs on its own machine and operates applications. A GUI Vuser can be programmed to read and act on information that appears on its machine's display.

Suppose that you have a bank server that services many automatic teller machines (ATMs). You could create a GUI Vuser script that:

- opens the ATM application
- enters an account number
- enters the amount of cash to be withdrawn
- withdraws cash from the account
- checks the balance of the account
- closes the ATM application
- repeats the process

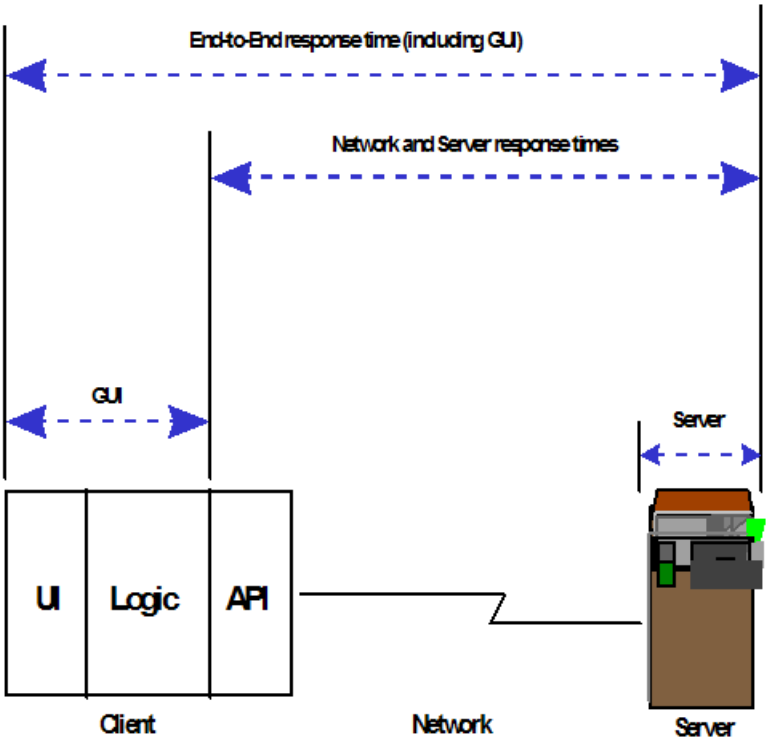
The actions of each GUI Vuser are described in a GUI Vuser script. You use QuickTest to create GUI Vuser scripts.

You monitor and manage GUI Vusers using the LoadRunner Controller. For instance, you can use the Controller to run, pause, or view Vusers, and to monitor scenario status.

Note: You cannot use VuGen to run a GUI Vuser script. You use the Controller to run a GUI Vuser script as part of a scenario; you use QuickTest to run a GUI Vuser script in standalone mode.

Understanding GUI Vuser Technology

GUI Vusers measure real end-to-end response times. End-to-end response times represent the total time that a user waits for a response after submitting a request. End-to-end response times include GUI response times as well as network and server response times.



Guidelines for Using QuickTest Scripts in LoadRunner

When creating test scripts in QuickTest that are going to be used as GUI Vuser scripts in a LoadRunner testing scenario, you need to follow certain guidelines to ensure smooth integration of the script. For detailed explanations about creating tests in QuickTest, see the QuickTest documentation.

This section also includes:

Limitations

QuickTest offers several features that are designed specifically for integration with LoadRunner. Some QuickTest features, however, may not be available when they are integrated with LoadRunner. For more information about specific limitations, see the QuickTest readme.

Including Transactions

To measure the performance of the server, you define **transactions**. A transaction represents an action or a set of actions that you are interested in measuring. You define transactions within your Vuser script by enclosing the appropriate sections of the script with **start** and **end** transaction statements.

For example, you can define a transaction that measures the time it takes for the server to process a request to view the balance of an account and for the information to be displayed at the ATM.

Note: LoadRunner only provides performance information for data that is included within a transaction. Therefore, your QuickTest test must include transactions to be used by LoadRunner.

For more information about using transactions in QuickTest, see the QuickTest documentation.

Adding Statements

You can use the **Services** object and its associated methods to insert statements that are specifically relevant to performance testing. These include **Abort**, **GetEnvironmentAttribute**, **LogMessage**, **SetTransactionStatus**, **ThinkTime**, **UserDataPoint**, **StartTransaction** and **EndTransaction**. For more information on these methods, see the QuickTest documentation.

Designing Tests for LoadRunner

Consider the following design guidelines when designing tests for use with LoadRunner:

- The QuickTest tests you use with LoadRunner should be simple tests, designed to pinpoint specific operations.
- LoadRunner cannot run nested action iterations.
- Do not include references to external actions or other external resources, such as an external Data Table file, environment variable file, shared object repositories, and so forth.
- Include transactions in your QuickTest test since LoadRunner only provides performance information for data that is included within a transaction.

Tasks

How to Add a QuickTest Script to a Load Test Scenario

This task describes how to integrate a QuickTest script into LoadRunner.

1 Navigate to the folder containing the script.

- For a new scenario, click **Browse** in the New Scenario dialog box.
- When adding the script to an existing scenario, click **Browse** in the Add Group/Add Script dialog box. The Open Test dialog box opens.

2 In the **Files of Type** box select **QuickTest Tests**.

3 Navigate to the appropriate script and add it to your scenario.

18

Managing Scenarios Using Application Lifecycle Management

This chapter includes:

Concepts

Tasks

Reference

Concepts

Managing Scenarios Using Application Lifecycle Managment Overview

The Controller works together with Application Lifecycle Managment (ALM), HP's Web-based test management tool. HP ALM provides an efficient method for storing and retrieving Vuser scripts, scenarios, and results. You can store scenarios in an ALM project and organize them into unique groups.

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

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

Tasks

How to Work with Scenarios in ALM Projects

The following steps describe the workflow of how to work with scenarios saved in an Application Lifecycle Managment project.

- "Connect to ALM" on page 339
- "Open the scenario" on page 339
- "Save the scenario" on page 339

1 Connect to ALM

Open a connection to the ALM server and project that contains the scenario. For task details, see "Connect to ALM" on page 339.

2 Open the scenario

Select **File** > **Open** and specify the location of the scenario.

3 Save the scenario

Select **File** > **Save as**. If the scenario is in a project that uses version control and is not checked out, the scenario is only saved as a temporary file on your local machine.

Connect to ALM

To store and retrieve scenarios 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.

The connection process has two stages. First, you connect to an ALM Web server. This server handles the connections between the Controller and the ALM project.

Next, you select the project you want to access. The project stores the scenarios that you created in the Controller.

To connect to Application Lifecycle Management:

1. Select **Tools** > **HP ALM Connection**.
2. Complete the HP ALM Connection dialog box and select **Connect**.
3. For user interface details, see "HP ALM Connection Dialog Box" on page 343.
4. To disconnect from ALM, click **Disconnect**.

How to Save Scenarios to ALM Projects

The following steps describe how to save a scenario to an ALM project.

➤ "Open/create the scenario" on page 340

➤ "Connect to HP Application Lifecycle Management" on page 340

➤ "Save the scenario to ALM" on page 341

1 Open/create the scenario

Create or open the desired scenario.

2 Connect to HP Application Lifecycle Management

Open a connection to the ALM server and project that you want to store the scenario. For task details, see "Connect to ALM" on page 339.

3 Define a test set

Define a Application Lifecycle Management test set where to save results as follows:

a Select **Results** > **Results Settings**. The Set Results Directory dialog box opens.

b Click **HP ALM...**

c Enter the required information in the Set Results Directory dialog box. For user interface details, see "Set Results Directory Dialog Box" on page 243.

d Click **OK**.

4 Save the scenario to ALM

Select **File** > **Save as** and specify the location.

How to Add Vuser Scripts from a Application Lifecycle Management Project

The following steps describe how to add Vuser scripts from a Application Lifecycle Management project to the Controller's script list. You can add the script to either a manual or a goal-oriented scenario.

➤ "Add a Vuser script to a manual scenario" on page 341

➤ "Add a Vuser script to a goal-oriented scenario" on page 341

Add a Vuser script to a manual scenario

1 Open a connection to the ALM server and project where the scripts are located. For task details, see "Connect to ALM" on page 339.

2 In the Scenario Groups pane, click the **Add Group** button.

3 In the Add Group dialog box, click **Browse**. The Open Test from HP ALM Project dialog box opens.

4 Select the script and click **OK**. The Script Path field displays [TD], the full subject path, and the script name.

For example:

[TD]\Subject\System\test_alm

5 Click OK. The script is displayed in the Scenario Groups pane.

Add a Vuser script to a goal-oriented scenario

1 Open a connection to the ALM server and project where the scripts are located. For task details, see "Connect to ALM" on page 339.

2 On the Scenario Scripts pane toolbar, click the **Add Script** button. The Add Script dialog box opens.

3. Click **Browse**. The Open Test from HP ALM Project dialog box opens and displays the test plan tree.
4. Select the script and click **OK**. The Script Path field displays [TD], the full subject path, and the script name.

   For example:

   [TD]\Subject\System\test_alm

5. Click **OK** to close the Add Script dialog box. The script appears in the Script Path column in the Scenario Scripts pane.

Reference

Application Lifecycle Management User Interface

This section includes:

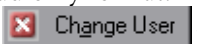
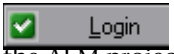
HP ALM Connection Dialog Box

This dialog box enables you to connect to an ALM project from within the Controller.

To access	**Tools > HP ALM Connection > Connect**

User interface elements are described below:

UI Elements (A-Z)	Description
Step 1: Connect to Server	➤ **Server URL.** The URL of the server that contains HP ALM. ➤ **Reconnect to server on startup.** Automatically reconnect to the server every time you start the application. ➤  /  . Connects to the server specified in the **Server URL** box. Only one button is visible at a time, depending on your connection status.

UI Elements (A-Z)	Description
Step 2: Authenticate User Information	➤ **User Name.** Your ALM user name. ➤ **Password.** Your ALM password. ➤ **Authenticate on startup.** Authenticates your user information automatically, the next time you open the application. This option is only available if you selected **Reconnect to server on startup** above. ➤  . 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  . 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. (If you are working with a project in versions of TestDirector earlier than version 7.5, the **Domain** box is not relevant.) ➤ **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. ➤  /  .Logs into and out of the ALM project.

Upload Scenario Dialog Box

This dialog box enables you to open a scenario from an ALM project or save a scenario to an ALM project.

To access	**File > Open > Click** HP ALM... **File > Save as > Click** HP ALM...

User interface elements are described below:

UI Elements (A-Z)	Description
Upload run time files	Uploads only the files needed to replay the scenario. Does not upload recording snapshot files and other unnecessary files. This results in a shorter download time.
Upload all files	Uploads all of the files associated with this scenario. This results in a longer upload time.

Part IV

Working with Firewalls

19

Working with Firewalls in LoadRunner

This chapter includes:

Concepts

Tasks

Reference

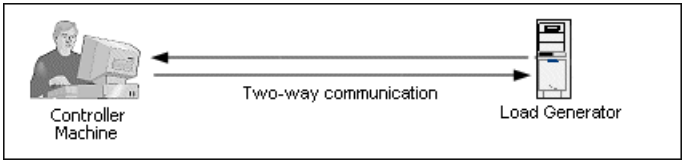
Concepts

About Using Firewalls in LoadRunner

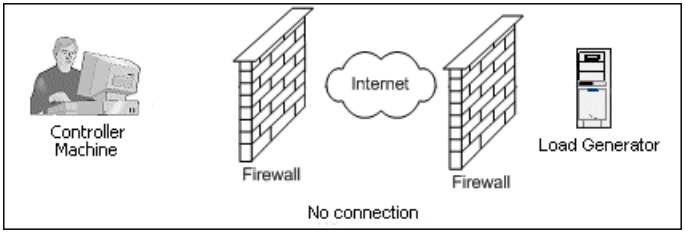
Working with a firewall means that you can prevent unauthorized access to or from a private network, on specific port numbers.

For example, you can specify that there is no access to any port from the outside world, with the exception of the mail port (25), or you can specify that there is no outside connection from any ports to the outside except from the mail port and WEB port (80). The port settings are configured by the system administrator.

In a regular LoadRunner load test scenario (not over a firewall), the Controller has direct access to the LoadRunner agents running on remote machines. This enables the Controller to connect directly to those machines.



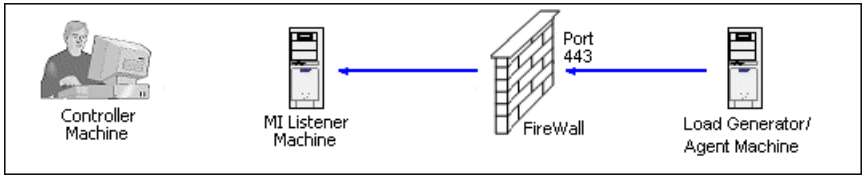
When running Vusers or monitoring applications over a firewall, this direct connection is blocked by the firewall. The connection cannot be established by the Controller, because it does not have permissions to open the firewall.



LoadRunner solves this problem by using a communication configuration based on HTTPS or secured TCP/IP. This configuration uses the standard SSL port on the firewall (port 443). For more information, see "Set Up Your Deployment (TCP or HTTPS)" on page 357.

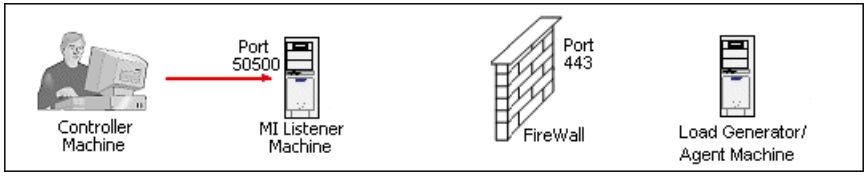
A LoadRunner agent is installed on load generators running Vusers over a firewall, and on Monitor Over Firewall machines that monitor the servers that are located over a firewall. The agent communicates with the MI Listener machine through port 443 in the firewall.

The MI Listener is a component that serves as a router between the Controller and the LoadRunner agent.

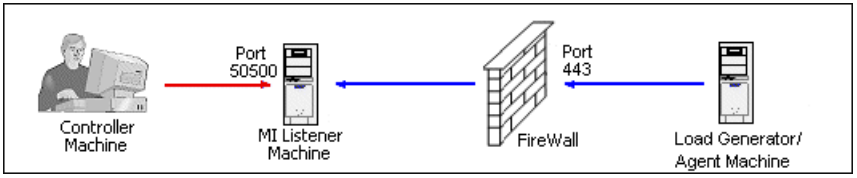


When the LoadRunner agent connects to the MI Listener, the MI Listener keeps a listing of the connection to the agent using a symbolic name that the agent passed to it.

When the Controller connects to the MI Listener, it communicates to the MI Listener through port 50500.

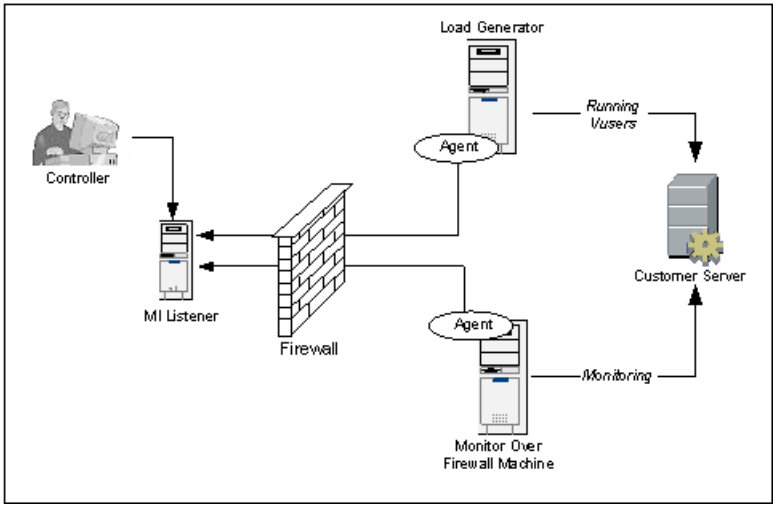


The Controller uses a symbolic name for the agent, and provides the MI Listener machine's name. If there has been a connection from the agent with the same symbolic name to this MI Listener, the connection is made between the Controller and the agent. Once you have a connection with the agent, you can run or monitor Vusers over a firewall.



Example of Over Firewall Deployment

The following diagram is a basic example of a LoadRunner deployment over a firewall.



As explained in the previous section, the LoadRunner agent is installed on both the load generator machine and the Monitor Over Firewall machine. During installation, the LoadRunner agent is added as a Windows service.

The MI Listener serves as a router between:

- The agent on the load generator machine and the Controller, enabling the Controller to run Vusers over a firewall.
- The agent on the Monitor Over Firewall machine and the Controller, enabling the Controller to monitor the servers that are located over a firewall.

Note: You can connect the Controller to load generators over a firewall or Monitor Over Firewall machines without using the MI Listener and LoadRunner agent. To do so, open port 54345 on a firewall in the load generator/Monitor Over Firewall machine's LAN and in the Controller's LAN to allow incoming and outgoing data.

Monitors Over a Firewall

To monitor servers over a firewall, you need to configure the Monitor Over Firewall machine. On the Monitor Over Firewall machine, you use the Server Monitor configuration tool to select which servers to monitor and to define specific measurements that LoadRunner collects for each monitored server.

To enable monitoring of your servers over a firewall, you install the Monitor Over Firewall component on a dedicated machine.

Important: Before you configure your system to monitor your servers over a firewall, ensure that you have completed the configuration steps described in "How to Configure the Over-Firewall System" on page 357.

After you have set up your LoadRunner system to work with firewalls, you need to configure the monitor settings on the Monitor Over Firewall machine.

You use the Server Monitor configuration tool to select which servers to monitor and to define specific measurements that LoadRunner collects for each monitored server. For more information, see "How to Configure Monitors Over a Firewall" on page 365.

Tasks

How to Set Up Your System to Use Firewalls

Setting up your system to use firewalls involves the following stages of configuration:

This task includes the following steps:

- "Install Components and Perform Initial Configuration" on page 355
- "Set Up Your System to Run Vusers Over the Firewall" on page 356
- "Configure Your System to Monitoring Servers Over a Firewall" on page 357
- "Check Connectivity" on page 357

1 Install Components and Perform Initial Configuration

Perform the following steps:

a Install the over-firewall components.

To enable over firewall communication, ensure that you have installed the following LoadRunner components:

- **MI Listener.** Serves as a router between the Controller and the LoadRunner agent. You install the MI Listener component on a dedicated machine. For installation instructions, refer to the *HP LoadRunner Installation Guide*.

  For instructions on configuring the MI Listener machine, see "Configure the MI Listener" on page 360.

Note: You can also use the Controller machine as the MI Listener without the need for a separate installation. When acting as the MI Listener, the Controller machine cannot have Vusers running on it. In this case, the Controller must be a pure Controller and not a Controller + Load Generator.

➤ **Monitor Over Firewall component.** Used to monitor the servers that are located over a firewall. You install the Monitors over Firewall component on a dedicated machine. For installation instructions, refer to the *HP LoadRunner Installation Guide*.

For information about configuring the Monitor Over Firewall machine, see "How to Configure Monitors Over a Firewall" on page 365.

b Perform the initial configuration of the over-firewall system.

See "How to Configure the Over-Firewall System" on page 357.

2 Set Up Your System to Run Vusers Over the Firewall

Note: Before configuring your system to run Vusers over a firewall, make sure that you have completed the steps described in "How to Configure the Over-Firewall System" on page 357.

To set up your system to run Vusers over a firewall, you configure the LoadRunner agent to communicate with the MI Listener on each load generator machine that will be running over the firewall. For more information, see "Configure the LoadRunner Agent on Each Monitor Over Firewall Machine" on page 361.

You then configure the Controller to recognize the load generator and MI Listener machines. For more information, see "Configure the Controller for Running Over a Firewall" on page 361.

3 Configure Your System to Monitoring Servers Over a Firewall

See "How to Configure the System to Monitor Servers Over a Firewall" on page 361

4 Check Connectivity

After installing a configuring all the necessary components, check that you are able to establish a connection between the LoadRunner agent, MI Listener, and the Controller machine. For more information, see "Checking Connectivity" on page 375.

How to Configure the Over-Firewall System

This task describes how to configure the Over-Firewall System.

This task includes the following steps:

1 Prerequisites

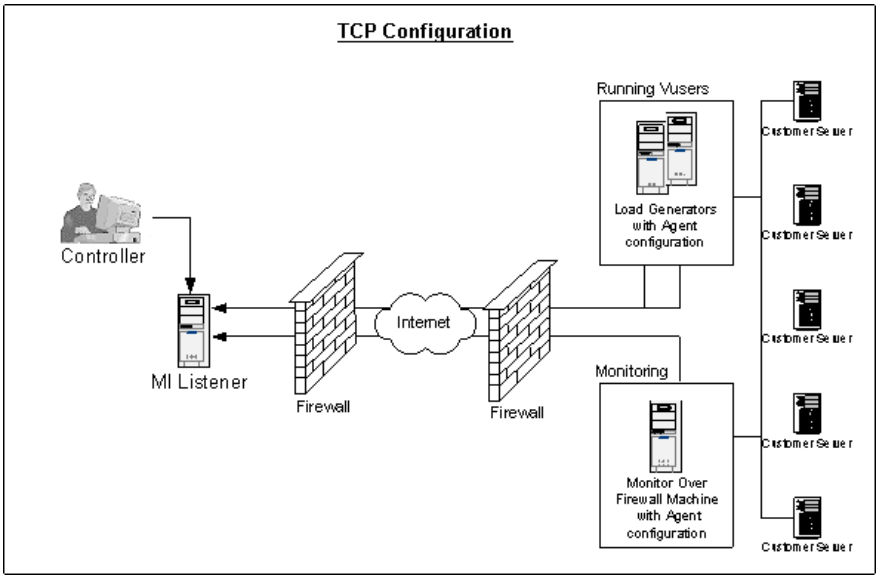
Before configuring the over-firewall system, make sure you have installed the necessary components as described in "Install Components and Perform Initial Configuration" on page 355.

2 Set Up Your Deployment (TCP or HTTPS)

To run Vusers or monitor servers over the firewall, configure your system according to one of the following configurations. Note that these configurations contain a firewall on each LAN. There may also be configurations where there is a firewall for the Over-Firewall LAN only.

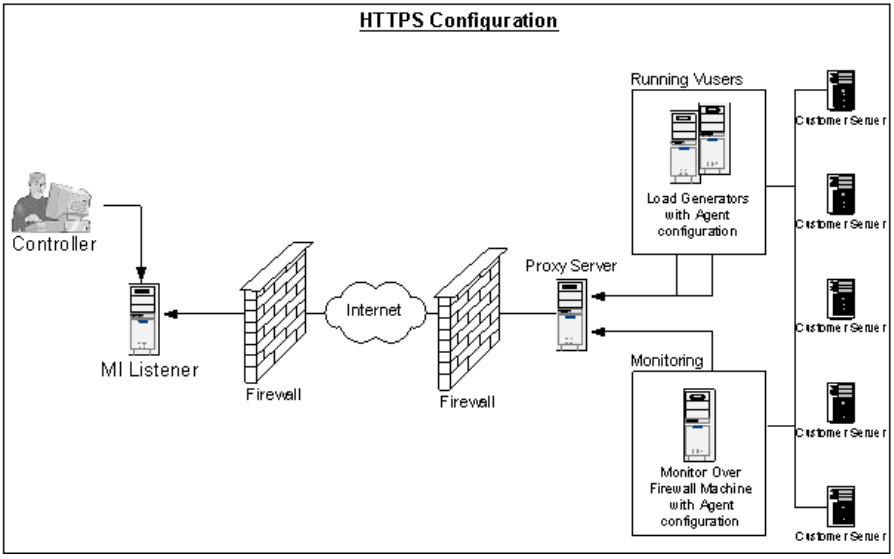
- **TCP Configuration**

The TCP configuration requires every LoadRunner agent machine behind the customer's firewall to be allowed to open a port in the firewall for outgoing communication.



➤ **HTTPS Configuration**

In the HTTPS configuration, only one machine (the proxy server) is allowed to open a port in the firewall. Therefore, it is necessary to tunnel all outgoing communications through the proxy server.



3 Configure the Firewall to Allow Agent Access

Modify your firewall settings to enable communication between the machines inside the firewall and machines outside the firewall.

a If your system has a TCP configuration:

The LoadRunner agent attempts to establish a connection with the MI Listener using port 443, at intervals specified in the Connection Timeout field in the Agent Configuration dialog box. To enable this connection, allow an outgoing connection for HTTPS service on the firewall for port 443. The agent can then connect to the MI Listener, and the MI Listener can connect back to the agent. From this point on, the agent listens to commands from the MI Listener.

b If your system has an HTTPS configuration:

The LoadRunner agent attempts to establish a connection with the MI Listener, using the proxy port specified in the Proxy Port field, and at intervals specified in the Connection Timeout field in the Agent Configuration dialog box. When the connection is established, the proxy server connects to the MI Listener. To enable this connection, allow an outgoing connection for HTTPS service on the firewall for port 443. The proxy server can then connect to the MI Listener, and the MI Listener can connect back to the agent through the proxy server. From this point on, the agent listens to commands from the MI Listener.

4 Configure the MI Listener

To enable running Vusers or monitoring over a firewall, you need to install the MI Listener on one or more machines in the same LAN as the Controller outside the firewall. For installation instructions, refer to the *HP LoadRunner Installation Guide*.

Note:

- The Controller installation automatically includes the MI Listener, so you can designate the Controller as the MI Listener machine.
- The MI Listener can only be installed on Windows machines.

For information on how to configure the MI Listener, see "MI Listener Configuration Dialog Box" on page 371.

How to Configure the System to Monitor Servers Over a Firewall

This task describes how to set up your system to monitor the servers over a firewall.

This task includes the following steps:

- "Install Components and Perform Initial Configuration" on page 355
- "Set Up Your System to Run Vusers Over the Firewall" on page 356
- "Configure Your System to Monitoring Servers Over a Firewall" on page 357
- "Check Connectivity" on page 357

1 Prerequisites

Before configuring the system to monitor servers over a firewall, make sure that you have completed the task "How to Configure the Over-Firewall System" on page 357.

2 Configure the LoadRunner Agent on Each Monitor Over Firewall Machine

See "How to Configure the LoadRunner Agent on Each Monitor Over Firewall Machine" on page 362.

3 Configure the Controller for Running Over a Firewall

To run or monitor Vusers over a firewall, you need to create a unique connection between the Controller and the agent machines. Agent machines include load generator machines that will be running over a firewall and all Monitor Over Firewall machines.

This connection is made through the MI Listener, which serves as a router between the Controller and the LoadRunner agent. To establish this connection, you configure the Controller machine to define the agent machine as a load generator.

To configure the Controller for running vusers or monitoring over the firewall, define the load generator settings as described in "Load Generators Dialog Box" on page 124. For the server name, be sure to use the same Local Machine Key setting as in the Agent Configuration.

Then, define the settings in the "MI Listener Configuration Dialog Box" on page 371, using the same MI Listener name as in the Agent Configuration.

Note: You cannot change the temporary directory on the host running or monitoring Vusers over the firewall.

---

4 Configure the Servers to Monitor and Define Measurements for Collection

You configure the monitor settings from the Monitor Over Firewall machine, using the Monitor Configuration tool (**Start** > **Programs** > **LoadRunner** > **Advanced Settings** > **Monitor Configuration**).

You select the type of monitors to run and the server whose resources you want to monitor, add the measurements to monitor for each server, and specify the frequency with which you want the monitored measurements to be reported.

For detailed information about how to use the Monitor Configuration tool, see "How to Configure Monitors Over a Firewall" on page 365.

How to Configure the LoadRunner Agent on Each Monitor Over Firewall Machine

On each load generator machine that will be running over a firewall and on each Monitor Over Firewall machine, you configure the LoadRunner agent to communicate with the MI Listener. The MI Listener serves as a router between the LoadRunner agent and the Controller.

This section includes:

➤ "To Configure the Windows LoadRunner Agent:" on page 363.

➤ "To Configure and Run the UNIX LoadRunner Agent:" on page 363.

➤ "To Restart the LoadRunner Agent:" on page 365.

To Configure the Windows LoadRunner Agent:

1 Stop the LoadRunner agent by right-clicking its icon in the system tray and selecting **Close**, and then setting the options in the Agent Configuration dialog box as described in "Agent Configuration Dialog Box" on page 368.

2 Restart the LoadRunner agent by double-clicking the shortcut on the desktop.

3 A green or red light next to the LoadRunner agent in the system tray indicates a successful or unsuccessful connection respectively.

To Configure and Run the UNIX LoadRunner Agent:

1 Open <**LoadRunner root folder**>**/dat/br_lnch_server.cfg** in a text editor.

2 In the Firewall section, set FireWallServiceActive to 1 and save your changes.

3 Run **agent_config** from the <**LoadRunner root folder**>**/bin** directory to display the following menu:

```
Menu:
1. Show current settings.
2. Change a setting.
3. Save changes and exit.
4. Exit without saving.
5. Use default values.
```

4 Enter 1 to display the current settings:

```
Settings:
---------
1. MI Listener Name =
2. Local Machine Key =
3. Connection Timeout (seconds) = 20
4. Connection Type = TCP
5. Use Secure Connection (SSL) = False
6. Check Server Certificates = False
7. Client Certificate Owner = False
8. Private Key User Name =
9. Private Key Password =
10. Proxy Name =
11. Proxy Port =
12. Proxy User Name =
13. Proxy Password =
14. Proxy Domain =


Menu:
1. Show current settings.
2. Change a setting.
3. Save changes and exit.
4. Exit without saving.
5. Use default values.
```

5 To change a setting, enter 2 to display the settings menu:

```
Settings:
---------
1. MI Listener Name =
2. Local Machine Key =
3. Connection Timeout (seconds) = 20
4. Connection Type = TCP
5. Use Secure Connection (SSL) = False
6. Check Server Certificates = False
7. Client Certificate Owner = False
8. Private Key User Name =
9. Private Key Password =
10. Proxy Name =
11. Proxy Port =
12. Proxy User Name =
13. Proxy Password =
14. Proxy Domain =

Enter number of setting to change or 0 to go back to menu.
```

Enter the setting and continue according to the menu instructions. Set each option according to the "Agent Configuration Settings Dialog Box" on page 369.

6 Restart the agent for the configuration changes to take effect.

To Restart the LoadRunner Agent:

1 To remove the LoadRunner agent, run the command m_daemon_setup -remove from the <**LoadRunner root folder**>/**bin** directory.

Note: When the LoadRunner agent is configured to run over a firewall, and the agent is connected to the MI Listener, a file called <local_machine_key>_connected_to_MI_Listener is created in the temporary directory of the LoadRunner agent machine. The file is removed when the LoadRunner agent disconnects from the MI Listener.

---

2 To start the LoadRunner agent, run the command m_daemon_setup -install from the <**LoadRunner root folder**>/**bin** directory.

How to Configure Monitors Over a Firewall

After you have installed and configured the LoadRunner agent, the Monitors over Firewall component, the MI Listener, and the Controller machine, you need to choose the server measurements that you want the Monitor Over Firewall machine to monitor.

You configure the server monitor properties from the Monitor Over Firewall machine, using the Monitor Configuration Dialog Box. You can select the type of monitors to run and the server whose resources you want to monitor, add the measurements to monitor for each server, and specify the frequency with which you want the monitored measurements to be reported.

