Predicting Application Deployment with Transaction Analyzer Models

AppTransaction Xpert includes predictive features that enable you to determine how network and application changes will affect application performance. This tutorial demonstrates how you can import traffic from AppTransaction Xpert to create a “virtual deployment” to test a proposed application’s performance. You will build a model and predict the performance of an application deployment to a large group of users.

Note—If you have an AppTransaction Xpert Plus license and want to run a discrete event simulation (DES), download and run IT Guru 16.0 or later. IT Guru will allow you to run DES using the AppTransaction Xpert Plus license.

The starting point is a series of transactions for a three-tier Oracle application; these transactions have been captured in a test lab using a local area network (LAN) environment. The requirement is to predict bandwidth needs and performance when this application is deployed on a wide area network (WAN).

The goal of this exercise is to answer the following questions:

1) What is the response time for a single user on the 256 Kbps Frame Relay circuit?

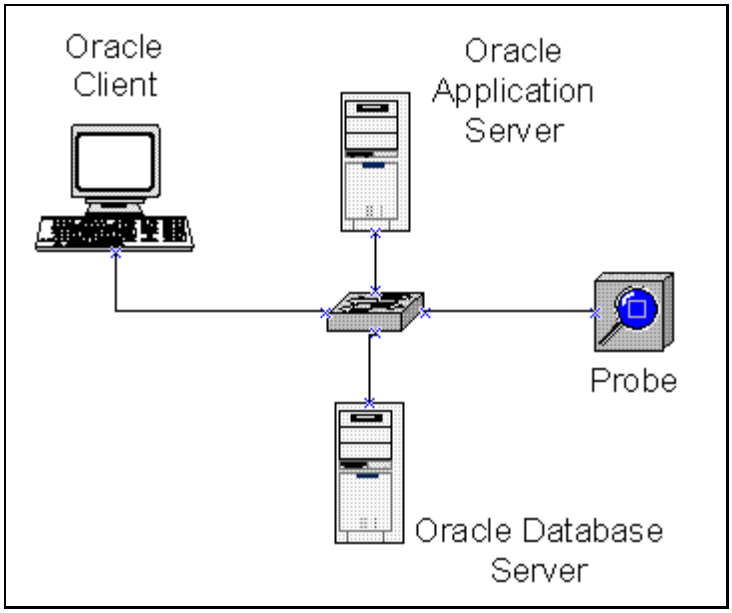
2) Can a 256 Kbps Frame Relay circuit support 200 users?

3) How much bandwidth will 200 users need?

4) With the existing traffic load on the circuit, will performance for 200 users be satisfactory?

The original packet traces were captured in a test lab where the application was deployed to a sample client machine on the same LAN as the Application and Database (DB) Servers.

Figure 4-1 Test Lab Topology



AppTransaction Xpert used the packet traces to create application fingerprints that characterize the data exchange between tiers. From these fingerprints, a simulation can show how the application will behave under different conditions.

Six separate transactions (Connect, Login, List Categories, Choose Category, View Record, and Logout) are used to build the application definition.

The Data Exchange Chart for each transaction is shown in the following figures.

