Avaya Solution & Interoperability Test Lab

Application Notes for Proxim Tsunami(TM) MP.11 WiMAX-Capable Point-to-Multipoint System with Avaya IP Office and Avaya IP Telephones in a Multi-Site Converged VoIP and Data Network - Issue 1.0

Abstract

These Application Notes describe a sample configuration of a Voice over IP (VoIP) solution using a Proxim Tsunami MP.11 WiMAX-Capable Point-to-Multipoint System with Avaya IP Office and Avaya IP Telephones in a Converged VoIP and Data Network. Proxim Tsunami MP.11 Base Stations (BSU) and Subscriber Units (SU) were compliance-tested with Avaya IP Office and Avaya IP Telephones with emphasis placed on verifying voice quality in a converged VoIP and Data network scenario. Information in these Application Notes has been obtained through compliance testing and additional technical discussions. Testing was conducted via the Developer*Connection* Program at the Avaya Solution and Interoperability Test Lab.

1. Introduction

These Application Notes describe a sample configuration of a Voice over IP (VoIP) solution using a Proxim Tsunami MP.11 WiMAX-Capable Point-to-Multipoint System with Avaya IP Office and Avaya IP Telephones in a Converged VoIP and Data Network. Proxim Tsunami MP.11 BSUs and SUs were compliance-tested with Avaya IP Office and Avaya IP Telephones with emphasis placed on verifying voice quality in a multi-site converged VoIP and Data network scenario. QoS (Quality of Service) based on 802.1p (Layer 2 Priority) and Layer 3 Differentiated Services was implemented across the network to prioritize voice traffic over the LAN. The Avaya IP Telephones get QoS priority settings from Avaya IP Office. The QoS settings are enforced in the network by the Tsunami MP.11 Series Base Station (BSU) and Subscriber Units (SU). Tests were performed by oversubscribing the LAN interfaces with low priority data and verifying that good voice quality was achieved when calls are routed over all LAN interfaces. Compliance testing included QoS, throughput, Open Shortest Path First (OSPF), Direct Media and the G.711 and G.729 codecs.

1.1. Tsunami MP.11 5054-R

The Tsunami MP.11 is a broadband wireless transport system based on WiMAX technology, including Quality of Service to enable smooth delivery of voice, video and data traffic. While WiMAX is generally a technology used by communications service providers, the MP.11 makes WiMAX capabilities available to enterprises through compact form factors and license-free radio frequency bands that are available for enterprise use. The system consists of an outdoor, roof- or pole-mounted Base Stations Unit (BSU) which serves as the hub, and Subscriber Units (SUs) which serve as the remotes.

1.2. Avaya IP Office and Proxim Tsunami MP.11

The configuration in **Figure 1** shows a multi-site converged VoIP and Data network with multiple locations configured with VLANs and OSPF.

For compliance testing, the DHCP server function on Avaya IP Office was disabled and a centralized DHCP server was used. To better manage the different traffic types, the voice and data traffic were separated onto different VLANs.

1.3. Campus Headquarters

The Campus Headquarters consists of an Avaya IP Office 406V2 with one Avaya 2400 Series Digital Telephone, Avaya IP Office Manager, Proxim Tsunami MP.11 5054-R BSU, Extreme Alpine 3804 and one DHCP/ File Server. The DHCP server provides IP network parameters to the Avaya IP Telephones. The Proxim Tsunami MP.11 5054-R, will enforce QoS policies that it is passed from the network endpoints.

1.4. Campus A

Campus A consists of an Proxim Tsunami MP.11 5054-R SU, Extreme Summit X450e-24p Switch, two Avaya 5600 Series IP Telephone on VLAN Voice1 and one PC on VLAN Datavlan2. The Proxim Tsunami MP.11 5054-R, will enforce QoS policies that it is passed from the network endpoints.

1.5. Campus B

Campus B consists of an Proxim Tsunami MP.11 5054-R SU, Extreme Summit X450e-24p Switch, two Avaya 5600 Series IP Telephone on VLAN Voice2 and one PC on VLAN Datavlan2. The Proxim Tsunami MP.11 5054-R, will enforce QoS policies that it is passed from the network endpoints.