The following steps describe how to configure monitors over a firewall:

➤ "Open the Monitor Configuration Dialog Box" on page 366

➤ "Add Monitored Servers" on page 366

➤ "(Optional) Clone a Monitored Server's Properties" on page 367

1 Open the Monitor Configuration Dialog Box

Select **Start** > **Programs** > **LoadRunner** > **Advanced Settings** > **Monitor Configuration**. For machines without the complete LoadRunner installation, select **Start** > **Programs** > **Server Monitor** > **Monitor Configuration.**

2 Add Monitored Servers

a To add servers, click the **Add Server** button. Type the name or IP address of the server whose resources you want to monitor in the **Monitored Server** field.

Note: To add several servers simultaneously, separate the server names or IP ranges with commas. For example: 255.255.255.0-255.255.255.5, server1, server2.

---

b From the Available Monitors list, select the monitors appropriate for the server being monitored.

Note: Data can only be viewed for the monitors that are enabled with your LoadRunner license key. To preview your license key information, select **Start** > **Programs** > **LoadRunner**. HP LoadRunner opens. Click the **License** button to display the LoadRunner license information.

For certain monitors, LoadRunner displays default measurements in the Measurements to be Monitored section. You can specify the frequency at which LoadRunner reports the measurement in the Measurement Properties section. For details on selecting measurements, see "How to Set Up the Monitoring Environment – Workflow" on page 443.

3 (Optional) Clone a Monitored Server's Properties

If you want to monitor the same properties on different server machines, you can clone a selected server's properties using the Clone Monitored Server Properties dialog box.

To clone a monitored server's properties, right-click the server you want to clone, and select **Clone**. In the Monitored Server box, type the name or IP address of the clone server you want to create.

Reference

Working With Firewalls in LoadRunner - User Interface

This section includes (in alphabetical order):

Agent Configuration Dialog Box

This dialog box enables you to open the Agent Configuration Settings dialog box in order to configure the LoadRunner agent on Windows machines.

To access	➤ Run **Agent Configuration** from **Start** > **Programs** > **LoadRunner** > **Advanced Settings.** ➤ Run **<LoadRunner root>\launch-service\bin\AgentConfig.exe.**
Important information	Stop the LoadRunner agent before working with this dialog box.
Relevant tasks	"How to Configure the LoadRunner Agent on Each Monitor Over Firewall Machine" on page 362
See also	"Agent Configuration Settings Dialog Box" on page 369.

User interface elements are described below:

UI Elements (A-Z)	Description
	Click to open the Agent Configuration Settings dialog box.
Enable Firewall Agent	Select of you are enabling or running Vusers over a firewall.
Enable Terminal Services	Select to enable distributing Vusers on a terminal server.

Agent Configuration Settings Dialog Box

This dialog box enables you to define the relevant settings in order to enable the LoadRunner agent on Windows machines.

To access	Run **Agent Configuration** from **Start** > **Programs** > **LoadRunner** > **Advanced Settings** > **Settings**
Relevant tasks	"How to Configure the LoadRunner Agent on Each Monitor Over Firewall Machine" on page 362
See also	"Agent Configuration Dialog Box" on page 368.

User interface elements are described below:

UI Elements (A-Z)	Description
Connection Timeout (seconds)	The length of time you want the agent to wait before retrying to connect to the MI Listener machine. If zero, the connection is kept open from the time the agent is run. **Default value:** 20 seconds
Connection Type - HTTP Proxy Domain	The user's domain if defined in the proxy server configuration. This option is required only if NTLM is used.

UI Elements (A-Z)	Description
Connection Type - HTTP Proxy Names	The name of the proxy server. This field is mandatory if the **Connection Type** setting is **HTTP.**
Connection Type - HTTP Proxy Password	The password of the user with connection rights to the proxy server.
Connection Type - HTTP Proxy Port	The proxy server connection port. This field is mandatory if the **Connection Type** setting is **HTTP**
Connection Type - HTTP Proxy User Name	The user name of a user with connection rights to the proxy server.
Connection Type - TCP/HTTP	Select either **TCP** or **HTTP**, depending on the configuration you are using. **Default:** TCP
Local Machine Key	A symbolic string identifier used to establish a unique connection between the Controller host and the agent machine, via the MI Listener machine.
MI Listener Name	The name, full name, or IP address of the MI Listener.
MI Listener Password	The password needed to connect to the MI Listener machine.
MI Listener User Name	The user name needed to connect to the MI Listener machine.
Server Domain	The domain name needed to connect to the MI Listener machine. This field is required only if NTLM is used.
Use Secure Connection (SSL)	Enable to connect using the Secure Sockets Layer protocol. **Default:** disabled
Use Secure Connection (SSL) - Private Key Password	The password that might be required during the SSL certificate authentication process. This option is relevant only if the **Client Certificate Owner** option is enabled.

UI Elements (A-Z)	Description
Use Secure Connection (SSL) - user Client Certificate	Enable to load the SSL certificate (if required by the server to allow the connection to be made). This option is relevant only if the **Use Secure Connection** option is enabled. **Default:** disabled
User Secure Connection (SSL) - Check Server Certificates	Authenticates the SSL certificates that are sent by the server. Select **Medium** to verify that the server certificate is signed by a trusted Certification Authority. Select **High** to verify that the sender IP matches the certificate information. This setting is available only if **Use Secure Connection** is set to **True**.

MI Listener Configuration Dialog Box

This dialog box enables you to configure the MI Listener.

To access	➤ Select **Start** > **Programs** > **LoadRunner** > **Advanced Settings** ➤ Run **<LoadRunner root folder>\launch_service\bin\MILsnConfig.exe**

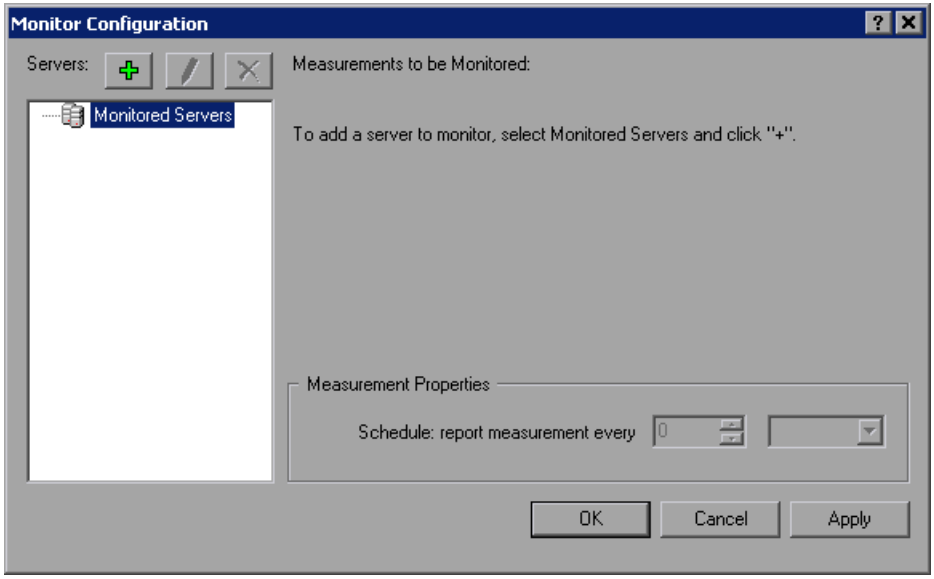
Important information	➤ Before configuring the MI Listener: ➤ Open incoming HTTPs service for port 443. The port settings are set by your system administrator. ➤ Stop the LoadRunner agent on the MI Listener machine by right-clicking it's icon in the system tray and selecting **Close** from the popup menu. ➤ After configuring the MI Listener: ➤ Restart the LoadRunner agent by double-clicking the shortcut on the desktop, or by selecting **Start** > **Programs** > **LoadRunner**. ➤ Make sure that no Web Servers are running on the MI Listener or Monitor over Firewall machine. These servers use port 443 and will not allow the access required by the listening and monitoring processes.
Relevant tasks	"How to Configure the Over-Firewall System" on page 357

User interface elements are described below:

UI Elements (A-Z)	Description
Check Client Certificates	Select **True** to request that the client send an SSL certificate when connecting, and to authenticate the certificate. Default value is **False**.
Private Key Password	The password that may be required during the SSL certificate authentication process. There is no default value.

Monitor Configuration Dialog Box

This dialog box enables you to select the type of monitors to run and the server whose resources you want to monitor, add the measurements to monitor for each server, and specify the frequency with which you want the monitored measurements to be reported.



To access	**Start** > **Programs** > **LoadRunner** > **Advanced Settings** > **Monitor Configuration**. For machines without the complete LoadRunner installation, select **Start** > **Programs** > **Server Monitor** > **Monitor Configuration.**
Relevant tasks	"How to Configure Monitors Over a Firewall" on page 365

User interface elements are described below:

UI Elements (A-Z)	Description
	Adds a server or measurement to the monitored server list. Type the name or IP address of the server whose resources you want to monitor in the **Monitored Server** field. **Note:** To add several servers simultaneously, separate the server names or IP ranges with commas. For example: 255.255.255.0-255.255.255.5, server1, server2. From the Available Monitors list, select the monitors appropriate for the server being monitored. **Note:** Data can only be viewed for the monitors that are enabled with your LoadRunner license key. To preview your license key information, select **Start** > **Programs** > **LoadRunner**. HP LoadRunner opens. Click the **License** button to display the LoadRunner license information.
	Removes a server or measurement.
	Opens the Monored Server Properties dialog box, allowing you to modify the settings.
Measurement Properties	Allows you to set a measurement schedule for each measurement to be reported. Select the configured server measurement you want to schedule and specify the frequency at which you want LoadRunner to report the measurement. Click **Apply** to save your settings.

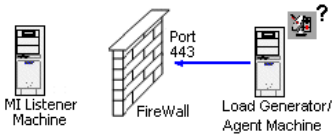
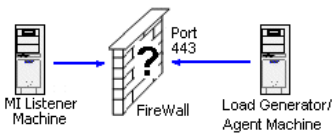
Troubleshooting

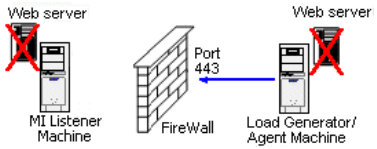
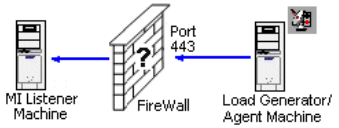
This section describes troubleshooting for working with firewalls in LoadRunner.

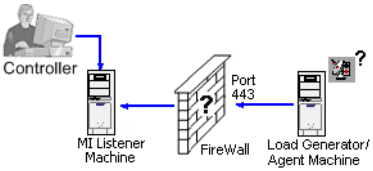
Checking Connectivity

To run Vusers or monitor servers over a firewall, you must be able to establish a connection between the LoadRunner agent, MI Listener, and the Controller machine.

If you encounter connectivity problems after installing and configuring all the necessary components, check the table below for troubleshooting tips.

Check	Solution
To check that the Firewall service was activated on the agent machine: 	There should be a traffic light on the right side of the LoadRunner Agent icon on the machine running/ monitoring Vusers over a firewall. If there is no traffic light, this indicates that the 'FirewallServiceActive=1' is not set in the [FireWall] section of the Agent Settings. See "Agent Configuration Settings Dialog Box" on page 369.
To check that port 443 is open: 	On the agent machine, open a Command Prompt window, and type the following: telnet <MI_Listener_IP>443. For example: telnet 111.111.111.1111 443. If port 443 is open, a new Telnet window will open. If port 443 is not open, contact your network administrator.

Check	Solution
To check that port 443 is available:  	If a Web server is running on the MI Listener or Monitor over Firewall machine, port 443 will not allow the access required by the listening and monitoring processes. Contact your network administrator to change the Web server port.
To check connectivity between the agent and the MI Listener, when running the LoadRunner agent as a service:  	If there is a red light on the right side of the LoadRunner Agent icon  when running the LoadRunner agent as a service, do the following: ➤ Check that port 443 is open. See the troubleshooting tip above. ➤ Check that the Agent Settings and Agent Configuration are correctly set. See "Agent Configuration Settings Dialog Box" on page 369. ➤ Run the agent as a Process. Launch **<Installation>\Launch_service\bin\ magentproc.exe**. If this works, this indicates an authentication issue with the LoadRunner Agent Service. Browse to the **Service** > **LoadRunner Agent Service**, and change the properties of this service to System User Account or provide the user name and password of someone who has administrative privileges on this machine.

Check	Solution
To check connectivity between the agent and the Controller, when monitoring over a firewall 	➤ Check that you entered the servers that you want to monitor in the Monitor Configuration dialog box. (See "Monitor Configuration Dialog Box" on page 373). ➤ Start the LoadRunner Agent Process on the Monitor Over Firewall machine. (See "How to Configure the LoadRunner Agent on Each Monitor Over Firewall Machine" on page 362). ➤ On the Controller, enter the name of the Monitor Over Firewall machine in the Load Generators dialog box, and click **Connect**. After about a minute, data should start streaming in from the Monitor Over Firewall machine through the MI Listener to the Controller. (See "How to Configure Monitors Over a Firewall" on page 365). ➤ If no data arrives at the Controller, try connecting the Controller to the MI Listener as if the Listener were used as a load generator. This will help identify the cause of the problem. Examine the log file on the Monitor Over Firewall machine by right-clicking the LoadRunner Agent icon. There should be no error messages. ➤ Start the MI Listener, and then manually start the LoadRunner Agent Process by running **<installation>\launch_service\bin\magnetproc.exe** on the Monitor Over Firewall machine. Allow the Monitor Over Firewall machine sufficient time to connect to the MI Listener, then connect the Controller to the Monitor Over Firewall machine. If the LoadRunner Agent Process crashes, either restart the agent or reboot the Monitor Over Firewall machine.

Part V
Working with Diagnostics

20

LoadRunner ERP/CRM Diagnostics Modules

This chapter includes:

Concepts

Tasks

Reference

Troubleshooting and Limitations on page 425

Concepts

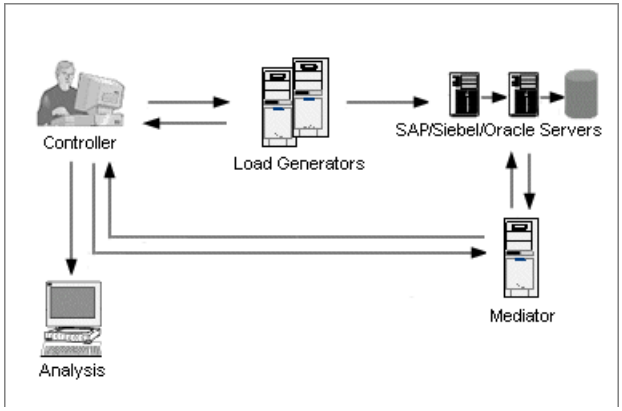
ERP/CRM Diagnostics Modules Overview

During a performance test, LoadRunner's diagnostics modules trace, time, and troubleshoot individual transactions across the Web, application, and database servers. You can drill down from a slow end-user transaction all the way to the bottlenecked method or SQL statement. The LoadRunner diagnostics modules enable organizations to:

- Trace the application components exercised by business processes
- Rapidly isolate application components that have a significant impact on end-user experience
- Provide developers with precise data on how to make performance improvements

ERP/CRM Diagnostics Modules Architecture

ERP/CRM Diagnostics architecture, as shown in the diagram below, is composed of the following components:



- **Mediator.** The ERP/CRM Mediator (“Mediator”) gathers and correlates offline transaction data from the Web, database, and application servers. For information on installing the Mediator, see the *HP LoadRunner Installation Guide*.

  For information on how the Mediator connects to remote Windows and UNIX servers, see "Connecting the Mediator to a Remote Server" on page 385.

- **Controller.** Before scenario execution, the Controller transfers all server information to the Mediator and distributes the percentage of users that will participate in the monitoring. After scenario execution, the Controller collects the aggregated transaction data files from the Mediators and collates the results. The files are then transferred to the results directory per diagnostics type as follows:

  - Siebel results are transferred to the **\sbl_bd** directory.
  - Oracle 11i results are transferred to the **\ora_bd** directory.
  - SAP results are transferred to the **\sap_bd** directory.

  You can view the status of diagnostics file collation in the Collate Results dialog box. For details, see "Collate Results Dialog Box" on page 327.

- **Load Generator.** When you execute a scenario, the Controller distributes each Vuser to a load generator, and the load generator executes the Vuser script.

- **Analysis.** Displays detailed diagnostics graphs and reports. For more information about the diagnostics graphs, see the *HP LoadRunner Analysis User Guide*.

Connecting the Mediator to a Remote Server

When you set up the ERP/CRM Diagnostics modules, you define a server to monitor by entering the user name of the server where trace/log files are stored. This section explains how the Mediator connects to the server when it is a remote Windows or UNIX server.

This section includes:

Connecting to a Remote Windows Server

When monitoring a remote Windows server, the Mediator attempts to connect to the server using the configuration details which you enter in the <diagnostics type> Server Configuration Dialog Box during the diagnostics configuration process. This configuration should give administrator permissions to the remote machine.

If the Mediator is already connected to the remote machine using another configuration, it maintains that prior connection. This may lead to an error if the remote machine user is a non-administrator. For more information, see "Microsoft Windows networking limitation: Failed to establish connection. System error 1219" on page 425.

Connecting to a Remote UNIX Server

When monitoring a remote UNIX server, the Mediator supports two types of connections:

Remote Shell (RSH/RCP) Connection

For more information on remote shell connections, see the *Verifying your UNIX Installation* section in the *HP LoadRunner Installation Guide*.

Secured Shell (PLINK/PSCP) Connection

The secured shell connection is based on the SSH protocol, which enables a secure connection to a remote machine by an authentication mechanism (using RSA and DSA) and encrypted communication.

SSH Protocol Security

The SSH protocol has the following security levels:

- Using a user name and password.
- Using a user name and key pair without passphrase protection.
- Using a user name, key pair and a passphrase protected private key.

SSH Protocol Implementation

The Mediator uses PuTTY as an SSH implementation.

You can find the following PuTTY tools in the bin directory of the LoadRunner installation:

- PUTTY.EXE
- PAGEANT.EXE
- PLINK.EXE
- PSCP.EXE
- PSFTP.EXE
- PUTTYGEN.EXE
- PUTTY.HLP

You can use the **Import** command from the **Conversions** menu of PuTTYgen to load the private key in OpenSSH format and ssh.com format and then generate it as a PuTTY format key. For more information, see the *PuTTY User Manual* which resides in the bin directory of the LoadRunner installation.

For more information on secured shell connections, see the *Verifying your UNIX Installation* section in the *HP LoadRunner Installation Guide*.

For troubleshooting information about connecting to a remote UNIX server, see "Troubleshooting and Limitations" on page 425.

Siebel and Siebel DB Diagnostics Modules Overview

LoadRunner's Siebel Diagnostics are split into the following modules:

- **Siebel Diagnostics Module.** Enables you to break down Siebel transactions into layers, areas, sub-areas, servers, and scripts. 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. Siebel-Web Vusers support Siebel Diagnostics. For information on how to configure the Siebel Diagnostics module, see "How to Configure Siebel Diagnostics" on page 389.
- **Siebel DB Diagnostics Module.** Helps you to rapidly identify and resolve database performance problems. You can view the SQLs for each transaction, identify the problematic SQL queries of each script, and identify at which point problems occurred. Siebel-Web Vusers support Siebel DB Diagnostics. For information on how to configure the Siebel DB Diagnostics module, see "How to Configure Siebel DB Diagnostics" on page 396.

Oracle 11i Diagnostics Module Overview

Oracle 11i Diagnostics helps pinpoint performance problems on Oracle NCA systems. The diagnostics information drills down from the transaction to the SQL statements, and to the SQL stages of each statement. Oracle NCA Vusers support Oracle 11i Diagnostics. For information on how to configure the Oracle 11i Diagnostics module, see "How to Configure Oracle 11i Diagnostics" on page 401.

SAP Diagnostics Module Overview

SAP Diagnostics enables you to pinpoint the root cause of a certain problem (i.e. 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.

The following table outlines the supported versions and required Kernel patches for the SAP Application Server and the SAPGUI Client:

	Supported Version	Required Kernel Patch
SAP Application Server	4.6C; 4.6D	Kernel Patch 1984 (released on 11/01/05, SAP note 0451251)
	4.7 and higher	No patch required
SAPGUI Client	SAPGUI for Windows 6.20	Minimal patch level: 48
	SAPGUI for Windows 6.40	Minimal patch level: 2

For information on how to configure the SAP Diagnostics module, see "How to Configure SAP Diagnostics" on page 406.

Tasks

How to Configure Siebel Diagnostics

This task describes how to configure the Siebel Diagnostics module to communicate with the Mediator and how to define the servers that you want to monitor in order to generate diagnostics data.

This task includes the following steps:

1 Prerequisites

- Make sure that the ERP/CRM Mediator is installed.

  The Mediator, which collects and processes the diagnostics data, is installed on the Controller machine as part of the LoadRunner Full Setup. For information on installing the ERP/CRM Mediator on a dedicated machine, see the *HP LoadRunner Installation Guide*.

- Make sure that the load test scenario is not already running.

  You must configure the diagnostics module before running the load test scenario.

- Manually define transactions in the Vuser script.

  To ensure that valid diagnostics data is generated, manually define the transactions in the Vuser script rather than using automatic transactions. Make sure to disable the following options in the Run-Time Settings' **General : Miscellaneous** node: **Define each action as a transaction** and **Define each step as a transaction**.

- If you are monitoring a Siebel Web Server in a DMZ.

Install the Mediator on the internal (over firewall) LAN and enable SMB/CIFS communication from the internal machine to the file server in the DMZ.

SMB/CIFS are the file sharing services that use the NBT (NetBIOS over TCP/IP) as the transport protocol.

To enable the NBT protocol between the client (over firewall machine) and the file server, use the following port configuration:

File Sharing Service	Port
SMB/CIFS over NBT	TCP 139 (SMB)
CIFS over TCP/IP (Direct SMB)	TCP 445

Example

Configure the firewall settings as follows:

Service enabled: "nbsession" for TCP 139 connection.

Service enabled: "Microsoft-ds" for TCP 445 connection.

Note: CIFS over TCP 445 (direct SMB over TCP/IP) is optional with Windows 2000 and above (since it is a more secure way of communicating with the file server). To enable CIFS over TCP/IP, you must disable the NetBIOS over TCP/IP protocol using the operating system configuration.

➤ **If connecting to a remote UNIX server with a remote shell (RSH/RCP) connection.**

➤ Verify that the RSH and RCP daemons are running on the UNIX server.

➤ Verify that the UNIX user has permission to run remote shell commands. To check this, type the following at the DOS command prompt:

```
rsh <server machine name> -l <UNIX user login name> -n <command>
```

Example

```
rsh my_unix -l my_name -n “cd ~;pwd”
```

Note: Only RSH commands that work from the DOS command prompt window work with LoadRunner.

➤ Verify that no output is generated after executing the RSH command.

Note: You should not generate output from the **.login**, **.profile**, and **.cshrc** files (for example, by **echo**, or in any other way, including commands that generate output indirectly, such as **biff**). Where an existing user generates output in the RSH step that cannot be deleted, you should create a new user that does not generate output, and who has permissions to run RSH and RCP commands on the server machine.

➤ **If connecting to a remote UNIX server with a secured shell (PLINK/ PSCP) connection.**

Note: Before proceeding with the following prerequisite steps, if you are not familiar with the PuTTY application, see "Secured Shell (PLINK/ PSCP) Connection" on page 385.

➤ Verify that the SSH daemon is running on the UNIX server.

➤ Verify that no output is generated after executing the PuTTY commands.

Note: You should not generate output from the **.login**, **.profile**, and **.cshrc** files, (for example, by **echo**, or by any other form, including commands that generate output indirectly, such as **biff**). Where an existing user generates output that cannot be deleted, you should create a new user that does not generate output.

➤ Verify that PuTTY commands are working without generating any errors. Type the following at the DOS command prompt under the bin directory of the installation:

```
PLINK.EXE <server machine name> -ssh -l <UNIX user login name> -i
<private key full name if used> -pw <password or passphrase> <command>
```

Example

Security Level A:

```
PLINK.EXE my_unix -ssh -l my_name -pw "my_password" "ls"
```

Security Level B:

```
PLINK.EXE my_unix -ssh -l my_name -i "my_private_key" -pw "" "ls"
```

Security Level C:

```
PLINK.EXE my_unix -ssh -l my_name -i "my_private_key" -pw "my_passphrase" "ls"
```

➤ Check the **PSCP.EXE** command as follows:

```
PSCP.EXE -scp -r -q <private key full name if used> -pw <password or
passphrase> <local file name> <UNIX user login name>@<server machine
name>:<remote file name>
```

2 Configure the server machine to enable diagnostics

To configure Siebel application and Web servers for diagnostics data collection:

a Enable Siebel Diagnostics on all Siebel application and Web servers involved in the load test scenario.

Set the environment variable on the Siebel server to:

```
SIEBEL_SarmEnabled=true
```

Then restart the server.

b Optimize the server performance settings.

You change the maximum memory caching and file size using the following variables:

```
SIEBEL_SarmMaxMemory= <bytes>
SIEBEL_SarmMaxFileSize = <bytes>
```

The **SIEBEL_SarmMaxMemory** value controls the size of the buffer that Siebel keeps in the memory before writing the information to the Siebel log files. You can improve server performance by increasing the parameter value. However, information from the end of the run will be missing from the Analysis graphs.

We recommend the following settings:

➤ **SIEBEL_SarmMaxMemory**

Value	Number of Vusers
5000	Less than 20 (low loads)
1000000	More than 100 (high loads)

➤ **SIEBEL_SarmMaxFileSize**

Value	Number of Vusers
5000000	Less than 20 (low loads)
25000000	More than 100 (high loads)

If more than one Siebel log file is generated on the server every 10 seconds, you should increase the **SIEBEL_SarmMaxFileSize**.

Note: For Siebel 7.7, the parameters differ slightly.

c Generate a list of Siebel Server IDs.

On the Siebel server, open a command window and run the following command:

```
<Siebel bin directory>\srvrmgr /u <username> /p <password> /g <gateway
server> /e <entrpr server> /c "list servers show SBLSRVR_NAME, SV_SRVRID"
```

where:

/u <username> is the server administrator username

/p <password> is the server administrator password

/g <gateway server> is the gateway server address

/e <entrpr server> is the enterprise server name

/c <command> is the execute a single command

This command generates a list of all the Siebel application servers and their IDs. Keep a record of the server IDs, since this information is required in the Siebel Server Configuration dialog box. For more information, see "Siebel Server Configuration Dialog Box" on page 424.

3 Copy files from the Siebel Application Server to the Mediator

After configuring the application server, copy the files listed below from the Siebel Application server **\bin** directory to either the <LR Mediator installation>\bin directory, <Windows>\System32 directory, or any other directory in PATH on the Mediator machine:

For Siebel 7.53, copy the following files:

➤ sarmanalyzer.exe ➤ sslcver.dll ➤ sslcsym.dll	➤ sslcshar.dll ➤ sslcosa.dll

For Siebel 7.7, copy the following files:

➤ sarmanalyzer.exe	➤ sslcosa.dll
➤ libarm.dll	➤ sslcosd.dll
➤ msvcp70.dll	➤ sslcrsa.dll
➤ msvcr70.dll	➤ sslcscr.dll
➤ sslcacln.dll	➤ sslcshar.dll
➤ sslccore.dll	➤ sslcsrd.dll
➤ sslcevt.dll	➤ sslcsym.dll
➤ sslcos.dll	➤ sslcver.dll

4 Enable the Siebel Diagnostics Module

To enable the Siebel Diagnostics module:

a Select **Diagnostics** > **Configuration** to open the Diagnostics Distribution dialog box. Then select **Enable the following diagnostics** and specify the percentage of Vusers for which you want to collect Siebel Diagnostics data. For user interface details, see "Diagnostics Distribution Dialog Box" on page 413.

b In the Diagnostics Distribution dialog box, click **Configure** next to Siebel Diagnostics to enable the module and to define server information. For user interface details, see "Siebel Configuration Dialog Box" on page 420.

How to Configure Siebel DB Diagnostics

This task describes how to configure the Siebel DB Diagnostics module to communicate with the Mediator and how to define the servers that you want to monitor in order to generate diagnostics data.

This task includes the following steps:

- "Prerequisites and recommendations" on page 396
- "Enable logging on the Siebel Server" on page 400
- "Enable the Siebel DB Diagnostics module" on page 401

1 Prerequisites and recommendations

- **Make sure that the ERP/CRM Mediator is installed.**

  The Mediator, which collects and processes the diagnostics data, is installed on the Controller machine as part of the LoadRunner Full Setup. For information on installing the ERP/CRM Mediator on a dedicated machine, see the *HP LoadRunner Installation Guide*.

  Note: We recommend that you not install the Mediator on a dedicated machine as this will increase the time taken to copy diagnostics files to the results directory.

- **Make sure that the load test scenario is not already running.**

  You must configure the diagnostics module before running the load test scenario.

- **If you are monitoring a Siebel Web Server in a DMZ.**

  Install the Mediator on the internal (over firewall) LAN and enable SMB/CIFS communication from the internal machine to the file server in the DMZ.

  SMB/CIFS are the file sharing services that use the NBT (NetBIOS over TCP/IP) as the transport protocol.

To enable the NBT protocol between the client (over firewall machine) and the file server, use the following port configuration:

File Sharing Service	Port
SMB/CIFS over NBT	TCP 139 (SMB)
CIFS over TCP/IP (Direct SMB)	TCP 445

Example

Configure the firewall settings as follows:

Service enabled: "nbsession" for TCP 139 connection.

Service enabled: "Microsoft-ds" for TCP 445 connection.

Note: CIFS over TCP 445 (direct SMB over TCP/IP) is optional with Windows 2000 and above (since it is a more secure way of communicating with the file server). To enable CIFS over TCP/IP, you must disable the NetBIOS over TCP/IP protocol using the operating system configuration.

➤ **Manually define transactions in the Vuser script.**

To ensure that valid diagnostics data is generated, manually define the transactions in the Vuser script rather than using automatic transactions. Make sure to disable the following options in the Run-Time Settings' **General : Miscellaneous** node: **Define each action as a transaction** and **Define each step as a transaction**.

➤ **Avoid session ID conflicts.**

Make sure that the Vusers log off from the Siebel system at the end of each session.

➤ **Add think time after transactions.**

When preparing your script for collection of diagnostics data, we recommend that you add think time at the end of each transaction using the ratio of one second per hour of testing.

➤ **Synchronize clocks (Windows Siebel Servers).**

Ensure that all the machines' clocks in the Siebel system are synchronized. This ensures that the correlation of SQLs to transactions is correct.

Synchronize the Siebel Gateway and load generators' clocks by running the following command from the load generator:

```
net time \ <Gateway name> /set /y
```

Replace <**Gateway name**> with the name of the Siebel Gateway.

➤ **Synchronize clocks (Unix Siebel servers).**

Ensure that all the machines' clocks in the Siebel system are synchronized. This ensures that the correlation of SQLs to transactions is correct.

You can synchronize the clocks on a UNIX system in one of the following ways:

- Use the **date** command on the UNIX Siebel Gateway server to change the time manually, so it will be synchronized with the Load Generator's clock.
- Change the time on the load generator so that it will be synchronized with the UNIX Siebel Gateway server.
- Configure the time difference in Analysis. For more information, see the chapter about Siebel DB Diagnostics Graphs in the *HP LoadRunner Analysis User Guide*.

➤ **If connecting to a remote UNIX server with a remote shell (RSH/RCP) connection.**

- Verify that the RSH and RCP daemons are running on the UNIX server.
- Verify that the UNIX user has permission to run remote shell commands. To check this, type the following at the DOS command prompt:

```
rsh <server machine name> -l <UNIX user login name> -n <command>
```

Example

```
rsh my_unix -l my_name -n “cd ~;pwd”
```

Note: Only RSH commands that work from the DOS command prompt window work with LoadRunner.