Figure 4-2 Step 1: Connect

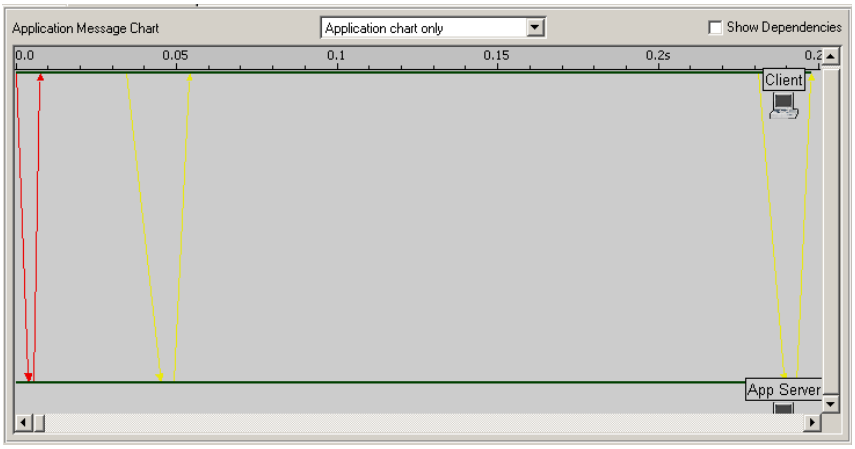


Figure 4-3 Step 2: Login

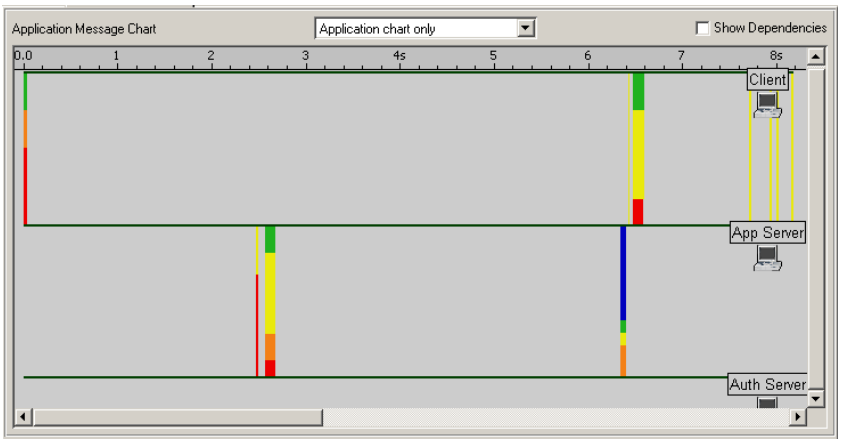


Figure 4-4 Step 3: List Categories

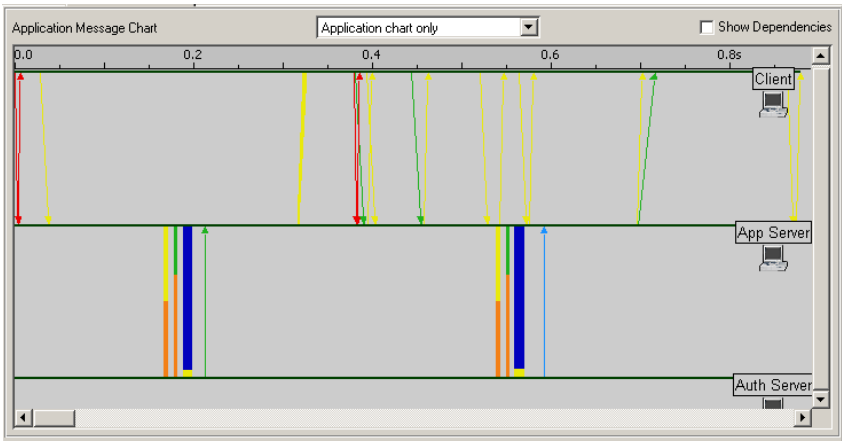


Figure 4-5 Step 4: Choose Category

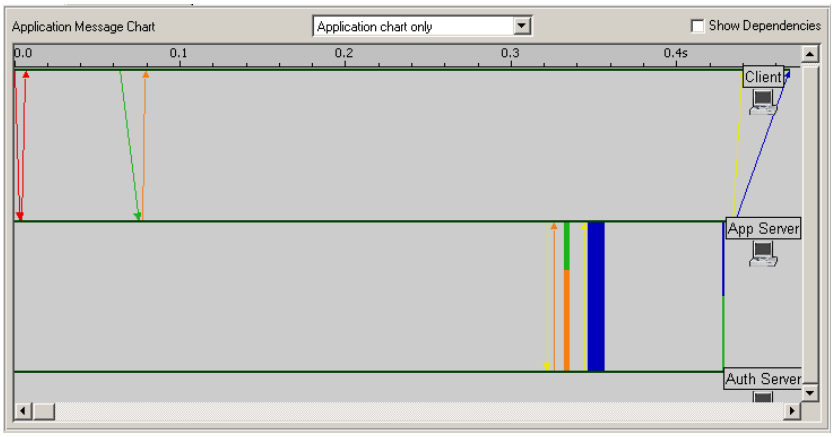


Figure 4-6 Step 5: View Record

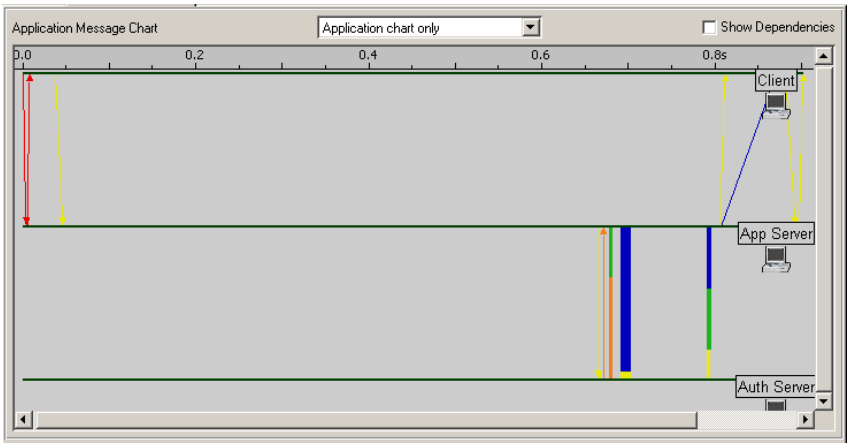
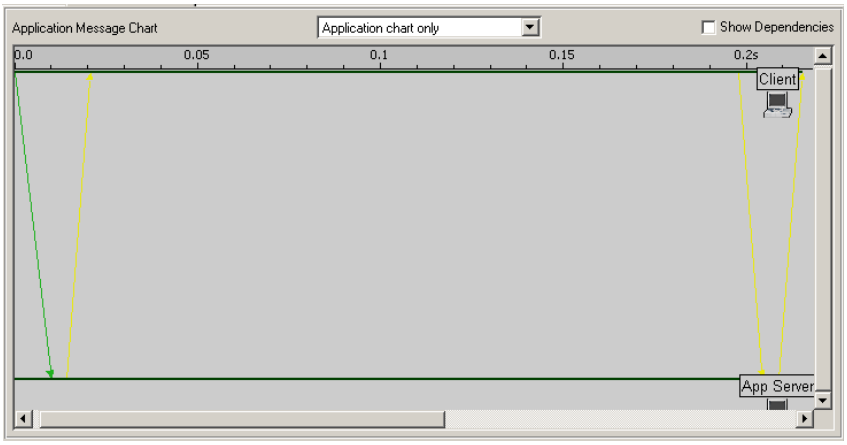


Figure 4-7 Step 6: Logout



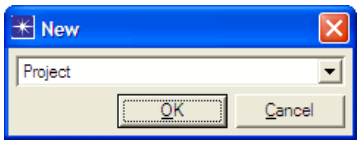
Import the Transaction Analyzer Model

Note—If you have an AppTransaction Xpert Plus license and want to run a discrete event simulation (DES), download and run IT Guru 16.0 or later. IT Guru will allow you to run DES using the AppTransaction Xpert Plus license.

The topology wizard builds network models from Transaction Analyzer models and defines settings that are specified during the import.

Procedure 4-1 Import the Transaction Analyzer Model into OPNET Analysis Software

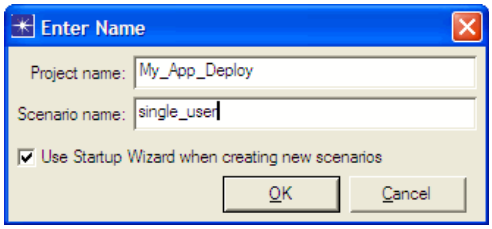
1 Open your OPNET analysis software (e.g.: IT Guru, SP Guru, OPNET Modeler), choose **File > New…**, select **Project** from the pull-down menu, and click **OK**.



2 Enter **<initials>_App_Deploy** as the project name. Name the scenario **single_user**.

Verify that the **Use Startup Wizard when creating new scenario** checkbox is selected. If not selected, click the checkbox to select it.

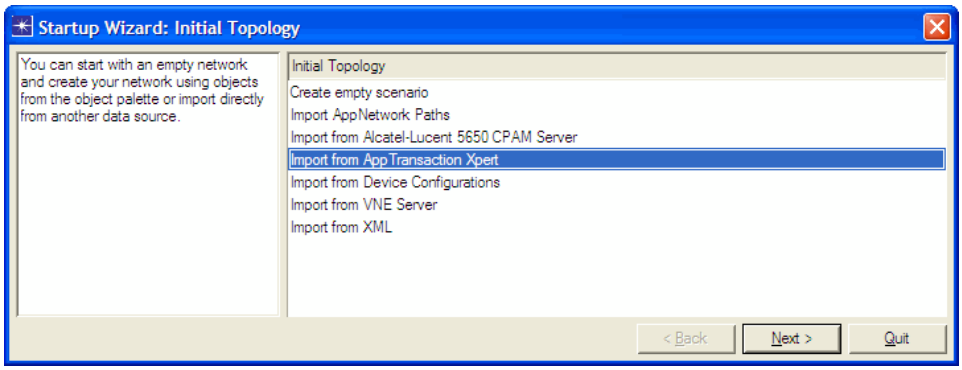
Click **OK**.



➥ The Startup Wizard appears.

3 In the “Startup Wizard: Initial Topology” dialog box, notice that you can import topologies from a variety of sources, including device configurations and XML files.

4 Select **Import from** AppTransaction Xpert. Click **Next >**.



End of Procedure 4-1

Configure the Application

Perform the following procedure to configure the application.

Procedure 4-2 Configuring the AppTransaction Xpert Application

1 Set the **Name** field to **Oracle Application**. This text string identifies the application in the model.

2 Set the **Repeat** field to **5**. This field controls how many times a user executes the application per hour.

3 Leave the limit at the default value, **Infinite**.

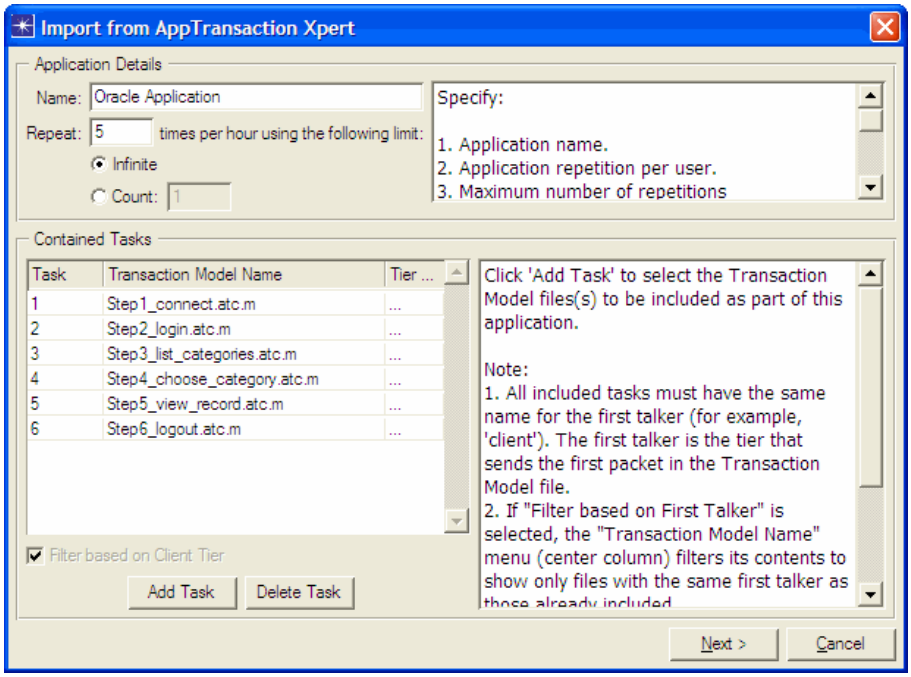
4 Click on **Add Task**. In the **Contained Tasks** table, click on the word **Specify...**, and then select **Step1_connect.atc.m** from the pull-down menu.

5 Repeat the previous step five more times to add the following tasks to the **Contained Tasks** list:

- **Step2_login.atc.m**
- **Step3_list_categories.atc.m**
- **Step4_choose_category.atc.m**
- **Step5_view_record.atc.m**
- **Step6_logout.atc.m**

The dialog box should look like the one shown in the following figure.