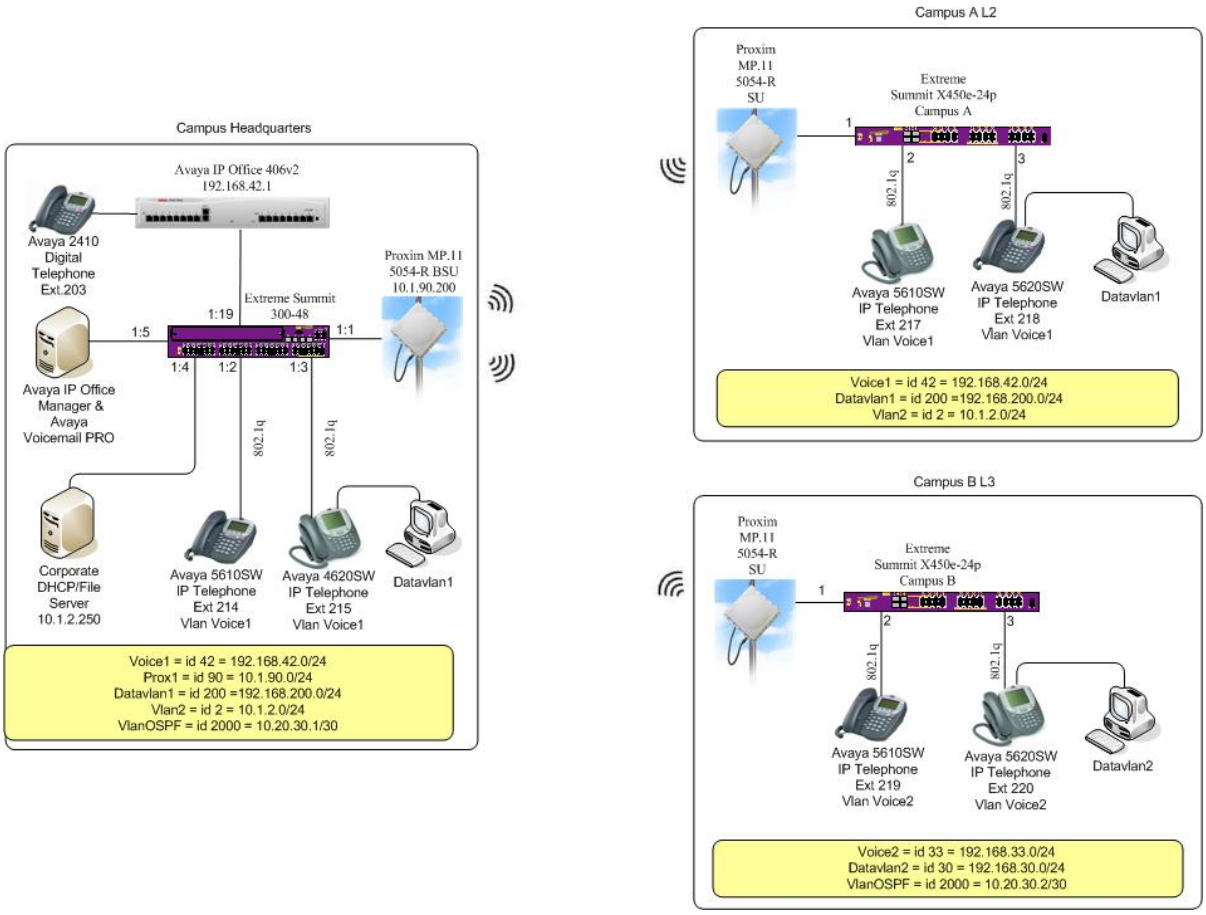


Figure 1: Network Configuration for Avaya IP Office and Proxim Tsunami MP.11 5054-R

2. Equipment and Software Validated

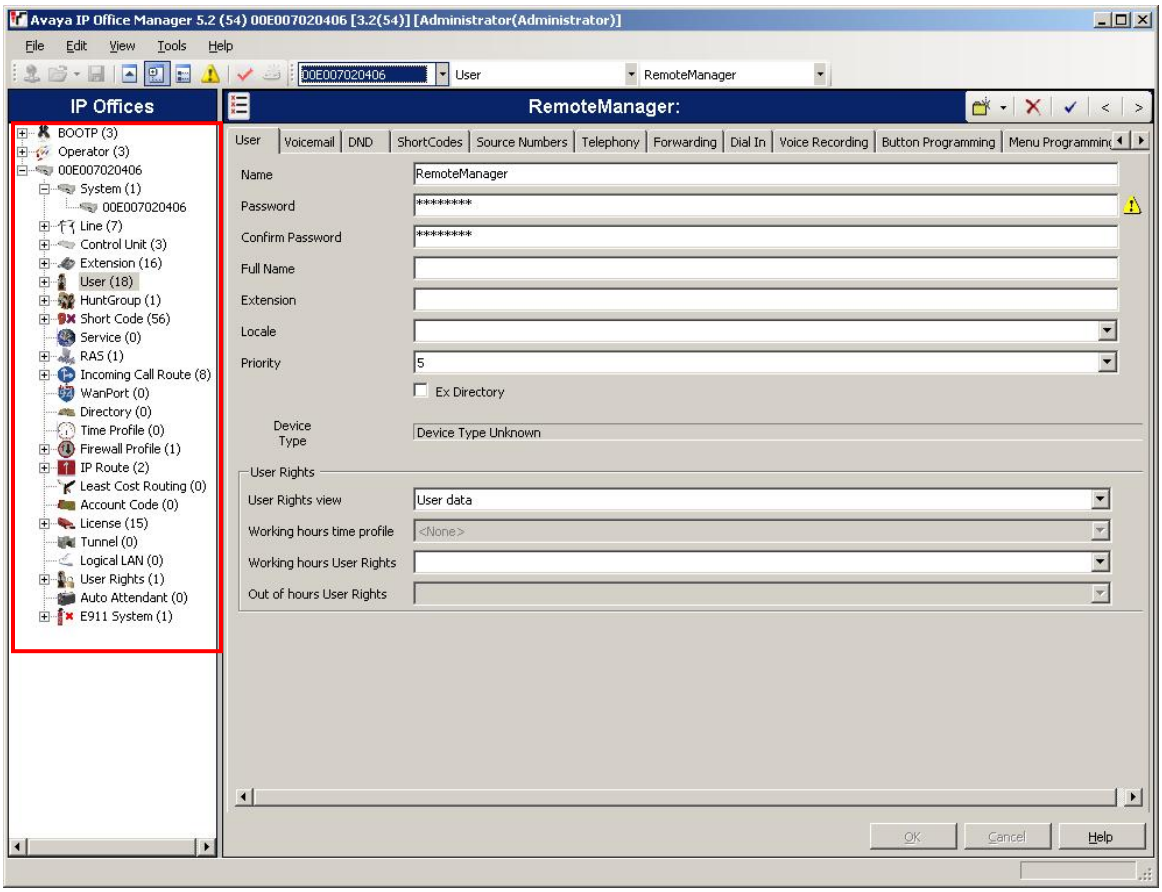
The following equipment and software/firmware were used for the sample configuration provided:

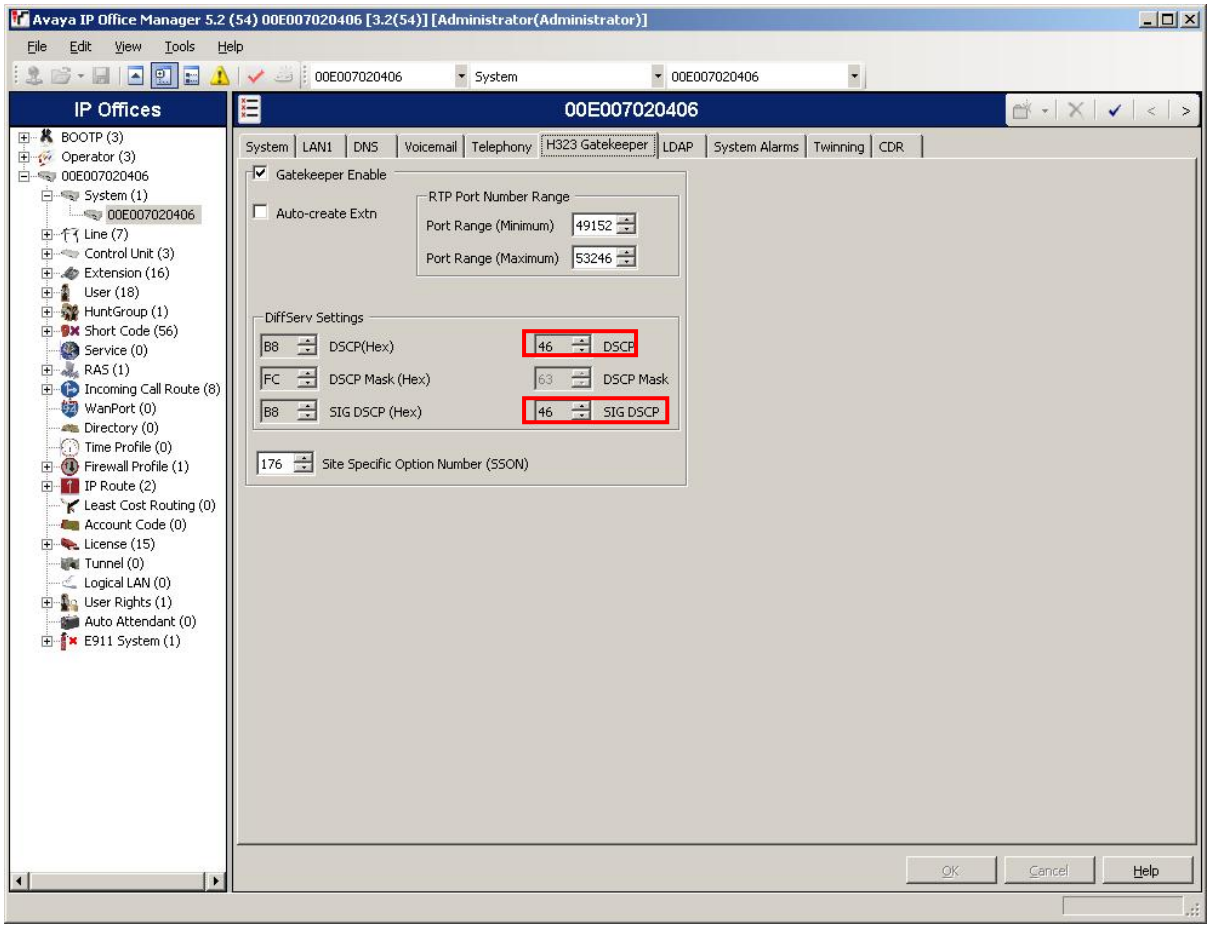
Equipment	Software/Firmware
Avaya IP Office IP406V2	3.2(54)
Avaya 4620SW IP Telephones (H.323)	2.3
Avaya 4610SW IP Telephones (H.323)	2.3
Avaya 5620SW Telephones (H.323)	2.3
Avaya 5610SW Telephones (H.323)	2.3
Avaya 2410 Digital Telephone	N/A
Avaya IP Office Manager	3.2(54)
Avaya Voicemail Pro	3.2(15)
Proxim Tsunami MP.11 5054-R	2.5.3 build 221
Extreme Summit X450e24p	ExtremeXOS 11.5.1.4 (FCS code)
Extreme Summit 300-48	ExtremeWare 7.6