➤ Verify that no output is generated after executing the RSH command.

Note: You should not generate output from the **.login**, **.profile**, and **.cshrc** files (for example, by **echo**, or in any other way, including commands that generate output indirectly, such as **biff**). Where an existing user generates output in the RSH step that cannot be deleted, you should create a new user that does not generate output, and who has permissions to run RSH and RCP commands on the server machine.

➤ **If connecting to a remote UNIX server with a secured shell (PLINK/PSCP) connection.**

Note: Before proceeding with the following prerequisite steps, if you are not familiar with the PuTTY application, see "Secured Shell (PLINK/PSCP) Connection" on page 385.

➤ Verify that the SSH daemon is running on the UNIX server.

➤ Verify that no output is generated after executing the PuTTY commands.

Note: You should not generate output from the **.login**, **.profile**, and **.cshrc** files, (for example, by **echo**, or by any other form, including commands that generate output indirectly, such as **biff**). Where an existing user generates output that cannot be deleted, you should create a new user that does not generate output.

➤ Verify that PuTTY commands are working without generating any errors. Type the following at the DOS command prompt under the bin directory of the installation:

```
PLINK.EXE <server machine name> -ssh -l <UNIX user login name> -i
<private key full name if used> -pw <password or passphrase> <command>
```

Example

Security Level A:

```
PLINK.EXE my_unix -ssh -l my_name -pw "my_password" "ls"
```

Security Level B:

```
PLINK.EXE my_unix -ssh -l my_name -i "my_private_key" -pw "" "ls"
```

Security Level C:

```
PLINK.EXE my_unix -ssh -l my_name -i "my_private_key" -pw "my_passphrase" "ls"
```

➤ Check the **PSCP.EXE** command as follows:

```
PSCP.EXE -scp -r -q <private key full name if used> -pw <password or
passphrase> <local file name> <UNIX user login name>@<server machine
name>:<remote file name>
```

2 Enable logging on the Siebel Server

For task details, see page 407.

3 Enable the Siebel DB Diagnostics module

To enable the Siebel DB Diagnostics module:

a Select **Diagnostics** > **Configuration** to open the Diagnostics Distribution dialog box. Then select **Enable the following diagnostics** and specify the percentage of Vusers for which you want to collect Siebel DB Diagnostics data. For user interface details, see "Diagnostics Distribution Dialog Box" on page 413.

b In the Diagnostics Distribution dialog box, click **Configure** next to Siebel DB Diagnostics to enable the module and to define server information. For user interface details, see "Siebel DB Configuration Dialog Box" on page 422.

How to Configure Oracle 11i Diagnostics

This task describes how to configure the Oracle 11i Diagnostics module to communicate with the Mediator and how to define the servers that you want to monitor in order to generate diagnostics data.

This task includes the following steps:

1 Prerequisites

- **Make sure that the ERP/CRM Mediator is installed.**

  The Mediator, which collects and processes the diagnostics data, is installed on the Controller machine as part of the LoadRunner Full Setup. For information on installing the ERP/CRM Mediator on a dedicated machine, see the *HP LoadRunner Installation Guide*.

- **Make sure that the load test scenario is not already running.**

You must configure the diagnostics module before running the load test scenario.

➤ **Manually define transactions in the Vuser script.**

To ensure that valid diagnostics data is generated, manually define the transactions in the Vuser script rather than using automatic transactions. Make sure to disable the following options in the Run-Time Settings' **General : Miscellaneous** node: **Define each action as a transaction** and **Define each step as a transaction**.

➤ **Clear the server of users while module is running.**

Make sure that no real or other virtual users are working on the Oracle server while the diagnostics module is running, as this may affect diagnostics results.

➤ **If connecting to a remote UNIX server with a remote shell (RSH/RCP) connection.**

➤ Verify that the RSH and RCP daemons are running on the UNIX server.

➤ Verify that the UNIX user has permission to run remote shell commands. To check this, type the following at the DOS command prompt:

```
rsh <server machine name> -l <UNIX user login name> -n <command>
```

Example

```
rsh my_unix -l my_name -n “cd ~;pwd”
```

Note: Only RSH commands that work from the DOS command prompt window work with LoadRunner.

➤ Verify that no output is generated after executing the RSH command.

Note: You should not generate output from the **.login**, **.profile**, and **.cshrc** files (for example, by **echo**, or in any other way, including commands that generate output indirectly, such as **biff**). Where an existing user generates output in the RSH step that cannot be deleted, you should create a new user that does not generate output, and who has permissions to run RSH and RCP commands on the server machine.

➤ **If connecting to a remote UNIX server with a secured shell (PLINK/PSCP) connection.**

Note: Before proceeding with the following prerequisite steps, if you are not familiar with the PuTTY application, see "Secured Shell (PLINK/PSCP) Connection" on page 385.

➤ Verify that the SSH daemon is running on the UNIX server.

➤ Verify that no output is generated after executing the PuTTY commands.

Note: You should not generate output from the **.login**, **.profile**, and **.cshrc** files, (for example, by **echo**, or by any other form, including commands that generate output indirectly, such as **biff**). Where an existing user generates output that cannot be deleted, you should create a new user that does not generate output.

➤ Verify that PuTTY commands are working without generating any errors. Type the following at the DOS command prompt under the bin directory of the installation:

```
PLINK.EXE <server machine name> -ssh -l <UNIX user login name> -i
<private key full name if used> -pw <password or passphrase> <command>
```

Example

Security Level A:

```
PLINK.EXE my_unix -ssh -l my_name -pw "my_password" "ls"
```

Security Level B:

```
PLINK.EXE my_unix -ssh -l my_name -i "my_private_key" -pw "" "ls"
```

Security Level C:

```
PLINK.EXE my_unix -ssh -l my_name -i "my_private_key" -pw "my_passphrase" "ls"
```

➤ Check the **PSCP.EXE** command as follows:

```
PSCP.EXE -scp -r -q <private key full name if used> -pw <password or passphrase> <local file name> <UNIX user login name>@<server machine name>:<remote file name>
```

2 Enable logging on the Oracle server

For task details, see "How to Enable Logging on the Oracle Server" on page 409.

3 Set or Disable the Oracle Server Diagnostics Password - Optional

To help LoadRunner deal with the Oracle server diagnostics password, you can either set the password in the Vuser script, or you can disable the password request on the server itself. For task details, see "How to Set and Disable the Oracle Server Diagnostics Password" on page 410.

4 Select the Oracle NCA application version

The Oracle 11i Diagnostics module supports Oracle NCA versions 11.5.0 and later. Enter the version of your Oracle application server in VuGen's run-time settings to enable the built-in trace mechanism.

Note: To check the version of your Oracle server, log on to the Oracle server and select **Help** > **About Oracle**. The version of your Oracle server is displayed in the Oracle Application field.

To enter your Oracle application version, open the script in VuGen and select **Vuser** > **Run-Time Settings**. In the **Oracle NCA: Client Emulation** node, select the version of Oracle NCA that you are using in the **Diagnostics** > **Application Version** field.

Note: If the Oracle 11i trace cannot be enabled using the built-in mechanism, you can enable it manually in the Vuser script using the **nca_set_custom_dbtrace** and **nca_set_dbtrace_file_index** functions. This may occur if you are using a custom application that does not have a standard user interface.

---

5 Enable the Oracle 11i Diagnostics module

To enable the Oracle 11i Diagnostics module:

a Select **Diagnostics** > **Configuration** to open the Diagnostics Distribution dialog box. Then select **Enable the following diagnostics** and specify the percentage of Vusers for which you want to collect Oracle 11i Diagnostics data. For user interface details, see "Diagnostics Distribution Dialog Box" on page 413.

b In the Diagnostics Distribution dialog box, click **Configure** next to Oracle 11i Diagnostics to enable the module and to define server information. For user interface details, see "Oracle 11i Configuration Dialog Box" on page 417.

How to Configure SAP Diagnostics

This task describes how to configure the SAP Diagnostics module to communicate with the Mediator and how to define the servers that you want to monitor in order to generate diagnostics data.

This task includes the following steps:

1 Prerequisites

➤ **Make sure that the ERP/CRM Mediator is installed.**

The Mediator, which collects and processes the diagnostics data, is installed on the Controller machine as part of the LoadRunner Full Setup. SAPGUI Client must be installed on the Mediator machine. For information on installing the ERP/CRM Mediator on a dedicated machine, see the *HP LoadRunner Installation Guide*.

➤ **Make sure that the load test scenario is not already running.**

You must configure the diagnostics module before running the load test scenario.

➤ **Manually define transactions in the Vuser script.**

To ensure that valid diagnostics data is generated, manually define the transactions in the Vuser script rather than using automatic transactions. Make sure to disable the following options in the Run-Time Settings' **General : Miscellaneous** node: **Define each action as a transaction** and **Define each step as a transaction**.

2 Enable the SAP Diagnostics module

To enable the SAP Diagnostics module:

a Select **Diagnostics** > **Configuration** to open the Diagnostics Distribution dialog box. Then select **Enable the following diagnostics** and specify the percentage of Vusers for which you want to collect SAP Diagnostics data. For user interface details, see "Diagnostics Distribution Dialog Box" on page 413.

b In the Diagnostics Distribution dialog box, click **Configure** next to SAP Diagnostics to enable the module and to define server information. For user interface details, For user interface details, see "SAP Configuration Dialog Box" on page 419.

How to Enable and Disable Logging on the Siebel Server

This task describes how to enable and disable logging on the Siebel server.

Note: Enabling logging on the Siebel server can negatively impact server performance. We recommend that you disable logging and restore the default logging settings at the conclusion of the load test scenario.

This task includes the following steps:

To enable logging on the Siebel server

Perform the following steps:

a **Open a command window and run the following command.**

```
<Siebel bin directory>\srvrmgr /g <gateway server> /s <Siebel server> /e
<enterprise server name> /u <username> /p <password>
```

where:

/u <username> is the server administrator username

/p <password> is the server administrator password

/g <gateway server> is the gateway server address

/e <entrpr server> is the enterprise server name

/s <siebel server > is the siebel server (the default server)

b Enter the following commands.

```
change evtloglvl ObjMgrsqllog=4 for comp <component name>

evtloglvl EventContext=3 for comp <component name>

evtloglvl ObjMgrSessionInfo =3 for comp <component name>
```

Example

For the Call Center component, enter **sccobjmgr_enu** as the component name, as follows:

```
change evtloglvl ObjMgrsqllog=4 for comp sccobjmgr_enu
```

To disable logging on the Siebel server

Perform the following steps:

a Open a command window and run the following command.

```
<Siebel bin directory>\srvrmgr /g <gateway server> /s <Siebel server> /e
<enterprise server name> /u <username> /p <password>
```

where:

/u <username> is the server administrator username

/p <password> is the server administrator password

/g <gateway server> is the gateway server address

/e <entrpr server> is the enterprise server name

/s <siebel server > is the siebel server (the default server)

b Enter the following commands:

```
change evtloglvl ObjMgrsqllog=0 for comp <component name>

change evtloglvl EventContext=0 for comp <component name>

change evtloglvl ObjMgrSessionInfo =0 for comp <component name>
```

How to Enable Logging on the Oracle Server

This task describes how to enable logging on the Oracle server.

This task includes the following steps:

➤ "Verify that the trace diagnostics are enabled" on page 409

➤ "Set the trace file size to unlimited" on page 410

1 Verify that the trace diagnostics are enabled

Perform the following steps:

a Log on to the Oracle application server with administrator privileges, and select the desired module in the Oracle application. The Responsibilities dialog box opens.

b Select **System Administrator** and click **OK**.

c In the **Functions** tab, select **Profile** > **System** and click **Open**. The System Profile Values dialog box opens.

d In the **Display** section, select **Site** and **Profiles with No Values**, enter %Diagnostics% in the **Profiles** field, and then click **Find**.

e If any diagnostics profiles are disabled (denoted by a “Yes” in the **Site** column), change the setting to “No”.

f Save your settings.

2 Set the trace file size to unlimited

For Oracle 9i:

On the Oracle server, run the following command in the SQL editor:

```
Alter system set max_dump_file_size=UNLIMITED scope=both;
```

For Oracle 8i:

a On the Oracle server, run the following command in the SQL editor:

```
Alter system set max_dump_file_size=2048000;
```

b Edit the **init*.ora** file on **$ORACLE_HOME\admin\<sid>\pfile\init<sid>.ora**. Find the line of the parameter, change its value, and then save the file.

Note: Verify that you have enough disk space on the database server since these trace files can be very large.

How to Set and Disable the Oracle Server Diagnostics Password

To help LoadRunner deal with the Oracle server diagnostics password, you can either set the password in the Vuser script, or you can disable the password request on the server itself.

➤ "Set the diagnostics password in the Vuser script" on page 410

➤ "Disable the diagnostics password request on the Oracle server" on page 411

Set the diagnostics password in the Vuser script

In VuGen, add the **nca_set_diagnostics_password(<password>)** function to your script and select a password.

Note: The **nca_set_diagnostics_password** function must come after the **nca_connect_server** function.

Disable the diagnostics password request on the Oracle server

Perform the following steps:

a Log on to the Oracle server with administrator privileges, and select the desired module in the Oracle application. The Responsibilities dialog box opens.

b Select **System Administrator** and click **OK**.

c In the **Functions** tab, select **Profile** > **System** and click **Open**. The System Profile Values dialog box opens.

d In the **Display** section, select **User**, and enter the required user name. In the **Profile** field, enter %Utilities:Diagnostics% and click **Find**. The Utilities:Diagnostics profile values are displayed.

e In the **User** column of the Utilities:Diagnostics profile, set the value to **Yes**.

f Save your settings.

How to View Diagnostics Results

This task includes the following steps:

➤ "Open Analysis" on page 412

➤ "View results in the Analysis diagnostics graphs" on page 412

1 Open Analysis

In the Run tab of the Controller, select **Results** > **Analyze Results**, or click the **Analyze Results** button.

2 View results in the Analysis diagnostics graphs

You can use the Analysis diagnostics graphs and reports to view the performance data and drill down to pinpoint problem areas in any layer of the application.

For information about specific diagnostics graphs, see the following sections in the *HP LoadRunner Analysis User Guide*:

- Siebel Diagnostics Graphs
- Siebel DB Diagnostics Graphs
- Oracle 11i Diagnostics Graphs
- SAP Diagnostics Graphs

Reference

LoadRunner Diagnostics Modules User Interface

This section includes (in alphabetical order):

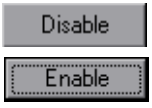
Diagnostics Distribution Dialog Box

This dialog box enables you to enable the ERP/CRM diagnostics modules.

To access	Select **Diagnostics** > **Configuration**

Important information	➤ The Diagnostics Distribution dialog box is disabled during scenario execution. You must enable and configure the diagnostics modules before running the scenario. ➤ The settings that you configure are per scenario. All scripts in the scenario will run under the same diagnostics configuration.
Relevant tasks	➤ "How to Configure Siebel Diagnostics" on page 389 ➤ "How to Configure Siebel DB Diagnostics" on page 396 ➤ "How to Configure Oracle 11i Diagnostics" on page 401 ➤ "How to Configure SAP Diagnostics" on page 406 ➤ "How to Configure a LoadRunner Scenario to use J2EE/.NET Diagnostics" on page 432

User interface elements are described below:

UI Elements (A-Z)	Description
	Enables/Disables Web Page Diagnostics graphs.
	Click to enable and configure the relevant diagnostics graphs.
	Indicates that the diagnostics type is disabled.
	Indicates that the diagnostics type is enabled.
Enable the following diagnostics	Enables LoadRunner to generate offline Web Page, Siebel, Siebel DB, Oracle 11i, and SAP Diagnostics graphs, and online and offline J2EE & .NET Diagnostics graphs.

UI Elements (A-Z)	Description
For X% of all the relevant Vusers in the current scenario	Specify the percentage of Vusers for which you want to collect diagnostics data. This value determines how many of the transactions on the application server are reported to the Controller. Reducing this percentage will reduce the overhead on the application server for Web Page, Oracle 11i, and J2EE & .NET Diagnostics. **Example:** If you enter a sampling value of 25% and run 12 Vusers in **group1**, 8 Vusers in **group2**, and 1 Vuser in **group3**, diagnostics data will be collected for 3 Vusers in **group1**, 2 Vusers in **group2**, and 1 Vuser in **group3**. **Note:** The minimum percentage of Vuser sampling allowed is 1%, or 1 Vuser per group, whichever is more. The maximum percentage allowed is the lowest of the **Max. Vuser Sampling** values of all the selected diagnostics types. **Example:** If you enable **Web Page** (max 10%), Oracle 11i (max 5%) and J2EE/.NET (max 100%) diagnostics, the percentage of Vuser participation for J2EE/.NET Diagnostics cannot exceed 5%.
J2EE/.NET	Generates online and offline J2EE/.NET Diagnostics graphs. The maximum percentage of Vusers for which J2EE/.NET Diagnostics data can be collected is 100% of the amount of Vusers selected in the **For X% of all the relevant Vusers in the current scenario** setting. To enable and configure J2EE/.NET Diagnostics, click **Configure**.
Oracle 11i	Generates offline Oracle 11i Diagnostics graphs. The maximum percentage of Vusers for which Oracle 11i Diagnostics data can be collected is 5% of the amount of Vusers selected in the **For X% of all the relevant Vusers in the current scenario** setting. To enable and configure oracle 11i Diagnostics, click **Configure**. For user interface details, see "Oracle 11i Configuration Dialog Box" on page 417.

UI Elements (A-Z)	Description
SAP Diagnostics	Generates offline SAP Diagnostics graphs. The maximum percentage of Vusers for which SAP Diagnostics data can be collected is 100% of the amount of Vusers selected in the **For X% of all the relevant Vusers in the current scenario** setting. To enable and configure SAP Diagnostics, click **Configure**. For user interface details, see "SAP Configuration Dialog Box" on page 419.
Siebel Diagnostics	Generates offline Siebel Diagnostics graphs. The maximum percentage of Vusers for which Siebel Diagnostics data can be collected is 10% of the amount of Vusers selected in the **For X% of all the relevant Vusers in the current scenario** setting, or no more that 100 Vusers. To enable and configure Siebel Diagnostics, click **Configure**. For user interface details, see "Siebel Configuration Dialog Box" on page 420.
Siebel DB Diagnostics	Generates offline Siebel DB Diagnostics graphs. The maximum percentage of Vusers for which Siebel DB Diagnostics data can be collected is 10% of the amount of Vusers selected in the **For X% of all the relevant Vusers in the current scenario** setting. To enable and configure Siebel DB Diagnostics, click **Configure**. For user interface details, see "Siebel DB Configuration Dialog Box" on page 422.
Web Page Diagnostics	Generates offline Web Page Diagnostics graphs. The maximum percentage of Vusers for which diagnostics data can be collected is 10%. **Default:** Enabled **See also:** Web Resource Graphs in the *HP LoadRunner Analysis User Guide*.

Oracle 11i Configuration Dialog Box

This dialog box enables you to set up the Oracle 11i Diagnostics module to communicate with the Mediator.

To access	Select **Diagnostics** > **Configuration**. Click **Configure** next to **Oracle 11i Diagnostics**.
Relevant tasks	"How to Configure Oracle 11i Diagnostics" on page 401
See also	➤ "Oracle 11i Server Configuration Dialog Box" on page 418 ➤ "Oracle 11i Diagnostics Graphs" in the *HP LoadRunner Analysis User Guide*

User interface elements are described below:

UI Elements (A-Z)	Description
	Opens the Oracle 11i Server Configuration dialog box where you can add Oracle 11i servers and to enter server information. For user interface details, see "Oracle 11i Server Configuration Dialog Box" on page 418.
	Tests the connections between the Oracle 11i Diagnostics module and the Mediator. **Note:** This does not check the connections to the Oracle servers.
Enable Firewall	Select if the Mediator is over a firewall.
Enable Oracle 11i Diagnostics	Enables Oracle 11i Diagnostics and allows you to configure the Oracle 11i Diagnostics settings.
MI Listener	The name, full name, or IP address of the MI Listener machine if you are monitoring over a firewall.

UI Elements (A-Z)	Description
Name	The name of the Mediator used to collect and process the Oracle 11i diagnostics data. Only one Mediator is supported for each diagnostics module. **Note:** If you are using a Mediator that is over a firewall, enter the local machine key of the Mediator instead of the Mediator machine name.
Servers Table	➤ **Server Name.** The name of the Oracle server. ➤ **Platform.** The platform of the Oracle server. ➤ **Log Directory**. The directory where the Oracle trace files (*.trc) are written.

Oracle 11i Server Configuration Dialog Box

This dialog box enables you to add Oracle 11i servers and to add server information.

To access	Select **Diagnostics** > **Configuration.** Click **Configure** next to **Oracle 11i Diagnostics** then click **Add**.
Relevant tasks	"How to Configure Oracle 11i Diagnostics" on page 401
See also	"Oracle 11i Configuration Dialog Box" on page 417

User interface elements are described below:

UI Elements (A-Z)	Description
Domain	The Oracle server domain.
Password/Passphrase	The user password or passphrase.
Private Key File	The name of the file where the Private Key is stored. This can be found on the Mediator. If you specify the file name only (without a path), the configuration automatically looks for the file in the Mediator's **<LoadRunner>\bin** directory.

UI Elements (A-Z)	Description
Server Log Directory	A location where the Oracle application saves the trace files. The trace files can be saved in a shared directory on the Oracle server or in a separate folder.
Server Name	The name of the Oracle server.
Server Platform	The Oracle server platform.
Use Secure Shell	Select if you are working with a Secure Shell connection.
User Name	The user name of the server where trace files are stored. **Note:** For Windows platforms, the user should have administrator privileges.

SAP Configuration Dialog Box

This dialog box enables you to set up the SAP Diagnostics module to communicate with the Mediator.

To access	Select **Diagnostics** > **Configuration**. Click **Configure** next to **SAP Diagnostics**.
Relevant tasks	"How to Configure SAP Diagnostics" on page 406
See also	"SAP Diagnostics Graphs" in the *HP LoadRunner Analysis User Guide*

User interface elements are described below:

UI Elements (A-Z)	Description
Validate	Validates the connection to the SAP server. When you click **Validate**, the Controller produces a report of all the servers that are available for diagnostics through the Server Host.
Enable SAP Diagnostics	Enables SAP Diagnostics and allows you to configure the SAP Diagnostics settings.

UI Elements (A-Z)	Description
Name	The name of the Mediator used to collect and process the SAP diagnostics data. Only one Mediator is supported for each diagnostics module. **Note:** If you are using a Mediator that is over a firewall, enter the local machine key of the Mediator instead of the Mediator machine name.
Enable Firewall	Select if the Mediator is over a firewall.
MI Listener	The name, full name, or IP address of the MI Listener machine if you are monitoring over a firewall.
Application Server	The name of the SAP server.
Router string	Optional. Enter the system router string of the SAP server.
System number	The system number of the SAP server.
User name	The user's unique name for logging onto the SAP server.
Password	The user's password for logging onto the SAP server.
Client number	The client number of the selected user.

Siebel Configuration Dialog Box

This dialog box enables you to set up the Siebel Diagnostics module to communicate with the Mediator.

To access	Select **Diagnostics** > **Configuration.** Click **Configure** next to **Siebel Diagnostics**.
Relevant tasks	"How to Configure Siebel Diagnostics" on page 389
See also	➤ "Siebel Server Configuration Dialog Box" on page 424 ➤ "Siebel Diagnostics Graphs" in the *HP LoadRunner Analysis User Guide*

User interface elements are described below:

UI Elements (A-Z)	Description
	Opens the Siebel Server Configuration dialog box where you can add Siebel servers and to enter server information. For user interface details, see "Siebel Server Configuration Dialog Box" on page 424.
	Tests the connections between the Siebel Diagnostics module and the Mediator. **Note:** This does not check the connections to the Siebel servers.
Enable Firewall	Select if the Mediator is over a firewall.
Enable Siebel Diagnostics	Enables Siebel Diagnostics and allows you to configure the Siebel Diagnostics settings.
MI Listener	The name, full name, or IP address of the MI Listener machine if you are monitoring over a firewall.
Name	The name of the Mediator used to collect and process the Siebel Diagnostics data. Only one Mediator is supported for each diagnostics module. **Note:** If you are using a Mediator that is over a firewall, enter the local machine key of the Mediator instead of the Mediator machine name.
Servers Table	➤ **Server Name.** The name of the Siebel server. ➤ **Server ID.** The Siebel server ID (for Siebel application servers only). ➤ **Platform.** The platform of the Siebel server. ➤ **Log Directory.** The Siebel server directory where Siebel log files (*.SARM) are written.

Siebel DB Configuration Dialog Box

This dialog box enables you to set up the Siebel DB Diagnostics module to communicate with the Mediator.

To access	Select **Diagnostics** > **Configuration.** Click **Configure** next to **Siebel DB Diagnostics**.
Relevant tasks	"How to Configure Siebel DB Diagnostics" on page 396
See also	➤ "Siebel DB Server Configuration Dialog Box" on page 423 ➤ "Siebel DB Diagnostics Graphs" in the *HP LoadRunner Analysis User Guide*

User interface elements are described below:

UI Elements (A-Z)	Description
	Opens the Siebel DB Server Configuration dialog box where you can add Siebel servers and to enter server information. For user interface details, see "Siebel DB Server Configuration Dialog Box" on page 423.
	Tests the connections between the Siebel DB Diagnostics module and the Mediator. **Note:** This does not check the connections to the Siebel servers.
Enable Firewall	Select if the Mediator is over a firewall.
Enable Siebel DB Diagnostics	Enables Siebel Diagnostics and allows you to configure the Siebel Diagnostics settings.
MI Listener	The name, full name, or IP address of the MI Listener machine if you are monitoring over a firewall.

UI Elements (A-Z)	Description
Name	The name of the Mediator used to collect and process the Siebel Diagnostics data. Only one Mediator is supported for each diagnostics module. **Note:** If you are using a Mediator that is over a firewall, enter the local machine key of the Mediator instead of the Mediator machine name.
Servers Table	➤ **Server Name.** The name of the Siebel server. ➤ **Platform.** The platform of the Siebel server. ➤ **Log Directory.** The Siebel server directory where Siebel log files (*.SARM) are written.

Siebel DB Server Configuration Dialog Box

This dialog box enables you to add Siebel servers and add server information.

To access	Select **Diagnostics** > **Configuration.** Click **Configure** next to **Siebel DB Diagnostics** then click **Add**.
Relevant tasks	"How to Configure Siebel DB Diagnostics" on page 396
See also	"Siebel DB Configuration Dialog Box" on page 422

User interface elements are described below:

UI Elements (A-Z)	Description
Domain	The Siebel server domain.
Password/Passphrase	The user password or passphrase.
Private Key File	The name of the file where the Private Key is stored. This can be found on the Mediator. If you specify the file name only (without a path), the configuration automatically looks for the file in the Mediator's **<LoadRunner>\bin** directory.

UI Elements (A-Z)	Description
Server Log Directory	A location where the Siebel application saves the log files. The log files can be saved in a shared log directory on the Siebel server or in a separate folder.
Server Name	The name of the Siebel server.
Server Platform	The Siebel server platform.
Use Secure Shell	Select if you are working with a Secure Shell connection.
User Name	The user name of the server where log files are stored. **Note:** For Windows platforms, the user should have administrator privileges.

Siebel Server Configuration Dialog Box

This dialog box enables you to add Siebel servers and to enter server information.

To access	Select **Diagnostics** > **Configuration.** Click **Configure** next to **Siebel Diagnostics** then click **Add**.
Relevant tasks	"How to Configure Siebel Diagnostics" on page 389
See also	"Siebel Configuration Dialog Box" on page 420

User interface elements are described below:

UI Elements (A-Z)	Description
App Server ID	The Siebel server ID. For information on generating a list of server IDs, see "Configure the server machine to enable diagnostics" on page 392.
Domain	The Siebel server domain.
OS	Select the Siebel server platform.
Password/Passphrase	The user password or passphrase.

UI Elements (A-Z)	Description
Private Key File	The name of the file where the Private Key is stored. This can be found on the Mediator. If you specify the file name only (without a path), the configuration automatically looks for the file in the Mediator's **<LoadRunner>\bin** directory.
Server Log Directory	Location where the Siebel application saves the log files (*.SARM). The log files can be saved in a shared log directory on the Siebel server or in a separate folder.
Server Name	The name of the Siebel server.
Server Type	The Siebel server type.
Use Secure Shell	Select if you are working with a Secure Shell connection.
User Name	The user name of the server where log files are stored. **Note:** For Windows platforms, the user should have administrator privileges.

Troubleshooting and Limitations

This section describes troubleshooting and limitations for ERP/CRM Diagnostics.

Microsoft Windows networking limitation: Failed to establish connection. System error 1219

Possible causes:

- The limitation might be a result of running the LoadRunner agent as a process.
- The limitation might appear if the Mediator is already connected to the Server with a prior configuration and if the server user is a non-administrator.

Solution: You can try the following:

- Run the LoadRunner agent as a service. For more information, see "Running the LoadRunner Agent as a Service" on page 524.
- Disconnect all previous Mediator connections to the server and try to connect again.
  - To check that a connection exists, at the Command prompt run the following:

```
net use
```

  - To remove a connection, at the Command prompt run the following:

```
net use \\servername\sharename /DELETE
```

- Use your own connection to the log directory by supplying the UNC-path to the log directory and marking the operating system as WINDOWS. When the Mediator runs, it will not try to create a connection but will rely on the given UNC-path instead.

Error: RSH Command Failed

Solution: Run the same command from the DOS command prompt to determine if it is a problem with the command or with LoadRunner. If it runs at the DOS command prompt, the command is valid and you should contact the HP Software Support Web site (www.hp.com/go/hpsoftwaresupport) for further help.

If you cannot run the command from the DOS command prompt either, then contact your UNIX administrator for further assistance.

For more information about RSH commands, see "UNIX Shell" on page 507.

Error: SSH Command Failed

Solution: Run the same command from the DOS command prompt to determine if it is a problem with the command or with LoadRunner. If it runs at the DOS command prompt, the command is valid and you should contact the HP Software Support Web site (www.hp.com/go/hpsoftwaresupport) for further help.

If you cannot run this command from the DOS command prompt either, then contact your UNIX administrator for further assistance.

21

Configuring J2EE/.NET Diagnostics

This chapter includes:

Concepts

Tasks

Reference

Concepts

J2EE/.NET Diagnostics Overview

The HP Diagnostics integration with LoadRunner allows you to monitor and analyze the performance of Java 2 Enterprise Edition (J2EE), .NET-connected, SAP, Oracle, and other complex environments.

For more information about working with diagnostics for J2EE and .NET, see the *HP Diagnostics User Guide*.

Monitoring Server Requests

When configuring a LoadRunner scenario to use J2EE/.NET Diagnostics, you can instruct LoadRunner to capture a percentage of server requests which occur outside the context of any Vuser transaction.

The benefit of enabling this functionality is that calls into a back-end VM can be captured even in the case where:

- The probe is not capturing RMI calls
- RMI calls cannot be captured (perhaps because an unsupported application container is being used)
- The application uses some other mechanism for communications between multiple VMs

Tasks

How to Specify J2EE/.NET Diagnostics Server Details in the Launcher

The first time you use LoadRunner to capture J2EE or .NET diagnostics data, you need to identify the machine on which the Diagnostics Server in Commander mode is running, and the port that it is using for communication with LoadRunner.

Note: You must update this information if you want to integrate with a different Diagnostics Server in Commander mode, or if you change the port it is using.

Update the LoadRunner configuration settings for HP Diagnostics

In the HP Diagnostics Commander, enter the details for the Diagnostics Server in Commander mode. For user interface details, see "Diagnostics for J2EE/.NET Setup Dialog Box" on page 435.