Figure 4-8 Import from AppTransaction Xpert Application Dialog Box



6 Click **Next >**.

End of Procedure 4-2

Create the Topology

Perform the following procedure to create the topology for one user of the application on a 256 Kbps Frame Relay circuit with 40 ms of latency.

Procedure 4-3 Create the Topology

1 In the **LAN Details** section of the dialog box, verify the following settings:

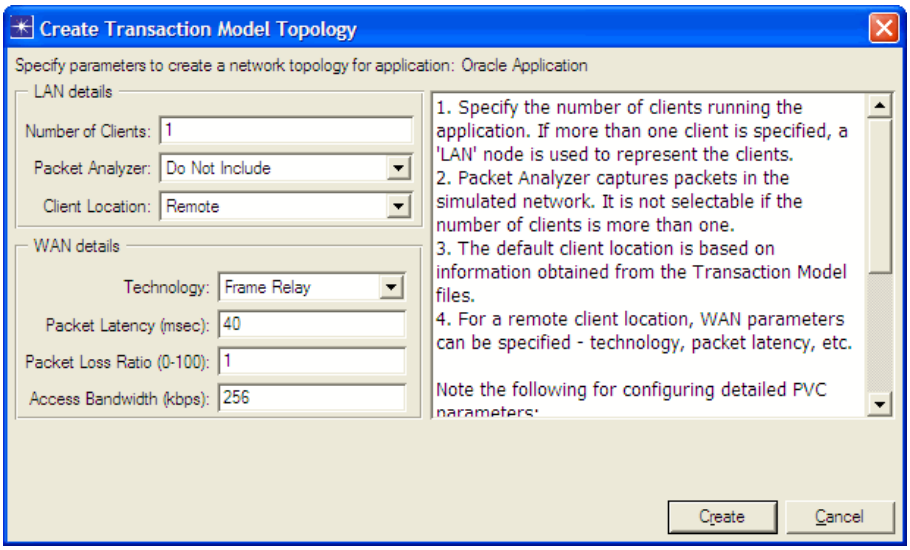
- Number of Clients: **1**
- Packet Analyzer: **Do Not Include**
- Client Location: **Remote**

2 In the **WAN Details** section of the dialog box, specify the following settings:

- Technology: **Frame Relay**
- Packet Latency: **40**
- Packet Loss Ratio: **1**
- Access Bandwidth: **256**

The dialog box should look like the one shown in the following figure.

Figure 4-9 Create AppTransaction Xpert Topology Dialog Box



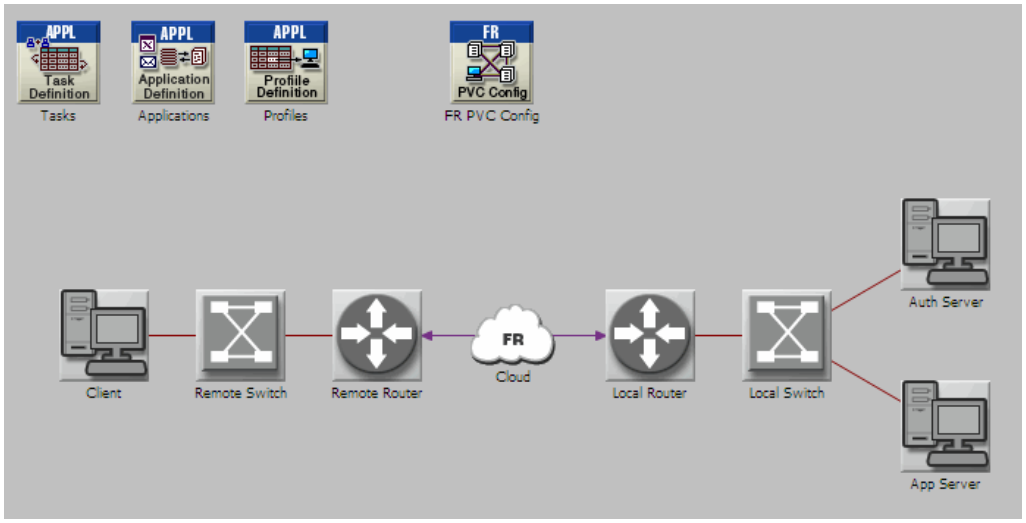
3 Click **Create**.

End of Procedure 4-3

Review the Model

The Wizard creates a topology similar to the one shown in the figure below. The Tasks, Applications, and Profiles objects have been configured according to the packet traces and the entries that you made in the Wizard. You can customize them further, if necessary.

Figure 4-10 Topology for One User Over 256 Kbps Frame Relay PVC



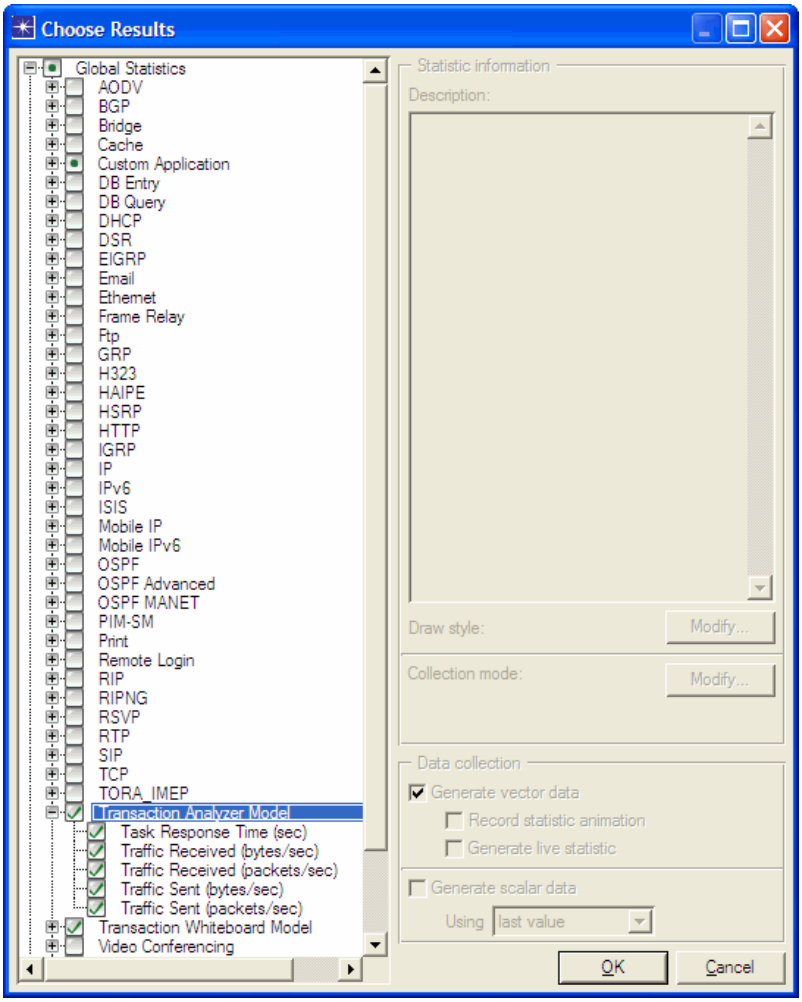
The topology consists of the Client, the Oracle App Server, and the Oracle Auth Server, which are assigned traffic profiles based on the imported Transaction Analyzer models. Access links connect switches and routers through a Frame Relay cloud.

The Wizard selects statistics that are commonly used in application deployment studies. You can select additional statistics or deselect statistics that are already selected.

Procedure 4-4 Selecting and Deselecting Statistics

1 To inspect the statistics that have been selected, choose **DES > Choose Individual Statistics…**

Figure 4-11 Statistics to be Collected by the Simulation



2 Examine the statistics that are available and the statistics that have been selected. Click **Cancel** when done.

3 Select **File > Save**, and then click **Save** to save the project.

End of Procedure 4-4

Run the Simulation

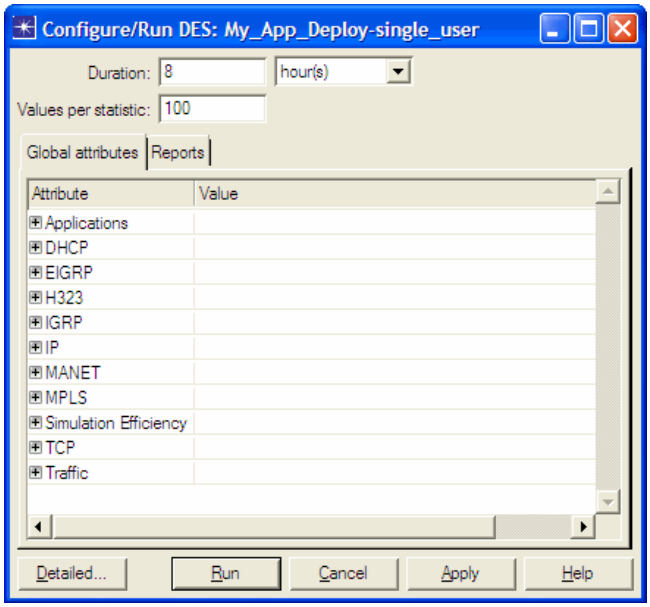
Now that the topology is created, you can run the simulation. The application will be activated five times per hour on a 256 Kbps Frame Relay circuit with 40 ms of latency.

