Load Runner

Introduction

LoadRunner enables you to test your system under controlled and peak load conditions. To generate load, LoadRunner runs thousands of Virtual Users that are distributed over a network. Using a minimum of hardware resources, these Virtual Users provide consistent, repeatable, and measurable load to exercise your application just as real users would. LoadRunner's in-depth reports and graphs provide the information that you need to evaluate the performance of your application.

LoadRunner emulates an environment in which thousands of users work with a client/server system concurrently. To do this, LoadRunner replaces the human user with a virtual user (Vuser). The actions that a Vuser perform are described in a Vuser Script.

The LoadRunner advantages over Manual performance testing:

- LoadRunner reduces the 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 hardware requirements.
- The 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.

Some of the most commonly used Terms in the LoadRunner

Scenarios: Using LoadRunner, you divide your application performance testing requirements into *scenarios*. A scenario defines the events that occur during each testing session. Thus, for example, a scenario defines and controls the number of users to emulate, the actions that they perform, and the machines on which they run their emulations.

Vusers: In the scenario, LoadRunner replaces human users with *virtual users* or *Vusers*. When you run a scenario, Vusers emulate the actions of human users working with your application. 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, in order 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 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 LoadRunner 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.

LoadRunner Vuser Types

LoadRunner has various types of Vusers. 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. The following Vuser types are available:

- ***Client/Server :*** For MSSQLServer, ODBC, Oracle (2-tier), DB2 CLI, Sybase Ctlib, Sybase Dblib, Windows Sockets and DNS protocols.

- ***Custom:*** For C templates, Visual Basic templates, Java templates, Javascript and VBScript type scripts.

- ***Distributed Components:*** For COM/DCOM, Corba-Java, and Rmi-Java protocols.

- ***E-business:*** For FTP, LDAP, Media Player, Multi Protocol Web/WS, Web (HTTP, HTML), Palm, and RealPlayer protocols.

- ***Enterprise Java Beans:*** For EJB Testing and Rmi-Java protocols.

- ***ERP:*** For Oracle NCA, Peoplesoft (Tuxedo), SAP, and Siebel protocols.

- ***Legacy:*** For Terminal Emulation (RTE).

- ***Mailing Services:*** Internet Messaging (IMAP), MS Exchange (MAPI), POP3, and SMTP.

- ***Middleware:*** For the Tuxedo (6, 7) protocol.

- ***Wireless:*** For i-Mode, VoiceXML, and WAP protocols.

The LoadRunner Testing Process

You can easily create and run load-test scenarios by following the LoadRunner testing process below. The following illustration outlines the testing process:
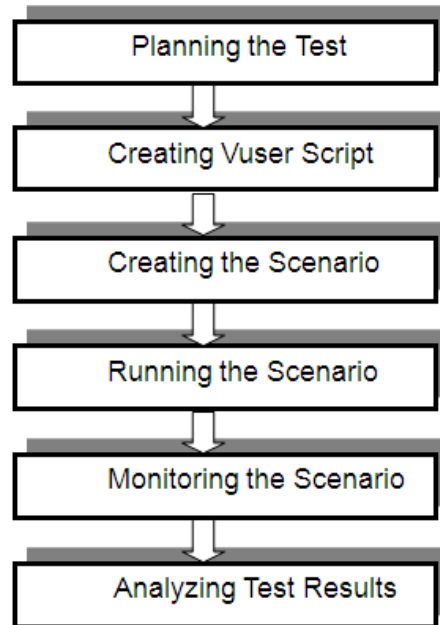
Step I: Planning the Test

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.

Step II: Creating the Vuser Scripts

Vusers emulate human users interacting with your Web-based application. A Vuser script contains the actions that each virtual user 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

Step III: Creating 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. You create scenarios using the LoadRunner Controller.

Creating a *Manual Scenario* You create a scenario by defining Vuser groups to which you assign a quantity of individual Vusers, Vuser scripts, and load generators to run the scripts. You can also create a scenario using the *Percentage Mode*, in which you define the total number of Vusers to be used in the scenario, and the load generator machines and percentage of the total number of Vusers to be assigned to each Vuser script. Creating a *Goal-Oriented Scenario* For Web tests, you can create a goal-oriented scenario, in which you define the goals you want your test to achieve. LoadRunner automatically builds a scenario for you, based on these goals.

Step IV: Running the Scenario

You emulate user load on the server by instructing multiple Vusers to perform tasks simultaneously. You can set the level of load by increasing and decreasing the number of Vusers that perform tasks at the same time.

Before you run a scenario, you set the scenario configuration and scheduling. This determines how all the load generators and Vusers behave when you run the scenario. You can run the entire scenario, groups of Vusers (Vuser groups), or individual Vusers. While a scenario runs, LoadRunner measures and records the transactions that you defined in each Vuser script. You can also monitor your system's performance online.

Step V: Monitoring a Scenario

You can monitor scenario execution using the LoadRunner online run-time, transaction, system resource, Web resource, Web server resource, Web application server resource, database server resource, network delay, streaming media resource, firewall server resource, ERP server resource, and Java performance monitors.
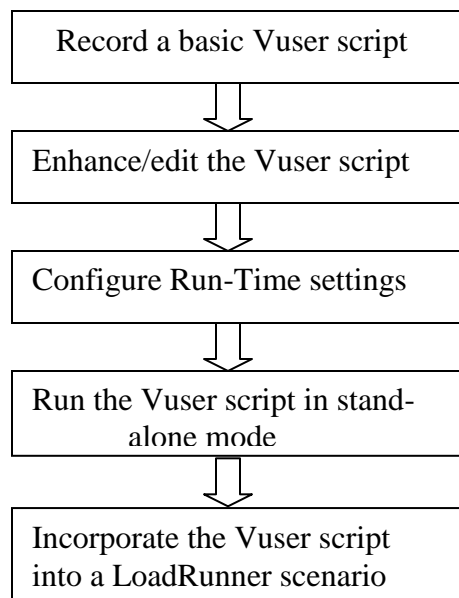
Step VI: Analyzing Test Results

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.

Creating the Vuser Scripts

The structure and content of a Vuser script differ from one Vuser type to another. For example, Database Vuser scripts always have three sections, are written in a code that resembles C, and include SQL calls to a database server. In contrast, GUI Vuser scripts have only one section, and are written in TSL (test script language).

The following diagram outlines the process of developing a Vuser script.

```
┌─────────────────────────────────┐
│   Record a basic Vuser script   │
└─────────────────────────────────┘
                 ⇓
┌─────────────────────────────────┐
│   Enhance/edit the Vuser script │
└─────────────────────────────────┘
                 ⇓
┌─────────────────────────────────┐
│   Configure Run-Time settings   │
└─────────────────────────────────┘
                 ⇓
┌─────────────────────────────────┐
│   Run the Vuser script in stand-│
│           alone mode            │
└─────────────────────────────────┘
                 ⇓
┌─────────────────────────────────┐
│   Incorporate the Vuser script  │
│   into a LoadRunner scenario    │
└─────────────────────────────────┘
```

You begin the process of developing a Vuser script by recording a basic script. LoadRunner provides you with a number of tools for recording Vuser scripts. You enhance the basic script by adding control-flow structures, and by inserting transactions and rendezvous points into the script. You then configure the run-time settings. The run-time settings include iteration, log, and timing information, and define how the Vuser will behave when it executes the Vuser script. To verify that the script runs correctly, you run it in stand-alone mode. When your script runs correctly, you incorporate it into a LoadRunner scenario.

Introducing VuGen

The Virtual User Generator, also known as *VuGen*, enables you to develop Vuser scripts for a variety of application types and communication protocols.

VuGen not only records Vuser scripts, but also runs them. Running scripts from VuGen is useful when debugging. It enables you to emulate how a Vuser script will run when executed as part of a scenario. When you record a Vuser script, VuGen generates various functions that define the actions that you perform during the recording session. VuGen inserts these functions into the VuGen editor to create a basic Vuser script.

The inserted functions include *general* Vuser functions and *protocol-specific* Vuser functions:

The *general Vuser functions* are also known as LR functions. They can be used in any type of Vuser script. There are separate LoadRunner functions for C and Java.

The *protocol-specific* Vuser functions are specific to the Vuser type. For example, VuGen uses LRT functions in a TUXEDO script, and LRS functions in a Windows Sockets script.

Vuser Script Sections

Each Vuser script contains at least three sections: *vuser_init*, one or more *Actions*, and *vuser_end*. Before and during recording, you can select the section of the script into which VuGen will insert the recorded functions.

The following table shows what to record into each section, and when each section is executed.

| Script Section	Used when recording...	Is executed when...
vuser_init	A login to a server	The Vuser is initialized (loaded)
Actions	Client activity	The Vuser is in "Running" status
vuser_end	A logoff procedure	The Vuser finishes or is stopped

When you run multiple iterations of a Vuser script, only the *Actions* sections of the script are repeated—the *vuser_init* and *vuser_end* sections are not repeated.

Recording Web Vuser Scripts with VuGen

1. Select Start > Programs > LoadRunner > Virtual User Generator. The VuGen main window opens.
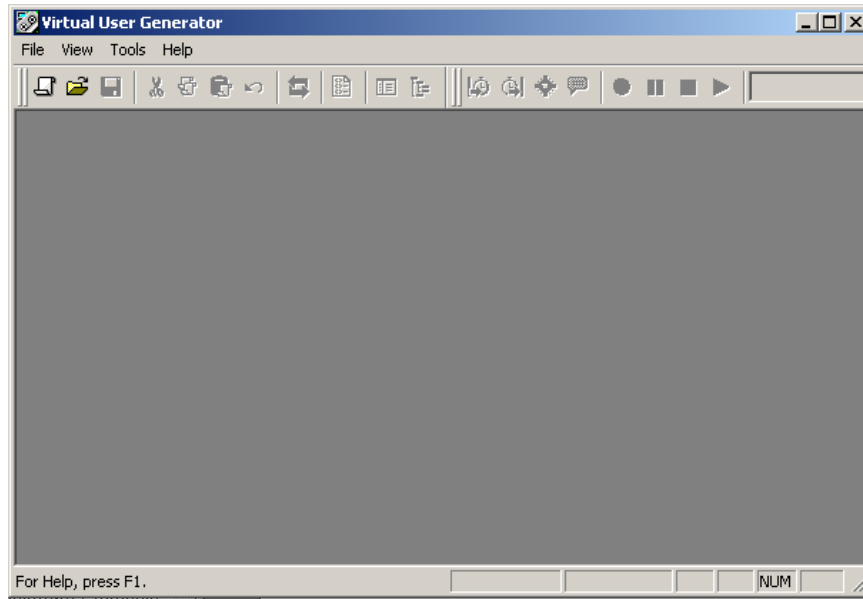
2. Select File > New or click the New button . The New Virtual User dialog box opens.
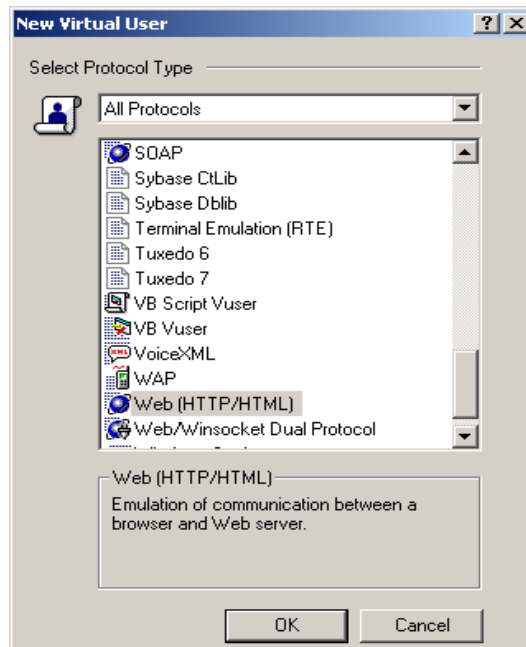
3. Select Web (HTTP/HTML) from the All Protocols list or from the E-Business folder, and click OK. VuGen opens a skeleton Vuser script.

4. Select Vuser > Start Recording, or click the Start recording button on the VuGen recording toolbar. The Start Recording dialog box opens.
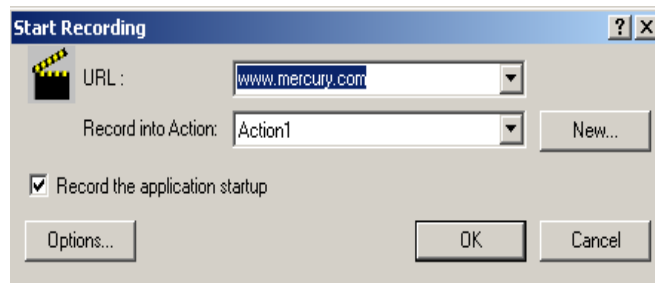
5. Click Options to set the recording mode, browser, proxy, and additional recording options.

6. Type a Web site address (URL) in the URL box, or select one from the list. This is where you will start recording the script.