How to Configure a LoadRunner Scenario to use J2EE/.NET Diagnostics

This task describes how to capture J2EE/.NET diagnostics metrics in a LoadRunner scenario and how to select the probes that will be included in the scenario.

This task includes the following steps:

1 Prerequisite

- **Start application server.**

  Make sure that the application server you are monitoring has already been started.

- **Make sure that the load test scenario is not already running.**

  You must configure J2EE/.NET diagnostics before running the load test scenario.

2 Enable J2EE/.NET Diagnostics

Perform the following steps:

a In the Controller, select **Diagnostics** > **Configuration** to open the Diagnostics Distribution dialog box. Then select **Enable the following diagnostics** and specify the percentage of Vusers for which you want to collect J2EE/.NET Diagnostics data. For user interface details, see "Diagnostics for J2EE/.NET Setup Dialog Box" on page 435.

b In the Diagnostics Distribution dialog box, click **Configure** by J2EE/.NET Diagnostics to enable the module. For user interface details, see "J2EE/.NET Configuration Dialog Box" on page 436.

How to View J2EE/.NET Diagnostics Data in LoadRunner During a Scenario Run

This task describes how to view diagnostics data for J2EE/.NET Diagnostics in LoadRunner for the whole scenario or for a specific transaction during a scenario run.

This task includes the following steps:

➤ "View diagnostics data for the whole scenario" on page 433

➤ "View Diagnostics Data for a Specific Transaction" on page 433

View diagnostics data for the whole scenario

In the Controller, select the **Diagnostics for J2EE/.NET** tab. HP Diagnostics opens, displaying the **Scenario Summary** dashboard view.

The **Scenario Summary** dashboard view displays monitoring versions of the transactions, server requests, load, and probe views for the current run.

Note: If you move to another tab during the scenario run and then return to the **Diagnostics for J2EE/.NET** tab, the last screen that you viewed will be displayed.

View Diagnostics Data for a Specific Transaction

Perform the following steps:

1. Select one of the Transaction graphs (for example, **Transaction Response Time**), to open the graph.
2. Right-click the relevant transaction in the graph legend and select **Show J2EE/.NET server side**.

   HP Diagnostics opens, displaying the Transactions view, which contains performance metrics and drill-down options for the selected transaction.

   For more information about interpreting data in the Diagnostics Transactions view, see the *HP Diagnostics User Guide*.

How to View Offline J2EE/.NET Diagnostics Results

This task includes the following steps:

1 Open Analysis

In the Run tab of the Controller, select **Results** > **Analyze Results**, or click the **Analyze Results** button.

2 View results in the Analysis diagnostics graphs

You can use the Analysis diagnostics graphs and reports to view the performance data and drill down to pinpoint problem areas in any layer of the application.

For specific information about J2EE/.NET diagnostics graphs, see J2EE & .NET Diagnostics Graphs in the *HP LoadRunner Analysis User Guide*.

Reference

LoadRunner J2EE/.NET Diagnostics Module User Interface

This section includes (in alphabetical order):

- Diagnostics for J2EE/.NET Setup Dialog Box on page 435
- J2EE/.NET Configuration Dialog Box on page 436

Diagnostics for J2EE/.NET Setup Dialog Box

This dialog box enables you to update the LoadRunner configuration settings for HP Diagnostics.

To access	In the LoadRunner launcher window, select **Configuration** > **Diagnostics for J2EE/.NET Setup**
Relevant tasks	"How to Specify J2EE/.NET Diagnostics Server Details in the Launcher" on page 431

User interface elements are described below:

UI Elements (A-Z)	Description
	Click to verify that you entered the correct information for the Diagnostics Server in Commander mode and that there is connectivity between the server and LoadRunner.
Login	The user name with which you log in to Diagnostics. **Default:** admin **Note:** The user name that you specify should have **view**, **change**, and **execute** privileges. For more information about user privileges, see the *HP Diagnostics Installation and Configuration Guide*.

UI Elements (A-Z)	Description
Password	Enter the password with which you log in to Diagnostics. **Default:** admin
Port	Enter the port number used by the Diagnostic server in Commander mode. **Default:** 2006 **Note:** LoadRunner does not support communication with the Diagnostics Server in Commander mode using HTTPS.
Server Name	Enter the name of the machine that is to host the Diagnostics Server in Commander mode.

J2EE/.NET Configuration Dialog Box

This dialog box enables you to set up the J2EE/.NET Diagnostics module.

To access	Select **Diagnostics** > **Configuration.** Click **Configure** by **J2EE/.NET Diagnostics**.
Important information	The dialog box is read only while a scenario is running.
Relevant tasks	"How to Configure a LoadRunner Scenario to use J2EE/.NET Diagnostics" on page 432
See also	"J2EE & .NET Diagnostics Graphs" in the *HP LoadRunner Analysis User Guide*

User interface elements are described below:

UI Elements (A-Z)	Description
Enable J2EE/.NET Diagnostics	Enables J2EE/.NET Diagnostics and allows you to configure the J2EE/.NET Diagnostics settings
Select probes table	☐ Selects a probe for monitoring. At least one probe must be selected. Clear the check box to disable a probe for the duration of the scenario. **Name.** The name of the probe. **Group.** The probe group. **Host Name.** The host the probe is running on (or the application server on which the probe is installed) la. **Note:** If you upgraded your Diagnostics installation, probes from existing scenarios may appear with a red status. Clear any probes that appear in red.
There is a firewall between the Mediator and the Controller	Select if the Diagnostics server (or a Diagnostics server in Mediator mode in a distributed environment) is located behind a firewall. **Note:** If there is a firewall between the LoadRunner Controller and the Diagnostics Server involved in a load test, you must configure the Controller and the Diagnostics Server to use the MI Listener to enable the transfer of the offline analysis file. For more information, refer to the *HP Diagnostics Installation and Configuration Guide*.
MI Listener server	Enter the name of the MI Listener server when the Diagnostics server (or a Diagnostics server in Mediator mode in a distributed environment) is located behind a firewall.

UI Elements (A-Z)	Description
Monitor server requests	Select to capture a percentage of server requests which occur outside the context of any Vuser transaction. For more information, see"Monitoring Server Requests" on page 430. **Notes:** ➤ The server requests will be captured at the same percentage that was selected for the percentage of Vusers in the Diagnostics Distribution dialog box. ➤ Enabling this option imposes an additional overhead on the probe.
Troubleshoot Diagnostics for J2EE/ .NET connectivity	Click to open the HP Diagnostics System Health Monitor to enable you to investigate any connectivity issues between the Diagnostics components.

Part VI

Monitoring Load Test Scenarios

22

Working with LoadRunner Online Monitors

This chapter includes:

Concepts

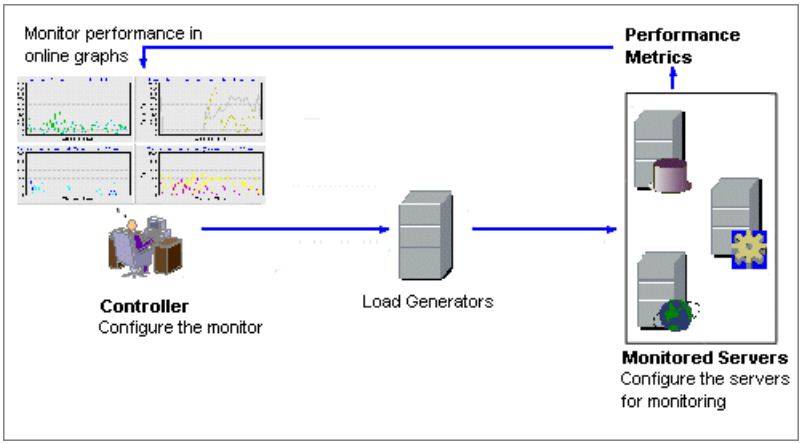
Tasks

Reference

Concepts

Monitoring Process Overview

Before monitoring a scenario, you need to set up and configure the LoadRunner monitoring components. Each monitor has different configuration requirements that are explained in the specific monitoring chapters. The following diagram illustrates the LoadRunner monitoring process.



Before monitoring a server, perform the following steps:

- Configure the monitoring environment on the server machine (if necessary).
- Configure the monitor on the Controller machine.

For details, see "How to Set Up the Monitoring Environment – Workflow" on page 443.

Tasks

How to Set Up the Monitoring Environment – Workflow

This task describes how to set up the LoadRunner online monitoring environment. You specify the machines and measurements that the Controller will monitor during a scenario execution in the Controller's Run tab. During scenario execution, the collected measurement data appears in the online graphs.

This task includes the following steps:

- "Configure the monitoring environment on the server machine" on page 443
- "Add the monitored server to the Controller" on page 444
- "For SiteScope monitors, configure the remote server" on page 445
- "Select the measurements that you want to monitor" on page 445
- "Change the monitor's default counters - Optional" on page 446
- "Improve the level of measurement information - Optional" on page 446

1 Configure the monitoring environment on the server machine

To use the following monitors, you must first install or configure monitoring components on the server machine. For details about configuring the monitoring components, see the specific monitoring sections.

- Citrix
- DB2
- IBM WebSphere MQ
- J2EE & .NET Diagnostics
- Network Delay
- Oracle
- PeopleSoft (Tuxedo)
- SAPGUI
- Tuxedo
- UNIX

2 Add the monitored server to the Controller

Select the server whose monitors you want to configure.

To monitor a server from the Controller, you need to add the machine and the measurements that you want to monitor.

a Click the desired monitor graph in the graph tree, and drag it into the right pane of the Run tab.

b Right-click the graph and select **Add Measurements**, or click anywhere on the graph and select **Monitors** > **Add Measurements**. The <Monitor> dialog box opens.

c Some monitors are native LoadRunner monitors (by default), but you can also monitor through the SiteScope monitor engine. If you want to monitor a server through the SiteScope monitor engine: Click **Advanced**. In the Choose Monitor Engine dialog box, select **SiteScope**. For more information, see the relevant monitoring section.

d In the **Monitored Server Machines** section of the <Monitor> dialog box, click **Add**. The Add Machine dialog box opens.

- Enter the server name or IP address of the machine you want to monitor. Select the platform on which the machine runs.
- For Sitescope monitors enter the name and port number of the SiteScope server, and specify whether you are using a Secure HTTP connection. To use an account, enter the relevant account information.

For user interface details, see "Add Machine Dialog Box" on page 450.

3 For SiteScope monitors, configure the remote server

You configure the remote machine according to your machine's platform: Windows or Unix.

a **Windows platform:** When you add measurements to monitor for the first time, the Configuring NT Remote Machine dialog box opens. For user interface details, see "Configuring NT Remote Machine Dialog Box" on page 452.

b **UNIX platform:** When you add measurements to monitor for the first time, the Configuring Unix Remote Machine dialog box opens. For user interface details, see "Configuring Unix Remote Machine Dialog Box" on page 455.

4 Select the measurements that you want to monitor

a Make sure that the monitor you are configuring is selected in the **Monitored Server Machines** area of the <Monitor> dialog box.

b In the **Resource Measurements** section of the <Monitor> dialog box, click **Add**. The <monitor> Configuration dialog box opens. Choose the measurements for the specific server.

Note: For the Citrix monitor, if the dialog box freezes after clicking **Add**, you may need to rebuild the localhost cache on the Citrix server machine. For more information, refer to Document IDs CTX003648 and CTX759510 in the Citrix Knowledge Base (http://knowledgebase.citrix.com/cgi-bin/webcgi.exe?New,KB=CitrixKB).

For user interface details, see "<Monitor> Configuration Dialog Box" on page 460.

For details about each monitor's default measurements, refer to the relevant reference section for the monitor.

5 Change the monitor's default counters - Optional

When you configure the System Resource, Microsoft IIS, Microsoft ASP, and SQL Server monitors, you are presented with a list of default counters that you can measure on the server you are monitoring. You can change the default counters for these monitors by editing the **res_mon.dft** file found in the **LoadRunner\dat** directory.

a Open a new scenario and click the **Run** tab.

b For each of the monitors, select the counters you want to measure.

c Save the scenario and open the scenario **.lrs** file and **res_mon.dft** file with an editor.

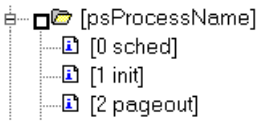
d From the scenario **.lrs** file, copy the **MonItemPlus** section of the each counter you selected into the **res_mon.dft** file.

e Count the number of new counters in the **res_mon.dft** file and update the **ListCount** parameter with this number.

6 Improve the level of measurement information - Optional

You can improve the level of measurement information for the SNMP, iPlanet (SNMP), or Check Point FireWall-1 monitor by enabling measurements with string values to be listed (in addition to measurements with numeric values), and by enabling the name modifier (which displays the string value as an identifying part of the measurement name).

In the following example of a measurement using the name modifier, the string value of ProcessName (sched) is displayed in addition to its instance ID (0):



To enable this feature, add the following line to the **snmp.cfg** file in the **LoadRunner\dat\monitors** directory:

```
SNMP_show_string_nodes=1
```

Note: You can select more than one name modifier, but the first in the hierarchy will be used. Each time the SNMP Add Measurements dialog box opens, the information is reread from the **snmp.cfg** file. You cannot add the same measurement twice (once with a name modifier and once without it). If you do so, an error message is issued.

You can modify the list of resources that you want to monitor at any point during the scenario run. A scenario does not have to be active in order for you to monitor the resources on a remote machine.

Reference

Monitor Types

All of the monitors allow you to view a summary of the collected data at the conclusion of the scenario. Using LoadRunner Analysis, you can generate a graph for any of the monitors. For more information, see the *HP LoadRunner Analysis User Guide*.

The online monitors are divided into the following categories:

Web Resource Monitors	Provide information about the number of Web connections, throughput volume, HTTP responses, server retries, and downloaded pages at the Web servers during the scenario run. For more information, see "Web Resource Monitors" on page 463.
Run-Time and Transaction Monitors	Display the transaction rate and response times, and the number and status of Vusers participating in the scenario, as well as the number and types of errors that the Vusers generate. For more information, see "Run-Time and Transaction Monitoring" on page 471.
System Resource Monitors	Measure the Windows, UNIX, Server, SNMP, and SiteScope resources used during a scenario run. For more information, see "System Resource Monitoring" on page 477.
Network Delay Monitors	Displays information about the network delays on your system. For more information, see "Network Delay Monitoring" on page 497.
Firewall Monitor	Measures statistics related to the firewall servers during the scenario run. For more information, see "Firewall Server Performance Monitoring" on page 481.
Web Server Resource Monitors	Measure statistics related to the Microsoft IISand Apache Web servers during the scenario run. For more information, see "Web Server Resource Monitoring" on page 513.

Web Application Server Resource Monitors	Measure statistics related to the Microsoft ASP and WebLogic (SNMP) application servers during the scenario run. For more information, see "Web Application Server Resource Monitoring" on page 521.
Database Server Resource Monitors	Measure statistics related to the SQL server, Oracle, and DB2 databases during the scenario run. For more information, see "Database Resource Monitoring" on page 531.
Streaming Media Monitors	Measure statistics related to the RealPlayer Client and Media Player Client servers during the scenario run. For more information, see "Streaming Media Monitoring" on page 557.
ERP/CRM Server Resource Monitors	Measure statistics related to the SAP Portal, SAP CCMS, SAPGUI, Siebel Server Manager, Siebel Web Server, and PeopleSoft (Tuxedo) servers during the scenario run. For more information, see "ERP/CRM Server Resource Monitoring" on page 563.
J2EE & .NET Diagnostics Monitors	Provide information to trace, time, and troubleshoot individual transactions through J2EE Web, application, and database servers. For more information, see the *HP Diagnostics User Guide*.
Application Component Monitors	Measures statistics related to the Microsoft COM+ server during a scenario run. For more information, see "Application Component Monitoring" on page 583.
Application Deployment Solutions Monitors	Measures statistics related to the Citrix MetaFrame XP server during a scenario run. For more information, see "Application Deployment Solution Monitoring" on page 589.
Middleware Performance Monitors	Measure statistics related to the Tuxedo and IBM WebSphere MQ servers during a scenario run. For more information, see "Middleware Performance Monitoring" on page 601

Infrastructure Resources Monitor	Displays information about network client data points during a scenario run using the Network Client graph. For more information, see "Infrastructure Resources Monitoring" on page 621.
Security Monitor	Displays information about simulated attacks on the server during a scenario run using the Distributed Denial of Service graph. For more information, see Part VII, "Appendixes."

Configuring Monitors User Interface

This section includes (in alphabetical order):

Add Machine Dialog Box

This dialog box enables you to add the machine that you want to monitor to the Monitored Server Machines list.

To access	Right-click a graph > **Add Measurements** > **Monitored Servers** section of **Monitored Server Machine** > **Add**.
Relevant tasks	"How to Set Up the Monitoring Environment – Workflow" on page 443

Monitored Machine Information

User interface elements are described below:

UI Element (A-Z)	Description
Name	The name or IP address of the machine that you want to monitor. ➤ **Server Resource monitors:** If you are using the HTTP method, enter the full URL of the CGI script. **Example:** http://demo.thiscompany.com/cgi-bin/run.sh ➤ **DB2 monitor:** Enter the DB2 server machine name followed by the @ sign and the database instance you specified in the DB2 Control Center. **Example:** localhost@DB2 ➤ **CheckPoint FireWall-1 monitor:** You can specify a machine name and port number using the format: **<machine name>:<port number>** ➤ **iPlanet (SNMP) monitor:** If the iPlanet SNMP agent is running on a different port than the default SNMP port, you need to define the port number using the format: **<server name>:<port number>** ➤ **MS-COM+ monitor:** To the monitor over a firewall, use the format: **<MI Listener machine>:<server machine key>** where server machine key is the unique key that you chose when configuring the firewall Agent on the server machine. **Example:** 12.12.12.3:serverid ➤ **MS IIS monitor:** To monitor an IIS server through a firewall, use TCP, port 139. ➤ **Tuxedo or PeopleSoft (Tuxedo) monitor:** For multiple instances of the Tuxedo or PeopleSoft (Tuxedo) monitor on the same machine, enter the port number of each monitor to distinguish each instance using the format: **<machine name>:<port number>** ➤ **WebLogic:** If If the WebLogic SNMP agent is running on a different port than the default SNMP port, use the format: **<server name>:<port number>.**
Platform	The platform of the machine you want to monitor.

SiteScope Server Information

User interface elements are described below:

UI Element (A-Z)	Description
Name	The name of the SiteScope server.
Port	The SiteScope port. **Default:** 8888
Use Account	Select this option to use a specific SiteScope user account. Enter the following account details: ➤ **Account.** The SiteScope account name or number ➤ **Username.** The user name defined to log in to the SiteScope account ➤ **Password.** The password defined to log in to the SiteScope account
Use Secure HTTP	Select this to use a Secure HTTP connection.

Configuring NT Remote Machine Dialog Box

This dialog box enables you to configure the remote Windows machine for SiteScope monitors.

To access	Right-click the graph and select **Add Measurements**. This dialog appears only when you add measurements for the first time.
Important information	You configure the NT remote server machine for SiteScope monitors only.
Relevant tasks	"How to Set Up the Monitoring Environment – Workflow" on page 443

User interface elements are described below:

UI Element (A-Z)	Description
Connection Limit	Controls the number of open connections that SiteScope will allow for this remote machine. If you have a large number of monitors configured to use this connection, then set this number high enough to relieve the potential bottleneck. **Note:** This setting does not affect the number of tests running on the remote machine. Tests will always create a new connection.
Connection Method	SiteScope can use the following connection types for monitoring remote Windows server resources: ➤ **NetBIOS.** The default server-to-server communication protocol for Windows networks. ➤ **SSH.** Secure Shell, a more secure communication protocol that can be installed on Windows based networks. This connection method normally requires installing SSH libraries on each server to which you want to connect.
Custom Commandline	The custom command line for a remote connection using the External Client. This option can be used when needing to pass specific options to the external client being executed. Valid substitution variables are: ➤ $root$. This will be translated to the SiteScope directory. ➤ $user$. This will be translated to the user name entered into the remote machine. ➤ $password$. This will be translated to the password entered into the remote. ➤ $host$. This will be translated to the host name entered into the remote machine.
Disable Connection Caching	Select to turn off connection caching for this remote machine. By default SiteScope caches open connections.

UI Element (A-Z)	Description
Key File for SSH connections	Select the file that contains the private key for this connection. **Default: SiteScope\groups\identity**. This setting only applies when the authentication method is **Key File**.
Login	The login for the remote server. If the server is within the same domain as the SiteScope machine, include the domain name in front of the user login name. **Example: domainname\user** If you are using a local machine login account for machines within or outside the domain, include the machine name in front of the user login name. **Example: machinename\user**
NT Server Address	The IP address or UNC-style name of the monitored Windows server. **Note:** The address can be an IP hostname if the SiteScope server can resolve this name into an IP address (using a hosts file, DNS, or WINS/DNS integration).
Password	The password for the remote server or the passphrase for the SSH key file. **Note:** When using SSH authentication with public/private key-based authentication enter the passphrase for the identity file here.
SSH Authentication Method	The authentication method to use for SSH connections. The currently supported methods are: ➤ **Password.** Authenticate using a password. ➤ **Key File**. Authenticate using public/private key authentication. When this option is selected SiteScope uses the private key in the file **SiteScope/groups/identity** to authenticate. The corresponding public key must be listed in the **authorized_keys** file on the remote host.

UI Element (A-Z)	Description
SSH Connection Method	The method to use for this connection. The currently supported methods are: ➤ **Internal Java Libraries.** Connect using the Java SSH client integrated with SiteScope. ➤ **Plink.** Connect using an external SSH client. On Windows, SiteScope ships with Plink. On UNIX or Linux SiteScope uses an installed client such as OpenSSH.
SSH Port Number	The port that the remote SSH server is listening on. **Default:** 22
SSH Version 2 Only	Select to force SiteScope to use SSH protocol version 2 only. This option only applies when using the integrated Java Client in SiteScope.
Title (Optional)	A title for the remote machine name. This name will appear in the drop-down list.
Trace	Select to have trace messages to and from the subject server recorded to the SiteScope RunMonitor.log file.

Configuring Unix Remote Machine Dialog Box

Enables you to configure the remote Unix machine for SiteScope monitors.

To access	Right-click the graph and select **Add Measurements**. This dialog appears only when you add measurements for the first time.
Important Information	You configure the UNIX remote server machine for SiteScope monitors only.
Relevant Tasks	"How to Set Up the Monitoring Environment – Workflow" on page 443

User interface elements are described below:

UI Elements (A-Z)	Description
<Test..>	After defining the server for SiteScope, you can test the settings by clicking the test link. SiteScope attempts to display the working directory of the remote machine (the "pwd" command on UNIX, or "cd" on Windows), as a test to ensure that the remote machine can be accessed and can run commands properly.
Connection Limit	The maximum number of connections for this remote machine.
Connection Method	The supported methods for connecting to the server: ➤ **Telnet.** Log in to the remote server using Telnet. ➤ **SSH.** Log in to the remote server using the SSH protocol. This may require additional software and setup depending on the version of UNIX you are working with. ➤ **Rlogin.** Log in to the remote server using the Rlogin protocol. ➤ **HTTP.** Connect to an HTTP server on the remote server and run the command via a CGI. For this method, the Login and Password are optional and are used for authorizing logging in to the remote machine if required.
Custom Commandline	The command for execution of the external SSH client. For substitutions, use $host$, $user$, and $password$ respectively. This setting is supported only for connections using an external process.
Disable Connection Caching	Select this to disable SSH connection caching.

UI Elements (A-Z)	Description
Initialize Shell Environment	Enter any shell commands to be executed at the beginning of the session. Separate multiple commands with a semicolon (;). This option allows you to specify shell commands to be executed on the remote machine directly after a Telnet or SSH session has been initiated. These commands can be used to customize the shell for each SiteScope remote machine. **Note:** Commands after a shell invocation will not be executed. **Examples:** ➤ The remote shell may not have the correct path set for SiteScope scripts to run. The following command will add the directory **/usr/local/bin** into the path of the current shell on the remote machine: export PATH=$PATH:/usr/local/sbin ➤ The remote shell may not be initializing the pseudo terminal correctly. The following command increases the terminal width to 1024 characters: stty cols 1024;${SHELL} ➤ There have been cases where the remote Telnet Server does not echo back the command line properly. This may cause strange behavior for monitors that rely on this behavior. The following command forces the remote terminal to echo: stty echo ➤ Certain UNIX shells have been known to behave erratically with SiteScope. This includes bash, ksh, and csh. The following command changes the shell to sh for the SiteScope connection: /bin/sh
Login	The log in string for the remote server.
Login Prompt	Enter the prompt to be displayed when the system is waiting for the log in string to be entered. **Default:** "login:"

UI Elements (A-Z)	Description
OS	Select the operating system running on the remote server. The following versions of UNIX are supported: ➤ AIX ➤ OPENSERVER ➤ FreeBSD ➤ SCO ➤ HP/UX ➤ SGI Irix ➤ HP/UX 64-bit ➤ Sun Solaris ➤ Linux ➤ Tru64 5.x ➤ MacOSX ➤ Tru64 Pre 4.x (Digital)
Password	The password for the remote server.
Password Prompt	The prompt to be displayed when the system is waiting for the password to be entered. **Default:** "password:"
Prompt	The prompt to be displayed when the system is ready to handle a command. **Default:** #.
Secondary Prompt	The prompt to be displayed if the Telnet connection to the remote server causes the remote server to prompt for more information about the connection. Separate multiple prompt strings by commas (,). **Example:** For Telnet connections to some remote servers, the remote server may ask what terminal type should be emulated for the connection. In this case you might need to enter Terminal type? as the secondary prompt. The response to the secondary prompt is entered in the Secondary Response field below.

UI Elements (A-Z)	Description
Secondary Response	The responses to secondary prompts required to establish connections with this remote server. Separate multiple responses with commas (,).
Server Address	Displays the IP address or host name of the server that you entered in the Add Machine Dialog Box.
SSH Authentication Method	Select the method to use to authenticate to the remote server (for SSH connections only). ➤ **Password.** Authenticate using a password. ➤ **Keyfile.** Authenticate using public/private key authentication. When this option is selected, SiteScope uses the private key in the file **SiteScope/groups/identity** to authenticate. The corresponding public key must be listed in the **authorized_keys** file on the remote host.
SSH Connection Method	Select the method to use to connect to the remote server. ➤ **Internal Java Libraries.** Connect using the Java SSH client integrated with SiteScope ➤ **Plink.** Connect using an external SSH client. On Windows, SiteScope ships with Plink.
SSH Port Number	The port on which the SSH service is running.
SSH Version 2 Only	Select to force SSH to only use SSH protocol version 2. This option is only supported when using the internal Java libraries connection method.
Title	A title for the remote machine name. This name will appear in the drop-down list in monitors that can connect to this server.
Trace	Select this option to trace messages to and from the remote server in the **RunMonitor.log** file.

<Monitor> Configuration Dialog Box

This dialog enables you to select the measurements to monitor during a scenario run.

To access	Right-click a graph > **Add Measurements** Click **Add** in the **Resource Measurements** section of <**monitor name**> dialog.
Important information	**For DB2 monitors:** If there is no application working with a database, you can only monitor the database manager instance.
Relevant tasks	"How to Set Up the Monitoring Environment – Workflow" on page 443

User interface elements are described below:

UI Elements (A-Z)	Description
Component/Counter Description	Describes the selected component or counter.
Host	The name of the monitored machine.
Measured Components	A hierarchical view of the available components. Browse the tree and select the component you want to monitor. A description of the highlighted component appears in the **Component/Counter Description** box.
Performance Counters	Select the required performance counters. For details about the default monitor counters, see the relevant reference section for your monitor.

<monitor name> Dialog Box

This dialog box enables you to add monitored server machines and access the dialogs to configure the measurements and data collection method.

To access	Right-click a graph > **Add Measurements**
Important information	Before configuring a monitor's measurements, many servers require initial setup. The first step of "How to Set Up the Monitoring Environment – Workflow" on page 443 contains links to the setup instructions.
Relevant tasks	"How to Set Up the Monitoring Environment – Workflow" on page 443

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

UI Elements (A-Z)	Description
Advanced	Opens the Choose Monitor Engine dialog box for selecting native LoadRunner or SiteScope monitoring. ➤ To monitor a server through LoadRunner, select **LoadRunner native monitors**. ➤ To monitor a server through SiteScope, select **SiteScope**. This button is enabled only for those monitors that can be configured as both a SiteScope monitor or a native LoadRunner monitor.
Description	Displays a description of the selected resource measurement.

UI Elements (A-Z)	Description
Monitored Server Machines	The machines whose resources are being monitored. Add... Displays the Add Machine dialog box, which adds the machine that you want to monitor to the existing list. Delete Removes the selected machine from the list.
Resource Measurements on <machine name>	Displays the resource measurements being monitored on the selected machine. Add... Displays the Resources dialog box that lets you create a list of resource measurements on the selected machine. Delete Removes the selected resource measurement from the list.

23

Web Resource Monitors

This chapter includes:

Concepts

Reference

Concepts

Web Resource Monitoring Overview

The Web Resource monitor enables you to analyze the following resources on the Web server during a scenario run: throughput, HTTP requests, downloaded pages, server retries, TCP/IP connections, and SSL Connections.

You can view the following resource monitor graphs during a scenario run:

Hits per Second Graph

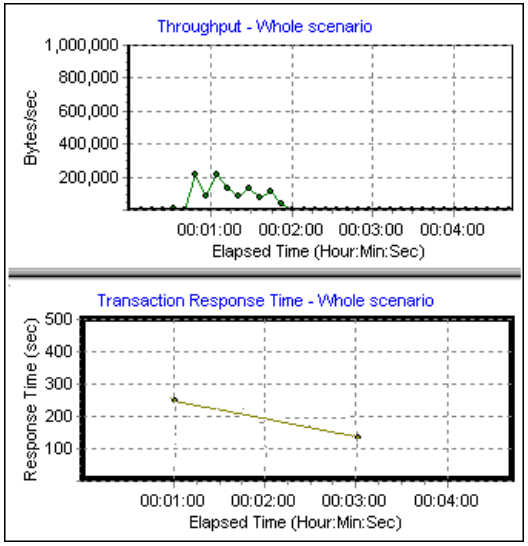
The **Hits Per Second** graph shows the number of hits (HTTP requests) to the Web server (y-axis) as a function of the elapsed time in the scenario (x-axis). This graph can display the whole step, or the last 60, 180, 600, or 3600 seconds. You can compare this graph to the Transaction Response Time graph to see how the number of hits affects transaction performance.

Throughput Graph

The **Throughput** graph shows the amount of throughput (y-axis) on the Web server during each second of the scenario run (x-axis). Throughput is measured in bytes and represents the amount of data that the Vusers received from the server at any given second. You can compare this graph to the Transaction Response Time graph to see how the throughput affects transaction performance.

In the following example, the Transaction Response time graph is compared with the Throughput graph. It is apparent from the graph that as the throughput decreases, the transaction response time also decreases. The peak throughput occurred at approximately 1 minute into the step. The highest response time also occurred at this time.

Example



HTTP Responses per Second Graph

The **HTTP Responses per Second** graph shows the number of HTTP status codes (y-axis)—which indicate the status of HTTP requests, for example, “the request was successful” or “the page was not found”—returned from the Web server during each second of the scenario run (x-axis).

The HTTP responses are grouped by status code. You can also group the results shown in this graph by script (using the "Group By" function) to locate scripts which generated error codes.

For a list of status codes and their explanations, see "HTTP Status Codes" on page 469.

Pages Downloaded per Second Graph

The **Pages Downloaded per Second** graph shows the number of Web pages (y-axis) downloaded from the server during each second of the scenario run (x-axis). This graph helps you evaluate the amount of load Vusers generate, in terms of the number of pages downloaded.