Procedure 4-5 Running the Simulation

1 Click the **Configure/Run Discrete Event Simulation** toolbar button.

➥ The Configure Discrete Event Simulation dialog box appears. If the dialog box is in the **Detailed** view, click the **Simple** button in the lower-left corner.

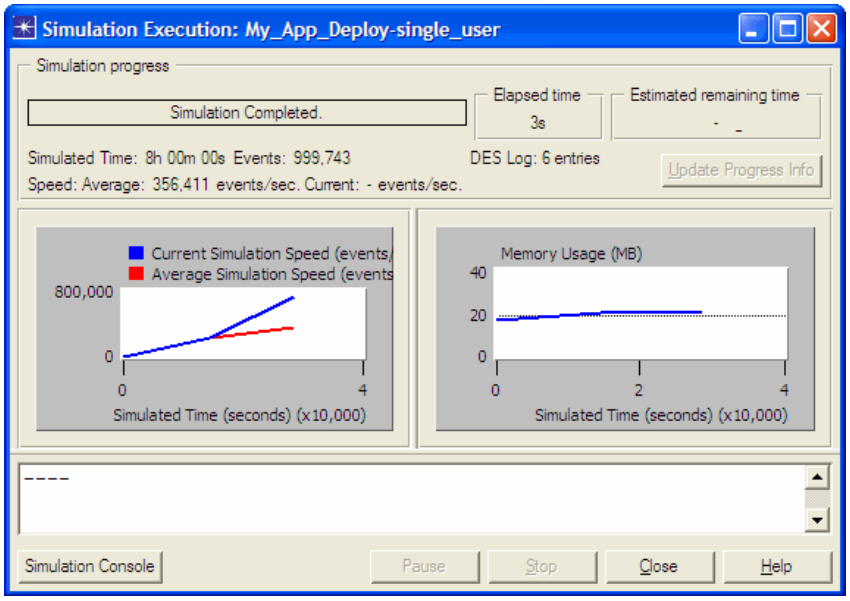
Figure 4-12 Configure Discrete Event Simulation Dialog Box



2 Set the **Duration** value to **8** hours. Keep the default values for all other fields, and then click **Run**.

3 Notice that the Simulation Execution dialog box provides a running update of the simulation as it progresses.

Figure 4-13 Simulation Execution Dialog Box



4 Close this dialog box when the simulation completes.

End of Procedure 4-5

View Results

Now view the response time for the individual tasks and the entire application.

Procedure 4-6 Viewing the Results

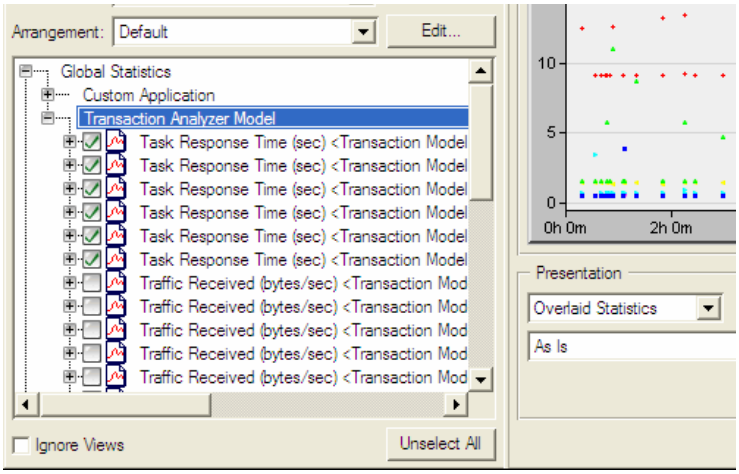
1 Click the **View Results** toolbar button.

➥ The **Results Browser** displays. The **Show results** panel in the lower-left corner provides a treeview for available statistics.

2 Expand the **Global Statistics** > **Transaction Analyzer Model** hierarchy by clicking on the **+** sign (arrow on Linux platforms) in the “Show results” pane. Scroll down and select the six **Task Response Time** statistics.

3 Set the view (pull-down menu under **Presentation**) for **Overlaid Statistics**.

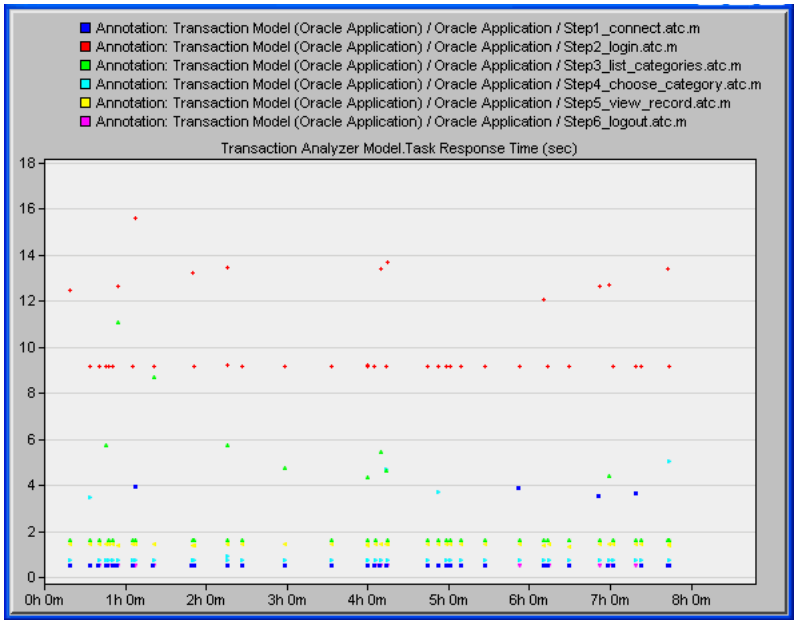
Figure 4-14 Select Statistics to View in a Graph



4 Click **Show**.

Note—Your results may be slightly different because the repetition rate is based on a random (exponential) distribution.

Figure 4-15 Response Time Statistics for the Individual Tasks



5 You see the response times of the individual tasks vary from about 0.5 seconds (**Step1_connect**) to over 10 seconds (**Step2_login**). You may see a different number of data points or a different start time. This occurs because the start time and repeatability are determined by exponential distributions.

6 In the Results Browser dialog box, click **Unselect All**.

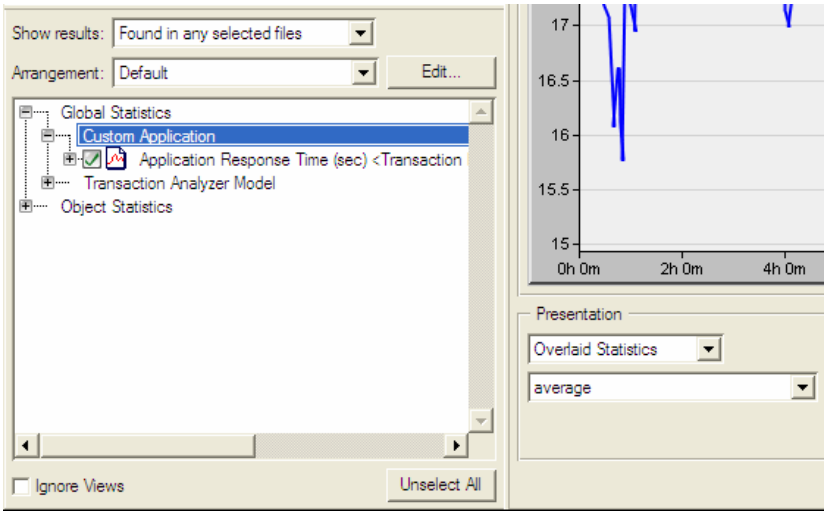
Now view the response time for the entire application.