7. From the Record into Action list, select the action into which you want to begin recording, or create a new action.

To create a new action, click the New button. The Create new action dialog box opens.
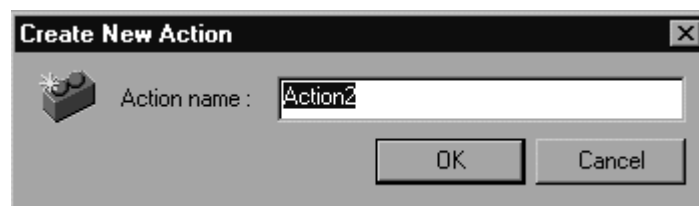

Type a name for the new action in the Action name box, or accept the default name, and click OK. When you create a new action, VuGen adds it to the Actions list in the skeleton Web Vuser script.

8. Click OK to launch the Web browser and start recording. The floating recording toolbar appears.

9. Navigate through your Web site by clicking hypertext and hypergraphic links, and submitting forms. Each link you click adds an Action icon to the Web Vuser script. Each form you submit adds a Submit Form icon to the Vuser script.

10. After performing all the required user processes, click the Stop Recording button on the floating recording toolbar. VuGen closes the browser and restores the VuGen main window.

By default, your recorded script appears in the tree view. If your script appears in the text-based script view, select View > Tree View to switch to the tree view.
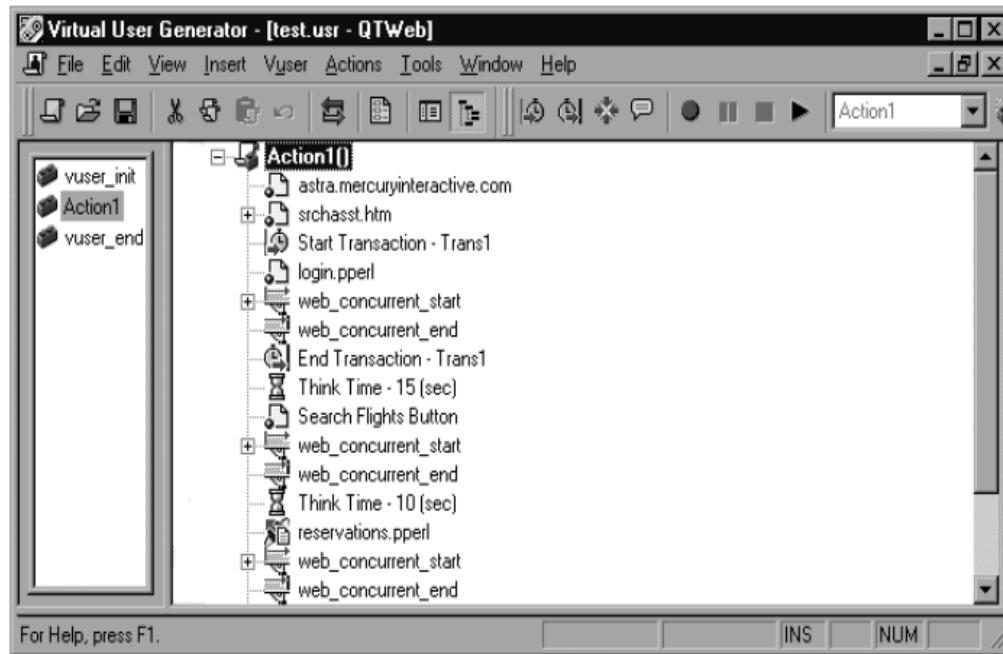
11. Select File > Save, or click the Save button to save the Vuser script. Specify a file name and location in the Save Test dialog box, and click Save.

VuGen can display a Web Vuser script in two ways:

As an *icon-based representation* of the Vuser script. This is the default view, and is known as the *tree view*.

As a *text-based representation* of the Vuser script. This is known as the *script view*.

To display the tree view of a Web Vuser script:

From the VuGen main menu, select View > Tree View, or click the View script as tree icon. The Vuser script is displayed in the icon-based tree view. If you are already in the tree view, the menu item is disabled.
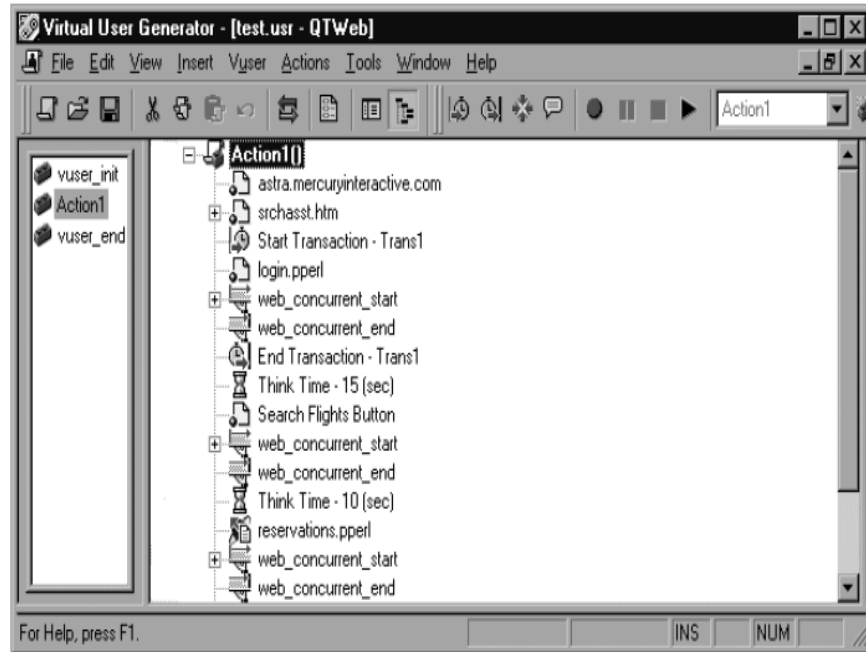
The tree view of a Vuser script is composed of icons. Each icon represents an action of the Vuser or a step in the Web Vuser script. The icons are divided into four categories:

> ➤ Action Icons
> ➤ Control Icons
> ➤ Service Icons
> ➤ Web Check Icons

Action Icons

Each *Action* icon in the Vuser script represents a user action during recording, that is, a jump to a new Web page or a change in the Web context.

VuGen uses five different Action icons, each one representing a different user action during recording and playback:

URL
Link
Image
Form/Data
Submission
Custom
Request

Control Icons

Each *Control* icon in the Vuser script represents a control used during load testing. Control steps include transactions, rendezvous points, and think time. You can add control steps either while recording, or after recording.

VuGen uses these Control icons:

Start Transaction
End Transaction
Rendezvous
Think Time

Service Icons

A Service icon represents a step that does not make any changes in the Web application context. Rather, service steps perform customization tasks such as setting proxies, providing authorization information, and issuing customized headers. Service steps in a Vuser script override any run-time settings that are set for the script.

Web Check Icons

When you add a *Web check* during or after recording, VuGen adds a Web Check icon to the current step in the Vuser script. Web Check icons are always indented under the associated step.

Creating a Scenario using LoadRunner Controller

To test your system with LoadRunner, you must create a scenario—a file with information about the test session. The scenario is the means by which you emulate a real-life user. The scenario contains information about how to emulate real users: the groups of virtual users (Vusers), the test scripts the Vusers will run, and the load generator machines upon which to run the scripts.

Introducing the LoadRunner Controller

To open the Controller:

Select **Start > Programs > LoadRunner > Controller**. The Controller opens with the New Scenario dialog box inside.
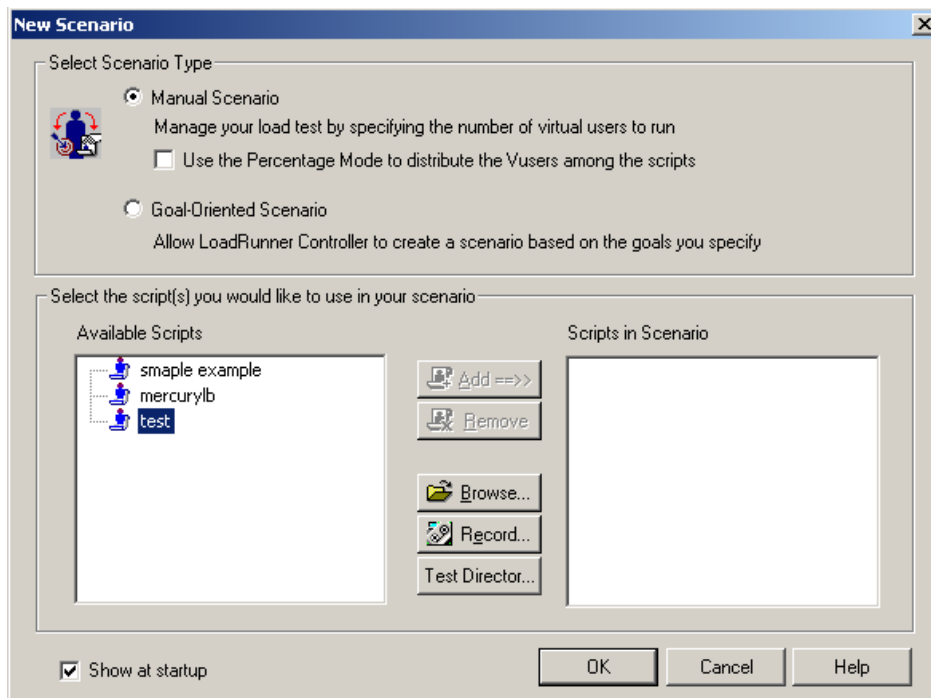
You can select one of two methods to create a scenario: **Manual Scenario** or **Goal-Oriented Scenario**. In a manual scenario, you create the scenario yourself by defining the number of Vuser groups you want to run, and building a schedule for LoadRunner to run these groups. You can also create a manual scenario by defining the total number of Vusers to be used in the scenario, and assigning a percentage of the total number of Vusers to each script. If you want to create a scenario using the Percentage Mode, select Use the Percentage Mode to distribute the Vusers among the scripts. 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.

To select the script or scripts that you want to use in your scenario:

1. Select a script from the Available Scripts list. By default, the list displays the fifty most recently used scripts.

2. Click the Add button to copy the script you selected to the Scripts in Scenario list.

3. Click the Remove button to remove a script from the Scripts in Scenario list.

4. To bypass this dialog box the next time you create a new scenario, clear the Show at startup check box. You will be able to add scripts later on, while building your scenario.

5. Click OK to close the dialog box.

The LoadRunner Controller window contains the following elements
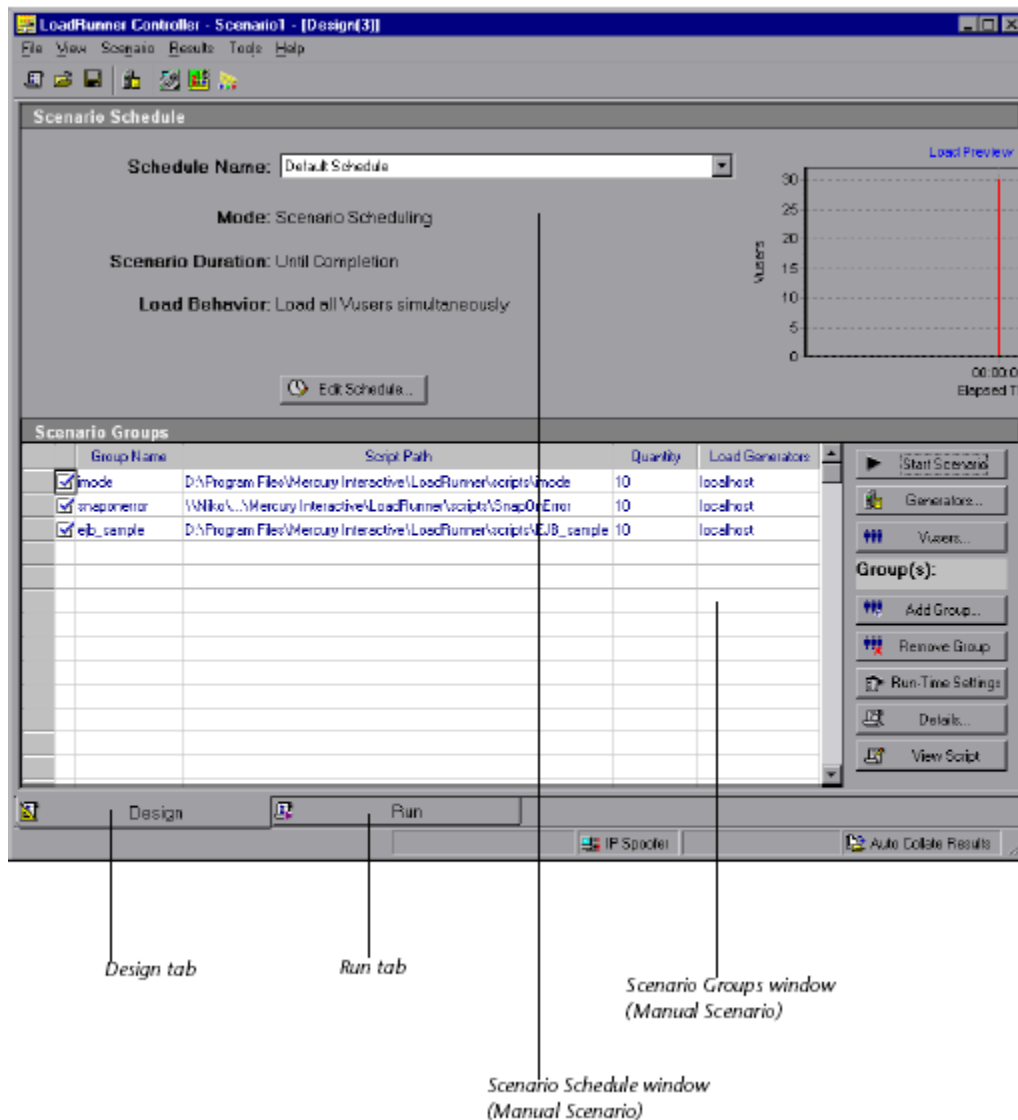
The Controller window has two tabs which correspond to two views:

Design view this view displays a list of all the Vuser groups/scripts in a scenario, and the load generator machines, and number of Vusers assigned to each group/script. This view also displays basic information about the scenario schedule (manual scenario) or goal (goal-oriented scenario).