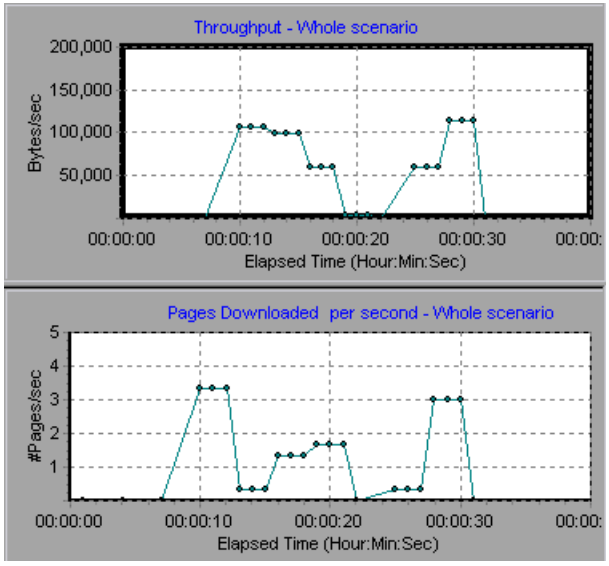
Note: To view the Pages Downloaded per Second graph, you must select **Pages per second (HTML Mode only)** from the script's run-time settings Preferences tab before running your scenario.

Like throughput, downloaded pages per second is a representation of the amount of data that the Vusers received from the server at any given second.

- 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 simply the number of pages.

In the following example, the Throughput graph is compared with the Pages Downloaded per Second graph. It is apparent from the graph that throughput is not proportional to the number of pages downloaded per second. For example, between 15 and 16 seconds into the scenario, the throughput decreased while the number of pages downloaded per second increased.

Example



Retries per Second Graph

The **Retries Per Second** graph shows the number of attempted Web server connections (y-axis) as a function of the elapsed time in the scenario (x-axis).

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
- the server was initially unable to resolve the load generator's IP address

Connections Graph

The **Connections** graph shows the number of open TCP/IP connections (y-axis) at each point in time of the scenario (x-axis). One HTML page may cause the browser to open several connections, when links on the page go to different Web addresses. Two connections are opened for each Web server.

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).

Connections per Second Graph

The **Connections Per Second** graph shows the number of new TCP/IP connections (y-axis) opened and the number of connections that are shut down each second of the scenario (x-axis).

This number 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.

SSLs per Second Graph

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

Because creating a new SSL connection entails heavy resource consumption, you should try to open as few new SSL connections as possible; once you have established an SSL connection, you should reuse it. There should be no more than one new SSL connection per Vuser.

If you set your run-time settings to simulate a new Vuser at each iteration (using the run-time settings **Browser Emulation** node), you should have no more than one new SSL connection per Vuser per iteration. Ideally, you should have very few new TCP/IP and SSL connections each second.

Reference

HTTP Status Codes

The following table displays a list of HTTP status codes. These codes appear in the HTTP Responses per Second Graph:

Code	Description	Code	Description
200	OK	406	Not Acceptable
201	Created	407	Proxy Authentication Required
202	Accepted	408	Request Timeout
203	Non-Authoritative Information	409	Conflict
204	No Content	410	Gone
205	Reset Content	411	Length Required
206	Partial Content	412	Precondition Failed
300	Multiple Choices	413	Request Entity Too Large
301	Moved Permanently	414	Request - URI Too Large
302	Found	415	Unsupported Media Type
303	See Other	416	Requested range not satisfiable
304	Not Modified	417	Expectation Failed
305	Use Proxy	500	Internal Server Error
307	Temporary Redirect	501	Not Implemented
400	Bad Request	502	Bad Gateway
401	Unauthorized	406	Not Acceptable
402	Payment Required	407	Proxy Authentication Required
403	Forbidden	503	Service Unavailable

Code	Description	Code	Description
404	Not Found	504	Gateway Timeout
405	Method Not Allowed	505	HTTP Version not supported

For more information on the above status codes and their descriptions, see http://www.w3.org/Protocols/rfc2616/rfc2616-sec10.html#sec10.

24

Run-Time and Transaction Monitoring

This chapter includes:

Concepts

Concepts

Run-Time Graphs Overview

The **Run-Time** monitor provides information about the status of the Vusers participating in the scenario, and the number and types of errors that the Vusers generate. In addition, the Run-Time monitor provides the User-Defined Data Points graph, which displays the real time values for user-defined points in a Vuser script.

The Run-Time monitor is enabled by default—it automatically begins monitoring Vusers at the start of a scenario.

You can view the following Run-Time monitor graphs during a scenario run:

Running Vusers Graph

The monitor's **Running Vusers** graph provides information about the status of the Vusers running in the current scenario on all load generator machines. The graph shows the number of running Vusers, while the information in the legend indicates the number of Vusers in each state.

Color	Scale	Status	Max	Min	Avg	Std	Last
	1	Running	14	2	7.632653...	3.783389...	14
	1	Error	0	0	0	0	0
	1	Finished	0	0	0	0	0

The Status field of each Vuser displays the current status of the Vuser. The following table describes each Vuser status.

Status	Description
Running	The total number of Vusers currently running on all load generators.
Ready	The number of Vusers that completed the initialization section of the script and are ready to run.

Status	Description
Finished	The number of Vusers that have finished running. This includes both Vusers that passed and failed.
Error	The number of Vusers whose execution generated an error. Check the Status field in the Vuser view or the Output window for a complete explanation of the error.

User-Defined Data Points Graph

The **User-Defined Data Points** graph displays the real-time 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, see the *HP LoadRunner Online Function Reference*.

By default, LoadRunner displays all of the data points in a single graph. The legend provides information about each data point. If desired, you can hide specific data points using the legend below the graphs.

You can also view data points offline, after the completion of the scenario. For more information, see the *HP LoadRunner Analysis User Guide*.

Error Statistics Graph

The monitor's **Error Statistics** graph provides details about the number of errors that accrue during each second of the scenario run. The errors are grouped by error source—for example, the location in the script or the load generator name.

Vusers with Errors Graph

The **Vusers with Errors** graph provides details about the number of Vusers that generate errors during scenario execution. The errors are grouped by error source.

 Transaction Monitor Graphs Overview

The Transaction monitor displays the transaction rate and response time during a scenario run. The Transaction monitor is enabled by default—it automatically begins monitoring Vuser transactions at the start of a scenario run. To conserve resources, you can disable the Transaction monitor from the Controller.

You can view the following Transaction monitor graphs during a scenario run:

- The **Transaction Response Time** graph shows the average response time of transactions in seconds (y-axis) as a function of the elapsed time in the scenario (x-axis).
- The **Transactions per Second (Passed)** graph shows the number of successful transactions performed per second (y-axis) as a function of the elapsed time in the scenario (x-axis).
- The **Transactions per Second (Failed, Stopped)** graph shows the number of failed and stopped transactions per second (y-axis) as a function of the elapsed time in the scenario (x-axis).
- The **Total Transactions per Second (Passed)** graph shows the total number of completed, successful transactions per second (y-axis) as a function of the elapsed time in the scenario (x-axis).

Note:

- If there are no transactions defined in your Vuser script or if no transactions are being executed, no data will be displayed in the online monitor graphs.
- To generate Web Page diagnostics for each transaction, configure the Diagnostics options from the Controller.

25

System Resource Monitoring

This chapter includes:

Concepts

Tasks

Reference

Concepts

System Resource Monitors Overview

You use LoadRunner's System Resource monitors to monitor a machine's system resource usage during a scenario run and isolate server performance bottlenecks.

A primary factor in a transaction's response time is its system resource usage. Using the LoadRunner resource monitors, you can monitor the Windows, UNIX, Server, SNMP, FireWall server, and SiteScope resources on a machine during a scenario run, and determine why a bottleneck occurred on a particular machine.

The resource monitors are automatically enabled when you execute a scenario. However, you must specify the machine you want to monitor and which resources to monitor for each machine. You can also add or remove machines and resources during the scenario run.

Windows Resource Monitoring

The Windows Resources monitor shows the Windows resources measured during the scenario run. Windows measurements correspond to the built-in counters available from the Windows Performance Monitor.

By default, LoadRunner monitors Windows resources using the native LoadRunner monitor engine.

If you are using the SiteScope monitor engine, ensure that SiteScope has been installed on a server. You can install SiteScope on the same server as the Controller, or on a dedicated server.

If you want to monitor a remote Windows server that does not use Windows domain security, you must authenticate the Controller on the remote Windows server. To authenticate the Controller, create an account, or change the password of the account used to log on to the Controller so that it matches the password and user name used to log on to the remote monitored Windows machine. When the remote Windows machine requests another machine's resources, it sends the logged-in user name and password of the machine requesting the resources.

UNIX Resource Monitoring

The UNIX Resources monitor shows the UNIX resources measured during the scenario. This graph helps you determine the impact of Vuser load on the various system resources.

The UNIX kernel statistics measurements include those available by the **rstatd** daemon. For a description of the measurements, see "UNIX Resources Performance Counters" on page 486.

Note: You must configure an **rstatd** daemon on all UNIX machines being monitored. For information, refer to the UNIX *man* pages, or see "How to Set up the UNIX Monitoring Environment" on page 482.

Server Resource Monitoring

The Server Resources monitor shows the resources of monitors (CPU, disk space, memory, or applications) used on remote Windows and UNIX servers measured during the scenario. This helps you determine the impact of Vuser load on the various system resources.

The Server Resources monitor includes the following monitors:

- **CPU Monitor.** Monitors CPU usage.
- **Disk Space Monitor.** Monitors disk space.

- **Memory Monitor.** Monitors pages per second and percentage of virtual memory used.
- **Service Monitor.** Verifies that specific processes are listed as running and checks CPU usage.

To display server resource data during a scenario run, you need to first select the desired measurements for the online monitor (from the Controller) before running the scenario.

Server Resource Monitor Environment

- Ensure that SiteScope has been installed on a server. You can install SiteScope on the same machine as the Controller, or on a dedicated server.
- Verify that SiteScope is collecting the required data from the servers it is monitoring. From the SiteScope Panel, select the monitor group polling the Server Resource machines, and check that the monitor displays a list of server measurements in the Status column.

SNMP Resource Monitoring

The SNMP Resource monitor shows statistics for a Windows or UNIX machine using the Simple Network Management Protocol (SNMP). The SNMP Resources monitor is available for monitoring any machine that runs an SNMP agent, using the Simple Network Management Protocol (SNMP).

You can configure this monitor as a native LoadRunner SNMP monitor, or as a SiteScope SNMP by MIB monitor. The native LoadRunner SNMP monitor can only monitor up to 25 measurements.

SiteScope Resource Monitoring

The SiteScope Resources monitor graph shows the SiteScope resources measured during the scenario run. The SiteScope monitor can measure server, network, and processor performance counters. For detailed information on the performance counters that SiteScope can monitor, refer to the relevant SiteScope documentation.

Before setting up the SiteScope monitor, ensure that SiteScope has been installed on a server. You can install SiteScope on the same machine as the Controller, or on a dedicated server. If SiteScope is installed on a machine other than the Controller, verify that the SiteScope machine is accessible from the Controller machine.

Firewall Server Performance Monitoring

The Firewall server online monitor measures the performance of a Firewall server during scenario execution, which enables isolation of server performance bottlenecks.

The Check Point FireWall-1 monitor displays statistics about the resource usage on Check Point's FireWall during the scenario run.

Tasks

How to Set up the UNIX Monitoring Environment

This task describes how to configure the UNIX environment before setting up the UNIX monitor.

This task includes the following steps:

- "Verify whether the rstatd daemon is already configured" on page 482
- "Configure the rstatd daemon" on page 483
- "Configure the monitor for a UNIX machine over a firewall (optional)" on page 483
- "Configure the monitor measurements in the Controller" on page 483

1 Verify whether the rstatd daemon is already configured

The rstatd daemon might already be configured, because when a machine receives an rstatd request, the inetd on that machine automatically activates the rstatd.

- The **rup** command reports various machine statistics, including rstatd configuration. Run the following command on the UNIX machine to view the machine statistics:

  ```
  >rup host
  ```

- You can also use **lr_host_monitor** and see if it returns any relevant statistics.

  If the command returns meaningful statistics, the rstatd daemon is already configured and activated. If not, or if you receive an error message, the rstatd daemon is not configured.

2 Configure the rstatd daemon

If the rstatd daemon is not yet configured, follow these steps to configure it:

a On the UNIX machine, run the command: **su root**

b Go to **/etc/inetd.conf** and look for the rstatd row (it begins with the word rstatd). If it is commented out (with a #), remove the comment directive, and save the file.

c From the command line, run:

```
kill -1 inet_pid
```

where inet_pid is the pid of the inetd process. This instructs the inetd to rescan the **/etc/inetd.conf** file and register all daemons which are uncommented, including the rstatd daemon.

d Run **rup** again.

If the command still does not indicate that the rstatd daemon is configured, contact your system administrator.

3 Configure the monitor for a UNIX machine over a firewall (optional)

To monitor a UNIX machine over a firewall, you must run a UNIX utility called rpcinfo and identify the rstatd's port number.

Run **rpcinfo -p <hostname>**. You will receive a list of all RPC servers registered in the host's portmapper, along with the port number. This list will not change until rstatd is stopped and rerun.

Some firewalls allow you to open an RPC program number instead of a port. In such cases, open program 100001. If are prompted to include a version number, specify versions 3 and 4.

4 Configure the monitor measurements in the Controller

For task details, see "How to Set Up the Monitoring Environment – Workflow" on page 443.

Click **Add** in the **Resource Measurements on: <machine>** section of the UNIX Resources dialog box to open the UNIX Kernel Statistics dialog box and select the available measurements and server properties. For more information, see "UNIX Kernel Statistics Dialog Box" on page 495.

For a description of the available UNIX monitor measurements, see "UNIX Resources Performance Counters" on page 486.

Reference

Check Point FireWall-1 Performance Counters

The following FireWall counters can be monitored:

Measurement	Description
fwRejected	The number of rejected packets.
fwDropped	The number of dropped packets.
fwLogged	The number of logged packets.

Server Resources Performance Counters

The following monitor measurements are available on the server machine:

Monitor	Measurements	Description
CPU Monitor	**Utilization**	Measures CPU utilization.
Disk Space Monitor	**Disk space**	Measures the percentage of disk space used.

Monitor	Measurements	Description
Memory Monitor	**MB free**	Measures the amount of disk space free, 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 Monitor		Monitors processes locally or on remote systems. Can be used to verify that specific processes are running.

UNIX Resources Performance Counters

The following default measurements are available for the UNIX machine:

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

Measurement	Description
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	Number of processes being swapped
Swap-out rate	Number of processes being swapped
System mode CPU utilization	Percent of time that the CPU is utilized in system mode
User mode CPU utilization	Percent of time CPU is utilized in user mode

Windows Resource Performance Counters

The following default measurements are available for Windows machines:

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.
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.

Object	Measurement	Description
Processor	**% Processor Time (Windows 2000)**	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	**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.
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.

Object	Measurement	Description
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 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. 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.

Object	Measurement	Description
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.

System Resource Monitors User Interface

This section includes (in alphabetical order):

Add Windows Resources Measurements Dialog Box

This dialog box enables you to select the Windows resources to monitor. The Windows resources correspond to the built-in counters available from the Windows Performance Monitor.

To access	Right-click a graph > **Add Measurements** In the **Resource Measurements** section of the **Windows Resources** dialog, click **Add**.
Relevant tasks	"How to Set Up the Monitoring Environment – Workflow" on page 443

User interface elements are described below:

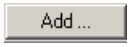
UI Elements (A-Z)	Description
	Displays a description of the selected counter.
Counters/ Measurements	The resource counter/measurement to monitor. Select multiple counters using the CTRL key. For a list of available measurements, see "Windows Resource Performance Counters" on page 488.
Instances	If multiple instances of the selected counter are running, select one or more instances to monitor for the selected counter.
Object	The object to monitor on the specified Windows machine.

CheckPoint FireWall-1 Dialog Box

This dialog box enables you to select the CheckPoint FireWall-1 server resources to monitor using the Simple Network Management Protocol (SNMP).

To access	Right-click a graph > **Add Measurements** In the **Resource Measurements** section of the **Monitored Server Machine** dialog, click **Add**.
Important information	The CheckPoint FireWall-1 monitor can monitor up to 25 measurements.
Relevant tasks	"How to Set Up the Monitoring Environment – Workflow" on page 443

User interface elements are described below:

UI Elements (A-Z)	Description
	Adds the selected measurement to the monitor graph.
	Hides the ID number and description of the selected object
	Displays an ID number and description of the selected object.
CheckPoint FireWall-1 SNMP Objects	Select each required object and click  .

Configuring SNMP by MIB Monitor Dialog Box

This dialog box enables you to configure the SiteScope SNMP by MIB monitor properties before you add monitor measurements.

To access	Right-click a graph > **Add Measurements** In the **Resource Measurements** section of the **Monitored Server Machine** dialog, click **Add**.
Important information	Many of these properties are applicable for specific versions of SNMP connections, as noted in the user interface descriptions below.
Relevant tasks	"How to Set Up the Monitoring Environment – Workflow" on page 443

User interface elements are described below:

UI Elements (A-Z)	Description
MIB File	The MIB file which contains the objects you are interested in monitoring. ➤ If you select a specific MIB file, then only the objects described in that MIB file are displayed. ➤ If you select **All MIBs**, then all objects retrieved from the agent during the MIB traversal will be displayed. ➤ If no MIB information is available for an object, the object is still displayed, but with no textual name or description. **Note:** To make this monitor aware of new or additional MIBs, place new MIB files in the **SiteScope/templates.mib** directory.
Port	The port to use when requesting data from the SNMP agent. **Default:** Port 161 is the port on which an SNMP agent will typically be listening.
Retries	The number of times each SNMP GET request should be retried before SiteScope considers the request to have failed. **Default:** 1 retry.
Server	The name of the server you want to monitor.
SNMP V3 Authentication Password	The authentication password to use for version 3 connections.
SNMP V3 Authentication Type	The type of authentication to use for version 3 connections.
SNMP V3 Context Engine ID	A hexadecimal string representing the Context Engine ID to use for version 3 connections.
SNMP V3 Context Name	The Context Name to use for version 3 connections.

UI Elements (A-Z)	Description
SNMP V3 Privacy Password	The privacy password if DES privacy encryption is desired for version 3 connections. Leave blank if you do not require privacy.
SNMP V3 Username	The user name for version 3 connections.
SNMP Version	The version of SNMP to use when connecting.
Timeout	The total time, in seconds, that SiteScope should wait for all SNMP requests (including retries) to complete. **Default:** 5 seconds.
Update every	How frequently the monitor should read the server statistics. The drop-down list to the right of the text box lets you specify time increments of seconds, minutes, hours, or days. You must specify a time increment of at least 3 seconds. **Default:** 3 seconds.
V1/V2 Community	The community string for version 1 or 2 connections.

UNIX Kernel Statistics Dialog Box

The UNIX Kernel Statistics dialog box lets you select the UNIX measurements and server properties to monitor.

To access	Right-click a graph > **Add Measurements.** In the **UNIX Resource Measurements** section of the **UNIX Resources** dialog, click **Add.**
Important information	Ensure that the rstatd daemon is correctly configured and running on the monitored UNIX machine.
Relevant tasks	➤ "How to Set up the UNIX Monitoring Environment" on page 482 ➤ "How to Set Up the Monitoring Environment – Workflow" on page 443

User interface elements are described below:

UI Elements (A-Z)	Description
Available Measurements	Select the measurements you want to add. To select more than one measurement, use the CTRL key. For a list of available measurements, see "UNIX Resources Performance Counters" on page 486.
Description	Displays a description of the selected measurement.

26

Network Delay Monitoring

This chapter includes:

Concepts

Tasks

Reference

Concepts

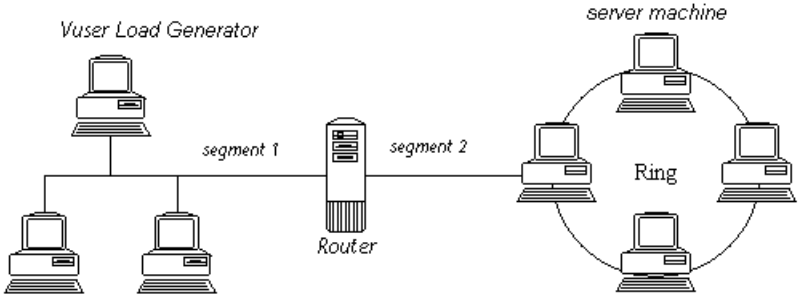
Network Monitoring Overview

Network configuration is a primary factor in the performance of applications. A poorly designed network can slow client activity to unacceptable levels.

You use Network monitoring to determine whether your network is causing a delay in the scenario. You can also determine the problematic network segment.

In a true Web or client/server system, there are many network segments. A single network segment with poor performance can affect the entire system.

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



The Network Delay Time monitor shows the delays for the complete path between the source and destination machines (for example the database server and Vuser host). The graph maps the delay as a function of the elapsed scenario time. Each defined path is represented by a separate line with a different color in the graph.

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. This time is the delay which appears in the Network Delay Time graph.

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.

Tasks

How to Set Up the Network Monitoring Environment

This task describes how to prepare your environment for network monitoring.

This task includes the following steps:

1 Prerequisites

To enable network monitoring, you must install the LoadRunner agent on the source machine. You do not have to install the LoadRunner agent on the destination machine.

To run the Network monitor, you must have administrator privileges on the Windows source machine (unless you are using the ICMP protocol).

2 Configure the UNIX source machine - optional

You can run the Network monitor on UNIX source machines, using UDP or ICMP. Before running the Network monitor from a UNIX source machine, configure the source machine. For task details, see "How to Configure the UNIX Source Machine for Network Monitoring" on page 502.

3 Configure the firewall between the source and destination machines - Optional

If you are monitoring a network in which there are firewalls between the source and the destination machines, you must configure the firewalls to allow the network data packets to reach their destinations.

- If you are using the TCP protocol, the firewall that protects the destination machine should not block outgoing ICMP_TIMEEXCEEDED packets (packets that are sent outside the firewall from the machine). In addition, the firewall protecting the source machine should allow ICMP_TIMEEXCEEDED packets to enter, as well as TCP packets to exit.
- If you are using the ICMP protocol, the destination machine's firewall should not block incoming ICMP_ECHO_REQUEST packets, or outgoing ICMP_ECHO_REPLY and ICMP_ECHO_TIMEEXCEEDED packets. In addition, the firewall protecting the source machine should allow ICMP_ECHO_REPLY and ICMP_ECHO_TIMEEXCEEDED packets to enter, and ICMP_ECHO_REQUEST packets to exit.
- If you are using the UDP protocol, ensure that the UDP protocol can access the destination machine from the source machine. The destination machine's firewall should not block outgoing ICMP_DEST_UNREACHABLE and ICMP_ECHO_TIMEEXCEEDED packets. In addition, the firewall protecting the source machine should allow ICMP_DEST_UNREACHABLE and ICMP_ECHO_TIMEEXCEEDED packets to enter.

Note: To run the Network Delay monitor when there are firewalls between the Controller and the source machine, you must configure the LoadRunner agent, MI Listener, and Network Delay monitor for monitoring over a firewall.

---

4 Specify the network monitor paths

In the Controller **Run** tab graph tree view, select the **Network Delay Time** graph and drag it into the right pane. Right-click the graph and select **Add Measurements**. Define the paths using the following three dialog boxes:

a Add source and destinations machines. For details, see the "Network Delay Time Dialog Box" on page 506.

b Define the network monitor path. For details, see the "Adding Destination Machines for Network Delay Monitoring Dialog Box" on page 505.

c Configure the monitor settings for the defined path. For details, see the "Network Monitor Settings for Defined Path Dialog Box" on page 508.

How to Configure the UNIX Source Machine for Network Monitoring

This task describes how to configure a UNIX source machine before running the network monitor.

This task includes the following steps:

➤ "Assign permissions where LoadRunner is installed locally." on page 502

➤ "Assign permissions where LoadRunner is installed on the network." on page 503

➤ "Connect to the Unix Source Machine Through RSH" on page 504

➤ "Connect to the Unix Source Machine Through the Agent" on page 504

1 Assign permissions where LoadRunner is installed locally.

Follow these steps to assign root permissions to the **merc_webtrace** process:

a Log in to the source machine as root.

b Type: **cd <LoadRunner_installation>/bin** to change to the **bin** directory.

c Type: **chown root merc_webtrace** to make the root user the owner of the **merc_webtrace** file.

d Type: **chmod +s merc_webtrace** to add the s-bit to the file permissions.

e To verify, type **ls -l merc_webtrace**. The permissions should look like this: **-rwsrwsr-x**.

2 Assign permissions where LoadRunner is installed on the network.

In a LoadRunner network installation, the **merc_webtrace** process is on the network, not on the source machine disk. The following procedure copies the **merc_webtrace** file to the local disk, configures **mdrv.dat** to recognize the process, and assigns root permissions to **merc_webtrace**:

a Copy **merc_webtrace** from <**LoadRunner_installation**>/**bin** to anywhere on the local disk of the source machine. For example, to copy the file to the **/local/**<**LoadRunner**> directory, type: cp /net/tools/LoadRunner_installation/bin/merc_webtrace /local/<LoadRunner>

Note: All of the source machines that use the same network installation must copy **merc_webtrace** to the identical directory path on their local disk (for example, /local/<LoadRunner>), since all of them use the same **mdrv.dat**.

---

b Add the following line to the <**LoadRunner_installation**>/**dat/mdrv.dat** file, in the [monitors_server] section:

ExtCmdLine=-merc_webtrace_path /local/xxx

c Log in to the source machine as root.

d Type: cd LoadRunner_installation/bin to change to the **bin** directory.

e Type: chown root merc_webtrace to make the root user the owner of the **merc_webtrace** file.

f Type: chmod +s merc_webtrace to add the s-bit to the file permissions.

g To verify, type ls -l merc_webtrace. The permissions should look like: -rwsrwsr-x.

3 Connect to the Unix Source Machine Through RSH

Follow these instructions if the Controller is connected to the source machine through RSH (default connection mode). In this case you do not need to activate the agent daemon.

Before running the Network monitor the first time, you enter an encrypted user name and password in the Network monitor configuration file.

a On the Windows taskbar, click **Start**, point to **Programs** > **LoadRunner** > **Tools**, and click **Password Encoder**. The Password Encoder window opens.

b In the **Password** box, type your RSH user name and password, separated by a vertical bar symbol. For example, myname|mypw.

c Click **Generate**. An encoded string is displayed in the Encoded string field.

d Click **Copy** to copy the encoded string to the clipboard.

e Add the following line to the <**LoadRunner_installation**>/**dat/monitors/ndm.cfg** file, in the [hosts] section:

Host = <encrypted string copied from clipboard>

f Close and open the current scenario. LoadRunner will read the updated configuration file and recognize the source machine for monitoring.

4 Connect to the Unix Source Machine Through the Agent

Follow these instructions for activating agent daemon on the source machine if the Controller is not connected to the source machine through RSH.

a Type m_daemon_setup -install from the <**LoadRunner_installation**>/**bin** directory.

b Make sure that the agent daemon is running whenever you activate the Network monitor.

c To stop the Network Delay Monitor agent daemon, type m_daemon_setup -remove.

Reference

Network Delay Monitoring User Interface

This section includes (in alphabetical order):

Adding Destination Machines for Network Delay Monitoring Dialog Box

This dialog box enables you to add destination machines for network delay monitoring, and configure additional network monitor settings.

To access	**Network Delay Time** dialog box > **To machine(s)** section> Click **Add**
Important information	The Network Delay Time Monitor cannot be configured to work in TCP mode on Windows XP SP2 or Vista.
Relevant tasks	"How to Set Up the Network Monitoring Environment" on page 500

User interface elements are described below:

UI Elements (A-Z)	Description
Add ...	Enter the name or URL of the machine at the final destination of the path you want to monitor in the New Machine Name dialog box. Repeat this for each path you want to monitor. **Note:** If the destination machine is **localhost**, enter the local machine's name and not **localhost**.
Delete	Deletes the destination machine, to remove this path from the monitor graph.
Rename	Renames the destination machine.
Properties	Opens the Configuring Network Monitor Settings for Defined Path dialog box.
From Machine	Displays the name of the source machine.
To Machines	Displays the names or URLs of the destination machines.

Network Delay Time Dialog Box

This dialog box enables you to select the network path you want to monitor.

To access	Right-click the Network Delay Time graph and select **Add Measurements**. This dialog appears only when you add measurements for the first time.
Important information	To run the Network monitor, you must have administrator privileges on the source machine (unless you are using the ICMP protocol).
Relevant tasks	"How to Set Up the Network Monitoring Environment" on page 500

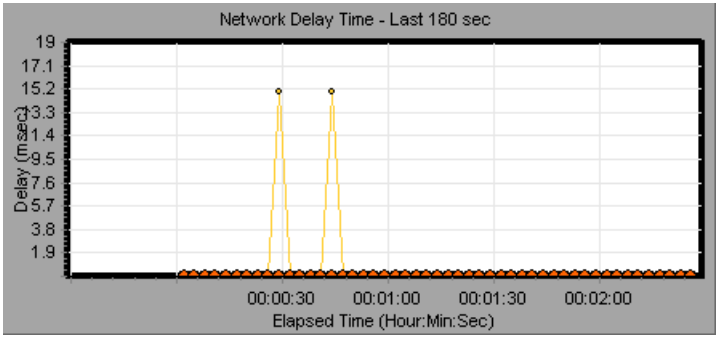
User interface elements are described below:

UI Elements (A-Z)	Description
Monitor the network delay from machine	Displays the name of the machine from which network monitoring begins (source machine). To add a machine, click Add ... and specify the server name or IP address and machine platform. Repeat this for each path you want to monitor. **Important:** If there is a firewall between the Controller machine and the source machine, enter the server name or IP address of the source machine according to the following format: <MI Listener machine>:<source machine local key> where where source machine local key is the Local Machine Key that you chose when configuring the LoadRunner agent on the source machine. (See "Agent Configuration Settings" on page 355.) **Example:** 12.12.12.3:vds
To machine(s)	Displays the network path in the format of **sourcemachine -> destination machine**. To add a new destination machine, click Add ... and define the machine in the Adding Destination Machines for Network Delay Monitoring dialog box.

Network Delay Time Graph

The Network Delay Time graph shows the delay for the complete path between the source and destination machines (y-axis) as a function of the elapsed scenario time (x-axis).

Each path defined in the Add Destination Machines for Network Delay Monitoring dialog box is represented by a separate line with a different color in the graph.



Network Monitor Settings for Defined Path Dialog Box

This dialog box enables you to set the network protocol, port, monitoring frequency, and monitoring packet retries.

To access	**Add Destination Machines for Newtork Delay Monitoring** > Click **Properties.**
Relevant tasks	"How to Set Up the Network Monitoring Environment" on page 500

User interface elements are described below:

UI Elements (A-Z)	Description
Monitor Settings	➤ **Send request using X protocol.** Select the network protocol you want the monitor to use: TCP, UDP, or ICMP. It is recommended that you use the default protocol. The default in Windows is TCP, and in UNIX is UDP. **Note:** When you use TCP or UDP protocols, administrator privileges are required on the source machine. ➤ **Send request to port.** Enter the port number to be used by the network path. ➤ **Enable display of network nodes by DNS names.** Enables you to view the DNS name of each node along the network path, in addition to its IP address. **Note:** Selecting this option will decrease the speed of the Network monitor.