7 Collapse the **Global Statistics > Transaction Analyzer Model** hierarchy by clicking on the **–** sign (< on Linux).

8 Expand the **Custom Application** hierarchy by clicking on the **+** sign, and then select the **Application Response Time (sec)** statistic.

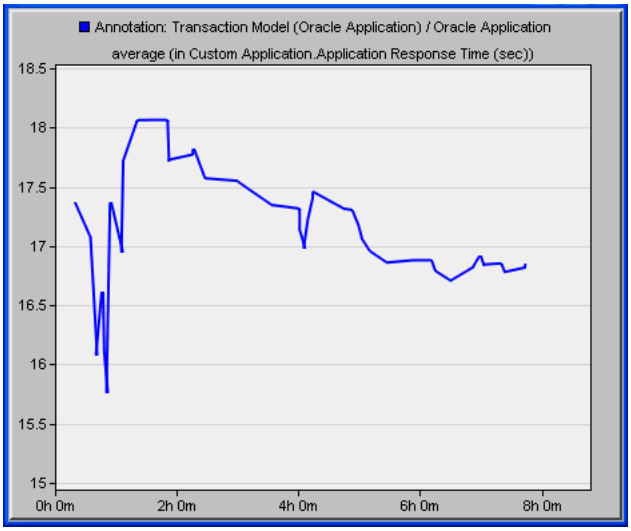
9 Change the filter menu from **As Is** to **average**.

Figure 4-16 Select the Application Response Time Statistic



10 Click **Show**.

Figure 4-17 Average Response Time for Entire Application



➥ The graph shows that the entire application had a response time of over 15 seconds. The application response time is the time it takes to complete all the tasks of the application.

You may see a shorter or longer curve (because the number of times the application repeats is based on a probability distribution) or a different start time.

Note—The outlier point that raises the average occurs because this model drops 1 percent of the packets on the Frame Relay cloud. Dropped packets cause TCP to retransmit; these retransmissions increase the average response time.

Now you can answer the first question posed in the Overview: the response time for a single user on the 256 Kbps circuit is over 16 seconds.

11 Close the graph panels and the Results Browser dialog box.

12 When prompted, click **Hide**.

This enables you to view the results later by clicking on the **Hide/Show Graph Panels** button.

13 Select **File > Save** to save the project.

End of Procedure 4-6

Simulate Multiple Users

Now that you know the response time for a single user, you want to see the response time for many simultaneous users over a Frame Relay circuit. You will create a new scenario that demonstrates the behavior of the application when deployed to 200 users.

Procedure 4-7 Simulating Multiple Users

1 Select **Scenario > Duplicate Scenario…**

2 Name the scenario **200_Users**, and then click **OK**.

3 Right-click on the client and choose **Edit Attributes (Advanced)**.

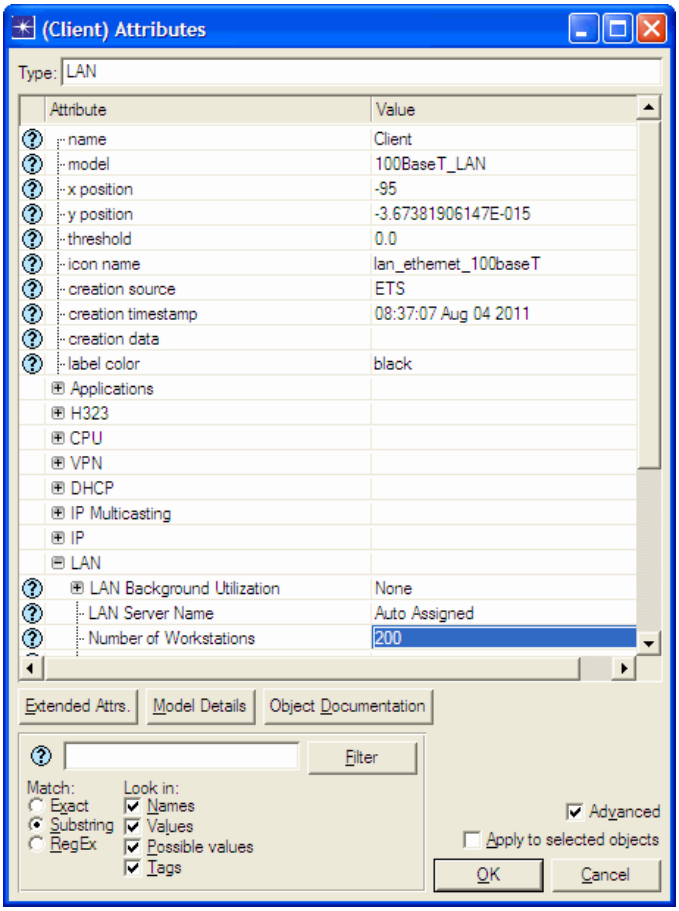
4 Change the model attribute from **ethernet_ace_wkstn** to **100BaseT_LAN**.

4.1 Click on the Model attribute value.

4.2 If a warning dialog box displays, select **Yes**.

4.3 From the pull-down list, select **100BaseT_LAN**.

5 Expand the LAN attribute: click on the **+** sign (arrow on Linux platforms). Change **Number of Workstations** from **10** to **200**. Click **OK** to close the window.



6 Click on the **Configure/Run Discrete Event Simulation** button. In the Configure/Run DES dialog box, change the **Duration** to **0.5** (hours). Click **Run**. This simulation may take a few minutes to complete.

7 Close the dialog box when the simulation completes.

End of Procedure 4-7

View Results for Multiple Users

Now you can look at the application behavior for 200 users.

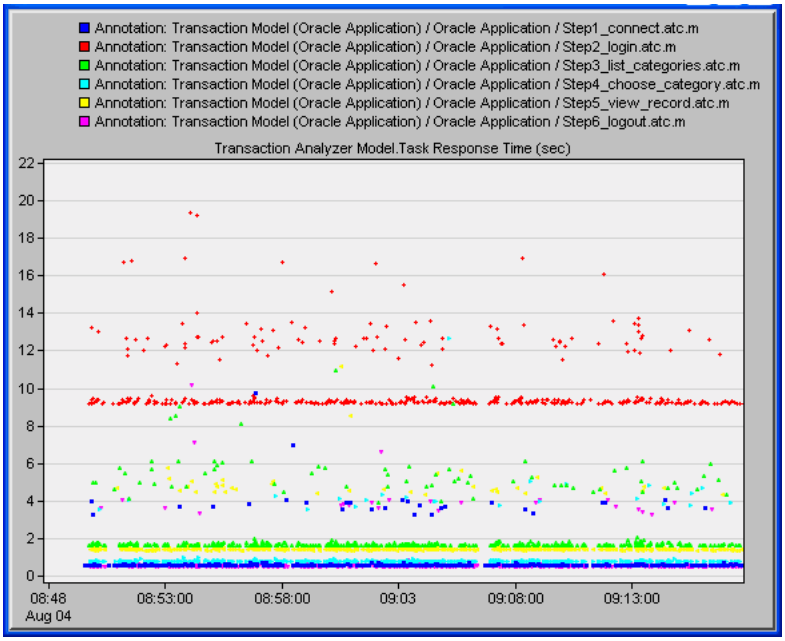
First, look at the global statistics for the tasks and application.

Procedure 4-8 Viewing Results for Multiple Users

1. Click the **View Results** toolbar button.
2. Expand the **Global Statistics > Transaction Analyzer Model** hierarchy. Scroll down and select the six **Task Response Time** statistics.
3. Set the view (left pull-down menu) for **Overlaid Statistics**.
4. Click **Show**.

   Note—The colors assigned to the statistics in the graph are determined by the order in which the statistics were selected in step 2; therefore, the colors in your graph may differ from the colors in the examples.

