Lab: QoS-Sensitive Applications and Services

Objectives

1) Compare the impact of CAR and Priority Queuing (PQ) on the application performance.

2) Configure QoS mechanisms to guarantee low delay for multimedia application without drastically affecting data traffic.

Time allotted: 30 minutes

Network description: The network consists of a Token Ring LAN and an Ethernet LAN connected through an IP backbone. The Token Ring LAN includes a Web client and a video client node. These client nodes are downloading HTTP and video traffic respectively from the corresponding servers located in the Ethernet LAN. The link between the “Access Router” and the “TR_Router” is a bottleneck.

Scenario 1: default_network

1. Open the project by choosing File/Open/Project

2. Select session_1315_lab, then click OK

Project “session_1315_lab_ref” is also provided, in case you simply want to follow along without actually exercising this lab. Scenario “default_network” opens as the first scenario. In this scenario traffic has been configured on the nodes. You will run simulations to study response times and deploy QoS in next scenarios.
3. Right-click in the project workspace and select **Choose Individual DES Statistics** from the pop-up menu

4. Verify that response time and traffic sent/received Node Statistics have been selected for “Client Http” and “Video Calling Party”

You will configure a Service Level Agreement (SLA) to monitor the video application performance.

5. Click on the DES menu and choose **Expert Service Prediction/Define Service Level Agreement**

6. Select **my_SLA** from the Service Level Agreement pull-down menu
7. Expand the Node Statistics and verify that “Packet Delay Variation” and “Packet End-to-End Delay” statistics for the Video Calling Party have been selected for SLA monitoring.

**Verifying the SLA configuration**

1. Click on the **Packet Delay Variation** statistics. Verify the “Show compliance” settings. Statistics must be below 10 microseconds 95 % of the time.

2. Click on the **Packet End-to End Delay** statistics. Verify the “Show compliance” settings. Statistics must be below 40 milliseconds 95 % of the time.

3. Close the ESP box and click **Cancel** when prompted to save.
4. Click on the **Configure/Run Discrete Event Simulation (DES)** action button. Note that the “Duration” is set to **200** and its corresponding unit to “second(s)”. Both applications (Http and video) have been configured to start at 100 seconds.

5. Click **Run**. The simulation takes about 2 minutes to complete.

6. Close the Simulation Sequence dialog box when the simulation completes. Results analysis templates have been provided with the project.

7. Click on the **Hide/Show Graph Panels** action button. The template panels show the following:
   - Video “Packet End-to-End Delay (sec)”
   - HTTP “Object Response Time (sec)”
   - SLA compliance statistics for both “Video Packet End-to-End Delay” and “Delay Variation”

8. Click on the **DES** menu and choose **Panel Operations/ Panel Templates/Load With Latest Results**.
9. Check the results

- Throughputs (video and HTTP). Note that the video traffic flow is about 3.8 Mbps.

- End-to-end delays (video and HTTP). Video ETE Delay fluctuates whenever there is data transmission for the HTTP application.
- SLA compliance for video traffic. Note that neither the delay nor the delay variation comply with the SLA.
Scenario 2: with CAR

1. From the Scenarios menu, choose Duplicate Scenario
2. When prompted, name the new scenario with_CAR

In this scenario you will enable CAR on the “Access Router” to limit the rate for HTTP traffic and thus ensure enough bandwidth is available for the video application.

3. Click on the object palette action button. Session_1315 palette opens.
4. Click on the **QoS Attribute Config** node and place it on the project workspace next to the application config object.

5. Close the object palette.

Next we will be creating “CAR Profiles” that will be used by the “Access Router” to provide traffic classification and policing for incoming traffic.

6. Right-click on the new global config object and set its name to **QoS Config**.

7. Right-click on the **QoS Config** object and select **Edit Attributes**.

8. Edit...the **CAR Profiles** attribute and set the Rows attribute to 2.
9. Name the two profiles **Http CAR Profile** and **Video CAR Profile**.

Configure the **Http CAR Profile**

1. Click on the Details column for the **Http CAR Profile**
2. Set the “COS Definition” to **Http Traffic**

Configure the **Rate Limits**.