UI Elements (A-Z)	Description
Monitoring Frequency	**Send next packet X milliseconds after receipt of previous packet.** Select the number of milliseconds the monitor should wait between receiving a packet and sending out the next packet. **Default:** 3000 milliseconds. **Note:** If you have a long, steady scenario, you can increase the interval by several seconds.
Monitoring Packet Retries	➤ **Wait X seconds for packet to return before retrying.** Select the maximum number of seconds that the monitor should wait for a packet to return before it retries to send the packet. **Default:** 3 seconds. **Note:** If your network is very large and loaded (an internet connection with a low capacity), you should increase the value by several seconds. If you have a small network (such as a LAN), you can decrease the value. ➤ **Number of retries.** Select the number of times the monitor should try resending a packet to a node if the packet is not initially returned. **Default:** 0.

Troubleshooting and Limitations

This section describes troubleshooting for the Network Delay monitor.

If monitoring is unsuccessful and LoadRunner cannot locate the source or destination machines, make sure that the specified machines are available to your machine. Perform a “ping” operation. At the command line prompt, type:

```
ping server_name
```

To check the entire network path, use the trace route utility to verify that the path is valid.

For Windows, type tracert <server_name>.

For UNIX, type traceroute <server_name>.

If the monitoring problem persists once you verify that the machines are accessible and that the network path is valid, perform the following procedures:

1. If you are using the TCP protocol, run <**LoadRunner root folder**>**bin****webtrace.exe** from the source machine to determine whether the problem is related to the Controller, or the WebTrace technology on which the Network Delay monitor is based. If you are using the UDP or ICMP protocols, the problem must be related to the Controller and not WebTrace, since these protocols are not WebTrace technology-based.
2. If you receive results by running **webtrace.exe**, the problem is related to the Controller. Verify that the source machine is not a UNIX machine, and contact the Customer Support Web site with the following information:
   - the Controller log file, **drv_log.txt**, located in the **temp** directory of the Controller machine.
   - the **traceroute_server** log file, located on the source machine.
   - the debug information located in the **TRS_debug.txt** and **WT_debug.txt** files in the path directory. These files are generated by adding the following line to the [monitors_server] section of the <**LoadRunner root folder**>**dat****mdrv.dat** file, and rerunning the Network monitor:

     ExtCmdLine=-traceroute_debug path
3. If you do not receive results by running **webtrace.exe**, the problem is related to the WebTrace technology, on which the Network Delay monitor is based. Perform the following procedures on the source machine:
   - Verify that the **packet.sys** file (the Webtrace driver) exists in the **WINNT****system32****drivers** directory.

- Check whether a driver (such as "Cloud" or "Sniffer") is installed on top of the network card driver. If so, remove it and run WebTrace again.
- Verify that there are administrator permissions on the machine.
- Using ipconfig /all, check that only one IP address is assigned to the network card. WebTrace does not know how to handle multiple IP addresses assigned to the same card (IP spoofing).
- Check the number of network cards installed. Run webtrace –devlist to receive a list of the available network cards.
- If there is more than one card on the list, run webtrace -dev <dev_name> <destination>, where <dev_name> is one of the network card names shown in the list. If you discover that WebTrace is binding to the wrong card, you can use webtrace set_device <dev_name> to set a registry key that instructs WebTrace to use a specified card instead of the default one.
- Verify that the network card is of the Ethernet type.
- Contact the Customer Support Web site with the output of webtrace.exe –debug (for example, webtrace.exe –debug www.merc-int.com) and ipconfig /all on the machine.

27

Web Server Resource Monitoring

This chapter includes:

Concepts

Tasks

Reference

Concepts

Web Server Resource Monitoring Overview

Web Server Resource monitors provide you with information about the resource usage of the Microsoft IIS and Apache Web servers during scenario execution. To obtain this data, you need to activate the online monitor for the server and specify which resources you want to measure before executing the scenario.

Note: Certain measurements or counters are especially useful for determining server performance and isolating the cause of a bottleneck during an initial stress test on a Web server. For more information about these counters, see "Useful Counters for Stress Testing" on page 396.

Tasks

How to change the Apache default server properties

This task describes how to modify the Apache default server properties that are defined in the monitor configuration file.

1 Open the **apache.cfg** file in the **<LoadRunner root folder>\dat\monitors** directory.

2 Edit the following parameters after the **Delimiter=:** statement:

InfoURL. Server statistics information URL

ServerPort. Server port number

SamplingRate. Rate (milliseconds) at which the LoadRunner monitor will poll the server for the statistics information. If this value is greater than 1000, LoadRunner will use it as its sampling rate. Otherwise, it will use the sampling rate defined in the Monitors tab of the Options dialog box.

3 Save and close the file.

Reference

Apache Performance Counters

The following table describes the measurements and server properties that can be monitored on the Apache Web server during the scenario run:

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

Microsoft IIS Performance Counters

The following table describes the measurements and server properties that can be monitored on the Microsoft IIS Web server during the scenario run:

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.

Object	Measurement	Description
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.

Web Server Resource Monitoring User Interface

This section includes (in alphabetical order):

Apache Dialog Box

This dialog box enables you to configure the measurements and server properties for the Apache monitor.

To access	Right-click a graph > **Add Measurements** Click **Add** in the **Resource Measurements** section of **Apache** dialog.
Relevant tasks	How to Set Up the Monitoring Environment – Workflow How to change the Apache default server properties

User interface elements are described below:

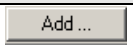
UI Elements (A-Z)	Description
Add ...	Adds the selected measurement to the list of measurements in the **Measurements on <machine>** section of the Apache dialog box.
Available Measurements	Select the counter to monitor Select multiple measurements using the **CTRL** key.
Description	Displays a description of the selected measurement.
Server Properties - Port	Type the port number of the Apache server **Note:** To monitor an Apache server through a firewall, use the Web server port (by default, port 80).
Server Properties - URL	Server statistics information URL. To verify the statistics information URL, try to view it through the browser using the following format: http://<server_name/IP address>:<port_number>/server-status?auto For example: http://stimpy:80/server-status?auto. **Format:** Enter the server statistics information URL, without the server name. **Default value:** /server-status?auto **Note:** The default port number and URL can vary from one server to another. Please consult your Web server administrator.

MS IIS Dialog Box

This dialog box enables you to configure the measurements for the MS IIS monitor.

To access	Right-click a graph > **Add Measurements** Click **Add** in the **Resource Measurements** section of **MS-IIS** dialog.
Relevant tasks	How to Set Up the Monitoring Environment – Workflow

User interface elements are described below:

UI Elements (A-Z)	Description
	Adds the selected measurement to the list of measurements in the **Measurements on <machine>** section of the MS IIS dialog box.
Counters	Select a resource counter to monitor. Select multiple counters using the **CTRL** key. For a definition of each counter, click **Explain**.
Instances	If multiple instances of the selected counter are running, select one or more instances to monitor for the selected counter.
Object	Select the Web Service object being monitored on the specified machine.

28

Web Application Server Resource Monitoring

This chapter includes:

Concepts

Tasks

Reference

Concepts

Web Application Server Resource Monitoring Overview

You use LoadRunner's Web Application Server Resource monitors to monitor Microsoft Active Server Pages and Weblogic (SNMP) Web application servers during a scenario run and isolate application server performance bottlenecks.

- The Microsoft Active Server Pages (ASP) monitor displays statistics about the resource usage on the ASP server during the scenario run.
- The WebLogic (SNMP) monitor displays statistics about the resource usage on the WebLogic (SNMP) server (version 6.0 and earlier) during the scenario run. The WebLogic (SNMP) monitor uses SNMP to retrieve server statistics.

Tasks

How to Set Up the WebLogic (SNMP) Monitoring Environment

This task describes the working order for setting up the monitoring environment.

This task includes the following steps:

- "Prerequisites" on page 523
- "Set the port" on page 523
- "Configure the WebLogic (SNMP) monitor from the Controller" on page 524

1 Prerequisites

- Verify that a version prior to WebLogic 6.0 is installed on the server.
- Install and activate the SNMP agent on the server.

  For instructions on installing the SNMP agent, see http://edocs.bea.com/wls/docs51/admindocs/snmpagent.html.

2 Set the port

To monitor a WebLogic (SNMP) server, use port 161 or 162, depending on the configuration of the agent.

To define a different default port for your WebLogic server, modify the configuration file, **snmp.cfg**, located in **<LoadRunner root folder>\dat\monitors**. For example, if the port used by the SNMP agent on your WebLogic server is 8888, you should edit the **snmp.cfg** file as follows:

```
; WebLogic
[cm_snmp_mon_isp]
port=8888
```

3 Configure the WebLogic (SNMP) monitor from the Controller

For task details (beginning with step 2), see "How to Set Up the Monitoring Environment – Workflow" on page 443.

Reference

MS Active Server Pages Performance Counters

The following table describes the default counters that can be monitored:

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 Run-Time	The number of failed requests due to run-time errors.
Sessions Current	The current number of sessions being serviced.
Transactions/sec	The number of transactions started per second.

WebLogic (SNMP) Performance Counters

The following tables describe the measurements and server properties that can be monitored.

Server Table

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	This value is 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
ServerNumEJBDeployment	The total number of EJB deployment units known to the server
ServerNumEJBBeansDeployed	The total number of EJB beans actively deployed on the server

Listen Table

The Listen Table is the set of protocols, IP addresses, 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.

Web Application Server Resource Monitoring User Interface

This section includes (in alphabetical order):

WebLogic (SNMP) Resources Dialog Box

This dialog box lets you select the items to monitor on the WebLogic (SNMP) application server.

To access	Right-click a graph > **Add Measurements** Click **Add** in the **Resource Measurements** section of the WebLogic (SNMP) dialog box
Relevant tasks	How to Set Up the WebLogic (SNMP) Monitoring Environment How to Set Up the Monitoring Environment – Workflow
See also	WebLogic (SNMP) Performance Counters

User interface elements are described below:

UI Elements (A-Z)	Description
Add ...	Adds the selected object to the list of measurements. **Note:** The WebLogic (SNMP) monitor can only monitor up to 25 measurements.
Explain >>	Displays a description of the selected object
WebLogic (SNMP) objects	A tree for browsing the list of available measurements. You can select only one object at a time in the tree.

Microsoft Active Server Pages Dialog Box

This dialog box enables you to select the items to monitor on the MS Active Server Pages application server.

To access	Right-click a graph > **Add Measurements** Click **Add** in the **Resource Measurements** section of **Microsoft Active Server Pages** dialog.
Relevant tasks	How to Set Up the Monitoring Environment – Workflow
See also	MS Active Server Pages Performance Counters

User interface elements are described below:

UI Elements (A-Z)	Description
Add ...	Adds the selected measurement to the list of measurements in the **Measurements on <machine>** section of the Microsoft Active Server Pages dialog box.
Counters	Select a resource counter to monitor. Select multiple counters using the **CTRL** key. For a definition of each counter, click **Explain**.
Instances	If multiple instances of the selected counter are running, select one or more instances to monitor for the selected counter.
Object	Select the object being monitored on the specified machine.

29

Database Resource Monitoring

This chapter includes:

Concepts

Tasks

Reference

Concepts

Database Resource Monitoring Overview

LoadRunner's Database Server Resource monitors measure database resource usage statistics for DB2, Oracle, or SQL Servers during a scenario run. You use these monitors to isolate database server performance bottlenecks.

The DB2 monitor is a native LoadRunner monitor. The SQL monitor can be configured as a native LoadRunner monitor, or as a SiteScope monitor.

There are two methods of monitoring Oracle database servers:

- The **Oracle native LoadRunner monitor** 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.
- The **SiteScope Oracle JDBC Monitor** monitors the server performance statistics from Oracle Database servers. You can monitor multiple parameters or counters with a single monitor instance. This allows you to watch server loading for performance, availability, and capacity planning. You can create a separate Oracle JDBC Monitor instance for each Oracle database server in your environment.

Before defining the monitoring measurements for the DB2 and Oracle monitors in the Controller, you must set up the monitoring environment on the database server:

- For details about the DB2 monitor configuration, see "How to Set Up the DB2 Monitoring Environment" on page 533.
- For details about the Oracle monitor configuration, see "How to Set Up the Oracle Monitoring Environment" on page 534.

You then enable each database resource monitor from the Controller by selecting the counters you want the monitor to measure.

Tasks

How to Set Up the DB2 Monitoring Environment

This task describes how to set up the monitor environment before monitoring a DB2 database server.

This task includes the following steps:

1 Prerequisites

Install all the DB2 client files and libraries on the Controller machine.

2 Connect to the DB2 server and define the monitor client

a Select **Start** > **Programs** > **DB2 for Windows NT** > **Control Center**.

b Enter your DB2 server username and password (with administrative privileges).

c In the console that opens, right-click **Systems**, and select **Add**.

d Enter the following settings in the dialog box:

- **System Name**. <server name>
- **Remote Instance**. DB2
- **Host Name**. <server name>
- **Service Name**. The DB2 server port. The default value is 50000.

e Click **Retrieve**, and then **OK**.

Note: If you receive an error message after clicking **Retrieve**, repeat steps c and d, and click **OK**.

3 Add the Database Manager instance to the server

You can only work with a single Database Manager instance during each monitoring session.

a Expand the <server name> node in the console tree.

b Right-click **Instance**, and select **Add**.

c Enter the following settings in the dialog box:

- **Remote Instance.** DB2
- **Instance Name.** the database instance to be called from the Controller
- **Host Name.** <server name>
- **Service Name.** The DB2 server port. The default value is 50000.

d Click **OK** and close the Control Center.

4 Configure the DB2 monitor from the Controller

For task details (beginning with step 2), see "How to Set Up the Monitoring Environment – Workflow" on page 443.

How to Set Up the Oracle Monitoring Environment

This task describes how to set up the monitor environment before monitoring an Oracle database server using the native LoadRunner monitor.

Note: If a problem occurs in setting up the Oracle environment, check the Oracle server to view the error messages.

This task includes the following steps:

1 Prerequisites

➤ Ensure that the Oracle client libraries are installed on the Controller machine.

➤ Verify that **%OracleHome%\bin** is included in the path environment variable. If it is not, add it.

➤ Ensure that the registries are updated for the version of Oracle that you are using and that they have the following key:
HKEY_LOCAL_MACHINE\SOFTWARE\ORACLE

➤ Verify that the Oracle server you want to monitor is up and running. Note that it is possible to monitor several Oracle database servers concurrently.

Note: Only the 32-bit Oracle client should be installed on the Controller machine running the Oracle monitor. If you have a 16-bit and a 32-bit Oracle client installation on the Controller machine, the 16-bit installation should be uninstalled.

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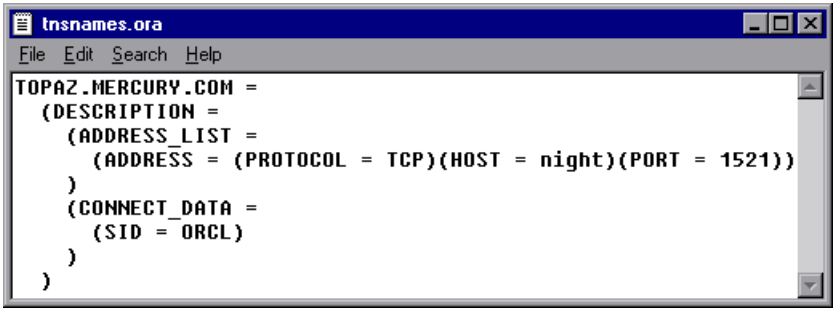
2 Configure the Oracle client/server connection

Set the connection parameters so the Oracle client (Controller machine) can communicate with the Oracle server(s) you plan to monitor.

On the Controller machine, set the following configuration parameter either by editing the **tnsnames.ora** file in a text editor, or using the Oracle service configuration tool (for example, **Start** > **Programs** > **Oracle for Windows NT** > **Oracle Net8 Easy Config**):

- a new service name (TNS name) for the Oracle instance
- TCP protocol
- the host name (name of monitored server machine)
- the port number (usually 1521)
- the database SID (the default SID is ORCL)

For example:



3 Connect to the monitored server machine and verify the connection

a Obtain a username and password for the service from your database administrator, and ensure that the Controller has database administrator privileges for the Oracle **V$** tables (V$**SESSTAT**, **V$SYSSTAT**, **V$STATNAME**, **V$INSTANCE**, **V$SESSION**).

b Verify connection with the Oracle server by performing **tns ping** from the Controller machine.

Note: There may be a problem connecting if the Oracle server is behind a DMZ/firewall that limits its communication to application servers accessing it.

---

c Run SQL*Plus from the Controller and attempt to log in to the Oracle server(s) with the desired username/password/server combination.

d Type **SELECT * FROM V$SYSSTAT** to verify that you can view the V$SYSSTAT table on the Oracle server. Use similar queries to verify that you can view the V$SESSTAT, V$SESSION, V$INSTANCE, V$STATNAME, and V$PROCESS tables on the server.

4 Modify the monitoring sample rate (optional)

To change the length of each monitoring sample (in seconds), edit the **dat\monitors\vmon.cfg** file in the LoadRunner root folder. The default rate is 10 seconds.

The minimum sampling rate for the Oracle Monitor is 10 seconds. If you set the sampling rate at less than 10 seconds, the Oracle Monitor will continue to monitor at 10 second intervals.

5 Configure the Oracle monitor from the Controller

For task details (beginning with step 2), see "How to Set Up the Monitoring Environment – Workflow" on page 443.

Reference

DB2 Performance Counters

This section includes:

DatabaseManager

The following table lists the DatabaseManager 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 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.

Measurement	Description
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_threshold_sorts	The number of sorts that have requested heaps after the sort heap threshold has been reached.

Measurement	Description
piped_sorts_requested	The number of piped sorts that have been requested.
piped_sorts_accepted	The number of piped sorts that have been accepted.

Database

The following table lists the 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.

Measurement	Description
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_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	Indicates 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	Indicates the number of logical read requests for index pages that have gone through the buffer pool.
pool_index_p_reads	Indicates the number of physical read requests to get index pages into the buffer pool.
pool_index_writes	Indicates the number of times a buffer pool index page was physically written to disk.
pool_read_time	Provides 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	Provides 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.

Measurement	Description
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.
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.

Measurement	Description
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 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.

Measurement	Description
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_used	The total amount of active log space currently used (in bytes) in the database.
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.

Measurement	Description
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	Indicates 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.
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.

Measurement	Description
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.

Application

The following table lists the 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 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.

Measurement	Description
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	Provides 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.
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.

Measurement	Description
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.
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.

Measurement	Description
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	Indicates 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.
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.

Measurement	Description
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.
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.

Measurement	Description
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 Performance Counters

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 10s 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 will 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) to work against the database.

SQL Server Performance Counters

The following table describes the default counters that can be monitored on version 6.5 of the SQL Server:

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 other threads.
% 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%.
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 2K 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 2K pages flushed to disk per second by the Lazy Writer.
I/O - Outstanding Reads	The number of physical reads pending.

Measurement	Description
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.

Configuring Oracle JDBC Monitor Dialog Box

This dialog box enables you to configure the connection parameters for the SiteScope Oracle JDBC monitor.

To access	Right-click the graph and select **Add Measurements**. This dialog appears only when you add measurements for the first time**.**
Relevant tasks	How to Set Up the Oracle Monitoring Environment
See also	Oracle Performance Counters

User interface elements are described below:

UI Elements (A-Z)	Description
Instance	The database SID. **Example:** ORCL
Database Connection URL	The connection URL to the database you want to monitor. The URL should contain a database user name and password in the following format (including the colons and @ symbol): **jdbc:oracle:thin:@<tcp addr>:<tcp port>:<db sid>** **Example:** To connect to the ORCL database on a machine using port 1521 you would use **jdbc:oracle:thin:@206.168.191.19:1521:ORCL**

UI Elements (A-Z)	Description
Database User Name	The user name that SiteScope should use to connect to the database. **Important:** You must have a valid Oracle user login that SiteScope will use to access the Oracle server for the Oracle JDBC Monitor. To verify that SiteScope will be able retrieve the Oracle database counters, sign in to the Oracle server with your user and try to execute the SQL statements found in the file: **SiteScope\templates.applications\commands.oraclejdbc**
Database Password	The password for the user name that SiteScope should use to connect to the database.
Database Driver	The driver used to connect to the database. Specify the the Oracle Database Driver that was installed on the SiteScope server when setting up the monitor. **Example:** The Database Driver for the Oracle thin JDBC driver is: **oracle.jdbc.driver.OracleDriver**
Connection Timeout	An optional the time out value, in seconds, that SiteScope should to wait for a database connection to respond.
Query Timeout	An optional the time out value, in seconds, that SiteScope should to wait for a response from the database query. If the database does not respond within the period specified, SiteScope will report an error. **Note:** Some commonly used databases and database drivers do not support the Query Timeout feature. In these cases the Query Timeout value should be set to zero.
Update every	How often the monitor should read the server statistics. The default interval is to run or update the monitor once every 10 seconds. **Important:** The sum of the **Connection Timeout** value and **Query Timeout** value should always be less than the **Update every** value for the monitor.

30

Streaming Media Monitoring

This chapter includes:

Concepts

Reference

Concepts

Streaming Media Monitoring Overview

To isolate server and client performance bottlenecks during a scenario run, you monitor the Windows Media Server and RealPlayer audio/video servers, as well as the RealPlayer and Media Player clients.

Note: For instructions on recording a script containing streaming media functions, see the HP Virtual User Generator.

The streaming media monitors provide you with performance information for the Windows Media Server and RealPlayer audio/video servers, as well as the RealPlayer and Media Player clients. To obtain data for the Windows Media Server and RealPlayer Server, you need to activate the streaming media monitor before executing the scenario, and indicate which statistics and measurements you want to monitor. The RealPlayer Client and Media Player Client do not require pre-session or scenario activation or configuration.

- The Real Client monitor graph shows statistics on the RealPlayer client machine as a function of the elapsed scenario time. The x-axis represents the time that has elapsed since the start of the scenario run. The y-axis represents the resource usage.
- The Media Player Client monitor graph shows statistics on the Windows Media Player client machine as a function of the elapsed scenario time. The x-axis represents the time that has elapsed since the start of the scenario run. The y-axis represents the resource usage.

Reference

RealPlayer Client Performance Counters

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

Measurement	Description
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

Media Player Client Performance Counters

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 of recovered packets	The number of lost packets that were recovered. This value is only relevant during network playback.
Total number of lost packets	The number of lost packets that were not recovered. This value is only relevant during network playback.

31

ERP/CRM Server Resource Monitoring

This chapter includes:

Concepts

Tasks

Reference

Concepts

ERP/CRM Server Resource Monitoring Overview

You use LoadRunner's ERP/CRM server resource monitors to monitor ERP/CRM servers during a scenario run and isolate server performance bottlenecks.

- The PeopleSoft (Tuxedo) monitor displays statistics about the resource usage of a PeopleSoft (Tuxedo) server during the scenario run.
- The Siebel Server Manager monitor displays statistics about the resource usage of a Siebel Server Manager during the scenario run.
- The SAPGUI monitor displays statistics about the resource usage of an SAP R/3 system during the scenario run. You can use the SAPGUI monitor to view:
  - the number of configured instances for each SAP system
  - data for all application instances (not just the one you logged on to)
  - transactions used and the users that call them
  - number of users working on the different instances
  - performance history for recent periods of all instances
  - response time distribution
  - resource consumption for any application server
  - application server workload for the current day or for a recent period

Tasks

How to Set Up the PeopleSoft (Tuxedo) Resource Monitor

This task describes the working order for setting up the monitoring environment. If Tuxedo 7.1 or later is installed, you can monitor more than one PeopleSoft (Tuxedo) application server at a time. If Tuxedo 6.5 or earlier is installed, you can monitor only one PeopleSoft (Tuxedo) application server at a time.

This task includes the following steps:

- "Prerequisites" on page 565
- "Define the environment variables on the Controller machine" on page 566
- "Check the Workstation Listener (WSL) Process" on page 566
- "Configure the PeopleSoft (Tuxedo) Resource monitor from the Controller" on page 566

1 Prerequisites

Ensure that a Tuxedo workstation client (not a native client), version 6.3 or later, is installed on the Controller machine.

Use a Tuxedo 6.x client if a Tuxedo 6.x server is used, and Tuxedo 7.1 or later client if a Tuxedo 7.1 or later server is used.

If you use a Tuxedo 6.5 or earlier server, you can still use a Tuxedo 7.1 or later client in order to monitor it, provided that you set the **WSINTOPPRE71** environment variable to **yes**.

Note: A Tuxedo workstation client communicates with the application server over the network, and is not required to run the Tuxedo application server on the same machine. A native client can only communicate with the Tuxedo application server if it is part of the relevant Tuxedo domain.

---

2 Define the environment variables on the Controller machine

a Set the **TUXDIR** variable to the Tuxedo installation directory (for example, **V:\environ\32\Tuxedo 8.0**).

b Add the Tuxedo **bin** directory to the **PATH** variable.

3 Check the Workstation Listener (WSL) Process

Ensure that the workstation listener (WSL) process is running. This enables the application server to accept requests from workstation clients.

The address and port number used to connect to the application server must match those dedicated to the WSL process.

Note: For information on configuring the WSL, refer to the BEA Tuxedo Web site (http://edocs.beasys.com/tuxedo/tux81/rf5/rf5101.htm#1534543).

---

4 Configure the PeopleSoft (Tuxedo) Resource monitor from the Controller

The first time you click Add to add a measurement in the Controller, you specify the PeopleSoft (Tuxedo) server logon information. For user interface details, see "PeopleSoft (Tuxedo) Logon Dialog Box" on page 577.

For task details (beginning with step 2), see "How to Set Up the Monitoring Environment – Workflow" on page 443.

How to Set Up the SAPGUI Server Resource Monitor

This task describes the working order for setting up the monitoring environment.

Note: The SAPGUI monitor supports SAP server versions 3.1 to 4.6, regardless of the SAP R/3 server's operating system and the platform on which it is installed.

This task includes the following steps:

- "Prerequisites" on page 565
- "Enable the last minute load from the client" on page 568
- "Configure the SAPGUI Server Resource monitor from the Controller" on page 568

1 Prerequisites

Note: Once the SAPGUI monitor is activated on the Controller machine, you cannot record a SAPGUI protocol script on that machine.

- Install the SAPGUI for Windows 6.20 client on the Controller machine.
- Install the latest patch for the SAPGUI for Windows 6.20 client. The lowest supported level is patch 36. (SAPGUI patches can be downloaded from https://websmp104.sap-ag.de/patches. You will need a valid Service Marketplace username and password to access this site.)

2 Enable the last minute load from the client

From the SAPGUI client application, click **F6** to determine whether you can access the st03 transaction and query for **last minute load** information.

If this functionality is not already enabled, enable it from the SAP R/3 client on the Controller machine, using the username and password defined in the Controller.

3 Configure the SAPGUI Server Resource monitor from the Controller

The SAP server information comes from the SAP Logon application. Before you configure this monitor from the Controller, verify the logon information on the SAP server.

The first time you click Add to add a measurement in the Controller, you specify the SAPGUI server logon information. For user interface details, see "SAPGUI Logon Dialog Box" on page 578.

For task details (beginning with step 2), see "How to Set Up the Monitoring Environment – Workflow" on page 443.

Reference

PeopleSoft (Tuxedo) Performance Counters

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 the APPQ/PSAPPSRV queue.

Monitor	Measurements
Machine	**% Busy Clients** - The percent of active clients currently logged in to the Tuxedo application server that are waiting for a response from the application server.
	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.

Monitor	Measurements
Queue	**% Busy Servers** - The percent 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 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.

SAPGUI Performance Counters

The following table lists the most commonly monitored counters:

Measurement	Description
Average CPU time	The average CPU time used in the work process.
Average response time	The average response time, measured from the time a dialog sends a request to the dispatcher work process, through the processing of the dialog, until the dialog is completed and the data is passed to the presentation layer. The response time between the SAP GUI and the dispatcher is not included in this value.
Average wait time	The average amount of time that an unprocessed dialog step waits in the dispatcher queue for a free work process. Under normal conditions, the dispatcher work process should pass a dialog step to the application process immediately after receiving the request from the dialog step. Under these conditions, the average wait time would be a few milliseconds. A heavy load on the application server or on the entire system causes queues at the dispatcher queue.
Average load time	The time needed to load and generate objects, such as ABAP source code and screen information, from the database.
Database calls	The number of parsed requests sent to the database.
Database requests	The number of logical ABAP requests for data in the database. These requests are passed through the R/3 database interface and parsed into individual database calls. The proportion of database calls to database requests is important. If access to information in a table is buffered in the SAP buffers, database calls to the database server are not required. Therefore, the ratio of calls/requests gives an overall indication of the efficiency of table buffering. A good ratio would be 1:10.

Measurement	Description
Roll ins	The number of rolled-in user contexts.
Roll outs	The number of rolled-out user contexts.
Roll in time	The processing time for roll ins.
Roll out time	The processing time for roll outs.
Roll wait time	The queue time in the roll area. When synchronous RFCs are called, the work process executes a roll out and may have to wait for the end of the RFC in the roll area, even if the dialog step is not yet completed. In the roll area, RFC server programs can also wait for other RFCs sent to them.
Average time per logical DB call	The average response time for all commands sent to the database system (in milliseconds). The time depends on the CPU capacity of the database server, the network, the buffering, and on the input/output capabilities of the database server. Access times for buffered tables are many magnitudes faster and are not considered in the measurement.

Siebel Server Manager Performance Counters

The following table shows the default counters that can be measured:

Measurement	Description
Average Connect Time	The average connection time.
Average Reply Size	The average size of a user reply.
Average Request Size	The average size of a user request.
Average Requests Per Session	The average number of user requests per session.
Average Response Time	The average amount of time that it takes the server to respond to a request.

Measurement	Description
Average Think Time	The average amount of think time taken to respond to a request.
Avg SQL Execute Time	The average SQL execute time.
Avg SQL Fetch Time	The average SQL fetch time.
Avg SQL Parse Time	The average SQL parse time.
CPU Time	The CPU time used in the work process.
Elapsed Time	The total amount of elapsed time.
Num of DBConn Retries	The number of database connection retries.
Num of DLRbk Retries	The number of DLRbk retries.
Num of Exhausted Retries	The total number of retries that expired.
Number of SQL Executes	The total number of SQL executes.
Number of SQL Fetches	The total number of SQL fetches.
Number of SQL Parses	The total number of SQL parses.
Number of Sleeps	The number of sleeps.
Object Manager Errors	The total number of object manager errors.
Reply Messages	The total number of reply messages.
Request Messages	The total number of request messages.
SQL Execute Time	The total SQL execute time.
SQL Fetch Time	The total SQL fetch time.
SQL Parse Time	The total SQL parse time.
Sleep Time	The total sleep time.
Tests Attempted	The number of tests attempted.
Tests Failed	The number of tests that failed.

Measurement	Description
Tests Successful	The number of tests that were successful.
Total Reply Size	The total reply size, measured in bytes.
Total Request Size	The total request size, measured in bytes.
Total Response Time	The total response time.
Total Tasks	The total number of tasks.
Total Think Time	The total think time.

ERP/CRM Server Resounce Monitoring User Interface

This section includes (in alphabetical order):

- Add Measurements Dialog Box on page 575
- PeopleSoft (Tuxedo) Logon Dialog Box on page 577
- SAPGUI Logon Dialog Box on page 578
- Siebel Server Manager Configuration Dialog Box on page 580

Add Measurements Dialog Box

This dialog box allows you to select the PeopleSoft (Tuxedo) or SAPGUI resources to monitor.

To access	Right-click a graph > **Add Measurements** Click **Add** in the **Resource Measurements** section of monitor dialog.