Run view Displays information on the running Vusers and Vuser groups, as well as online monitor graphs.

In addition, if you select View > Show Output, the Controller opens the Output window which displays error, warning, notification, debug, and batch messages generated during scenario execution.

A scenario describes the events that occur during each load testing session. You create a scenario using the Design view of LoadRunner Controller.

Creating a New Scenario

You can build a manual scenario by creating groups and specifying the scripts, the load generators, and the number of Vusers included in each group. You can also build a manual scenario using the Percentage Mode, which allows you to define the 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.

If you chose to create a regular manual scenario, each script you selected in the New Scenario dialog box is assigned to a Vuser group. To each Vuser group you then assign a number of virtual users. You can instruct all Vusers in a group to run the same script on the same load generator machine, or you can assign different scripts and load generators to the various Vusers in a group.

Creating Vuser Groups

A scenario consists of groups of Vusers which emulate human users interacting with your application. When you run a scenario, the Vusers generate load on the server, and LoadRunner monitors the server and transaction performance.
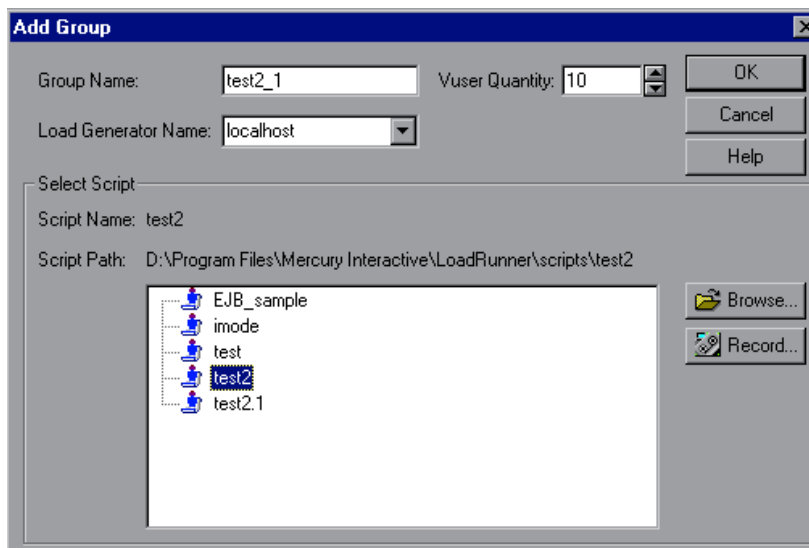
You create Vuser groups from the Scenario Groups window of the Controller.

The following figure show the scenario group window.
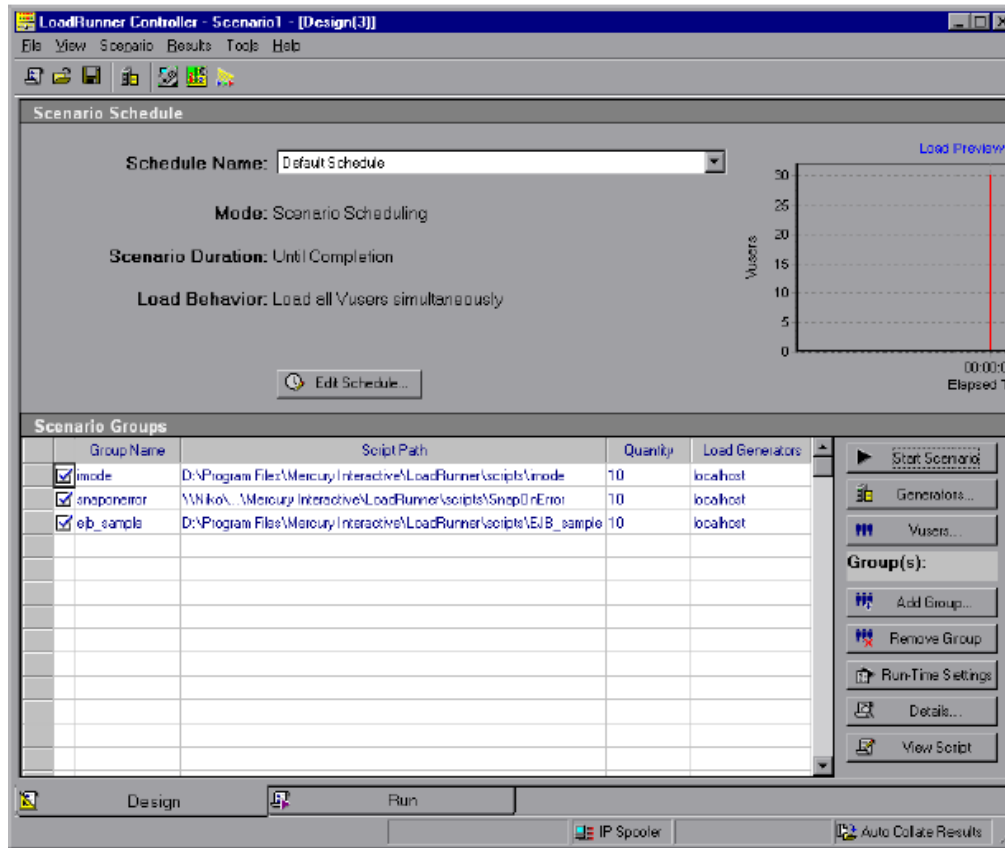
To create Vuser Groups:

1. Click the **Add Group** button to the right of the Scenario Groups window.
The Add Group dialog box opens:

2. In the Group Name box, enter a name for the Vuser group.

3. From the Vuser Quantity box, select the number of Vusers that you want to create in the group.

4. Select a load generator from the Load Generator Name list. The Load Generator list contains all load generators that you previously added to the scenario.

To use a load generator that does not appear, select Add from the Load Generator Name list. The Add Load Generator dialog box opens: Type the name of the load generator in the Name box. In the Platform box, select the type of platform on which the load generator is running. By default, LoadRunner stores temporary files on the load generator during scenario execution, in a temporary directory specified by the load generator's TEMP or TMP environment variables. To override this default for a specific load generator, type a location in the Temporary Directory box.
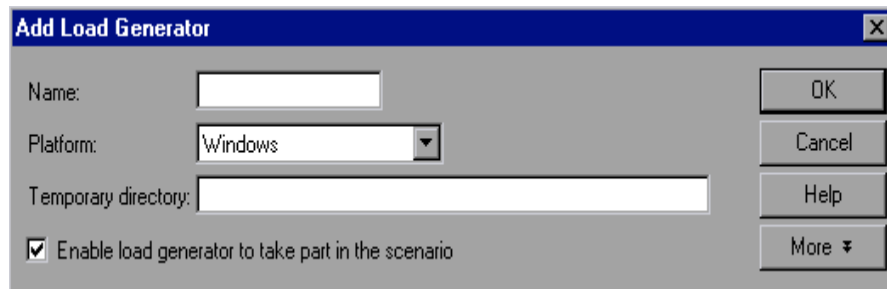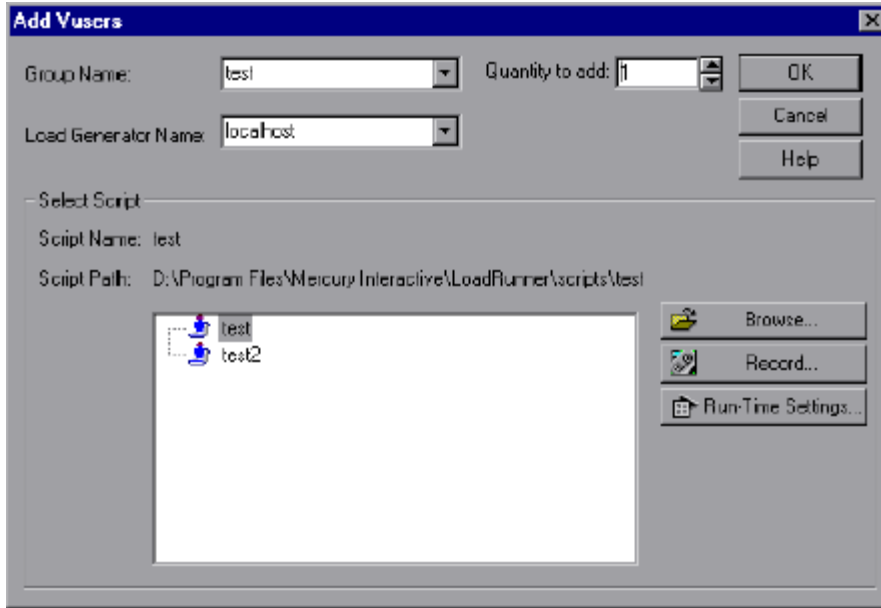

6. Click OK to close the Add Group dialog box. The new group's properties appear in the Scenario Groups window

Adding Vusers to a Vuser Group

You add Vusers to a Vuser group and define their properties using the Add Vusers dialog box.

To add Vusers to a Vuser group:

1. In the Vusers dialog box, click the **Add Vuser(s)** button. The Add Vusers dialog box opens.

2. From the Group Name box, select the name of the Vuser group.

3. From the Quantity to add box, select the number of Vusers that you want to add to the group.

4. Select a load generator from the Load Generator Name list.

5. Select a script from the script list. The script list contains all scripts that you previously added to the scenario.

6. Click **OK** to close the Add Vusers dialog box. The new Vuser's properties appear in the Vusers dialog box.

Running a Scenario

Once you have designed your scenario, you are ready to run it. You can control the Vusers and Vuser groups and monitor their performance online using the Run view of the LoadRunner Controller. The following figure shows the Run view.

During scenario execution, you use the Scenario Groups window in the Run view to monitor the actions of all the Vusers and Vuser groups in the scenario. The Status field of each Vuser group displays the current state of each Vuser in the group.