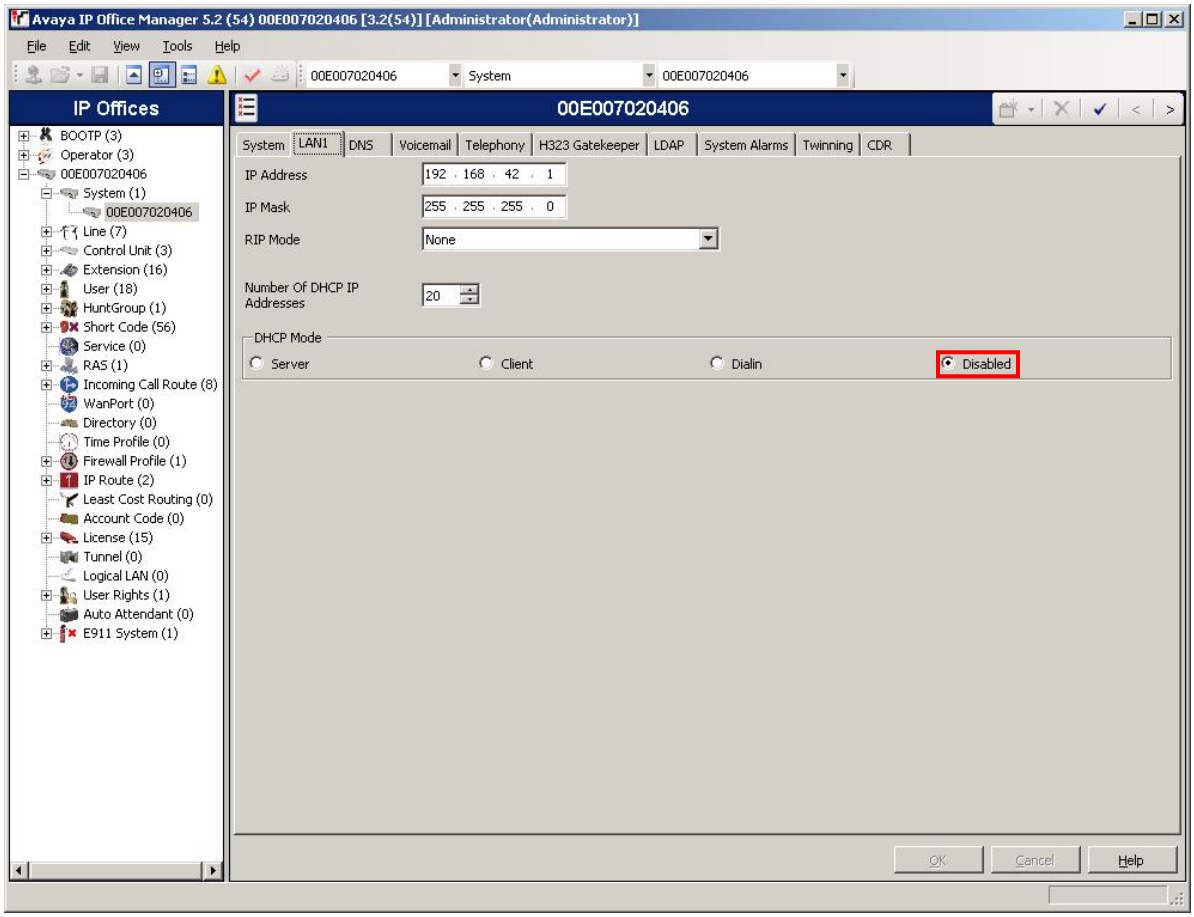
3. Avaya IP Office Settings

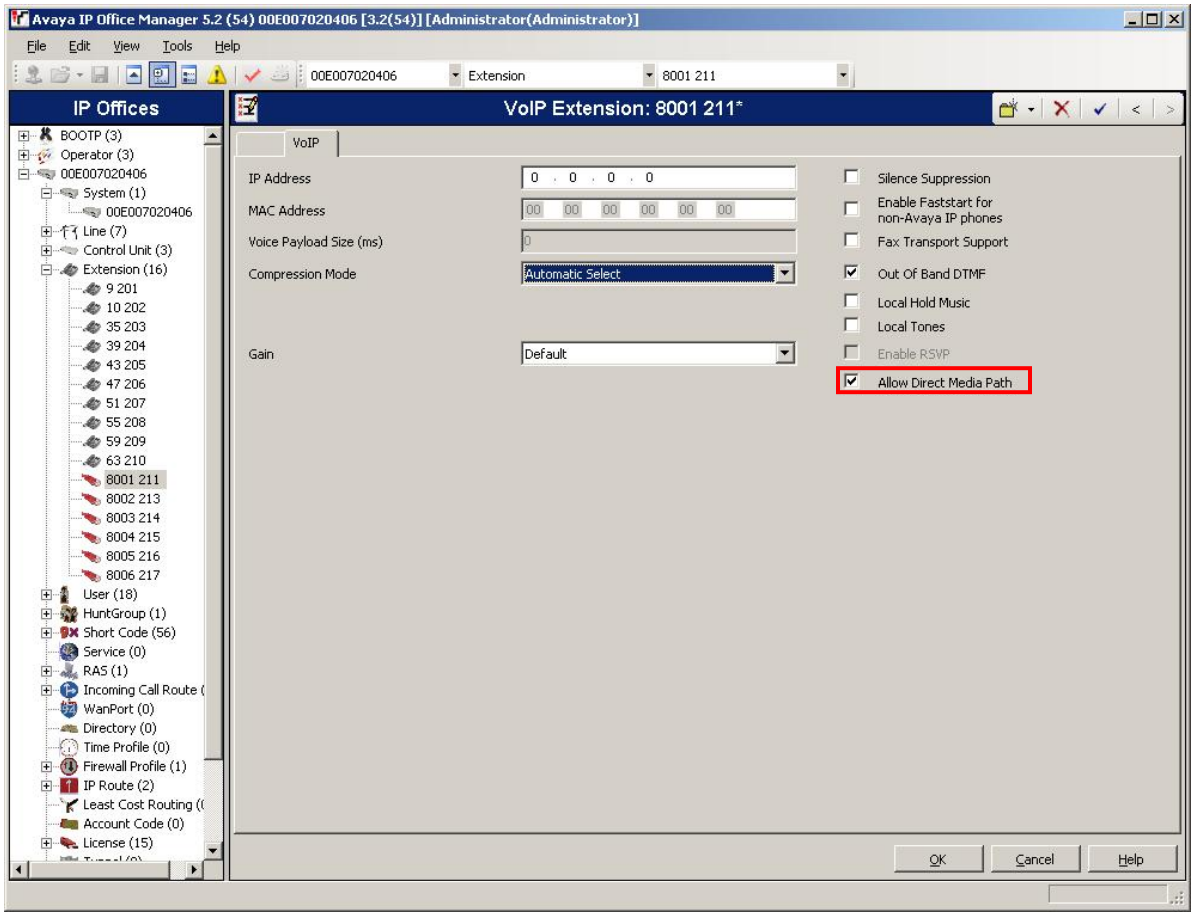
This section was included to verify that Avaya IP Office was configured correctly. Except where stated, the parameters in all steps are the default settings and are supplied for reference. For all other provisioning information such as provisioning of the trunks, call coverage, and extensions, please refer to the Avaya IP Office product documentation.