Relevant tasks	How to Set Up the PeopleSoft (Tuxedo) Resource Monitor How to Set Up the SAPGUI Server Resource Monitor How to Set Up the Monitoring Environment – Workflow
See also	PeopleSoft (Tuxedo) Performance Counters SAPGUI Performance Counters

User interface elements are described below:

UI Elements (A-Z)	Description
	Adds the selected measurement to the list of measurements in the **Measurements on <machine>** section of the PeopleSoft (Tuxedo) or SAPGUI dialog box.
Counters/ Measurements	Select a resource counter to monitor. Select multiple counters using the **CTRL** key. For a definition of each counter, click **Explain**.
Instances	If multiple instances of the selected counter are running, select one or more instances to monitor for the selected counter.
Object	Select the object being monitored on the specified machine.

PeopleSoft (Tuxedo) Logon Dialog Box

This dialog box configures the connection information for the Tuxedo server.

To access	Right-click the Tuxedo graph and select **Add Measurements**. This dialog appears only when you add measurements for the first time.
Important information	If you are using PeopleSoft 7.x, you can determine the logon information from the **Logon** section of the **tpinit.ini** file in the recorded script's directory If you are using Tuxedo 6.5 or below, the monitor can only connect to one application server during a Controller scenario. Once it connects to an application server, that server is the only one used by the monitor until the Controller is closed. This applies even when all of the counters are deleted from the monitor.
Relevant tasks	How to Set Up the PeopleSoft (Tuxedo) Resource Monitor How to Set Up the Monitoring Environment – Workflow

User interface elements are described below:

UI Elements	Description
	Enables you to navigate to the **tpinit.ini** file of a recorded Tuxedo script. It is recommended that you use the Browse button and select the **tpinit.ini** file from a recorded script, rather than enter the values manually. For more information, see "Tuxedo tpinit.ini File" on page 615.
Advanced	To authenticate the Tuxedo monitor, click **Advanced**, and enter the authentication data as a hexadecimal string (beginning with "0x") in the data field. The authentication data value can be obtained from the **tpinit.ini** file of an existing Tuxedo script.

UI Elements	Description
Login Name	The user login name to access the Tuxedo server. **Default:** PS **Note:** You can determine the client name from the **lrt_tpinitialize** statement in the recorded script
Password	The user password to access the Tuxedo server **Default:** PS
Server Name	Enter the name of the server. The format of the server name is //<**machine name**>:<**port number**>. The default port is 7000. Alternatively, you can specify the IP address or the hexadecimal format used by old versions of Tuxedo. **Note:** You cannot use quotation marks.
Client Name	Enter the name of the client machine. If a Tuxedo server was previously monitored, its name is displayed in the Server Name box.

SAPGUI Logon Dialog Box

This dialog box enables you to connect to the SAPGUI server. The server information comes from the definitions in the SAP Logon application.

To access	Right-click the SAPGUI graph and select **Add Measurements**. This dialog appears only when you add measurements for the first time.
Important information	Once the SAPGUI monitor is activated on the Controller machine, you cannot record a SAPGUI protocol script on that machine.
Relevant tasks	How to Set Up the SAPGUI Server Resource Monitor How to Set Up the Monitoring Environment – Workflow
See also	SAPGUI Performance Counters

User interface elements are described below:

UI Elements (A-Z)	Description
Advanced..	To change the default language, click **Advanced..** and enter a 2-letter string in the **Language** field.
Client	Number used in the Client field of the SAP logon details
Login Name	Login name used to access the SAPGUI server.
Password	Password for the login name.
Server Name	Name of the SAPGUI server. Use one of the following formats: ➤ Server **Description** as displayed in the SAP Logon application ➤ String in the format server_network_name[:system_number where **server_network_name** is the name or IP address of the application server (for example: **pipeline.HP.com**), and **system_number** (preceded by ":") is the system number as displayed in the SAP Server Properties dialog box. If the system number is omitted, "00" is used by default. **Note:** If an SAP router string is also specified in the Properties dialog box, the **server_network_name** should be the concatenation of the router string and the application server (for example, **/H/199.35.107.9/H/204.79.199.5/H/cpce801**)

Siebel Server Manager Configuration Dialog Box

This dialog box allows you to select the Siebel Server Manager resources to monitor.

To access	Right-click a graph > **Add Measurements** Click **Add** in the **Resource Measurements** section of Siebel Server Manager monitor dialog.
Relevant tasks	How to Set Up the Monitoring Environment – Workflow
See also	Siebel Server Manager Performance Counters Troubleshooting and Limitations

User interface elements are described below:

UI Elements (A-Z)	Description
Component/Counter Description	Displays a description of the highlighted component.
Host	Displays the name of the monitored machine.
Measured Components	Displays the available components. Browse the tree and select the component you want to monitor.
Performance Counters	Displays the available counters for the selected component. Select the resource counter to monitor.

Troubleshooting and Limitations

This section describes troubleshooting for the Siebel Server Manager Monitor

The Siebel Server Manager monitor uses a Siebel command line utility (srvrmgr) to gather it's statistics. If you are having trouble getting the Siebel Server Manager monitor to work, run this command from the Siebel Server Manager client:

```
srvrmgr /s <server> /g <gateway> /e <enterprise> /u <user> /p <pw>
```

If this command works from the command line, but SiteScope has trouble executing the command, open **/sitescope/templates.applications/commandline.siebel,** and verify that you can run the following command from the command line:

```
CONNECT_COMMAND:$PATH$/srvrmgr /g $GATEWAY$ /e $ENTERPRISE$ /
s $SERVERS$ /u $USERNAME$ /p $PASSWORD$
```

Note: On a Windows 2000 Advanced Server platform this command must be changed to:

```
CONNECT_COMMAND:$PATH$\srvrmgr.exe /g $GATEWAY$ /e
$ENTERPRISE$ /s $SERVERS$ /u $USERNAME$ /p $PASSWORD$
```

32

Application Component Monitoring

This chapter includes:

Concepts

Reference

Concepts

Application Component Monitoring Overview

Using LoadRunner's Application Component monitors, you can monitor the Microsoft COM+ server during a scenario run in order to isolate server performance bottlenecks.

The Microsoft COM+ monitor is an Application Component monitor that provides performance information for the Microsoft COM+ server. Before monitoring a Microsoft COM+ server, you install the Microsoft COM+ Server Monitor Probe on the server machine. You can then specify which measurements and resources you want the Microsoft COM+ monitor to measure. You select these counters using the Controller's monitor configuration dialog box.

This section also includes:

➤ "Setting up the Monitoring Environment" on page 584

➤ "Configuring the Microsoft COM+ Monitor Over a Firewall" on page 585

Setting up the Monitoring Environment

To monitor the Microsoft COM+ server performance, you must first install the Microsoft COM+ Server Monitor Probe on the server machine. You can then specify which measurements and resources you want the Microsoft COM+ monitor to measure. You select these counters using the Controller's monitor configuration dialog box.

Note: The data sampling rate for the COM+ monitor is fixed and cannot be modified using the Controller **Tools** > **Options**> **Monitors** dialog.

For more information on installing the Microsoft COM+ server add-in, refer to the *HP LoadRunner Installation Guide*.

Configuring the Microsoft COM+ Monitor Over a Firewall

Before running the Microsoft COM+ Monitor over a firewall:

- Make sure that the MI Listener is installed on any machine (including the Controller machine) outside of the firewall. Refer to the *HP LoadRunner Installation Guide* for installation instructions.
- Configure the firewall agent on the server machine. For details, see "Working with Firewalls in LoadRunner" on page 349,.
- Specify the correct connection string on the client machine. For details, see "Add Machine Dialog Box" on page 450.

Reference

Microsoft COM+ Performance Counters

The following tables describe the default counters that can be measured:

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 Events

Measurement	Description
Activation	Frequency of application activation or startup.
Shutdown	Frequency of application shutdown or termination.

Thread Events

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.

Measurement	Description
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.
Object Activate	Rate of retrieving instances of a new JIT-activated object.
Object Deactivation	Rate of freeing JIT-activated object via SetComplete or SetAbort.

Measurement	Description
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.

33

Application Deployment Solution Monitoring

This chapter includes:

Concepts

Tasks

Reference

Concepts

Application Deployment Solution Monitoring Overview

Using LoadRunner's Application Deployment Solution monitor, you can isolate server performance bottlenecks by monitoring the Citrix server during a scenario run.

LoadRunner's Citrix monitor provides you with information about the application deployment usage of the Citrix server during a scenario execution. The Citrix monitor allows you to monitor the server performance statistics from Citrix servers. You can monitor multiple parameters (counters) with a single monitor instance. This allows you to watch server loading for performance, availability, and capacity planning.

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.

Tasks

How to Set up the Citrix Monitoring Environment

This task describes the working order for setting up the monitoring environment.

This task includes the following steps:

1 Prerequisites

- Make sure that Citrix Server has been installed and is running.
- If Citrix Server machine is running Windows 2000, make sure that the server machine is also running the Remote Registry service.
- Make sure that the LoadRunner machine has administrator privileges to access the Citrix server.
- Measurements that monitor instances are valid for the currently running Citrix session only. If you run this scenario again, you will need to reconfigure the measurements that are instance-oriented.

  To monitor the different instances, ensure that the server login and logout procedures are recorded in the **Vuser_init** and **Vuser_end** sections respectively, and not in the Action section of the script. For more information, see the *HP Virtual User Generator User Guide*.

2 Map the Network Drive

From the Controller machine, map a network drive to the Citrix server machine. This ensures that the required authentication is provided to the Controller to access the resource counters.

3 Launch PerfMon

Launch PerfMon from the Controller machine to enable the counters on the Citrix server. This allows you to monitor the same counters for the ICA Session object on the Citrix monitor.

4 Open the Connection with the Citrix Server

You can configure the Citrix monitor to view ICA Session object counters only if at least one session is being run on the Citrix server. If no “real” user has opened a connection with the Citrix server, you need to first initialize or run a Citrix Vuser against the server, and only then configure the Citrix Monitor and add the ICA Session counters. If you configure the Citrix monitor without first initializing or running a Citrix Vuser (or connecting to the Citrix server as a “real” user), you will not be able to view the ICA Session object.

5 Configure the Citrix monitor from the Controller

For task details (beginning with step 2), see "How to Set Up the Monitoring Environment – Workflow" on page 443.

Reference

Citrix MetaFrame Performance Counters

The following sections describe some of the counters that can be measured.

➤ "Non-Virtual Counters" on page 593

➤ "Virtual Channel Counters" on page 596

Non-Virtual Counters

The following table describes 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. This does not include File Control Operations.

Measurement	Description
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.

Measurement	Description
Latency – Session Average	This value represents the average client latency over the life of a session.
Latency – Last Recorded	This value represents the last recorded latency measurement for this session.
Latency – Session Deviation	This value represents the difference between the minimum and maximum measured values for a session.
Input Session Bandwidth	This value represents the bandwidth from client to server traffic for a session in bps.
Input Session Compression	This value represents the compression ratio for client to server traffic for a session.
Output Session Bandwidth	This value represents the bandwidth from server to client traffic for a session in bps.
Output Session Compression	This value represents the compression ratio for server to client traffic for a session.
Output Session Linespeed	This value represents the line speed from server to client for a session in bps.

Virtual Channel Counters

The following table describes virtual channel counters:

Measurement	Description
Input Audio Bandwidth	This value represents the bandwidth from client to server traffic on the audio mapping channel. This is measured in bps.
Input Clipboard Bandwidth	This value represents the bandwidth from client to server traffic on the clipboard mapping channel. This is measured in bps.
Input COM1 Bandwidth	This value represents the bandwidth from client to server traffic on the COM1 channel. This is measured in bps.

Measurement	Description
Input COM2 Bandwidth	This value represents the bandwidth from client to server traffic on the COM2 channel. This is measured in bps.
Input COM Bandwidth	This value represents the bandwidth from client to server traffic on the COM channel. This is measured in bps.
Input Control Channel Bandwidth	This value represents the bandwidth from client to server traffic on the ICA control channel. This is measured in bps.
Input Drive Bandwidth	This value represents the bandwidth from client to server traffic on the client drive mapping channel. This is measured in bps.
Input Font Data Bandwidth	This value represents the bandwidth from client to server traffic on the local text echo font and keyboard layout channel. This is measured in bps.
Input Licensing Bandwidth	This value represents the bandwidth from server to client traffic on the licensing channel. This is measured in bps.
Input LPT1 Bandwidth	This value represents the bandwidth from client to server traffic on the LPT1 channel. This is measured in bps.
Input LPT2 Bandwidth	This value represents the bandwidth from client to server traffic on the LPT2 channel. This is measured in bps.
Input Management Bandwidth	This value represents the bandwidth from client to server traffic on the client management channel. This is measured in bps.
Input PN Bandwidth	This value represents the bandwidth from client to server traffic on the Program Neighborhood channel. This is measured in bps.
Input Printer Bandwidth	This value represents the bandwidth from client to server traffic on the printer spooler channel. This is measured in bps.

Measurement	Description
Input Seamless Bandwidth	This value represents the bandwidth from client to server traffic on the Seamless channel. This is measured in bps.
Input Text Echo Bandwidth	This value represents the bandwidth from client to server traffic on the local text echo data channel. This is measured in bps.
Input Thinwire Bandwidth	This value represents the bandwidth from client to server traffic on the Thinwire (graphics) channel. This is measured in bps.
Input VideoFrame Bandwidth	This value represents the bandwidth from client to server traffic on the VideoFrame channel. This is measured in bps.
Output Audio Bandwidth	This value represents the bandwidth from server to client traffic on the audio mapping channel. This is measured in bps.
Output Clipboard Bandwidth	This value represents the bandwidth from server to client traffic on he clipboard mapping channel. This is measured in bps.
Output COM1 Bandwidth	This value represents the bandwidth from server to client traffic on the COM1 channel. This is measured in bps.
Output COM2 Bandwidth	This value represents the bandwidth from server to client traffic on the COM2 channel. This is measured in bps.
Output COM Bandwidth	This value represents the bandwidth from server to client traffic on the COM channel. This is measured in bps.
Output Control Channel Bandwidth	This value represents the bandwidth from server to client traffic on the ICA control channel. This is measured in bps.
Output Drive Bandwidth	This value represents the bandwidth from server to client traffic on the client drive channel. This is measured in bps.

Measurement	Description
Output Font Data Bandwidth	This value represents the bandwidth from server to client traffic on the local text echo font and keyboard layout channel. This is measured in bps.
Output Licensing Bandwidth	This value represents the bandwidth from server to client traffic on the licensing channel. This is measured in bps.
Output LPT1 Bandwidth	This value represents the bandwidth from server to client traffic on the LPT1 channel. This is measured in bps.
Output LPT2 Bandwidth	This value represents the bandwidth from server to client traffic on the LPT2 channel. This is measured in bps.
Output Management Bandwidth	This value represents the bandwidth from server to client traffic on the client management channel. This is measured in bps.
Output PN Bandwidth	This value represents the bandwidth from server to client traffic on the Program Neighborhood channel. This is measured in bps.
Output Printer Bandwidth	This value represents the bandwidth from server to client traffic on the printer spooler channel. This is measured in bps.
Output Seamless Bandwidth	This value represents the bandwidth from server to client traffic on the Seamless channel. This is measured in bps.
Output Text Echo Bandwidth	This value represents the bandwidth from server to client traffic on the local text echo data channel. This is measured in bps.
Output Thinwire Bandwidth	This value represents the bandwidth from server to client traffic on the Thinwire (graphics) channel. This is measured in bps.
Output VideoFrame Bandwidth	This value represents the bandwidth from server to client traffic on the VideoFrame channel. This is measured in bps.

Citrix Monitor Dialog Box

This dialog box enables you to configure the measurements for the Citrix monitor.

To access	Right-click a graph > **Add Measurements** Click **Add** in the **Resource Measurements** section of **Citrix Monitor** dialog.
Important information	**Note:** For Citrix monitoring, if the dialog box freezes after clicking **Add**, you may need to rebuild the localhost cache on the Citrix server machine. For more information, refer to Document IDs CTX003648 and CTX759510 in the Citrix Knowledge Base (http://knowledgebase.citrix.com/cgi-bin/webcgi.exe?New,KB=CitrixKB).
Relevant tasks	How to Set up the Citrix Monitoring Environment
See also	How to Set Up the Monitoring Environment – Workflow

User interface elements are described below:

UI Elements (A-Z)	Description
Add ...	Adds the selected measurement to the list of measurements in the **Measurements on <machine>** section of the Citrix dialog box.
Counters	Select a resource counter to monitor. Select multiple counters using the CTRL key. For a definition of each counter, click **Explain**.
Instances	If multiple instances of the selected counter are running, select one or more instances to monitor for the selected counter.
Object	Select the object being monitored on the specified machine.

34

Middleware Performance Monitoring

This chapter includes:

Concepts

Tasks

Reference

Concepts

Middleware Performance Monitoring Overview

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 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.

- The Tuxedo monitor allows you to measure and view your Tuxedo server performance. It provides information about the host machine, workstation handler, and queue in a Tuxedo system. To run the Tuxedo monitor, you must install the Tuxedo client libraries on the machine you want to monitor.
- The IBM WebSphere MQ monitor is used to monitor channel and queue performance counters on an IBM WebSphere MQ (version 5.x) Server.

The procedures for selecting monitor measurements and configuring the monitors vary according to server type. The following sections contain specific configuration instructions for each server type.

Tasks

How to Set Up the Tuxedo Monitor

This task describes the working order for setting up the monitoring environment.

Note: If Tuxedo 7.1 or higher is installed on the Controller machine, more than one Tuxedo application server can be monitored at a time. However, if Tuxedo 6.5 or below is installed on the Controller machine, only one Tuxedo application server can be monitored at a time.

This task includes the following steps:

- "Prerequisites" on page 603
- "Define the Tuxedo Environment Variables" on page 604
- "Check the Workstation Listener (WSL) Process" on page 604
- "Configure the Tuxedo monitor from the Controller" on page 604

1 Prerequisites

Ensure that a Tuxedo workstation client (not a native client) is installed on the Controller machine. Use a Tuxedo 6.x client if a Tuxedo 6.x server is used, and Tuxedo 7.1 or above client if a Tuxedo 7.1 or above server is used.

If you use a Tuxedo 6.5 or earlier server, you can still use a Tuxedo 7.1 or later client to monitor it, provided that you set the WSINTOPPRE71 environment variable to “yes”.

Note: A Tuxedo workstation client communicates with the application server over the network, and is not required to run the Tuxedo application server on the same machine. A native client can only communicate with the Tuxedo application server if it is part of the relevant Tuxedo domain.

---

2 Define the Tuxedo Environment Variables

Define the Tuxedo environment variables on the Controller machine—set the TUXDIR variable to the Tuxedo installation directory (for example, V:\environ\32\Tuxedo8.0), and add the Tuxedo **bin** directory to the PATH variable.

3 Check the Workstation Listener (WSL) Process

Ensure that the workstation listener (WSL) process is running. This enables the application server to accept requests from workstation clients.

The address and port number used to connect to the application server must match those dedicated to the WSL process.

Note: For information on configuring the WSL, refer to the BEA Tuxedo Web site (http://edocs.beasys.com/tuxedo/tux81/rf5/rf5101.htm#1534543).

---

4 Configure the Tuxedo monitor from the Controller

The first time you click Add to add a measurement in the Controller, you specify the Tuxedo server logon information. For user interface details, see "Tuxedo Logon Dialog Box" on page 619.

For task details (beginning with step 2), see "How to Set Up the Monitoring Environment – Workflow" on page 443.

How to Set Up the IBM WebSphere MQ Monitor

This task describes how to configure the Controller and IBM WebSphere MQ machines:

This task includes the following steps:

1 Prerequisites

Ensure that an IBM WebSphere MQ Client Connection (version 5.21 only) is installed on the Controller machine.

For additional information on installing the IBM WebSphere MQ Server/ Client, refer to the IBM Web site (http://www.ibm.com/).

2 Configure the server environment to monitor events

The LoadRunner MQ Monitor retrieves event messages from two standard MQSeries queues only:

- SYSTEM.ADMIN.PERFM.EVENT – performance events, such as “queue depth high”
- SYSTEM.ADMIN.CHANNEL.EVENT – channel events, such as “channel stopped”

a Events must be enabled for the queue manager (and in many cases, on the applicable object, as well). Performance events are enabled by setting attributes for the queue on the MQ Server. Channel events are enabled by default, and cannot be disabled.

Note: The IBM WebSphere MQ monitor does not retrieve data from a queue manager after the queue manager has been restarted.

---

b Run the following MQSC command:
ALTER QMGR PERFMEV(ENABLED).

c Set the queue attributes. For a list of queue attributes, see "IBM WebSphere MQ Queue Attributes" on page 611.

Note: If you encounter an MQ Server error message (starting with the characters MQRC_), refer to the WebSphere MQ family support Web site (http://www-306.ibm.com/software/integration/mqfamily/support/).

---

3 Add the monitored server to the Controller

a In the Controller Run view, click the IBM WebSphere MQ graph in the graph tree, and drag it into the right pane.

b Right-click the graph and select **Add Measurements**, or click anywhere on the graph and select **Monitors** > **Add Measurements**. The IBM WebSphere MQ dialog box opens.

In the **Monitored Server Machines** section, click **Add.** The Add Machine dialog box opens.

c The first time that you add measurements, enter the server name or IP address of the machine you want to monitor. The format of the server name is <machine name>:<port number>. Select the platform on which the machine runs, and click **OK**.

d In the **Resource Measurements** section of the IBM WebSphere MQ dialog box, click **Add**.

4 Configure the IBM WebSphere MQ monitor

The IBM WebSphere MQ monitor connects to the IBM WebSphere MQ server (via the MQ Client Connection installed on the Controller machine). In MQ Client environments, the client machine connects to an MQ Server instance, and uses the Server's resources as if they were local to the client machine.

➤ Specify the connection information and measurements in the MQ Monitor Add Measurements dialog. For user interface details, see "MQ Monitor Add Measurements Dialog Box" on page 616.

Reference

IBM WebSphere MQ Performance Counters

The following tables list the available IBM WebSphere MQ monitor measurements:

Queue Performance Counters

The following table describes the 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 (events per second)	An event triggered when the queue depth reaches the configured 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	Current count of messages on a local queue. This measurement applies only to local queues of the monitored queue manager.

Measurement	Description
Status - Open Input Count	Current count of open input handles. Input handles are opened so that an application may "put" messages to a queue.
Status - Open Output Count	Current count of open output handles. Output handles are opened so that an application may "get" messages from a queue.

Channel Performance Counters

The following table describes the Channel Performance counters:

Measurement	Description
Event - Channel Activated (events per second)	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)	Event generated when a channel, attempts to become active but inhibited from doing so due to a shortage of queue manager channel slots.
Event - Channel Started (events per second)	Event generated when a channel is started.
Event - Channel Stopped (events per second)	Event generated when a channel is stopped, regardless of source of stoppage.
Event - Channel Stopped by User (events per second)	Event generated when a channel is stopped by a user.
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).

Measurement	Description
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.

IBM WebSphere MQ Queue Attributes

You set the following queue attributes using the MQSC command ALTER QMGR PERFMEV(ENABLED):

Measurement	Set Event Attributes
Event - Queue Depth High	➤ **QDEPTHHI(integer)** - where integer is a value expressed as a percentage of maximum messages allowed, and is in the range of 0 to 100 inclusive. ➤ **QDPHIEV(action)** - where action is the word "ENABLED" or "DISABLED", enabling or disabling the generation of the event, respectively.
Event - Queue Depth Low	To enable the event for a queue, the following attributes of the queue must be set: ➤ **QDEPTHLO(integer)** - where integer is a value expressed as a percentage of maximum messages allowed, and is in the range of 0 to 100 inclusive. ➤ **QDPLOEV(action)** - where action is the word "ENABLED" or "DISABLED", enabling or disabling the generation of the event, respectively.
Event - Queue Full	➤ **QDEPTHHI(integer)** – where integer is a value expressed as a percentage of maximum messages allowed, and is in the range of 0 to 100 inclusive. ➤ **QDPMAXEV(action)** – where action is the word "ENABLED" or "DISABLED", enabling or disabling the generation of the event, respectively.

Measurement	Set Event Attributes
Event - Queue Service Interval High	➤ **QSVCINT(integer)** – where integer is a value expressed as milliseconds, in the range of 0 and 999,999,999, inclusive. Note: this value is shared with Queue Service Interval OK. ➤ **QSVCIEV(type)** – where type is the word "HIGH", "OK", or "NONE", enabling service interval high events, enabling service interval ok events, or disabling the generation of the event, respectively.
Event - Queue Service Interval OK	➤ **QSVCINT(integer)** – where integer is a value expressed as milliseconds, in the range of 0 and 999,999,999, inclusive. Note: this value is shared with Queue Service Interval High. ➤ **QSVCIEV(type)** – where type is the word "HIGH", "OK", or "NONE", enabling service interval high events, enabling service interval ok events, or disabling the generation of the event, respectively.

Tuxedo Performance Counters

The following table lists the available Tuxedo monitor measurements. 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 percent of active clients currently logged in to the Tuxedo application server that are waiting for a response from the application server.
	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.

Monitor	Measurements
Queue	**% Busy Servers** - The percent 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 - 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 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.

Tuxedo tpinit.ini File

The tpinit.ini file is saved in the recorded script's directory. It contains information for connecting the Tuxedo monitor to the server. The client logon information is located in the Logon section of the tpinit.ini file.

In the following example of a **tpinit.ini** file, the Tuxedo monitor was configured for a server named psft1 using port 7000, and a client named bankapp. The logon user name was PS and the password was PS.

```
[Logon]
LogonServername=//psft1:7000
LogonUsrName=PS
LogonCltName=bankapp
LogonGrpName=
LogonPasswd=PS
LogonData=
```

Middleware Performance Monitoring User Interface

This section includes (in alphabetical order):

Add Tuxedo Measurements Dialog Box

This dialog box allows you to select the resources to monitor on the Tuxedo client.

To access	Right-click a graph > **Add Measurements** Click **Add** in the **Resource Measurements** section of **Tuxedo** dialog.
Relevant tasks	How to Set Up the Monitoring Environment – Workflow
See also	Tuxedo Performance Counters

User interface elements are described below:

UI Elements (A-Z)	Description
Add ...	Adds the selected measurement to the list of measurements in the **Measurements on <machine>** section of the Tuxedo dialog box.
Counters	Select a resource counter to monitor. Select multiple counters using the **CTRL** key. For a definition of each counter, click **Explain**.
Instances	If multiple instances of the selected counter are running, select one or more instances to monitor for the selected counter.
Object	Select the object being monitored on the specified machine.

MQ Monitor Add Measurements Dialog Box

This dialog box enables you toconfigure the monitor by choosing which measurements to monitor on the machine.

To access	Right-click a graph > **Add Measurements** Click **Add** in the **Resource Measurements** section of the **IBM WebSphere MQ** dialog.
Important information	User entries for any text box are limited to 48 characters.
Relevant tasks	How to Set Up the IBM WebSphere MQ Monitor
See also	IBM WebSphere MQ Performance Counters

User interface elements are described below:

UI Elements	Description
Alternate Queue	If the event configured for monitoring is from a remote queue manager (other than the one identified in the queue manager field of the IBM WebSphere MQ Add Measurements dialog box), click **Alternate Queue** to enter the name of an alternate queue manager. **Note:** When you add an alternate queue manager, this becomes the default queue manager for any events that you subsequently add. To return to the queue manager to which you are connected, enter that name in the Alternate Queue Manager dialog box.
Available Measurements	**Object Type.** Select an object type from either Channel or Queue. **Object Name.** Enter a name for object you want to monitor. **Event/Attribute.** Select the events and attributes you want to monitor for the selected object. **Filter System Objects.** Select to enable the system objects filter. **Add Object.** Enables you to add a new object name to the Object name list. **Add.** Enables you to add an Event or Attribute to an object. **Remove.** Enables you to remove a monitored object event or attribute from the Object name list. **Alternate Queue.** Enter the name of an alternate queue manager if the event is from a remote queue manager.

UI Elements	Description
Connections Information	**Server.** The name of the server you are monitoring. **Client Channel.** Enter the name of the channel through which a client connection is made to an MQ Server. ➤ **Note:** You can set up a specific channel on an MQ Server instance, or use the default "SYSTEM.DEF.SVRCONN" channel. If the client channel is undefined, the MQ Server will be inaccessible via client connections (the MQ Monitor will not work, as it will not be able to connect to the queue manager which it is supposed to monitor). **Queue Manager.** Enter the name of the queue manager to be monitored. ➤ **Note:** The monitor is not restricted to monitoring only the queue manager to which it is connected. You can configure multiple queue managers to write to the event queue of a central queue manager for centralized monitoring (this applies to Events only, not polled object attributes). All events contain a queue manager attribute identifying their source. ➤ **Note:** A queue manager can only be accessed by one Controller or monitoring application at any one time.
Filter system objects	By default, only user-defined objects are displayed in the **Object name** list. To show all objects, clear the **Filter System Objects** check box. You can modify the filter settings, in the **<LoadRunner_installation>\dat\monitors\ mqseries.cfg** file.
Monitored Object list	A list of monitored objects, including the object's name, events and attributes, and alternate queue manager.

Tuxedo Logon Dialog Box

This dialog box configures the connection information for the Tuxedo server.

To access	Right-click the Tuxedo graph and select **Add Measurements**. This dialog appears only when you add measurements for the first time.
Important information	If you are using Tuxedo 6.5 or below, the monitor can only connect to one application server during a scenario. Once it connects to an application server, the server is the only one used by the monitor until the Controller is closed. This applies even when all of the counters are deleted from the monitor.
Relevant tasks	How to Set Up the Tuxedo Monitor How to Set Up the Monitoring Environment – Workflow

User interface elements are described below:

UI Elements	Description
	Enables you to navigate to the **tpinit.ini** file of a recorded Tuxedo script. It is recommended that you use the Browse button and select the **tpinit.ini** file from a recorded script, rather than enter the values manually. For more information, see "Tuxedo tpinit.ini File" on page 615.
Advanced	To authenticate the Tuxedo monitor, click **Advanced**, and enter the authentication data as a hexadecimal string (beginning with "0x") in the data box. The authentication data value can be obtained from the **tpinit.ini** file of an existing Tuxedo script.
Login Name	The user login name to access the Tuxedo server. **Note:** You can determine the client name from the **lrt_tpinitialize** statement in the recorded script
Password	The user password to access the Tuxedo server

UI Elements	Description
Server Name	Enter the name of the server. The format of the server name is //**<machine name>:<port number>**. Alternatively, you can specify the IP address or the hexadecimal format used by old versions of Tuxedo. **Note:** You cannot use quotation marks.
Client Name	Enter the name of the client machine. If a Tuxedo server was previously monitored, its name is displayed in the Server Name box.

35

Infrastructure Resources Monitoring

This chapter includes:

Concepts

Reference

Concepts

Infrastructure Resources Monitoring Overview

Using LoadRunner's Network Client monitor, you can monitor network client resources for FTP, POP3, SMTP, IMAP, and DNS Vusers during a scenario run and isolate client performance bottlenecks.

Activating the Network Client Monitor

The Network Client online monitor graph is only available during scenarios that run relevant scripts, such as FTP, POP3, and so forth.

You can view this graph by dragging it from the Infrastructure Resources Graph section in the graph tree into the right pane of the Run view. The graph appears in the graph view area.