Design tab   *Run tab*

Scenario Groups window   *Online Monitor Graphs*   *Scenario Status window*
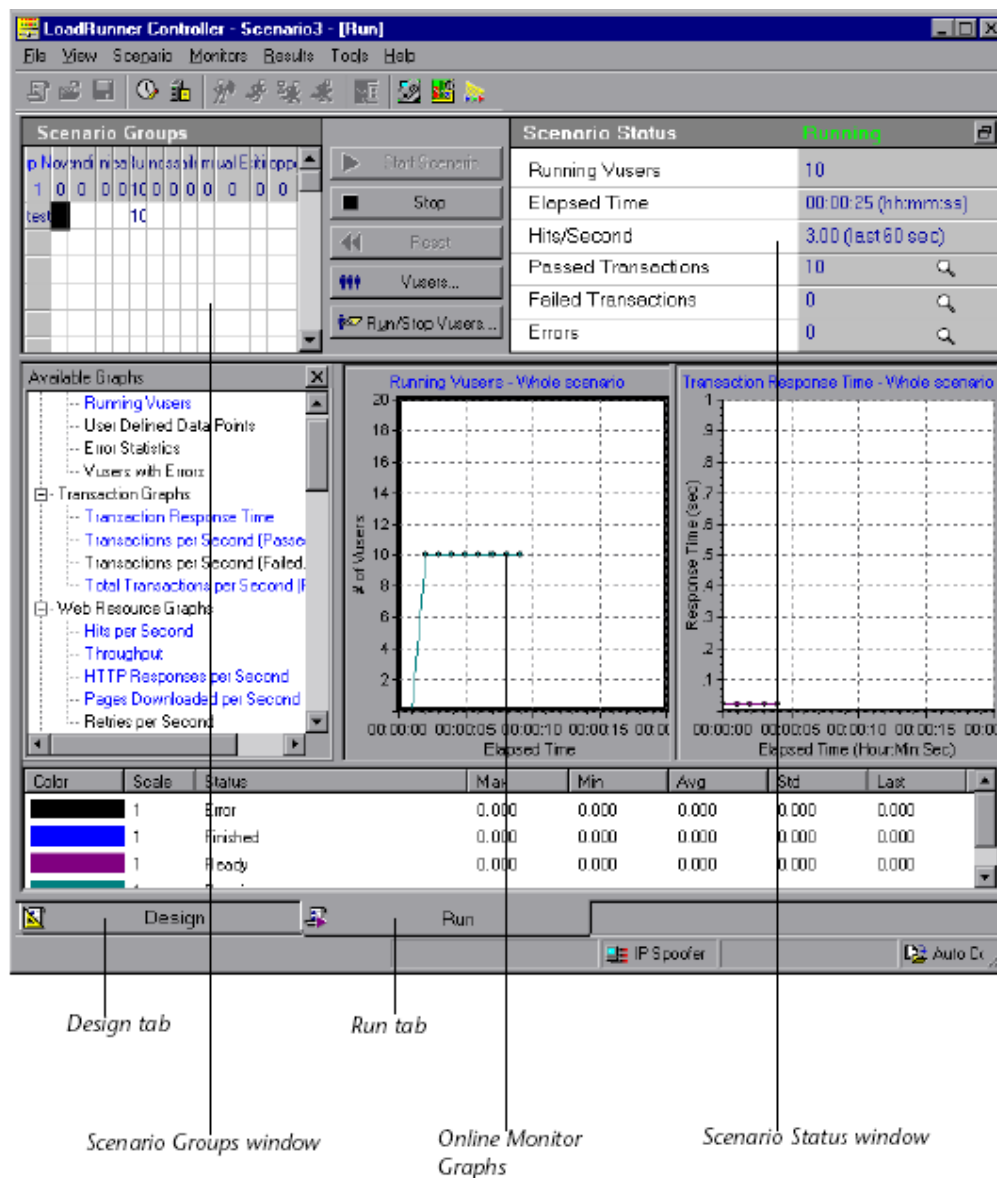
You can also manipulate individual Vusers within the Vuser groups you have defined by selecting a group and clicking the Vusers button. The Vusers dialog box appears, with a list of the ID, Status, Script, Load Generator, and Elapsed Time (since the beginning of the scenario) for each of the Vusers in the group
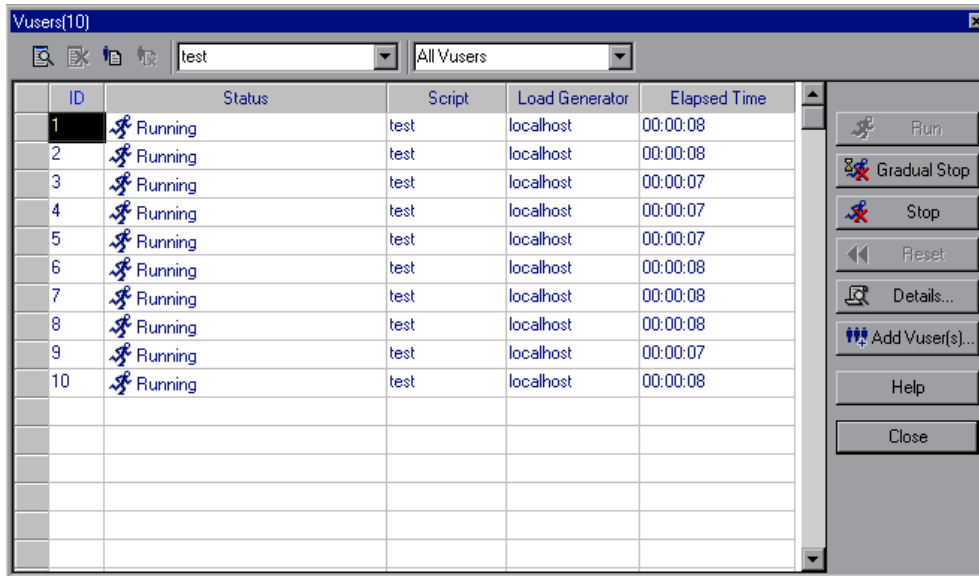
Note that you can detach the Scenario Status window from the Run view, thereby enlarging the Scenario Groups window.

While the scenario runs, the Vusers and load generators send error, notification, warning, debug, and batch messages to the Controller. You can view these messages in the Output window (View > Show Output).
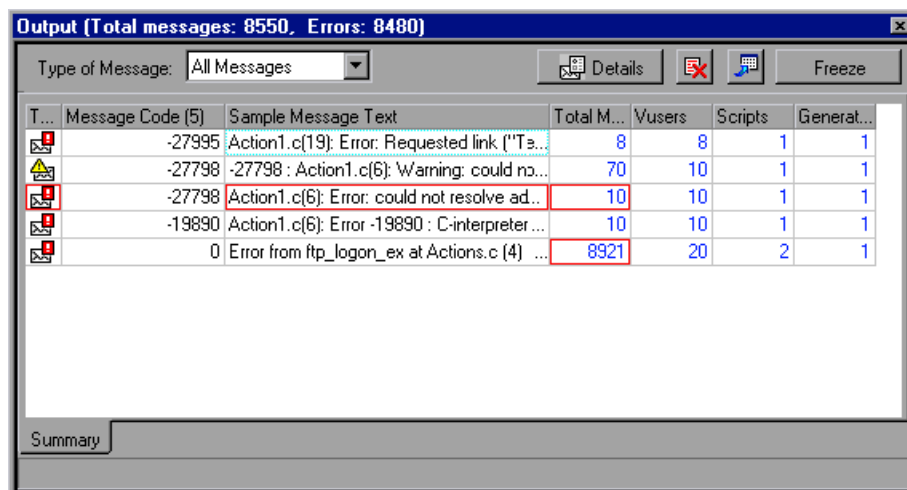
Viewing Vusers During Execution

LoadRunner lets you view Vuser activity during a scenario:

- On the Controller load generator machines, you can view the Output window, monitor Vuser performance online, and check the status of Vusers executing the scenario.
- On remote machines, you can view the Agent summary with information about the active Vusers.

Monitoring Vuser Status

During scenario execution, you can use the Scenario Groups window in the Run view to monitor the actions of all the Vusers and Vuser groups in the scenario.

The Status field of each Vuser group displays the current state of each Vuser in the group. The following table describes the possible Vuser states during a scenario.

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 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.
EXITING	The Vuser has finished running or has been stopped, and is now exiting.
STOPPED	The Vuser stopped when the Stop command was invoked.

Inserting Steps

You can manually add steps to your Web Vuser script. You can insert functions specific to the Web or Wireless protocols, or generic functions.

1. Select Insert > New Step to insert a step after the selected step, or select Insert After or Insert Before from the right-click menu. The Add Step dialog box opens.
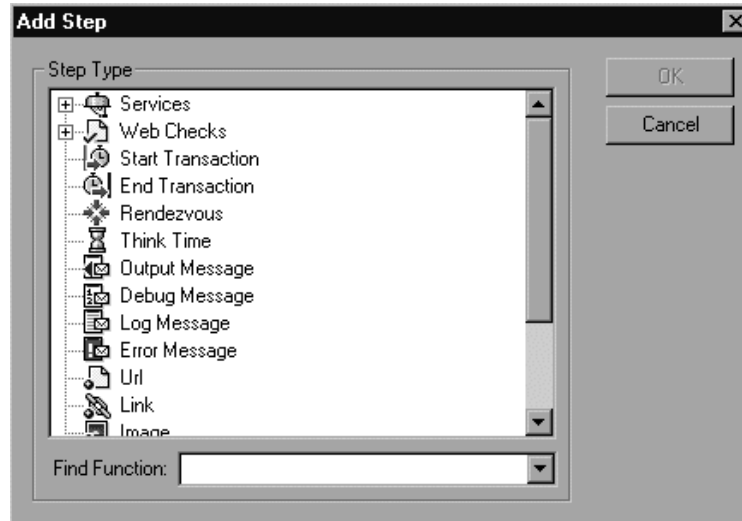

2. Select the function to add to the Vuser script, or expand the branch for Service or Web Check functions. Click OK.

3. To find a function, type it in the Find Function box. The Step Type window expands the relevant branch and displays the functions that correspond to the letters that you typed.

Inserting Transactions

You insert *transactions* into a Web Vuser script to enable the Controller to measure the performance of your Web server under various load conditions. Each transaction measures the time that it takes for the server to respond to one or more tasks submitted by Vusers. You can create transactions to measure simple tasks, such as accessing a URL, or complex processes, such as submitting several queries and waiting for a response.

To define a transaction, you insert a Start Transaction and End Transaction icon into the Vuser script.
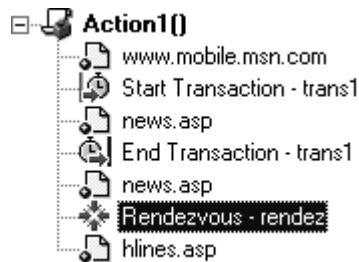
Within a Vuser script, you can mark an unlimited number of transactions. You insert transaction statements into your script either while recording or after the recording session.

During a scenario execution, the Controller measures the time it takes to perform each transaction. After a scenario run, you use LoadRunner's graphs and reports to analyze the server's performance.

To mark the start of a transaction while recording:

1. Click the Start Transaction button on the VuGen toolbar. The Start Transaction dialog box opens.
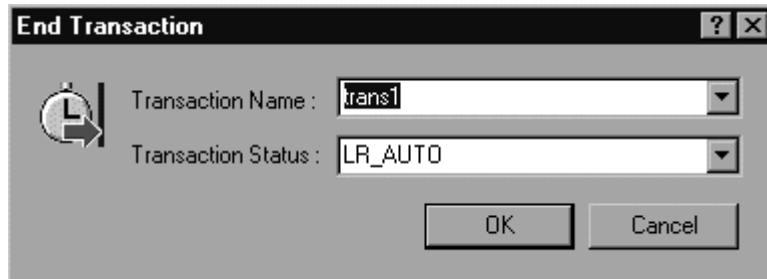

2. Type a transaction name in the Transaction Name box.

3. Click OK to accept the transaction name. VuGen inserts an "lr_start_transaction " statement in the Vuser script.

Example.

      lr_start_transaction(" transample");

To mark the end of a transaction while recording:

1. Click the End Transaction button on the VuGen toolbar. The End Transaction dialog box opens.

2. Click the arrow in the Transaction Name box to display a list of open transactions. Select the transaction to close.

3. Select the transaction status from the Transaction Status list. You can manually set the status of the transaction, or you can allow LoadRunner to detect it automatically.

- To manually set the status, you perform a manual check within the code of your script, evaluating the return code of a function. For the "succeed" return code, set the status to LR_PASS. For the "fail" return code, set the status to LR_FAIL.

- To instruct LoadRunner to automatically detect the status, specify LR_AUTO. LoadRunner returns the detected status to the Controller.

4. Click OK to accept the transaction name and status. VuGen inserts an "lr_end_ transaction "statement in the Vuser script.
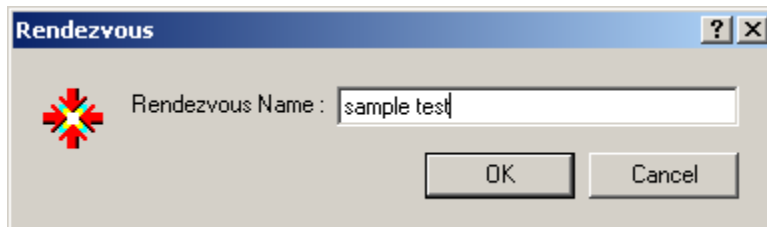
Rendezvous Points

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. In order to emulate the required user load on the server, you instruct all the Vusers to check account information at exactly the same time.

Ensure that multiple Vusers act simultaneously by creating a *rendezvous point*. When a Vuser arrives at a rendezvous point, it is held there by the Controller. The Controller releases the Vusers from the rendezvous either when the required number of Vusers arrives, or when a specified amount of time has passed.

To Insert Rendezvous Point

1. While recording a Vuser script, click the **Rendezvous button** on the recording toolbar. The Rendezvous Dialog Box opens

2. Type a name for the rendezvous point in the rendezvous name box.

Click **OK** to accept the rendezvous name. VuGen inserts an lr_rendezvous statement into the Vuser script.

Using Rendezvous Point

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 one thousand Vusers simultaneously deposit cash. The second rendezvous ensures that another thousand Vusers simultaneously withdraw cash.

If you want to measure how the server performs when only five hundred Vusers deposit cash, you can deactivate (disable) the "withdraw" rendezvous, and instruct only five hundred Vusers to participate in the "deposit" rendezvous.

The following procedure outlines how to control load peaks on the server:

1. Create the **Vuser scripts** by inserting the necessary **rendezvous points**.

2. Create a **scenario**.

When you add a Vuser to a scenario, LoadRunner scans the associated Vuser script for the names of the rendezvous points and adds them to the list in the Rendezvous window.]f you create another Vuser that runs the same script, the Controller adds the new Vuser to the rendezvous and updates the list.

3. Set the **level of emulated user** load. You determine the exact level of load by selecting the rendezvous points that will take part in the scenario, and how many Vusers will Participate in each rendezvous.

4. Set the attributes for the rendezvous (optional). For each rendezvous you can set the timeout and policy attributes.

5. Run the **scenario.**

Setting the Rendezvous Attributes

You can set the following rendezvous attributes from the Rendezvous Information dialog box:

- Timeout
- Rendezvous Policy
- Enabling and Disabling Rendezvous
- Enabling and Disabling Vusers

In addition, the dialog box displays general information about the rendezvous point: which script is associated with the rendezvous and release history.