Step	Description
1.	IP Office is configured via the IP Office Manager program. Log into the IP Office Manager PC and select **Start → Programs → IP Office → Manager** to launch the Manager application. Log into the Manager application using the appropriate credentials (not shown).

Step	Description
2.	**IP Office Manager Window** The main IP Office Manager window appears. The following steps refer to the Configuration Tree, which is in the left pane of the window. 

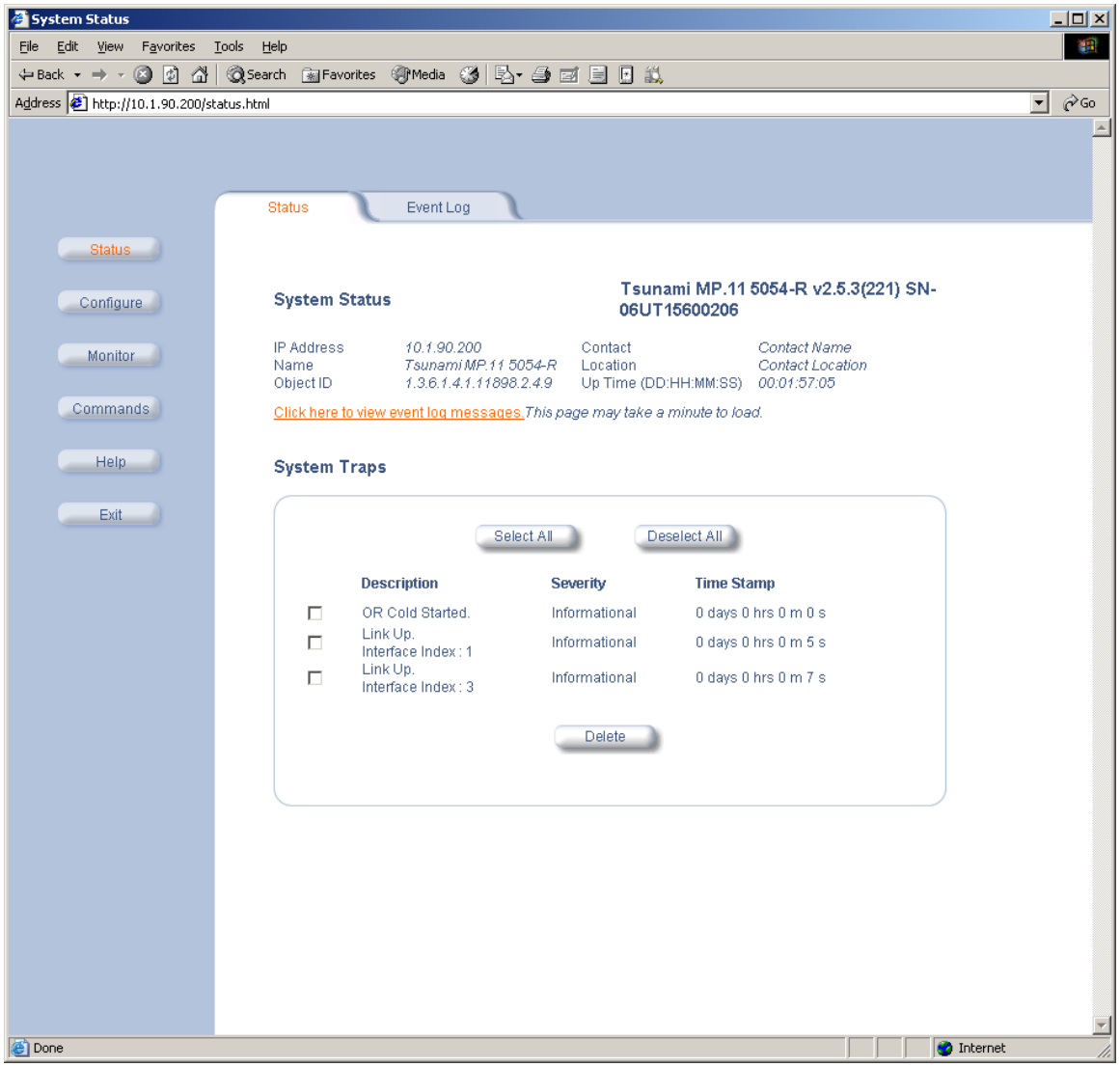
Step	Description
3.	**Verify H323 Gatekeeper information** The Avaya IP Telephones will get Differentiated Services information from the Avaya IP Office. This information will be utilized for QoS by the Proxim MP.11. In the Manager window, go to the Configuration Tree and double-click **System**. Select the **H323 Gatekeeper** tab. Verify that the **DiffServ Settings** for **DSCP** and **SIG DSCP** are set to **46** and **46,** respectively. 