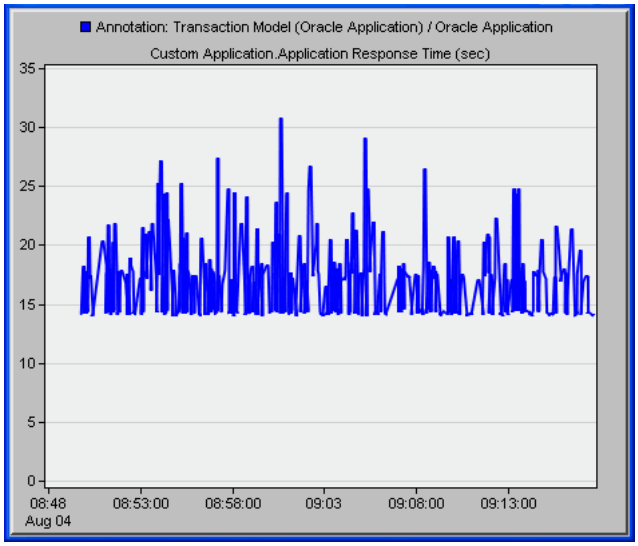
   Figure 4-18 Response Time Statistics for the Individual Tasks for 200 Users



5. In the View Results dialog box, click **Unselect All**.
6. Collapse the **Transaction Analyzer Model** hierarchy by clicking on the **–** sign.
7. Expand the **Custom Application** hierarchy, then select the **Application Response Time (sec)** statistic.

8 Click **Show**.

Figure 4-19 Response Time for Entire Application for 200 Users



Your graph might vary slightly from the figure above, but the trend should be similar.

The graph shows an average response time of over 15 seconds for 200 users; this is in the same range as the delay experienced by one user. You can verify the average by using the average filter.

9 Save the project and close the Results Browser dialog box.

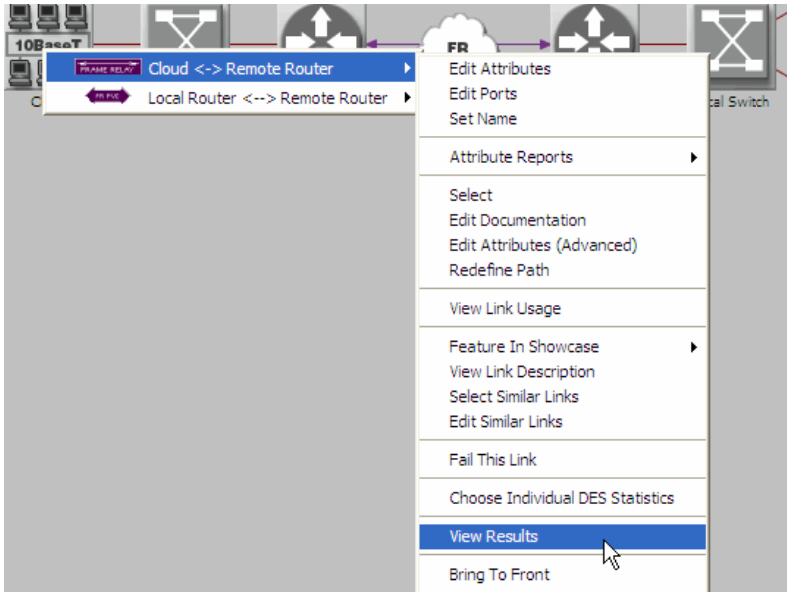
10 Click on the **Hide/Show Graph Panels** button to hide the current results.

This answers the second question posed in the Overview: the 256 Kbps Frame Relay link can support the 200 users in the remote site.

Now, look at the throughput for a specific link.

11 Right-click on the link between the Cloud and the Remote Router, and then select **View Results** from the pop-up menu. (If a menu with multiple items displays, choose **Cloud <-> Remote Router**, and then select **View Results** from the pop-up menu.)

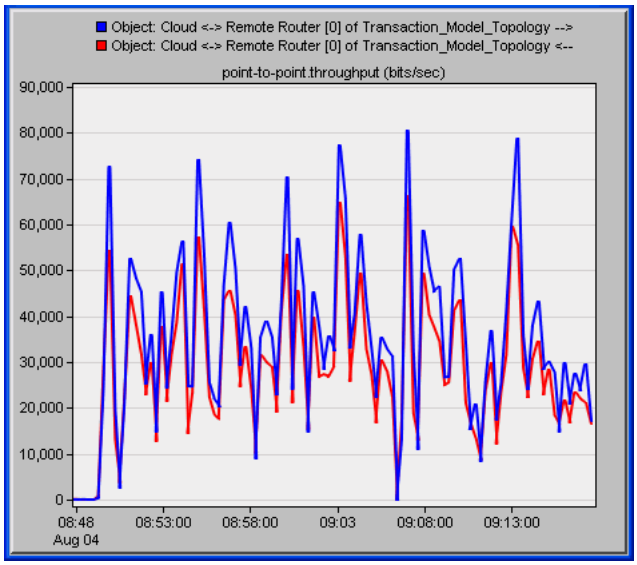
Figure 4-20 Select the Remote 256 Kbps Link



12 Expand the Object Statistics hierarchy until point-to-point is expanded. Then select the two statistics for **throughput (bits/sec)** and choose **Overlaid Statistics**.

13 Click **Show**.

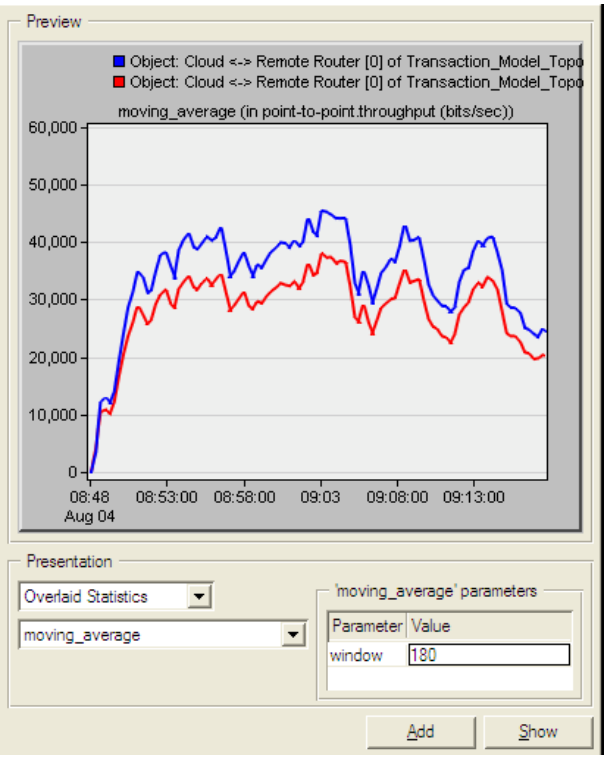
Figure 4-21 Throughput on the WAN Link for 200 Users



14 This graph shows instantaneous throughput. To see this data as an average, apply the moving average filter.

In the Results Browser dialog box, change the filter from **As Is** to **moving_average**.

Figure 4-22 Apply the moving_average Filter to the Throughput Statistic



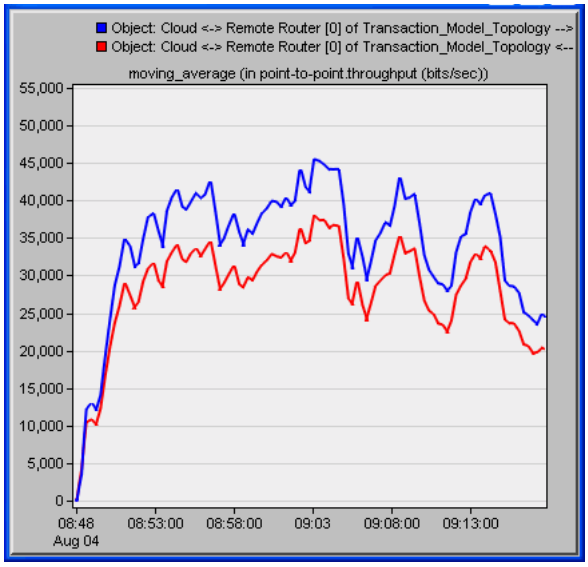
15 In the moving_average parameters box, enter a window value of **180** seconds.

16 Click **Show**.

17 Review the throughput displayed as a moving average. Your results may vary slightly.

The moving average filter groups data into “buckets” of a specified size (180 seconds in this example), calculates the average of all data points in the bucket, and then creates a graph from the average for each bucket. This filter removes the extremes but shows how throughput changes over time.

Figure 4-23 Throughput with moving_average Filter



18 Save the project and close the Results Browser dialog box.

19 Click on the **Hide/Show Graph Panels** button to hide the current results.

End of Procedure 4-8

This answers the third question posed in the Overview: 200 users consume an average of 30 Kbps of the available 256 Kbps.