Setting Timeout Behavior Attribute

The timeout determines the maximum time (in seconds) that LoadRunner waits for each Vuser to arrive at a rendezvous. After each Vuser arrives at the rendezvous, LoadRunner waits up to timeout seconds for the next Vuser to arrive. If the nest Vuser does not arrive within the timeout period, then the Controller releases all the Vusers from the rendezvous. Each time a new Vuser arrives, the timer is reset to zero. The default timeout is thirty seconds. You set a timeout for each rendezvous point.

To set a timeout:

1. Choose **Scenario > Rendezvous**. The Rendezvous Information dialog box opens.

2. Select the **Rendezvous** from the Rendezvous list for which you want to set a timeout.

3. In the **Behavior section**, locate the Timeout box. Enter a timeout value—the default is 30 seconds.

4. Click **OK** to close the dialog and set the timeout for the rendezvous.

Setting the Release Policy Attribute

The policy attribute determines how the Controller releases Vusers From the rendezvous. For each rendezvous you can set the following Policies:

All Arrived Instructs the Controller to release the Vusers from the rendezvous only when all die Vusers included in the rendezvous arrive. All the Vusers are released simultaneously.

The default policy is All Arrived

Quota Sets the number of Vusers that must arrive at a rendezvous point before the Controller releases the Vusers. For instance, suppose that you are testing a scenario of fifty Vusers and that you want a particular operation to be executed simultaneously by ten Vusers. You can designate the entire scenario as participants in the Rendezvous and set a quota of ten Vusers. Every time ten Vusers arrive at the rendezvous, they are released.

To set the policy attribute:

1. Choose **Scenario > Rendezvous**. The Rendezvous Information dialog Box opens.

2. Click a **rendezvous** in the Rendezvous list.

3. In the Behavior section, locate the **Policy box**.

4. To set the policy to All Arrived, select All Arrived from the list. The new policy appears in the Policy field.

5. To set the policy to Quota, select Quota from the list. The Rendezvous Quota dialog box appears. Enter the number of Vusers in the Quota box

Disabling and Enabling Rendezvous Points

        You can temporarily disable a rendezvous and exclude it from the scenario. By disabling and enabling a rendezvous, you influence the level of server load. You use the Disable and Enable buttons on the Rendezvous Information dialog box, to change the status of a rendezvous.

To disable a rendezvous:

1. Choose **Scenario > Rendezvous**. The Rendezvous Information dialog box opens.

2. Select the **rendezvous** you want to **disable**.

3. Click the **Disable button**. The button changes to Enable and the rendezvous becomes disabled.

To enable a rendezvous

1. Choose **Scenario > Rendezvous**. The Rendezvous Information dialog box opens.

2. Select the **disabled rendezvous** that you want to enable.

3. Click the **Enable button**. The button changes to Disable and the rendezvous becomes enabled.

Disabling and Enabling Vusers at Rendezvous Points

In addition to disabling a rendezvous for all Vusers in a scenario. LoadRunner lets you disable it for specific Vusers. By disabling Vusers at a rendezvous, you temporarily exclude them from participating in the rendezvous. Enabling disabled Vusers returns them to the rendezvous. You use the Disable and Enable commands to specify which Vusers will take part in a rendezvous.

To disable a Vuser in a rendezvous:

1. Choose **Scenario > Rendezvous**. The Rendezvous Information dialog box opens.

2. Select the **rendezvous** from the Rendezvous list for which you want to disable Vusers.

3. Click **OK** to insert the comment and close the dialog box. The text is placed at the current point in the script, enclosed by comment markers.

The following script segment shows how a comment appears in a Vuser script:

Note: You can insert comments into your script after you complete a recording session, by selecting **Insert > Comment** from the VuGen menu.

```
/*
* This is the first query
*/
```

4. In the section **Enable/Disable** Vusers, select the Vuser(s) you want to exclude from die rendezvous. Select multiple Vusers using the CTRL key.

5. Click **Disable** (the button directly below the Vuser list). The disabled Vusers change from black to gray and will not take part in the rendezvous.

6. To enable a Vuser, select it and click **Enable**.

Scheduling a Scenario

After you create a scenario, you can set the time at which the scenario will begin running. In addition, for a manual scenario, you can set the duration time of the scenario or of the Vuser groups within the scenario. You can also select to gradually run and stop the Vusers within the scenario or within a Vuser group.

Load runner provides several scheduling options for scenario execution.

- Delaying the scenario start
- Limiting the scenario duration

You can instruct LoadRunner to begin executing a scenario with a delay. You can specify the number of minutes to wait from the time a run command is issued, until the scenario begins.

You can also limit the time duration of a scenario. You specify the number of minutes a scenario should be in the running state. When a scenario reaches its time limitation, it finishes.

Delaying the Start of a Scenario For both manual and goal-oriented scenarios, you can instruct LoadRunner to start running the scenario at a later point in time. You can specify either the number of minutes you want LoadRunner to wait from the time a *Run* command is issued, or the specific time at which you want the scenario to begin.

To delay the start of the scenario:

1. Select **Scenario > Start Time**. The Scenario Start dialog box opens, with the default option, without delay is selected.
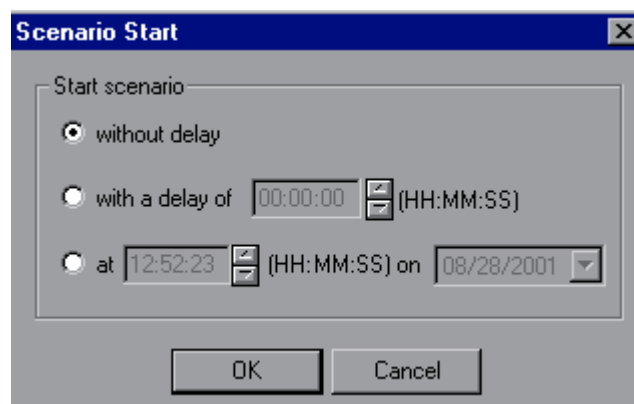
2. Select with a delay of X (HH: MM: SS) and enter the amount of time (in hours: minutes: seconds format) by which you want to delay the start of your scenario. Alternatively, you can select at X (HH: MM: SS) on X and specify the time (in hours: minutes: seconds format) and date for the start of the scenario.

3. Click **OK** to close the dialog box and save your settings.

Getting started with LoadRunner scheduler

1) Create a **scenario** using LoadRunner controller

2) **Start**->**programs**->**LoadRunner**->**scheduler**-> LoadRunner scheduler is opened.

3) **View menu**->**schedule layout**->

    Basic time event /basic mode - is used if you only want to schedule group execution times.

    Expert Time event - if you want to specify dependencies, sequences, command events or delay events

4) **Schedule menu**-> **schedule group**-> select the group that are to be scheduled and select the startup time.

5) **Set the timing properties**->set the timing related specifications for the scenario such as duration, initialization, ramp up, ramp down

6) Create a **schedule external events**->define delays and external events and schedule them at the desired points. This setting only applies to expert event   I mode.

Basic Time- Event Mode

The Basic time- event mode lets you schedule groups based on time. You configure the properties for each group separately.

The available properties are Duration, Initializing, Ramp Up, and Ramp Down.

Duration: The amount of time the current group participates in the scenario.

Initializing: the number of Vusers to initialize to the ready state during the specified time interval, this emulates a logon procedure usually done once a day.

Ramp Up: The pace at which Vusers run this script (i.e. Transition from Ready to Run state). This usually emulates actions that are repeated multiple times.

Ramp down: The pace at which Vusers are terminated, this setting is only available if the group is set to run for a fixed duration.

Expert Time- Event Mode

The Expert Time- Event mode provides additional scheduling capabilities:

- Dependencies
- Sequencing
- Command Events
- Delay Events

Defining External Events

The LoadRunner Scheduler allows us to schedule external events or tasks not included in our Vuser script

Two types of external events:

- Command Events
- Delay Events

Note: To create external events you must enable the Expert event mode.

Command Events

A Command event is an external task that must be executed during the scenario. For example, you may need to initialize a system, restore a database, or start a monitor during a scenario run.

Before scheduling a Command event, you must define a list of commands. These commands can either be an executable program or a batch file. When you schedule multiple commands, you can indicate whether to execute them in parallel or sequentially.

In normal operation, the scheduler waits until all of the commands in the list have been completed before continuing with the next scheduled group or event.

To create a Command event:

1. Verify that you are working in Expert mode.

      To enable Expert mode, select **View > Scheduler Layout > Expert Time**-Event in the LoadRunner Scheduler window.

2. Choose **Edit > Create Command Event** or click the Create Command Event button. The Command Properties dialog box opens.

3. Specify an alias name for the list of command events in the Alias box.

4. Click the Browse button near the Command- line operation box and locate a batch or executable file.

5. Click Add to add the event to the list. Repeat the above steps for all the commands you need to execute.

6. By default, the Scheduler executes the commands sequentially. To run the commands simultaneously, select Execute commands in parallel.

7. Clicks **OK**.

8. To schedule an event choose **Schedule > Schedule Event** or click on the **Add Group** button. The Select Event and Start Time dialog box opens. Select the event you want to schedule and specify a start time.

Delay Events

      To insert a delay into your scenario, you schedule a *Delay* event. This event instructs LoadRunner to wait the specified amount of time before resuming with the next action. The delay may be a fixed or random value. This feature may be useful if you want to wait for your system to stabilize before continuing. Unlike groups, Delay events are reusable. You can include the same delay in multiple locations in the scenario schedule.

To Create a Delay event:

1. Verify that you are working in **Expert mode**.

      To enable Expert mode, select **View > Scheduler Layout > Expert Time**-Event in the Load Runner Scheduler window.

2. Choose **Edit > Create Delay Event** or click the Create **Delay** Event button. The Delay Properties dialog box opens.

3. Specify an alias name for the Delay event in the Alias box.

4. To wait a fixed amount of time between events, select Wait for fixed amount of time and specify time duration.

5. To wait a random amount of time between events, select Wait a random delay and specify a minimum and maximum for the random value.
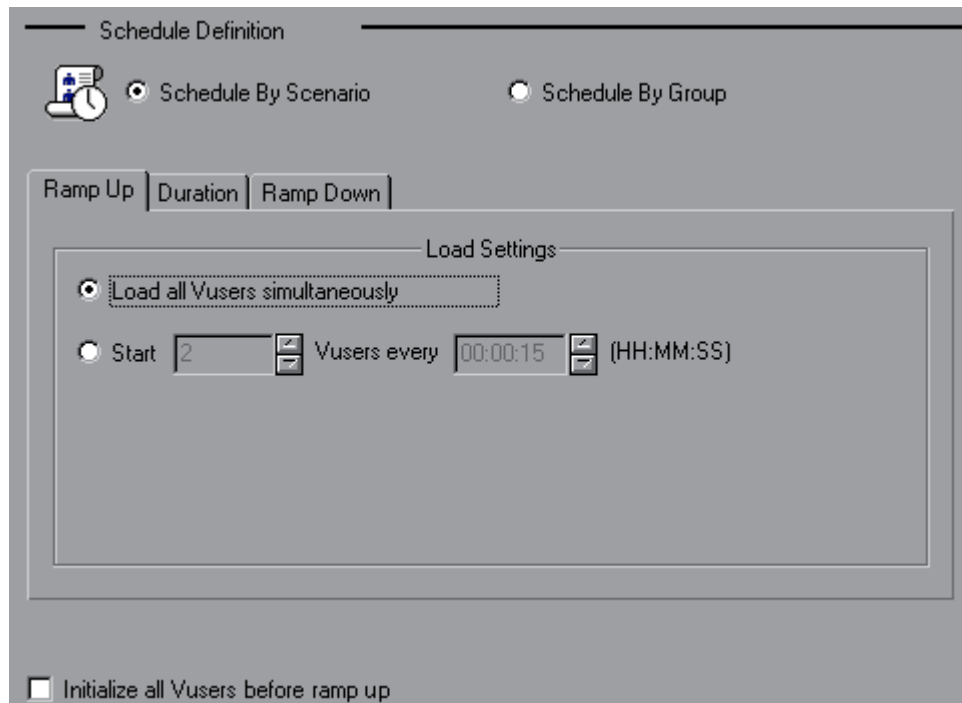
6. Click **OK**.

Scheduling a Scenario Using the Schedule Builder

      you can control the execution of your scenario by:

- Limiting the scenario duration
- Gradually running Vusers within a scenario
- Gradually stopping Vusers within a scenario

To set the scheduling options for a scenario:

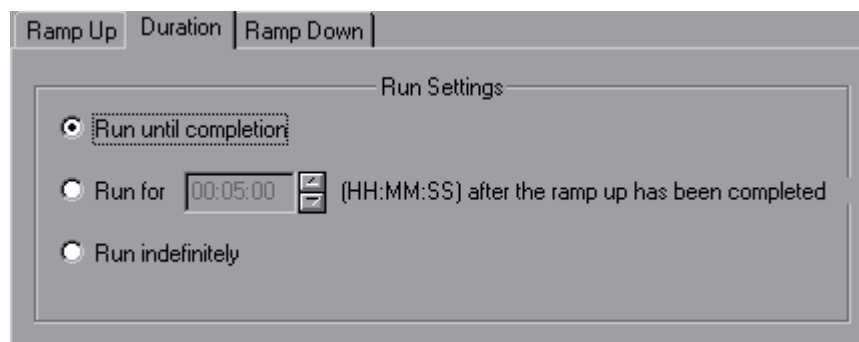1. Select the Schedule By Scenario option.