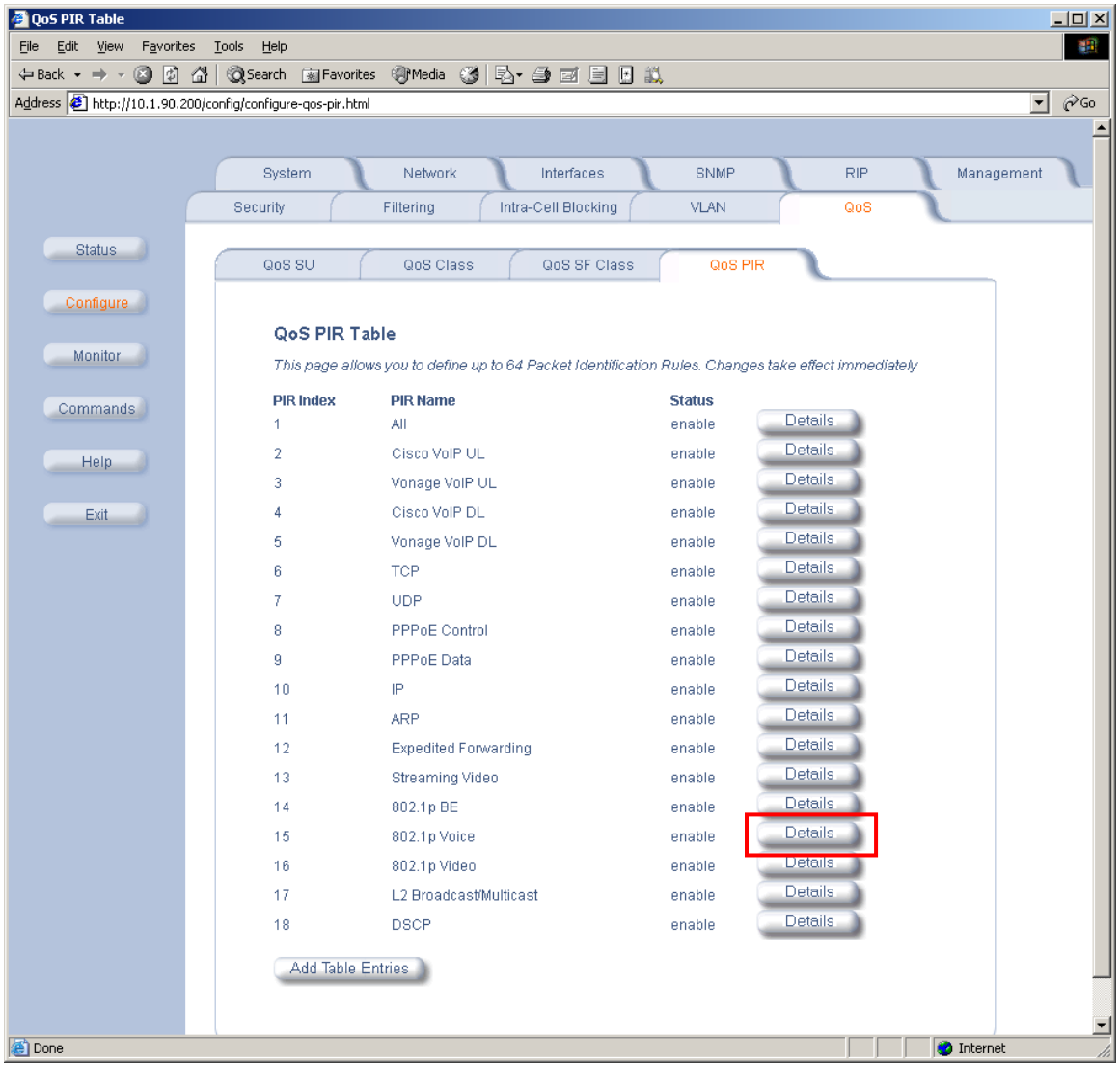
Step	Description
4.	**Disable DHCP server on Avaya IP Office** Select the **LAN1** tab. Set the **DHCP Mode** to **Disabled**. Click the **OK** button to continue. **Note:** The **OK** button remains grayed-out if no changes are required. 