You will limit the Http traffic average rate to 50kbps to leave enough of the 4Mbps bottleneck link bandwidth for the video application

1. Click on Edit under **Rate Limit**
2. Set “Average Rate” to **50,000**
3. Set “Normal Burst Size” to **50,000**
4. Set “Excess Burst Size” to **100,000**

Configure the **Conforming Traffic Policy**

1. Set “Set Precedence” to **Best Effort (0)**
2. Set “Action” to **Transmit**

Configure the **Exceeding Traffic Policy**

1. Set “Set Precedence” to **Best Effort (0)**
2. Set “Action” to **Drop**

3. Close the “Details Table” of Http CAR Profile

**Configure the Video CAR Profile**

1. Click on the “Details” column for the Video CAR Profile
2. To configure the COS Definition, set the “Incoming Port” to **0**
3. To configure the Rate Limits, you will set the video traffic average rate to **5Mbps** to provide enough bandwidth for the **3.8 Mbps video stream**
4. Set “Average Rate” to **5 Mbps**
5. Set “Normal Burst Size” to **5 Mbits**
6. Set “Excess Burst Size” to **10 Mbits**

**Configure the Conforming Traffic Policy**

1. Set “Set Precedence” to **Interactive Multimedia (5)**
2. Set “Action” to **Transmit**
Configure the Exceeding Traffic Policy

1. Set “Set Precedence” to **Streaming Multimedia (4)**
2. Set “Action” to **Transmit**
3. Click **OK** to close all the open dialog boxes.

Configure CAR Profiles

You will now configure CAR profiles on the “Access Router”. You will determine the connected interfaces for the “Access Router”. The interface information will be used while configuring the “Access Router” with QoS profiles.

1. One-by-one, right-click on the three links connected to the “Access Router” and select **Edit Ports**.
The A dialog box will appear showing the interface information on both ends of the link. Verify that the links are attached to following interfaces on the “Access Router”:

- Access Router to Network Router 2: **IF0**
- Access Router to Network Router 1: **IF1**
- Access Router to TR_Router: **IF8**

2. To configure the CAR profiles on the Access Router, right-click on the Access Router and select **Edit Attributes**.

3. Expand the **IP** attribute suite and edit the **IP QoS Parameters**.

![IP attribute suite and IP QoS Parameters](image)

4. Click on **Interface Information** and select **Edit ...**

5. Change the row count to 2 and set the interface names to **IF0** and **IF1**.

![Interface Information Table](image)
Configure the QoS Scheme for IF0

1. Set the “Type” to **Inbound Policing**
2. Set the “Name” to **Video CAR Profile**

**Configure the QoS Scheme for IF1**

1. Set the “Type” to **Inbound Policing**
2. Set the “Name” to **Http CAR Profile**
3. Click OK to close all the windows.
4. Save this new scenario with this project by performing a **File/Save** operation.
   Click on the **Configure/Run Discrete Event Simulation (DES)** action button. Click **Run** to run the simulation.
7. Close the Simulation Sequence dialog box when the simulation completes.
8. Clear the result templates and load them with latest results.
9. Click on the **Hide/Show Graph Panels** action button
10. Click on the **DES** menu and choose **Panel Operations/Panel Templates/Create From All Panels**
11. Click on the DES menu and choose Panel Operations/Panel Templates/Load With Latest Results. Check the new results.

- Throughputs (video and HTTP). Note that the HTTP flow has been smoothed by the applied CAR policy.
- End-to-end delays (video and HTTP). Note that the video delay has been greatly reduced compared to the previous scenario, from 0.1 to 0.007 sec.

- SLA compliance for video traffic. Note that the ETE delay complies with the configured SLA limits while the delay variation does not.
Scenario 3: with CAR and PQ

To reduce the video traffic delay variation we will configure Priority Queuing at the outgoing interface to the Token Ring network from the “Access Router” (in addition to CAR configured in the previous scenario).

- From the Scenarios menu, choose Duplicate Scenario. When prompted, name the new scenario with_CAR_and_PQ.

Configure Priority Queuing on the Access Router.
Remember that interface “IF8” is used to transmit datagrams to the Token Ring network

1. Edit the “IP QoS Parameter/ Interface Information”.
2. Add a new row in the table by changing the row count to 3.

![Interface Information Table]

3. Set the interface name to IF8

**Configure the QoS Scheme for IF8**

1. Set the “Type” to **Priority Queuing**
2. Set the “Name” to **ToS Based**

![QoS Scheme Table]

3. Click **OK** to close all the windows.
4. Save this new scenario with this project by performing a **File/Save** operation. Click on the **Configure/Run Discrete Event Simulation (DES)** action button. Click **Run** to run the simulation.

7. Close the Simulation Sequence dialog box when the simulation completes.
8. Clear the result templates and load them with latest results.
9. Click on the **Hide/Show Graph Panels** action button
10. Click on the **DES** menu and choose **Panel Operations/Panel Templates/Create From All Panels**
11. Click on the **DES** menu and choose Panel Operations/Panel Templates/Load With Latest Results. Check the new results.

- End-to-end delays (video and HTTP). Note that introducing Priority Queuing did not further improve the **average** video ETE delay.
SLA compliance for video traffic. As a result of introducing Priority Queuing, the video delay variation is reduced. Both the video ETE delay and the delay variation comply with the configured SLA.