2. To determine how to start the scenario, click the **Ramp Up tab**.

Choose one of the following options:

- Load all Vusers simultaneously: Starts all the Vusers in the scenario at once.

- Start X Vusers every X (HH:MM:SS): Begins running the specified number of Vusers concurrently, and waits the specified time between Vuser ramp ups.
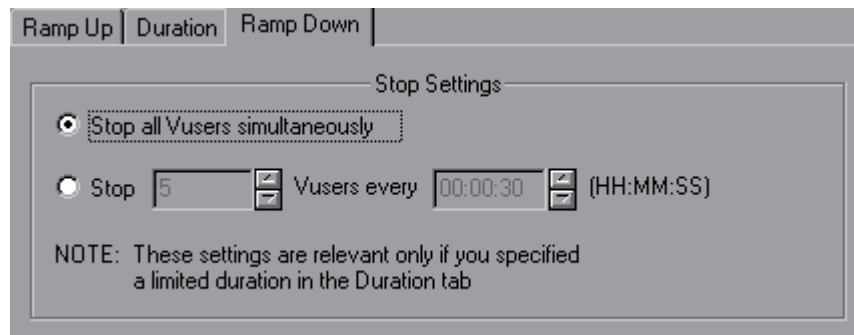
3. To set the duration of the scenario, click the **Duration tab**.

Choose one of the following options:

- Run until completion
- Run for X (HH:MM:SS) after the ramp up has been completed: Runs the scenario for a specified amount of time, once all the Vusers have been ramped up.
- Run indefinitely

4. To determine how to stop the scenario, click the **Ramp Down tab**.

Choose one of the following options:

- Stop all Vusers simultaneously: Stops all the Vusers in the scenario at once.
- Stop X Vusers every X (HH:MM:SS): Stops a certain number of Vusers within a specified time frame.

5. To instruct LoadRunner to initialize Vusers before beginning to load them, select Initialize all Vusers before ramp up.

Note that LoadRunner will only begin to load the Vusers once they have all reached the READY state.

6. Click **OK** to close the Schedule Builder and save your settings.

Scheduling Vuser Groups

After you create a Vuser group, you can schedule the group's script execution by setting:

- The amount of time after the start of the scenario that the group must wait before it starts running.
- The number of Vusers that will run within a specified period of time.
- The number of Vusers that will be stopped within a specified period of time.
- The amount of time the group will run.

To schedule a Vuser Group:

1. Select the **Scheduling By Group** option.
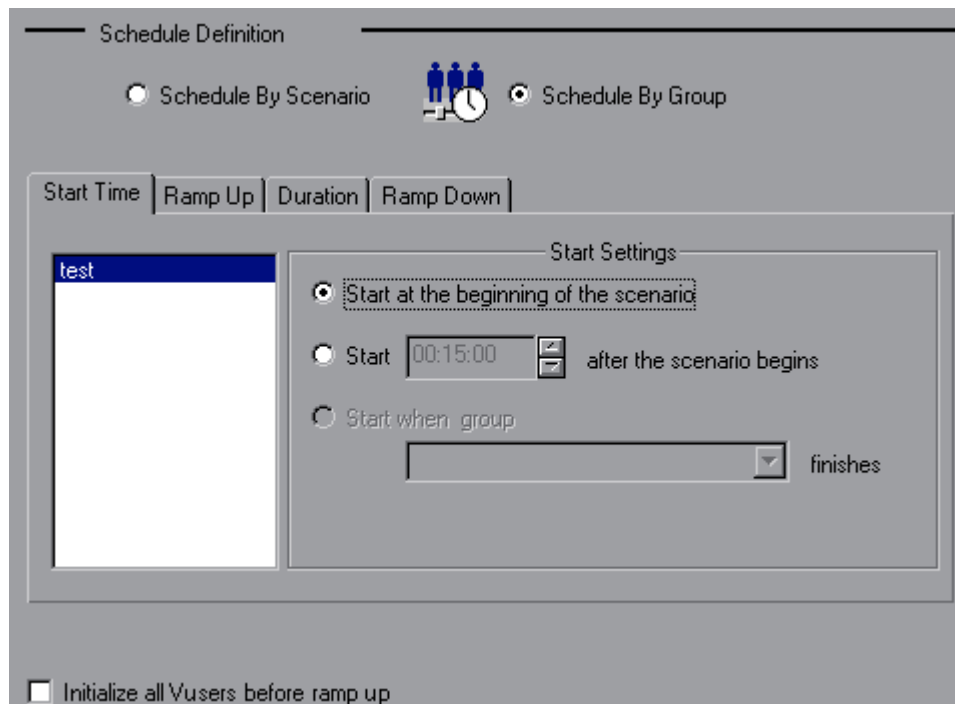
2. Select a group from the box on the left.

3. To set the start time for the group, click the **Start Time tab**.

Choose one of the following three options:

- Start the group at the beginning of the scenario
- Start X after the scenario begins: Waits the specified amount of time before running the group.
- Start when group X finishes: Begins running the group after the specified group has finished running.
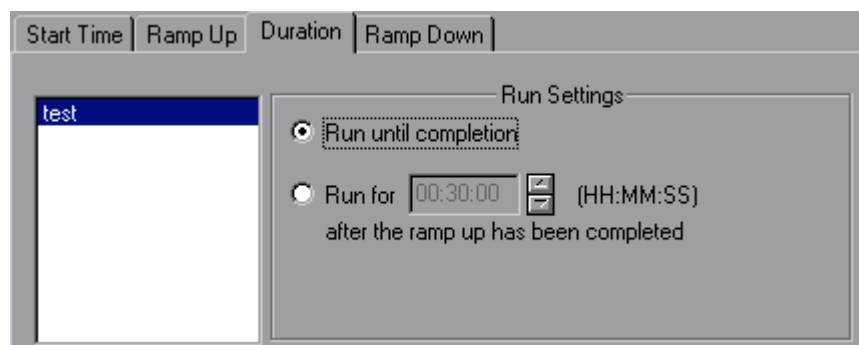
4. To set the ramp up for the group, click the **Ramp Up** tab.
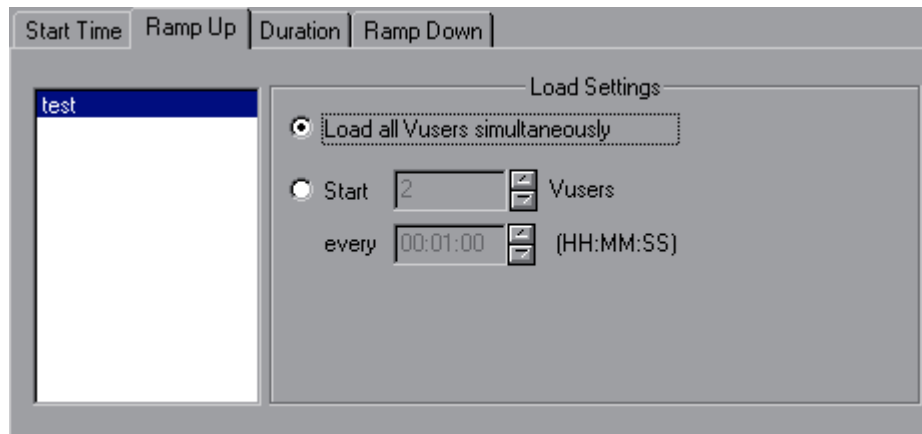
Choose one of the following options:

- Load all of the Vusers simultaneously: Starts all the Vusers in the at once.

- Start X Vusers every X (HH:MM:SS): Begins running the specified number of Vusers concurrently, and waits the specified time between Vuser Ramp Up.
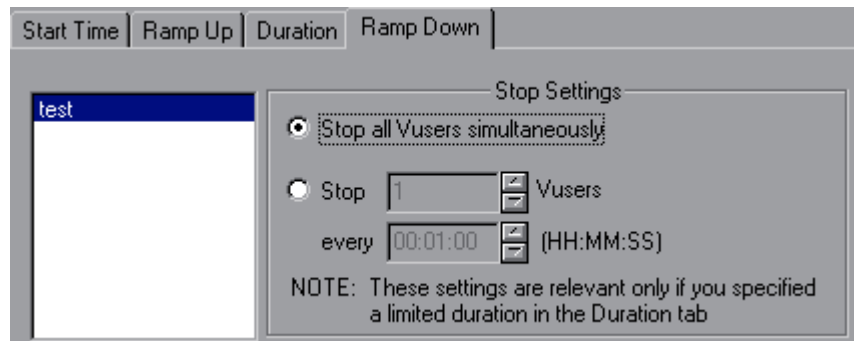
5. To set the duration of the group, click the **Duration** tab.

Choose one of the following options:

- Run until completion

- Run for X (HH:MM:SS) after the ramp has been completed: Runs the group for the specified amount of time, once all the Vusers have been ramped up.

6. To determine how to stop the Vuser group, click the **Ramp Down** tab.

Choose one of the following options:

- Stop all Vusers simultaneously: Stops all the Vusers in the group at once.

- Stop X Vusers every X (HH:MM:SS): Stops a certain number of Vusers within a specified time frame.

7. Click OK to close the Schedule Builder and save your settings.

Monitoring a Scenario

Monitoring scenario execution using the LoadRunner online transaction, Web server resource, Database server resource and Java performance monitors.

The following describes the online monitor user interface:

- Starting the Monitors.

- Configuring Online Monitors.

- Setting Monitor Options.

- Configuring Online Graphs.

- Configuring Online Measurements.

- Exporting Online Monitor Graphs.

- Viewing Data Offline

Online Monitoring

LoadRunner provides the following online monitors:

- **Run-Time** monitor displays the number and status of Vusers participating in the scenario, as well as the number and types of errors that the Vusers generate. It also provides the User-Defined Data Point graph that displays the real-time values for user-defined points in a Vuser script.

- **Transaction** monitor displays the transaction rate and response time during scenario execution.

- **Web Resource** monitors measures statistics at the Web server(s) during scenario runs. It provides information about the number of Web connections, throughput volume, HTTP responses, server retries, and downloaded pages during the scenario.

- **Network Delay** monitor displays information about the network delays on your system. To activate the Network Delay monitor, you must set up the network paths to monitor before you run your scenario.

- The **Firewall** monitor measures statistics at the firewall servers during the scenario. To activate the Firewall monitor, you must set up a list of resources to monitor before you run your scenario.

- The **Database Server Resource** monitors measure statistics related to the SQL server, Oracle, Sybase, and DB2 databases. To activate the Database Server Resource monitors, you must set up a list of measurements to monitor before you run your scenario.

- The **Streaming Media** monitors measure statistics at the Windows Media Server and RealPlayer audio/video servers, as well as the RealPlayer client. To activate the Streaming Media monitors, you must set up a list of resources to monitor before you run your scenario.

- The **ERP Server Resource** monitor measures statistics at the ERP servers during the scenario. To activate the ERP Server Resource monitor, you must set up a list of resources to monitor before you run your scenario.

- The **Java Performance** monitors measure statistics of Enterprise Java Bean (EJB) objects and Java-based applications, using EJB, JProbe, Sitraka JMonitor, and TowerJ Java virtual machines. To activate the Java Performance monitors, you must set up lists of resources to monitor before you run your scenario.

Starting the Monitors

To start the online monitors:

1. Start the scenario. Select the Vuser groups you want to run and click the **Start Scenario** button, or choose **Scenario** > **Start**.

2. Click the **Run tab**. The default graphs are displayed below the Scenario Groups window.
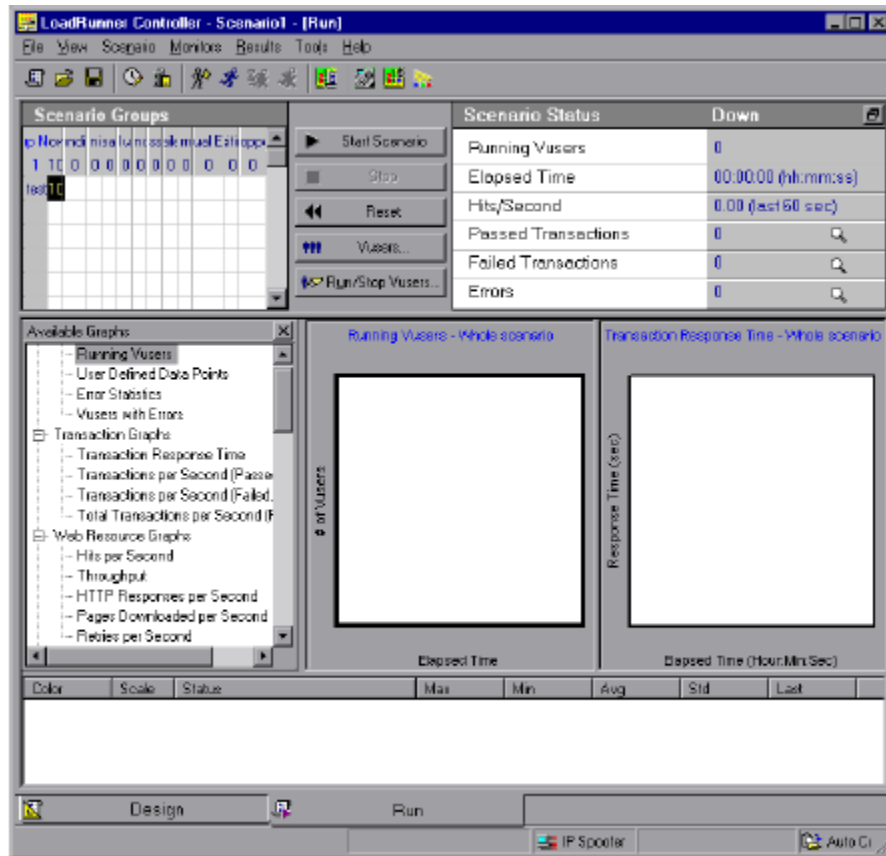
3. Double-click a graph to maximize it. Repeat the operation to restore the tiled view.