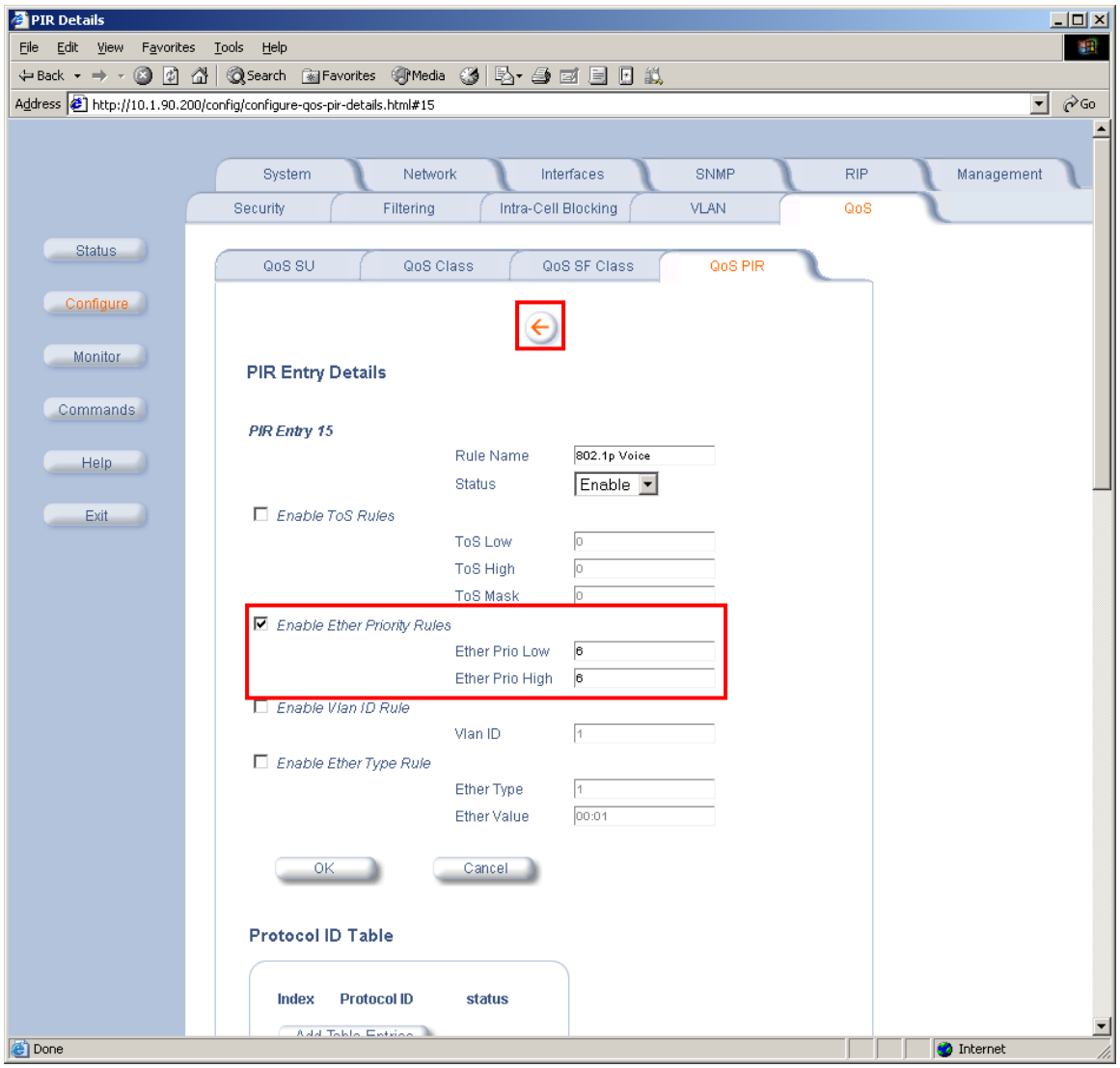
Step	Description
5.	**Verify Direct Media Path** From the Configuration Tree, select **Extension**. Double-click on the IP telephone extension to verify. Select the **VoIP** tab. Verify that **Allow Direct Media Path** is checked. Click the **OK** button to continue. 

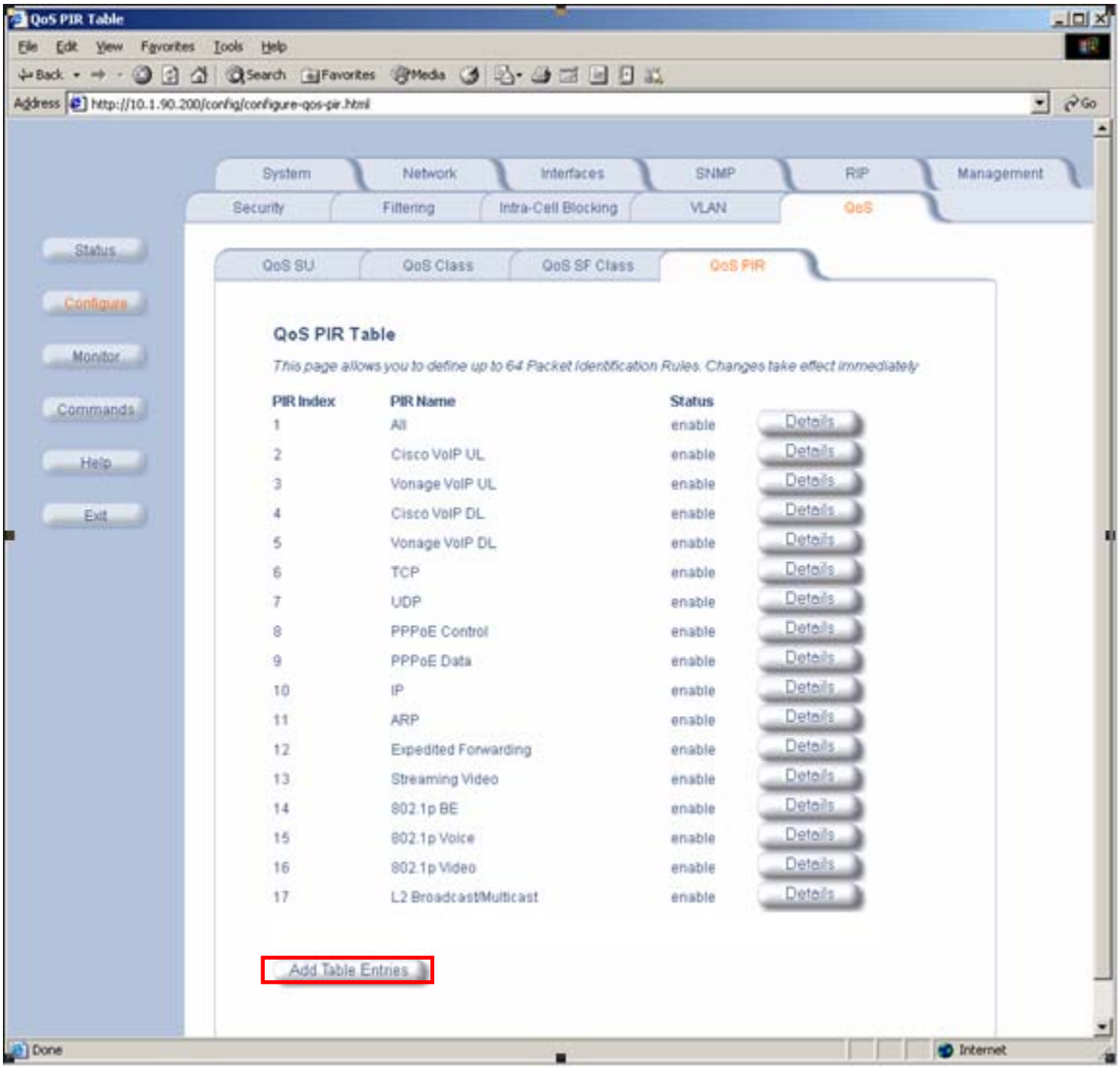
4. Configure Proxim Tsunami MP.11 5054-R Base Station at the Headquarters