Reference

Network Client Performance Counters

The following table describes the Network Client measurements that are monitored:

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

Part VII

Appendixes

36

Secure Host Communication

This chapter includes:

Concepts

Tasks

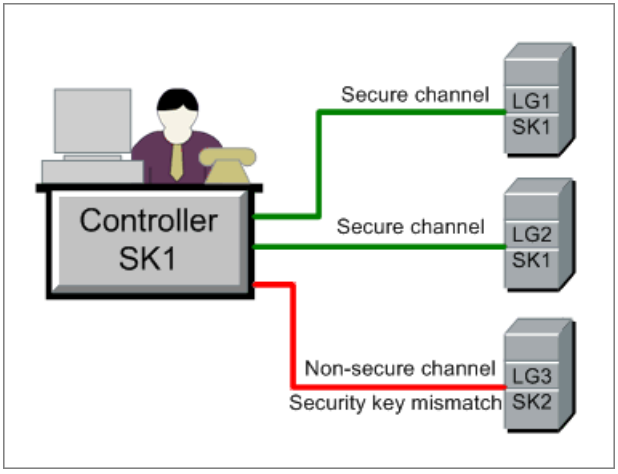
Reference

Concepts

Secure Host Communication Overview

The need to secure communication channels from hackers attacking the corporate networks is critical. Securing communication channels ensures confidentiality, integrity, and the user's authenticity within the scope of the load testing application.

Secure communication is established between the Controller and load generator hosts using a **security key**. Each host in the system must be set up with the identical security key. If security keys on the hosts do not match, secure communication cannot be established.



A host is in **secure mode** when it has a security key and security is enforced.

A host is in **non-secure mode**:

- if it has no security key
- if it has a security key but security is **not** enforced

When a host in secure mode tries to communicate with a host in non-secure mode, security is automatically enforced on the non-secure host—assuming their security keys match—allowing secure communication to be established.

Note:

- When you run a scenario, if secure communication cannot be established between a secure host (Controller or load generator) and another host participating in the scenario run, the scenario cannot run.
- By definition, non-secure hosts can communicate with each other and participate in scenario runs over non-secure channels.

This can be summarized in the following table:

	Both Hosts in Secure Mode	**Security Mode on Hosts Differ**	**Both Hosts in Non-Secure Mode**
Security keys match	Scenario runs over secure channel	Scenario runs over secure channel	Scenario runs over non-secure channel
Security keys do not match	Scenario does not run	Scenario does not run	Scenario runs over non-secure channel

Host Security Configuration

When you install the hosts (Controllers and load generators), by default no security settings are defined on them, and communication channels between the hosts are not secure. To enforce secure communication between the hosts, you must configure security settings on each host machine immediately after installing the hosts.

When configuring these settings **for the first time**, to avoid configuration over non-secure channels, we recommend setting the security on each host locally using the **Host Security Setup utility**. For details, see "How to Configure Security Settings Locally on Hosts" on page 633.

After initial security configuration, you can update security settings locally or simultaneously across all the hosts in the LoadRunner system from a remote location using the **HP Host Security Manager** utility. This utility is installed on the same machine as the Controller. For details, see "How to Update Host Security Settings Remotely" on page 635.

Remote Security Configuration

You can align security settings across all the hosts in LoadRunner simultaneously from a remote location using **HP Host Security Manager**.

The utility lists all the hosts in LoadRunner, as well as the MI Listeners required to connect to the hosts that are over a firewall, where applicable.

Using Host Security Manager, you can update the security key on all the hosts, or update the security mode on selected hosts. For details, see "How to Update Host Security Settings Remotely" on page 635.

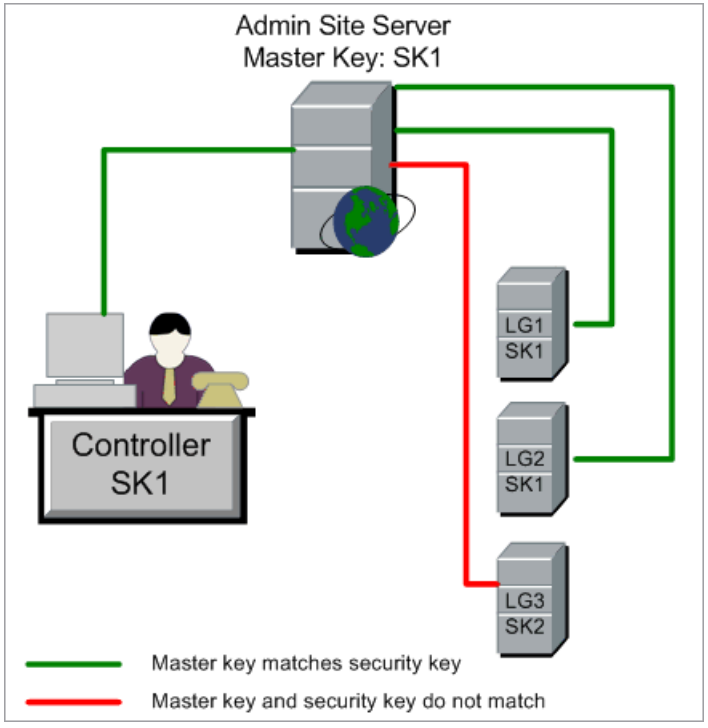
This section also includes:

Master Security Key

To update security settings on the hosts, Host Security Manager uses a master key that matches the security keys on all the hosts. This enables secure communication between Host Security Manager and the hosts for the purpose of remotely updating the security settings.

If the master key and security key on a particular host do not match, Host Security Manager cannot update security settings on that host.

When you open Host Security Manager for the first time, you are prompted for a key. Host Security Manager stores this key as a master key for secure communication with the hosts. If you do not enter the key at this point, you are prompted for it again when you try to update the security settings.



Considerations for Updating UNIX Load Generators

- UNIX load generators that use rsh (remote shell) to connect to the Controller cannot be updated using Host Security Manager. To update security settings on such load generators, use the local Host Security Setup utility. See "How to Configure Security Settings Locally on Hosts" for UNIX load generators on page 633.
- To update security settings on a UNIX load generator using Host Security Manager, you must launch the load generator daemon for a user and manually grant write permissions to the user on **<installation folder>/config**.

Host Security Best Practices

- To avoid sending security settings over a non-secure channel, perform **initial configuration** of the security settings on each host locally (see "How to Configure Security Settings Locally on Hosts" on page 633).
- Security settings should be changed once a month.
- Security settings can be updated:
  - manually on each host
  - remotely on all hosts simultaneously using the Host Security Manager utility

  If, when using the Host Security Manager utility, updating a host's settings fails, update the settings manually.

Tasks

How to Configure Security Settings Locally on Hosts

This task describes how to configure security settings locally on Controllers and load generators.

Windows Hosts

1 On the host, launch the Host Security Setup utility (**Start** > **Programs** > **LoadRunner** > **Tools** > **Host Security Setup**).

For user interface details, see "Host Security Setup Dialog Box" on page 642.

2 Select a security mode for the host.

3 If you selected to enforce secure communication, enter a security key (6 - 16 characters). Enter the key a second time for confirmation.

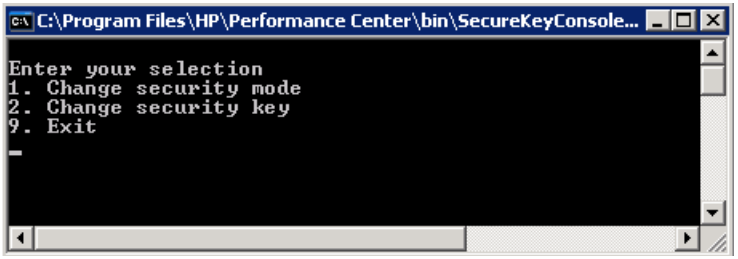
UNIX Hosts

1 Log in as root user and change for tcsh.

2 Go to the **/opt/HP/HP_LoadGenerator** directory and type:

```
>source ./env.csh
```

3 Run **SecurityKeyConsole.exe**, located in **<Installation_folder>/bin/** directory.



4 In the Console window, enter an option as follows:

- To change the security mode, enter 1.
- To change the security key, enter 2.

5 If you are changing the security mode:

- To turn the security on, enter 1.
- To turn the security on, enter 0.

6 If you are changing the security key, enter the new key. A valid key is 6 - 16 characters long.

How to Register Hosts in Host Security Manager

This task describes how to register hosts in Host Security Manager.

This task includes the following steps:

- "Add hosts to the Hosts list" on page 634
- "For hosts over a firewall, specify the MI Listener" on page 634

1 Add hosts to the Hosts list

In Host Security Manager (**Start** > **Programs** > **LoadRunner** > **Tools** > **Host Security Manager**), click **Add Hosts**.

Enter the names or IP addresses of the Controllers and load generators you want to add. When entering multiple hosts, separate entries by a comma.

For user interface details, see"Add Hosts Dialog Box" on page 638.

2 For hosts over a firewall, specify the MI Listener

In the main Host Security Manager window:

a Select the host that is over the firewall. If other hosts over a firewall communicate through the same MI Listener, select these hosts as well to set the MI Listener for all of the hosts simultaneously.

Tip: To select multiple hosts, hold down the CTRL key on your keyboard while selecting the relevant hosts.

---

b Click **Set MI Listener**, and enter the name / IP address of the MI Listener that the host uses to communicate over the firewall.

How to Update Host Security Settings Remotely

This task describes how to use Host Security Manager to update security settings on the LoadRunner hosts remotely, from the Controller.

This task includes the following steps:

- "Prerequisites" on page 635
- "Update the security settings" on page 635
- "Results" on page 637

Prerequisites

- Hosts to be updated must be registered in Host Security Manager. For details, see "How to Register Hosts in Host Security Manager" on page 634.
- Hosts in the Host Security Manager list that are not relevant must be deleted from the list.
- Each host must have a security key defined on it, and all of the hosts' security keys must be identical.
- Host Security Manager must have a master security key that is identical to the security key on all of the hosts. For details, see "Master Security Key" on page 630.

Update the security settings

1 Open Host Security Manager (**Start** > **Programs** > **LoadRunner** > **Tools** > **Host Security Manager**).

2 Update the desired security setting:

- **Security key.** Click **Update Security Key**, enter the new key, and enter it again for confirmation.
- **Security Mode.** Select the hosts in the list that you want to update. To select multiple hosts, hold down the CTRL key on your keyboard while selecting the relevant hosts. Click **Update Security Mode**, and select a security mode.

3 Click **Update**.

Host Security Manager attempts to update the security setting on the hosts listed under **Update progress**. As it attempts to update each host, it displays the update status, **Updated** or **Failed**, before attempting to update the next host.

If a host is not updated successfully, check for possible reasons. You can stop the update process by clicking **Stop**.

If there is a mismatch between Host Security Manager's master security key and the host's security key, the Update Error dialog box opens, prompting you for an appropriate action:

- **Skip host.** Skip updating this host.
- **Establish a secure channel using this key.** Use a different security key to communicate securely with the host.
- **Communicate over non-secure channel.** Update the security setting over a non-secure channel. **This action is not recommended**, especially when updating the host security to secure mode. You should rather update the security setting locally on the host (see "How to Configure Security Settings Locally on Hosts" on page 633).

To apply the selected action to all similar mismatches, select **Use this solution with all similar mismatches**.

Note: The security key update also updates Host Security Manager's master security key. If the update fails on all the hosts, the Host Security Manager's master key is not updated.

Results

If the update was successful, Host Security Manager displays the time and status of the security key/mode update for each host.

Reference

Secure Host Communication Interface

This section includes (in alphabetical order):

Add Hosts Dialog Box

This window enables you to add hosts to the Hosts list in Host Security Manager.

To access	**Start > Programs > LoadRunner > Tools > Host Security Manager > Add Hosts**
Relevant tasks	"How to Register Hosts in Host Security Manager" on page 634

User interface elements are described below:

UI Elements	Description
Add	Adds the Controller and load generators to the list of hosts.

UI Elements	Description
Controller (name or IP)	Enter the name or IP address of the Controller you want to register in Host Security Manager. **Note:** You can enter more than one Controller at a time, separated by commas.
Load Generators (name or IP), separated by commas	Enter the names or IP addresses of the load generator hosts you want to register in Host Security Manager. **Note:** You can enter more than one load generator at a time, separated by commas.

Host Security Manager Window

This window enables you to update security settings remotely on all of the hosts in the load testing system.

To access	**Start** > **Programs** > **LoadRunner** > **Tools** > **Host Security Manager**
Important information	➤ You must provide Host Security Manager with a master security key before you can update the security settings. ➤ Every time you use Host Security Manager to update security settings, make sure that the list of hosts is up to date. Hosts that were added to the system must be added to the list, and those deleted, should be deleted from the list. To add a host, see "How to Register Hosts in Host Security Manager" on page 634. To delete a host, select it and click **Delete**.
Relevant tasks	"How to Update Host Security Settings Remotely" on page 635
See also	"Secure Host Communication Overview" on page 628

User interface elements are described below:

UI Elements	Description
Add Hosts...	Opens the Add Hosts dialog box where you can register hosts in Host Security Manager.
Delete	Enables you to delete hosts from the Hosts list in Host Security Manager.
Set MI Listener...	Enables you provide the name/IP address of the MI Listener that the host (or hosts) uses to communicate over the firewall.
Update Security Key...	Opens the Update Security Key dialog box where you can update the security key on all the hosts.
Update Security Mode...	Opens the Update Security Mode dialog box where you can update the security mode on selected hosts.
Set Master Key...	Opens the Set Master Key dialog box where you update Host Security Manager's master security key.

UI Elements	Description
History...	Opens the History dialog box where you can view the history of updates made to the hosts. The information displayed includes the date of the update, the operation (key/mode update), and the update status (Passed/Failed).
<**Hosts table**>	Displays the following information: ➤ **Host Name/IP.** The name or IP address of the host. ➤ **Host Type.** The type of host: Controller / Load Generator. ➤ **MI Listener.** When the host is over a firewall, the name of the MI Listener through which the host communicates with the other hosts. ➤ **Last Key Update.** The last time the security key was updated. ➤ **Key Update Status.** The status of the last security key update. ➤ **Last Security Mode Update.** The last time the security mode was updated. ➤ **Security Mode Update Status.** The status of the last security mode update. **Tip:** You can sort the details on this page in ascending or descending order by clicking the heading of the column by which you want to sort. Click the column heading again to reverse the sort order.

Host Security Setup Dialog Box

This dialog box enables you to update a host's security settings manually.

To access	On the Controller machine, select **Start** > **Programs** > **LoadRunner** > **Tools** > **Host Security Setup**
Important information	When configuring security settings on hosts for the first time, to avoid configuration over non-secure channels, it is recommended to configure security settings on each host locally using the Host Security Setup utility. After initial security configuration, you can update security settings locally, or simultaneously across all the hosts in the LoadRunner system from the Controller using the HP Host Security Manager utility. For details, see "Remote Security Configuration" on page 630.
Relevant tasks	"How to Configure Security Settings Locally on Hosts" on page 633 (Windows)
See also	"Host Security Configuration" on page 629

User interface elements are described below:

UI Elements	Description
Select a security mode	Select one of the following security modes: ➤ **Allow non-secure communication.** Allows the host to communicate with other machines over a non-secure channel. (Default) ➤ **Enforce secure communication.** Enforces the host to communicate with other machines over a secure channel. If you select this option, you must provide the key (6 - 16 characters long) matching the security key on the other hosts with which it needs to communicate.

Update Security Key Dialog Box

This dialog box enables you to update the security key simultaneously on all the hosts.

To access	**Host Security Manager > Update Security Key** button
Important information	When you update the security key, the Host Security Manager's master security key is also updated. If the update fails on all the hosts, the Host Security Manager's master key is not updated.
Relevant tasks	"How to Update Host Security Settings Remotely" on page 635

User interface elements are described below:

UI Elements (A-Z)	Description
	Updates the security key on all of the hosts.
	Stops updating the hosts.
Security Key/ Confirm Security Key	Enter the new security key to be updated on all of the hosts, and a second time for confirmation. **Note:** The key must be 6 - 16 characters long.
Update progress	Displays the hosts and their status during and after the update.

Update Security Mode Dialog Box

This dialog box enables you to update the security mode simultaneously on selected hosts.

To access	**Host Security Manager** > **Update Security Mode** button
Relevant tasks	"How to Update Host Security Settings Remotely" on page 635

User interface elements are described below:

UI Elements (A-Z)	Description
Update	Updates the security mode on the selected hosts.
Stop	Stops updating the hosts.
Secure mode	Select a security mode: ➤ **Non-secure**. Allows non-secure communication. ➤ **Secure**. Enforces secure communication
Update progress	Displays the hosts, their previous status (if known), and their status during and after the update.

Troubleshooting

This section describes troubleshooting for secure host communication.

Cannot Run Scenario Over Secure Channels

Problem description: When you try to run a scenario over secure channels, the scenario cannot initialize because cannot connect to Controller or load generator.

Troubleshooting

Verify that the reason the scenario cannot run is because of a security key mismatch: try to run the same scenario with the same hosts from a local Controller.

If a Security Key Mismatch error is displayed in the error log, then the keys do not match and you need to align the security keys on all the host machines.

Scenario Run Fails. Load Generator Status is Changed to Resource Failure

Problem description: When trying to run a scenario over secure channels, the scenario fails to run and the load generator status changes to **Resource Failure**.

Troubleshooting

When trying to run a scenario over secure channels, if the security keys on the Controller and load generator do not match the scenario run fails, and the status of the load generators changes to **Resource Failure**. To re-enable the load generators, manually reset the status on each affected load generator to **Operational**.

37

Controller Command Line Arguments

This chapter includes:

Concepts

Tasks

Reference

Concepts

Controller Command Line Arguments Overview

When you invoke the Controller from the command line, you can pass arguments to instruct the Controller how to behave. By passing arguments in the command line, you configure Controller scenario settings without the need to manually define them using the Controller UI.

When invoked, the Controller checks all of the received arguments and sets its start-up environment accordingly. If no arguments are passed, the Controller uses its default settings.

For example, you can instruct Controller to Connect to HP Application Lifecycle Management on start-up, save results to a directory other than the directory defined in the scenario, and invoke Analysis upon scenario termination.

For information on how to invoke the Controller from the command line, see "Invoke the Controller from the command Line" on page 649.

For a list of rules relating to invoking the Controller from the command line, see "Command Line Arguments - Rules" on page 650.

Tasks

Invoke the Controller from the command Line

This task describes how to invoke the Controller from the command line and enter command line arguments.

This task includes the following steps:

- "Prerequisite" on page 649
- "Invoke the Controller from the command line and enter the desired command line arguments" on page 649

1 Prerequisite

Before invoking the Controller from the command line, you should be familiar with the rules relating to command line arguments. For details, see "Command Line Arguments - Rules" on page 650.

2 Invoke the Controller from the command line and enter the desired command line arguments

Type wlrun in the command line, followed by the desired arguments.

Notes:

- The arguments are case sensitive.
- Each argument should be preceded by a dash.

Example:

```
wlrun -TestPath C:\LoadRunner\scenario\Scenario.lrs -Run
```

Reference

Command Line Arguments - Rules

When you invoke the Controller from the command line, the following rules apply:

- If the Controller is invoked with no arguments in the command line, the Controller uses its default settings.
- The Controller will always overwrite results.
- The Controller will automatically terminate upon scenario termination and results will be collected. If you don't want the Controller to automatically terminate upon scenario termination, add the flag -DontClose to the command line.
- The Controller launched through the command line behaves normally except when using the -Run option. Using the -Run option, dialogs and message boxes that usually open and require the user to close them in a usual launch, do not open in a command line launch.
- The Controller's settings are loaded from **wlrun5.ini**, located in Windows directory.

Application Lifecycle Management Arguments

These arguments define the LoadRunner integration with Application Lifecycle Management. For more information about the LoadRunner Application Lifecycle Management integration, see "Managing Scenarios Using Application Lifecycle Management" on page 337.

ConnectToQC	Specifies whether the Controller should connect to ALM on startup (**0/1** or **ON/OFF**)
QCServer	Application Lifecycle Management server name. Must be a machine where Application Lifecycle Management is installed
QCDB	Application Lifecycle Management database name. Use the format: **<Domain name>.<Project name>**.
UserName	User name for connecting to Application Lifecycle Management
Password	Password corresponding to the user name
TestPath	Path to scenario in Application Lifecycle Management database. For example, "[TD]\Subject\LoadRunner\Scenario1" If path includes blank spaces, use quotation marks.
TestId	Test ID (used by ALM only)
ResultCleanName	For use with **ResultCycle** only. Example: "Res1"
ResultCycle	Application Lifecycle Management cycle. For example, "LR_60_SP1_247" **Note:** The **ResultCycle** and **ResultCleanName** arguments are required if you wish to store the results within the Application Lifecycle Management database.

Run Time Arguments

These arguments specify the run-time related scenario settings. For more information on scenario settings, see "Before Running Your Scenario" on page 237.

TestPath	Path to the scenario, for example, C:\LoadRunner\scenario\Scenario.lrs This argument can also be used for a scenario residing in a Application Lifecycle Management database. For example, "[TD]\Subject\LoadRunner\Scenario1" If the path includes blank spaces, use quotation marks.
Run	Runs the scenario, dumps all output messages into **res_dir\output.txt**, and closes Controller
InvokeAnalysis	Instructs LoadRunner to invoke Analysis upon scenario termination. If this argument is not specified, LoadRunner uses the scenario default setting.
ResultName	Full results path. For example, "C:\Temp\Res_01"
ResultCleanName	Results name. For example, "Res_01"
ResultLocation	Results directory. For example, "C:\Temp"

38

Working with Digital Certificates

This chapter includes:

Concepts

Tasks

Concepts

Digital Certificates Overview

A Digital Certificate is an electronic “credit card” that establishes your credentials when doing business or other transactions on the Web. It is issued by a Certification Authority (CA). It contains the IP address of the machine for which it was issued, a validation date, and the digital signature of the certificate-issuing authority.

Using Digital Certificates with Firewalls

When the MI Listener sends its Public Key to the LoadRunner agent, it always sends its certificate as well (this is the server-side certificate). The LoadRunner agent can be configured to authenticate the certificate which it received, as described in "Working with Firewalls in LoadRunner" on page 349.If the agent is configured to authenticate the certificate, it can verify whether the sender is really the machine that it claims to be by:

- Comparing the certificate's IP address with the sender’s IP address
- Checking the validation date
- Looking for the digital signature in its Certification Authorities list

The MI Listener may also require the LoadRunner agent to send a certificate at any point in the session. This is called the client-side certificate, as described in the MI Listener Configuration Settings in "Working with Firewalls in LoadRunner" on page 349. If the LoadRunner agent owns a certificate, it sends it to the MI Listener for the same authentication process. If the LoadRunner agent does not own a certificate, the communication might not be continued.

An SSL CA list and an SSL Certificate are included in each LoadRunner installation. This certificate is the same for all LoadRunner installations, which means that it can be obtained by third parties. Therefore, if you are interested in a more secure process, you should create your own Certificate Authority and include it in the list, and issue matching certificates for your machines.

Tasks

Create and Use Digital Certificates

This task describes how to create a Certification Authority and a Digital Certificate.

This task includes the following steps:

- "Create a Certification Authority (CA)" on page 656
- "Create a Digital Certificate" on page 658

1 Create a Certification Authority (CA)

Note: This step describes how to create a CA using the **gen_ca_cert.exe** utility. If you are working on a UNIX platform, use the **gen_ca_cert** utility instead.

To create the CA, perform the following steps:

a Run the **gen_ca_cert** utility from the **<LoadRunner root folder>\launch_service\bin** directory.

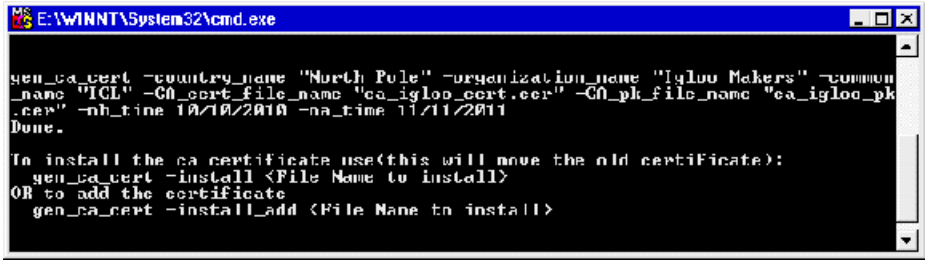
b Run the **gen_ca_cert** command with at least one of the following options:

- -country_name
- -organization name
- -common_name

This process creates two files in the directory from which the utility was run: the CA Certificate (**cacert.cer**), and the CA Private Key (**capvk.cer**). To provide different file names, use the **-CA_cert_file_name** and the **-CA_pk_file_name** options respectively.

Note: By default, the CA is valid for three years from when it is generated. To change the validation dates, use the **-nb_time** (beginning of validity) and/or **-na_time** (end of validity) options.

The following example creates two files: **ca_igloo_cert.cer** and **ca_igloo_pk.cer** in the current directory:



c Install the CA using one of the following options:

- **-install <name of certificate file>**. Replaces any previous CA list and creates a new one that includes this CA only.
- **-install_add <name of certificate file>.** Adds the new CA to the existing CA list.

Note: The -install and -install_add options install the certificate file only. Keep the private key file in a safe place and use it only for issuing certificates.

---

2 Create a Digital Certificate

Note: This step describes how to create a digital certificate using the **gen_cert.exe** utility. If you are working on a UNIX platform, use the **gen_cert** utility instead.

To create a digital certificate, perform the following steps:

a Run the **gen_cert** utility from the **<LoadRunner root folder>\launch_service\bin** directory.

b Run the **gen_cert** command with at least one of the following options:

- **-country_name**
- **-organization_name**
- **-organization_unit_name**
- **-eMail**
- **-common_name**

It is important to note the following:

- The CA Certificate and the CA Private Key files are necessary for the creation of the certificate. By default, it is assumed that they are in the current directory, and are named **cacert.cer** and **capvk.cer** respectively. In any other case, use the **-CA_cert_file_name** and **-CA_pk_file_name** options to give the correct files and locations.
- The certificate file is created in the directory from which the utility was run. By default, the file name is **cert.cer**. To provide a different name, use the **-cert_file_name** option.

39

Troubleshooting Online Monitors

This chapter includes:

Concepts

Reference

Concepts

Troubleshooting Online Monitors Overview

LoadRunner monitors allow you to view the performance of the scenario during execution.

These troubleshooting tips help solve issues related to connecting to the monitor server machine, and issues related to network usage.

Reference

Troubleshooting and Limitations

Troubleshooting Server Machine Connections

To monitor resources on a server machine, you must be able to connect to that machine. If monitoring is unsuccessful and LoadRunner cannot locate the specified server, make sure that the specified server is available. Perform a "ping" operation by typing ping <server_name> from the Controller machine command line.

Once you verify that the machine is accessible, check this table for

additional tips on troubleshooting the monitor.

Problem	Solution
Cannot monitor a Windows machine on a different domain, or "access denied."	To gain administrative privileges to the remote machine, perform the following from the command prompt: %net use \\<MachineName>/ user:[<Domain>\<RemoteMachineUsername>] At the password prompt, enter the password for the remote machine.
Cannot monitor a Windows machine (An error message is issued: "computer_name not found" or "Cannot connect to the host")	The Windows machine you want to monitor only enables monitoring for users with administrator privileges. To allow monitoring for non-admin users, you must grant read permission to certain files and registry entries (Microsoft tech-note number Q158438.) The required steps are: **a.** Using Explorer or File Manager, give the user READ access to: %windir%\system32\PERFCxxx.DAT %windir%\system32\PERFHxxx.DAT where xxx is the basic language ID for the system—for example, 009 for English. These files may be missing or corrupt. If you suspect this; expand these files off of the installation cd. **b.** Using REGEDT32, give the user READ access to: HKEY_LOCAL_MACHINE\Software\Microsoft\Windows NT\CurrentVersion\Perflib and all sub keys of that key. **c.** Using REGEDT32, give the user at least READ access to: HKEY_LOCAL_MACHINE\System\CurrentControlSet\Control\SecurePipeServers\winreg
Some Windows default counters are generating errors	Remove the problematic counters and add the appropriate ones using the "Add Measurement" dialog box.

Problem	Solution
You cannot get performance counters for the SQL server (version 6.5) on the monitored machine.	There is a bug in SQL server version 6.5. As a workaround, give read permission to the following registry key at the monitored machine (use regedt32): HKEY_LOCAL_MACHINE\SOFTWARE\Microsoft\MSSQLServer\MSSQLServer (Microsoft tech-note number Q170394)
The selected measurements are not displayed in the graph.	Ensure that the display file and online.exe are registered. To register the monitor dll's, without performing a full installation, run the **set_mon.bat** batch file located in **LoadRunner\bin**.
When monitoring a Windows machine, no measurements appear in the graph.	Check the built-in Windows Performance Monitor. If it is not functional, there may be a problem with the communication setup.
When monitoring a UNIX machine, no measurements appear in the graph.	Ensure that an **rstatd** is running on the UNIX machine (Refer to "UNIX Resource Monitoring" on page 479)

Troubleshooting Monitor Network Connections

If you notice extraordinary delays on the network, refer to one of the following sections to increase the performance:

- Network Bandwidth Utilization
- Ethernet-bus Based Networks
- Working on a WAN or Heavily Loaded LAN

Network Bandwidth Utilization

In most load-testing scenario, the network card has little impact on scenario performance. Network cards are manufactured to handle the bandwidth of the physical network layer. Packets are transferred over an Ethernet at a rate that complies with IEEE 803.x standards. If the network becomes a bottleneck, the issue is not the brand of the network card, but rather the bandwidth limitations on the physical layer (--i.e. Ethernet, FDDI, ATM, Ethernet Token-ring, etc.).

That is, instead of load testing over a T10 line, upgrade your line to DS3 (45Mbps), or T100 (100Mbps).

Below are a few tips that will help qualify the need to upgrade the network:

- Run the performance monitor on the Vuser load generators. As the number of Vusers increases, check the network byte transfer rate for saturation. If a saturation point has been reached, do not run any more Vusers without upgrading the network—otherwise performance of Vusers will degrade. Degradation is exponential in networking environments.
- Run the performance monitor on the server machine. Run many Vusers on several load generator machines. Check the kernel usage and network transfer rate for saturation. If saturation is reached with less than the desired Vuser load, upgrade the network.
- Every network has a different Maximum Transmission Unit or MTU, which is set by the network administrator. The MTU is the largest physical packet size (in bytes) that a network can transmit. If a message is larger than the MTU, it is divided into smaller packets before being sent.

If clients and servers are passing large data sets back and forth, instruct the network administrator to increase the MTU to yield better bandwidth utilization. Ideally, you want the MTU to be the same as the smallest MTU of all the networks between your machine and a message's final destination.

If you send a message that is larger than one of the MTUs, it will be broken up into fragments, slowing transmission speeds. If the MTU is too high, it may cause unintended degradation. Trial and error is the only sure way of finding the optimal MTU, but there are some guidelines that can help. For example, most Ethernet networks have an MTU of 1500.

If the desired MTU reduces performance, upgrade the network or reduce the MTU to improve performance.

Ethernet-bus Based Networks

The following guidelines apply to Ethernet-bus based networks:

- Networks with only 2 active machines communicating yield a maximum of 90% bandwidth utilization.
- Networks with 3 active machines communicating yield a maximum of approximately 85% bandwidth utilization.
- As the number of active machines on the network increases, the total bandwidth utilization decreases.

Working on a WAN or Heavily Loaded LAN

When you work with LoadRunner on a WAN or heavy loaded LAN, you may notice some unusual LoadRunner behavior, which indicates network problems. The Output window may contain messages about retries, lost packets, or message mismatch. This is because some of the messages from the Controller may not be reaching the LoadRunner agent. To solve this problem, you should reduce the network traffic or improve the network bandwidth.

The following steps may help reduce network traffic:

- Click the **Run-Time Settings** button and select the **General: Log** node. Clear the **Enable logging** check box.
- Initialize all users before running them. Run them only after initialization is completed.

Index

H

I

J

K

L

M

N

O

P

Q

R

S

T

U

V

W