4. Click the "+" in the left pane to expand the graph tree. To hide the graph tree view, select **View > Hide Available Graphs**, or click the **X** button in the right-hand corner of the Available Graphs list.

5. Select a graph from the tree and drag it into the right pane. You can also drag graphs between panes.

Configuring Online Monitors

Using LoadRunner it is possible to configure the settings for your online monitors. And also, we can set graph measurements and properties, such as the sampling time, the colors of the lines, and the scale of the graph.

Monitor options: global sampling rate, error handling, debugging, and the frequency settings.

Graph properties: refresh rate, display type, graph time for the x-axis, and the y-axis scale.

Measurement settings: line color, scale of the y-axis, and whether to show or hide the line.
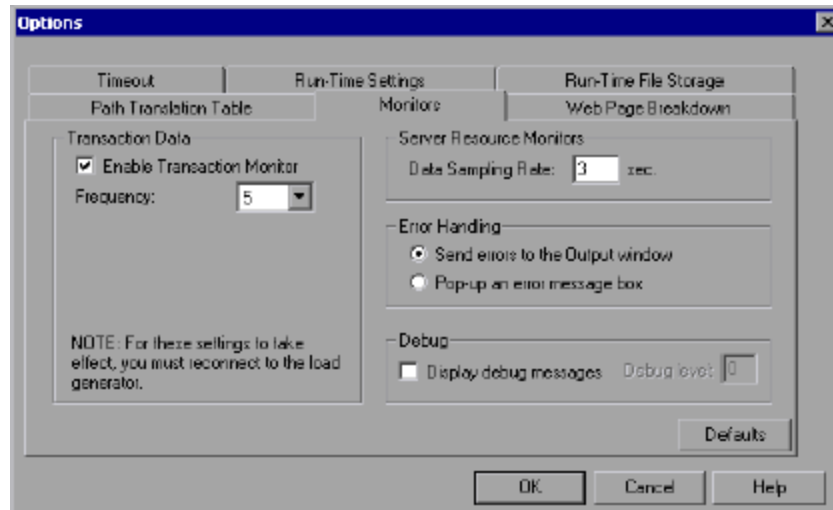
Setting Monitor Options

Before running your scenario, you can set monitor options in the following areas:

- **Sampling Rate:** The sampling rate is the period of time (in seconds) between consecutive samples. By default, the online monitor samples the data at intervals of three seconds. If you increase the sampling rate, the data is monitored less frequently. This setting applies to all graphs.

- **Error Handling:** You indicate how LoadRunner should behave when a monitor error occurs—issue a popup message box (default) or send error messages to the Output window.

- **Debug:** The online monitor provides debugging capabilities. It displays the debug messages in the output log. For the Network monitor, you can indicate the debug (detail) level of messages sent to the log, ranging from 1-9.

- **Frequency:** You set the frequency at which the monitor sends updates to the Controller for the Transaction, Data Point, and Web Resource graphs. The data is averaged for the frequency period defined, and only one value is sent to the Controller.

To set monitor options:

1. Select **Tools** > **Options** and select the **Monitors** tab.

2. Specify the frequency at which the monitor should send updates to the Controller for the Transaction, Data Point, and Web Resource graphs. The default value is 5 seconds. For a small scenario, it is recommended that you use a frequency of 1. For a large scenario, it is recommended that you use a frequency of 3-5.

3. Enter a sampling rate.

4. Set the desired **Error** Handling option.

5. To display debug messages in the Output window, select the **Display Debug Messages** check box. For the Network monitor, specify a **Debug level** from 1-9.

6 Click **OK** to save your settings and close the Options dialog box.

Configuring Online Graphs

You can customize your graph in the following areas:

- **Refresh Rate :** The refresh rate is the interval in 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.

- **X-Axis Style :** By using this it is possible to displays the x-axis time: *Don't Show*, *Clock Time*, or *Relative to Scenario Start*. The *Don't Show* setting instructs LoadRunner not to display values for the x-axis. The *Clock Time* setting displays the absolute time, based on the system clock. The *Relative to Scenario Start* setting displays the time relative to the beginning of the scenario.

In the following example, the graph is shown with the *Don't Show* and *Clock Time* options:

Don't Show   Clock Time
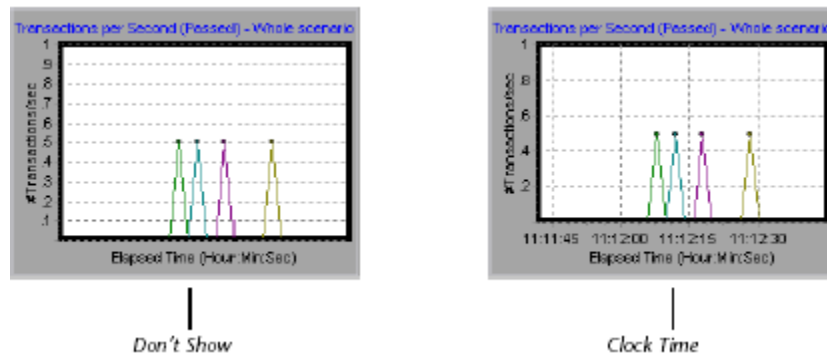
- **Graph Time :** The Graph Time settings indicate the scale for a graph's x-axis when it is time-based. A graph can show 60 or 3600 seconds of activity. To see the graph in greater detail, decrease the graph time. To view the performance over a longer period of time, increase the graph time. The available graph times are: *Whole scenario*, *60*, *180*, *600*, and *3600* seconds.

- **Display Type :** You can specify whether LoadRunner displays the Network Delay Time graph as a line, pie, or area graph. By default, the graph is displayed as a line graph.

- **Y-Axis Style** You can instruct LoadRunner to display graphs using the default y-axis scale, or you can specify a different y-axis scale. Click **Automatic** if you want LoadRunner to use the default y-axis values.

To customize your graphs:

1. Select the online graph you want to configure (in either the right or left pane) and choose **Monitors > Online Graphs** > **Configure**. Alternatively, right-click a graph and select **Configure**. The Graph Configuration dialog box opens.

2. To apply the dialog box settings to all graphs, select **Apply to all graphs**.

3. Enter the desired refresh rate—the time between graph updates—in the Refresh Rate box.

**4.** Select a style for the x-axis from the Time box.
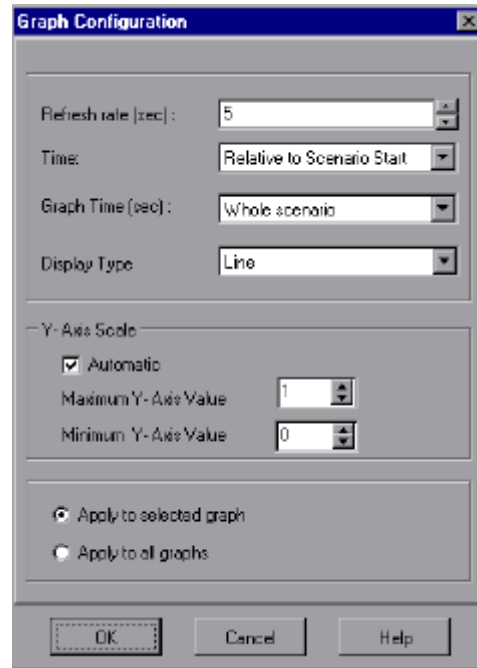
5. Select a value from the Graph Time box. The graph time is the time in seconds displayed by the x-axis.

6. For the Network Delay Time graph, select a graph style (Line, Pie, or Area) from the Display Type box.

7. Select a maximum or minimum value for the y-axis, or choose **Automatic** to view graphs using the default y-axis scale.

8. Click **OK** to save your settings and close the Graph Configuration dialog box.

Configuring Online Measurements

You can configure the following online measurement settings:

- **Changing Line Colors:** LoadRunner assigns a unique color to each measurement. You can modify the color using the configuration interface.

- **Setting the Scale of the Measurement :** You can modify the scale of a measurement—the relationship between the y-axis and the graph's actual value. For example, a scale set at 1 indicates that the measurement's value is the value of the y-axis. If you choose a scale of 10, you must divide the y-axis value by 10 to obtain the true value of the measurement.

In the following example, the same graph is displayed with a scale of 1 and 10.
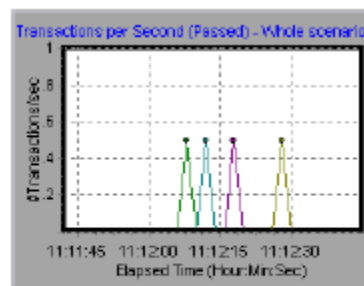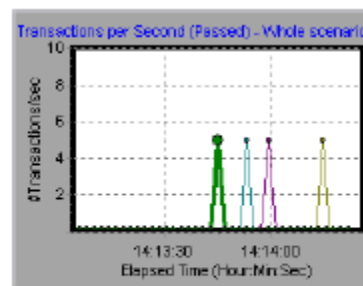
scale = 1   scale = 10

- **Showing and hiding resources :** By default, the resource monitor displays a line for each item in the resource list. You can hide the line for any of the monitored resources in order to focus on a specific measurement and scale factor.

Exporting Online Monitor Graphs

LoadRunner allows you to export the online graph to HTML for viewing at a later stage. When you export to HTML, the legend is also displayed with the graph. You can export all graphs or only the selected one.

To export online graphs to HTML:

1. To export a specific graph, select the graph you want to export and choose **Monitors > Online Graphs > Export to** HTML. The Select Filename and Path dialog box opens.

2. To export all graphs in the Online Monitor view, choose **Monitors > Export Online Graphs to HTML.** The Select Filename and Path dialog box opens.

3. Specify a filename and path and click **Save**.

Viewing Data Offline

After monitoring resources during a scenario run, you can view a graph of the data that was gathered using the LoadRunner Analysis. When you run the Analysis utility, it processes the data and generates a graph for each measurement that was monitored.

LoadRunner Analysis

During scenario execution, Vusers generates results of data as they perform their transactions. To monitor the scenario performance *during* test execution, use the online monitoring tools. To view a summary of the results *after* test execution, you can use one or more of the following tools:

- **Vuser log files** contain a full trace of the scenario run for each Vuser. These files are located in the scenario results directory. (When you run a Vuser script in standalone mode, these files are placed in the Vuser script directory.)

- **Controller Output window** displays information about the scenario run. If your scenario run fails, look for debug information in this window.

- **Analysis graphs** help you determine system performance and provide information about transactions and Vusers. You can compare multiple graphs by combining results from several scenarios or merging several graphs into one.

- **Graph Data** and **Raw Data** views display the actual data used to generate the graph in a spreadsheet format. You can copy this data into external spreadsheet applications for further processing.

- **Report utilities** enable you to view a Summary HTML report for each graph or a variety of Performance and Activity reports.

Starting the Analysis

The analysis is the LoadRunner component that processes results gathered during a scenario execution and generates graphs and reports. You can open the Analysis through the LoadRunner program group as an independent application, or directly from the Controller.

- To open the new Analysis utility as an **independent application**, choose **Analysis** from the **LoadRunner Program Group**

- To open the Analysis directly from the **Controller**, select **Results > Analyze Results**. This option is only available after running a scenario.

Collating Execution Results

When you run a scenario, by default all Vuser information is stored locally on each Vuser host. After scenario execution the results are automatically *collated* or consolidated—results from all of the hosts are transferred to the results directory.

Disabling automatic collation, by choosing **Results > Auto Collate Results** from the Controller window, to clear the check mark adjacent to the option.

To manually collate results, choose **Results > Collate Results**. If your results have not been collated, the Analysis will automatically collate the results before generating the analysis data.

Viewing Summary Data

In large scenarios, with results exceeding 100 MBs, it can take a while for the Analysis to process the data. While LoadRunner is processing the complete data, you can view a summary of the data collected.

To view the summary data, choose **Tools > Options**, and select the **Result Collection tab**. Select **Display summary** data while generating complete data if you want the Analysis to process the complete data graphs while you view the summary data, or select Generate summary data only if you do not want LoadRunner to process the complete Analysis data.

Note : The following graphs are not available when viewing summary data only: Rendezvous, Data Point (Sum), Web Page Breakdown, Network Monitor, and Error graphs.

Analysis Graphs

The Analysis graphs are divided into the following categories:

- **Vuser graphs** display information about Vuser states and other Vuser statistics.

- **Error graphs** provide information about the errors that occurred during the scenario.

- **Transaction graphs** provide information about transaction performance and response time.