However, this simulation is a simplified and optimistic analysis. In reality, the WAN circuit is already carrying traffic from other applications, and during a typical business day, the 256 Kbps WAN link is 80 percent utilized. Your analysis of this application rollout should incorporate the existing traffic.

Simulate Multiple Users with Existing Traffic

The simplest way to simulate the existing traffic is to apply background utilization traffic to the WAN.

The simulation run in this section can take up to 10 minutes to complete, depending on the speed of your computer.

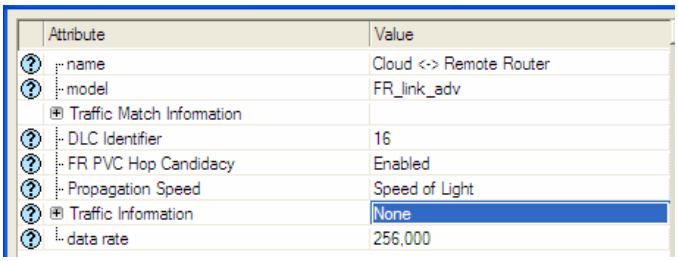
Procedure 4-9 Simulating Multiple Users with Existing Traffic

1 Select **Scenario > Duplicate Scenario…** Name the new scenario **200_Users_w_background_load**, and then click **OK**.

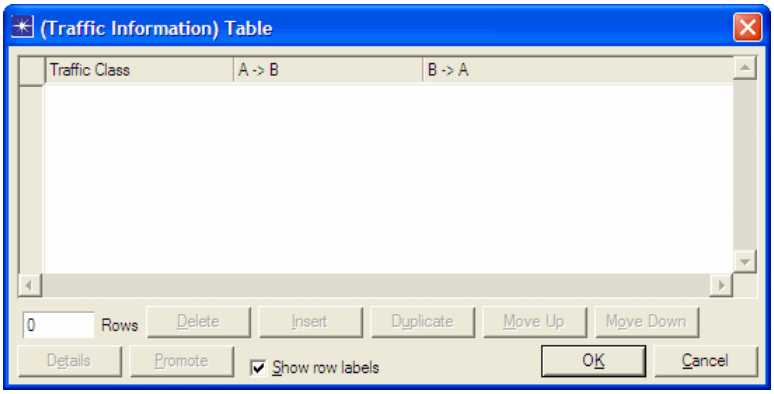
2 Set a bidirectional background load of 200 Kbps on the **Cloud <-> Remote Router** link:

2.1 Right-click on the link between the Remote Router and Cloud, and select **Edit Attributes** from the pop-up menu. (If a menu with multiple items appears, choose **Cloud <-> Remote Router**, and then select **Edit Attributes** from the pop-up menu.)

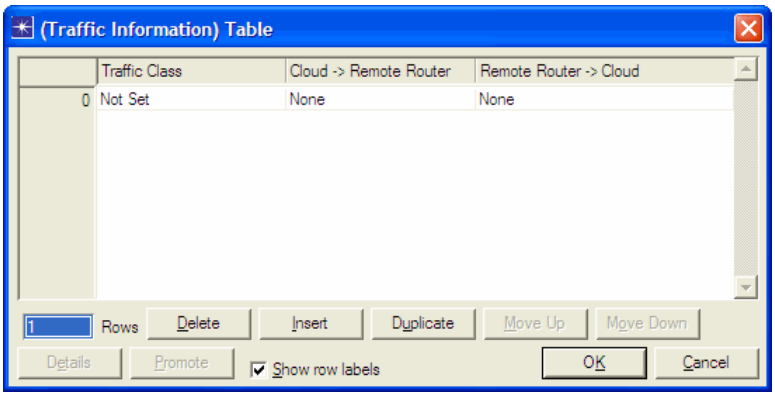
Figure 4-24 Edit Attributes Dialog Box—Detail



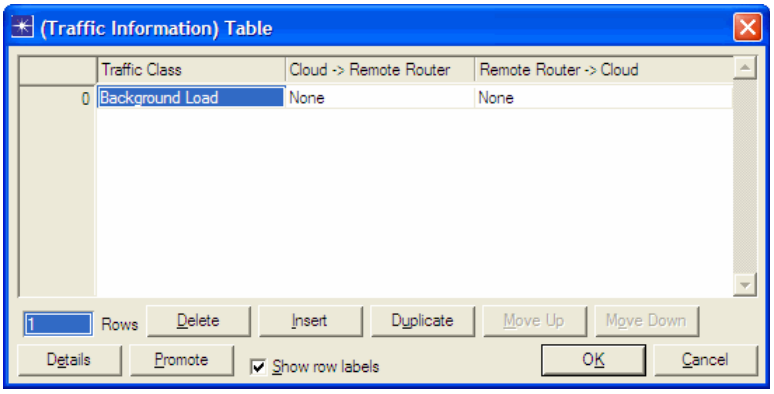
2.2 Change the **Value** field of **Traffic Information** from **None** to **Edit…**



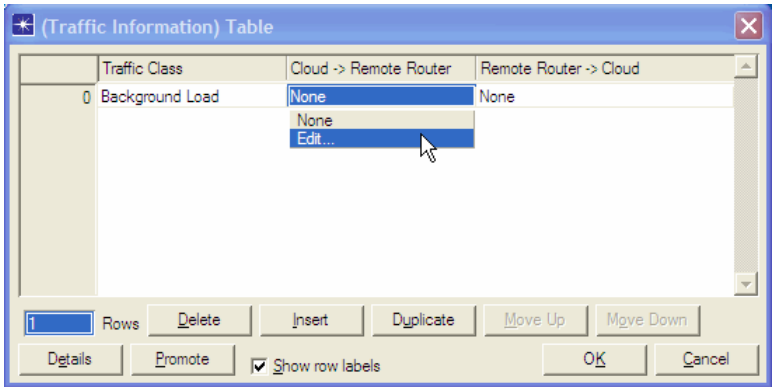
2.3 Change the value of the **Rows** field to **1** and press **Enter**.



2.4 Change the value of Traffic Class to **Background Load** and press **Enter**.

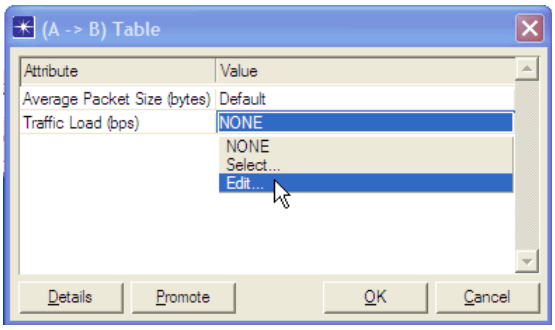


2.5 Click on the cell under **Cloud -> Remote Router** and select **Edit**.

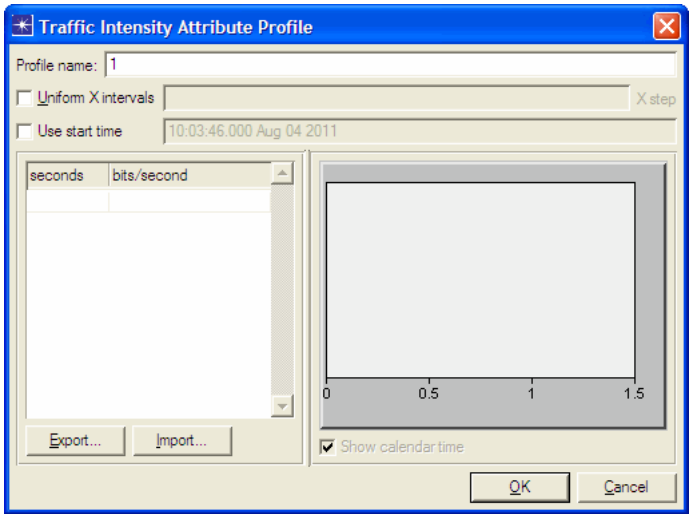


➥ The (A -> B) attribute table appears. The table contains attributes for specifying unidirectional traffic on the link.