- **Web Resource graphs** provide information about the throughput, hits per second, HTTP responses per second, number of retries per second, and downloaded pages per second for Web Vusers.

- **Web Page Breakdown graphs** provide information about the size and download time of each Web page component.

- **User-Defined Data Point graphs** display information about the custom data points that were gathered by the online monitor.

- **System Resource graphs** show statistics relating to the system resources that were monitored during the scenario using the online monitor.

Working with Analysis Graphs

The Analysis provides a number of utilities that enable you to customize the graphs in your session so that you can view the data displayed in the most effective way possible.

Using the Analysis utilities, you can determine :

- Point's coordinates or drill down on a graph.
- Enlarge a section of a graph.
- Change the granularity of a graph's x-axis.
- View a graph's data as a spreadsheet or as raw data.

Determining a Point's Coordinates

You can determine the coordinates and values at specific points in a graph. Place the cursor over the point you want to evaluate. The Analysis displays the axis values and other grouping information. The following figure represents the point's coordinates.
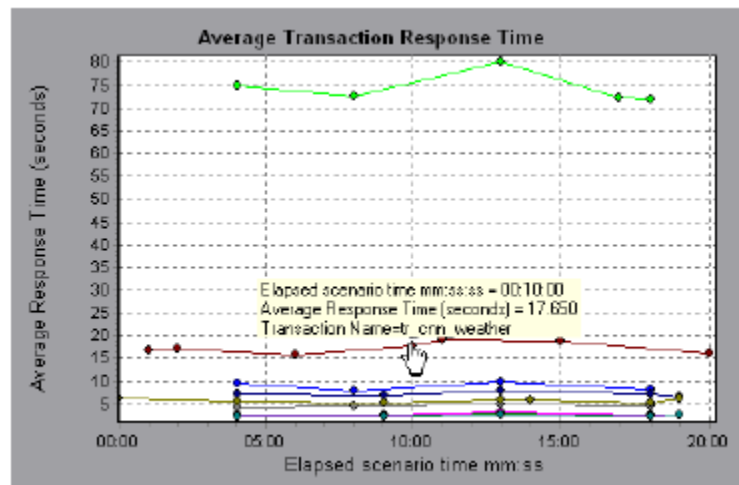
Enlarging a Section of a Graph

Graphs initially display data representing the entire duration of the scenario. You can enlarge any section of a graph to zoom in on a specific period of the scenario run. For example, if a scenario ran for ten minutes, you can enlarge and focus on the scenario events that occurred between the second and fifth minutes.

To zoom in on a section of the graph:

1. Click inside a graph.

2. Move the mouse pointer to the beginning of the section you want to enlarge, but not over a line of the graph.

3. Hold down the left mouse button and draw a box around the section you want to enlarge.

4. Release the left mouse button. The section is enlarged.

5. To restore the original view, choose **Clear Display Option** from the right click menu.

Changing the Granularity of the X-Axis

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

To change the granularity of a graph:

1. Click inside a graph.

2. Select **View** > **Set Granularity**, or click the **Set Granularity** button. The Granularity dialog box opens.
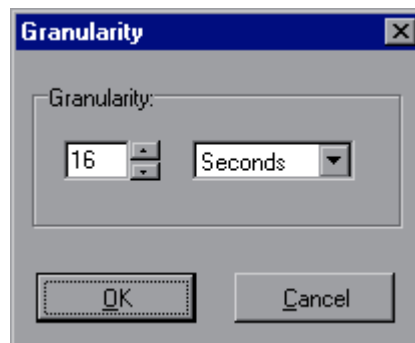

3. Enter a new granularity value in milliseconds, minutes, seconds, or hours.

4. Click **OK**.

For example, the Hits per Second graph is displayed using different granularities. The y-axis represents the number of hits per second within the granularity interval.

For a granularity of 1, the y-axis shows the number of hits per second for each one second period of the scenario.

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

For a granularity of 10, the y-axis shows the number of hits per second for every ten-second period of the scenario
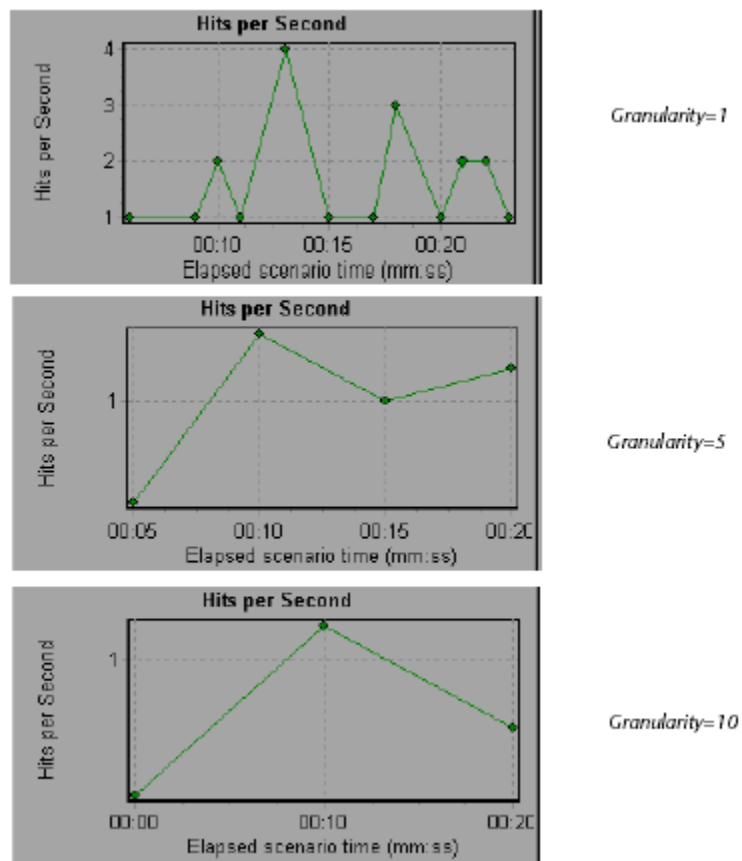
In the above graphs, the same scenario results are displayed in a granularity of 1, 5, and 10. The lower the granularity, the more detailed the results. For example, using a low granularity as in the upper graph, you see the intervals in which no hits occurred. It is useful to use a higher granularity to study the overall Vuser behavior throughout the scenario. By viewing the same graph with a higher granularity, you can easily see that overall, there was an average of approximately 1 hit per second.

Viewing the Data as a Spreadsheet and as Raw Data

The Analysis allows you to view graph data in two ways:

Spreadsheet View

You can view the graph displayed by the Analysis in spreadsheet format using the **Graph Data** tab below the graph.

Raw Data View

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

Viewing the raw data can be especially useful for:

- Determining specific details about a peak—for example, which Vuser was running the transaction that caused the peak value(s).

- Performing a complete export of unprocessed data for your own spreadsheet application.

Understanding Analysis Reports

After running a scenario, you can view reports that summarize your system's performance. The Analysis provides the following reporting tools:

- **Summary report:** The Summary report provides general information about the scenario run. You can view the Summary report at any time from the Analysis window.

- **HTML reports:** The Analysis creates an HTML report for each one of the open graphs.

- **Transaction reports:** Transaction reports provide performance information about the transactions defined within the Vuser scripts. These reports give you a statistical breakdown of your results and allow you to print and export the data.

Viewing Summary Reports

The Summary report provides general information about scenario execution. This report is always available from the tree view or as a tab in the Analysis window. It lists statistics about the scenario run and provides links to the following graphs: Running Vusers, Throughput, Hits Per Second, HTTP Responses per Second, Transaction Summary, and Average Transaction Response Time.

Creating HTML Reports

The Analysis lets you create HTML reports for your scenario run. It creates a separate report for each one of the open graphs and a Summary report. The Summary report is identical to the Summary report that you access from the Analysis window. The report also provides a link to an Excel file containing the graph data.

To create HTML reports:

1. Open all graphs that you want to be included in the report.

2. Choose **Reports > HTML Report** or click the **Create HTML Report** button. The Select Report Filename and Path dialog box opens.

3. Specify a path and file name for the HTML report and click **OK**.

4. To view an HTML report for one of the graphs, click on its link in the left frame.

5. To copy the HTML reports to another location, be sure to copy the filename and the folder with the same name. For example, if you named your HTML report *test1*, copy *test1.html* and the folder *test1* to the desired location.

Working with Transaction Reports

LoadRunner's Transaction reports are divided into the following categories:

- **Activity** reports provide information about the number of Vusers and the number of transactions executed during the scenario run. The available Activity reports are *Scenario Execution*, *Failed Transaction*, and *Failed Vusers*.

- **Performance** reports analyze Vuser performance and transaction times. The available Performance reports are *Data Point*, *Detailed Transaction*, and *Transaction Performance by Vuser*.

Note : In order to view a report, you must generate it from the Analysis window. LoadRunner reports are displayed in a Report Viewer. You can print, save, or export the data using the viewer.

Selecting and Displaying Reports

The Analysis provides several built-in reports which contain detailed summaries about the scenario, the transactions and Vusers.

To display a report:

1. Open the desired Analysis session file (.lra extension), or LoadRunner result file (.lrr extension), if it is not already open.

2. From the Reports menu choose a report. The report is generated and displayed. You can display multiple copies of the same report.

Scenario Execution Report

The Scenario Execution report is an Activity report that provides details about major events that occurred during the scenario run. This includes information on every Vuser, such as when it was ready to run and for how long it ran.

Group: g1

Vuser	Host	Ready At	Running At	Duration	Termination Status
Vuser1	10.1.1.30	14.52:58	14:53:30	00:05:43 (343sec)	Abort
Vuser2	10.1.1.30	14.52:58	14:53:30	00:05:43 (343sec)	Abort
Vuser3	10.1.1.30	14.52:58	14:53:30	00:05:43 (343sec)	Abort
Vuser4	10.1.1.30	14.52:58	14:53:30	00:05:43 (343sec)	Abort
Vuser5	10.1.1.30	14.52:58	14:53:30	00:05:43 (343sec)	Abort

Summary

Vusers: 5

Passed: 0   *Failed:*   0   *Error:*   0   *Stopped:*   5

Failed Transaction Report

The Failed Transaction report is an Activity report that provides details about the beginning time, end time, and duration of the failed, but completed transaction.

Failed Vuser Report

The Failed Vuser report is an Activity report that provides details about all Vusers that were in the ERROR, STOPPED, or DONE:FAILED states during the scenario execution. The *Ready At* and *Running At* times are relative to the computer's system clock.

Group: g2

Vuser	Host	Ready At	Running At	Duration	Termination Status
Vuser1	localhost	14.53:36	14:54:42	00:05:14 (314sec)	Abort
Vuser2	localhost	14.53:36	14:54:42	00:05:14 (314sec)	Abort
Vuser3	localhost	14.53:36	14:54:42	00:05:14 (314sec)	Abort
Vuser4	localhost	14.53:36	14:54:42	00:05:14 (314sec)	Abort
Vuser5	localhost	14.53:36	14:54:42	00:05:14 (314sec)	Abort

Summary

Vusers: 5

Failed: 0   *Error:*   0   *Stopped:*   5

In this scenario, all five Vusers were stopped.

Group: **g1**

Vuser : Vuser1

Transaction	Start time	End time	Duration
Apache_Server	14:58:36.117	14:58:37.319	00:00:01.202
Surf_Apache	14:58:33.043	14:58:37.319	00:00:04.276

Vuser : Vuser2

Transaction	Start time	End time	Duration
Apache_Server	14:58:35.265	14:58:37.328	00:00:02.063
Surf_Apache	14:58:24.810	14:58:37.328	00:00:12.518

Detailed Transaction Report

The Detailed Transaction (by Vuser) report is a Performance report that provides a list of all transactions executed by each Vuser during a scenario. The report provides details about the execution time of each transaction per Vuser.

The following values are reported:

Start time: the system time at the beginning of the transaction

End time: the actual system time at the end of the transaction, including the think time and wasted time.

Group: **zorb**

Vuser_id. 1

Transaction	Start time	End time	Duration	Think Time	Wasted Time	Result
end_section	14:07:59.029	14:08:00.045	00:00:01.016	00:00:01.016	00:00:00.000	Pass
General	14:05:27.748	14:06:06.482	00:00:38.518	00:00:21.715	00:00:00.116	Pass
General	14:06:06.482	14:07:02.701	00:00:37.104	00:00:21.716	00:00:19.115	Pass
General	14:07:02.701	14:07:59.029	00:00:37.212	00:00:21.715	00:00:19.116	Pass
mc_run	14:05:37.310	14:05:41.764	00:00:04.453	00:00:02.609	00:00:00.001	Pass
mc_run	14:06:16.045	14:06:20.248	00:00:04.202	00:00:02.609	00:00:00.001	Pass
mc_run	14:07:12.264	14:07:15.920	00:00:03.655	00:00:02.609	00:00:00.001	Pass

Duration: the duration of the transaction in the following format: hrs:minutes:seconds:milliseconds. This value includes think time, but does not include wasted time.

Think time: the Vuser's think time delay during the transaction.

Wasted time: the LoadRunner internal processing time not attributed to the transaction time or think time. (primarily RTE Vusers)

Results: the final transaction status, either Pass or Fail.