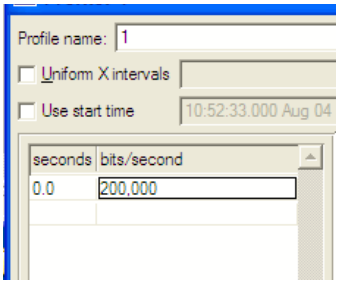
2.6 Change the Value field of **Traffic Load (bps)** from **NONE** to **Edit…**



➥ The Traffic Intensity Attribute Profile window appears. You can use this window to define, view, and edit background load traffic from the Cloud to the Remote Router.



2.7 Enter **0.0** seconds and **200,000** bits/second as shown in the following figure:



2.8 Click **OK** to save this background load, which is about 80 percent of the 256 Kbps link speed.

➥ This specifies the background load of 200 Kbps background load from the Cloud to the Remote Router.

2.9 Specify the same 200 Kbps load in the opposite direction (that is, from the Remote Router to the Cloud): Repeat Steps 2.5 through 2.8 for the background load in the Remote Router -> Cloud direction.

2.10 Click **OK** to close the **(Traffic Information) Table**.

2.11 Click **OK** to close the **Cloud <-> Remote Router Attributes** window.

3 Click the **Configure/Run Simulation** toolbar button. In the Configure Discrete Event Simulation dialog box, leave the duration as **0.5** hour. Click **Run**.

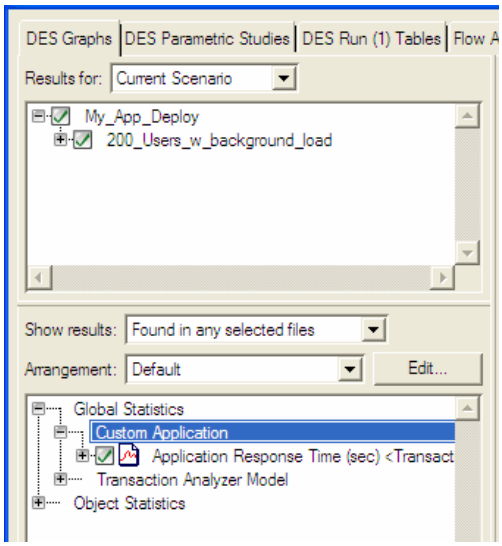
4 Close this dialog box after the simulation finishes.

These results show how the link utilization impacts the application response time.

5 Click the **View Results** toolbar button.

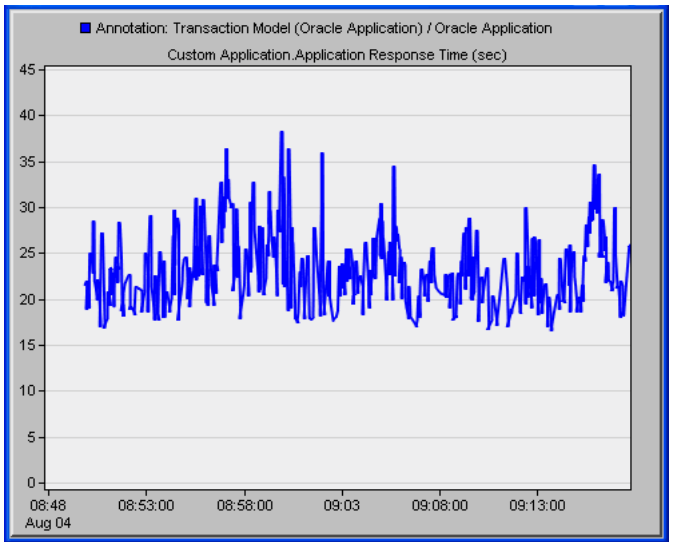
6 Expand the **Custom Application hierarchy**. Select **Application Response Time (sec)**.

Figure 4-25 Select the Application Response Time (sec) Statistic



7 Click **Show**.

Figure 4-26 Response Time for 200 Users on 80% Utilized WAN Link



You might see higher or lower spikes, but most response times should be 20–25 seconds.

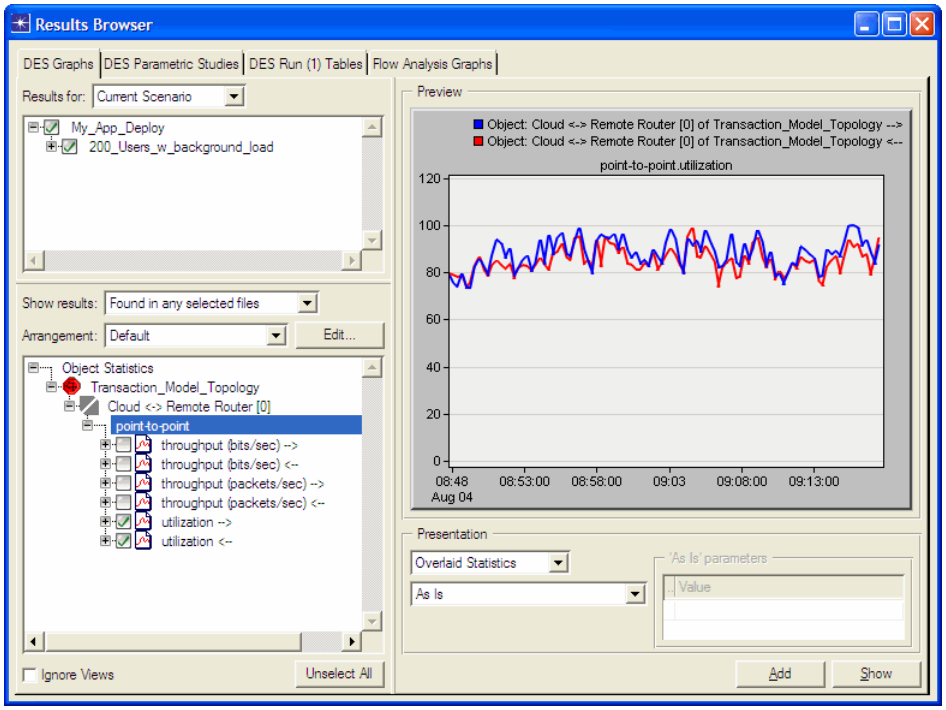
8 Notice that at certain times, the response time spikes up much higher. What is the link utilization during those periods?

9 Close the Results Browser dialog box.

10 Right-click on the link between the Remote Router and the Cloud, and then choose **View Results**.

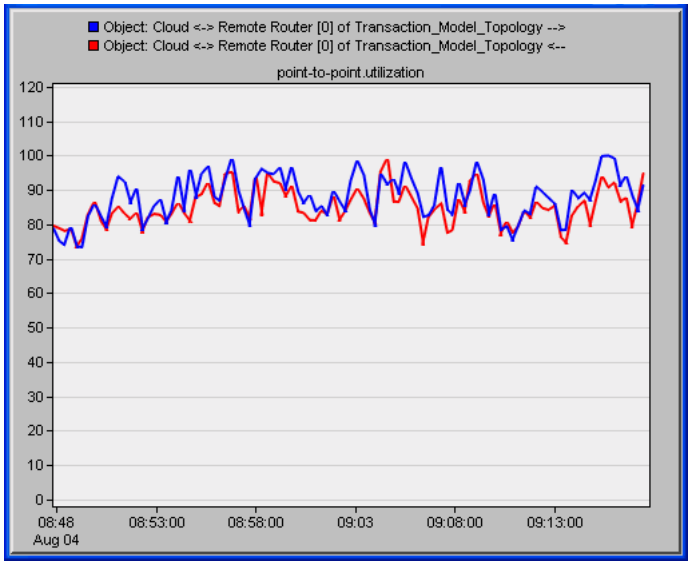
11 Select both **utilization** statistics, specify **Overlaid Statistics**, and then set the filter to **As Is**.

Figure 4-27 Select the Utilization Statistics



12 Click **Show**.

Figure 4-28 Utilization on 256 Kbps Frame Relay Circuit



Link utilization is 100 percent

13 Click the **Hide/Show Graph Panel** button to hide the displayed results.

14 Save and close the project.

End of Procedure 4-9

Now you can answer the final question: this scenario shows that there will be significant performance problems if this application is deployed to the 200 remote users. When you model the existing 80 percent load, response times will vary from over 15 seconds, as predicted by the second scenario, to much higher spikes.

The utilization graph shows that these spikes in application response time correspond to periods of link congestion. There are several instances where the WAN link reaches 100 percent utilization.

This scenario suggests that the 256 Kbps WAN link should be upgraded before deploying this application.