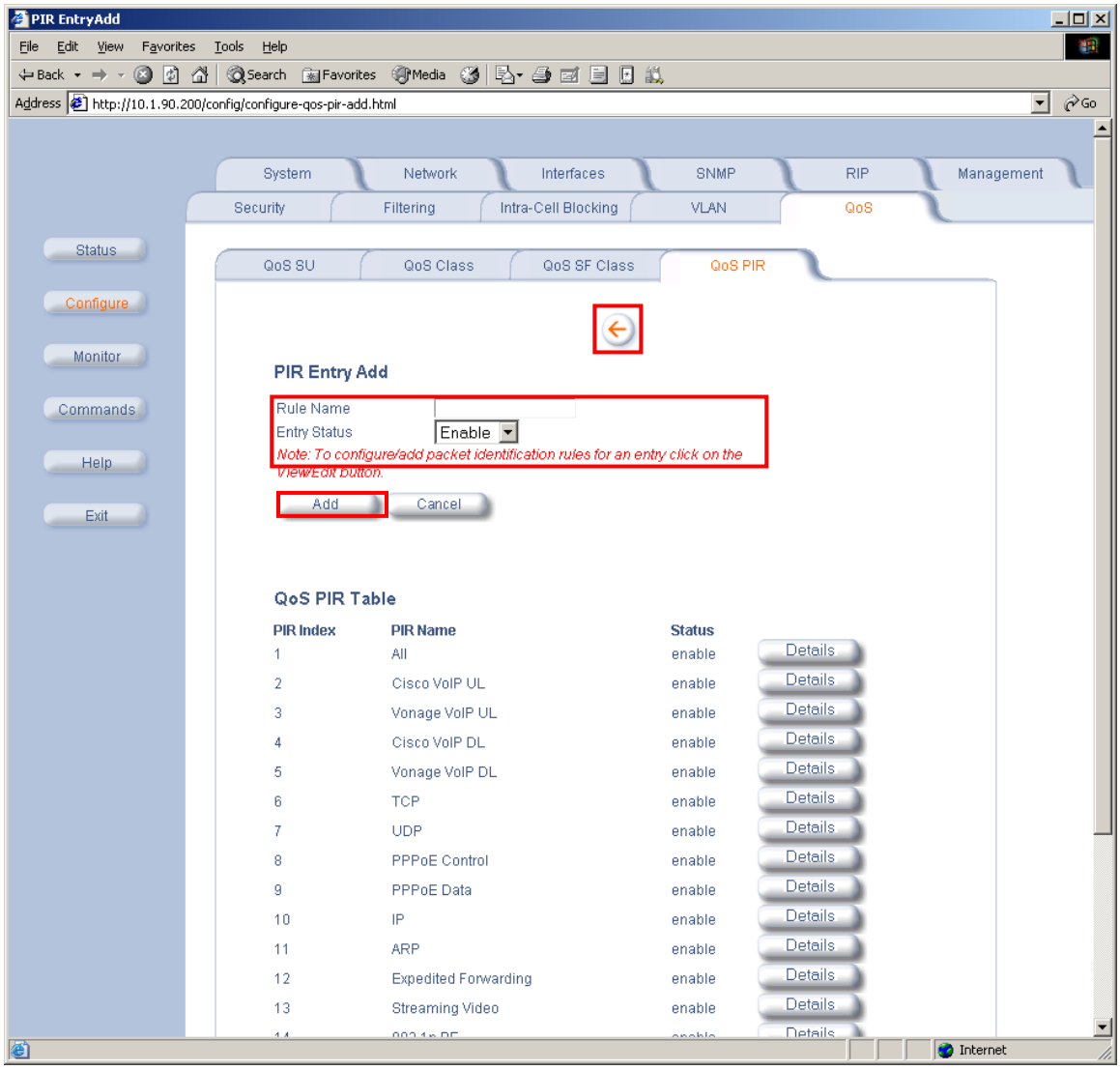
This section shows the necessary steps in configuring the Proxim Tsunami MP.11 5054-R base station at the headquarters as shown in the sample network. Except where stated the parameters in all steps are the default settings and are supplied for reference.

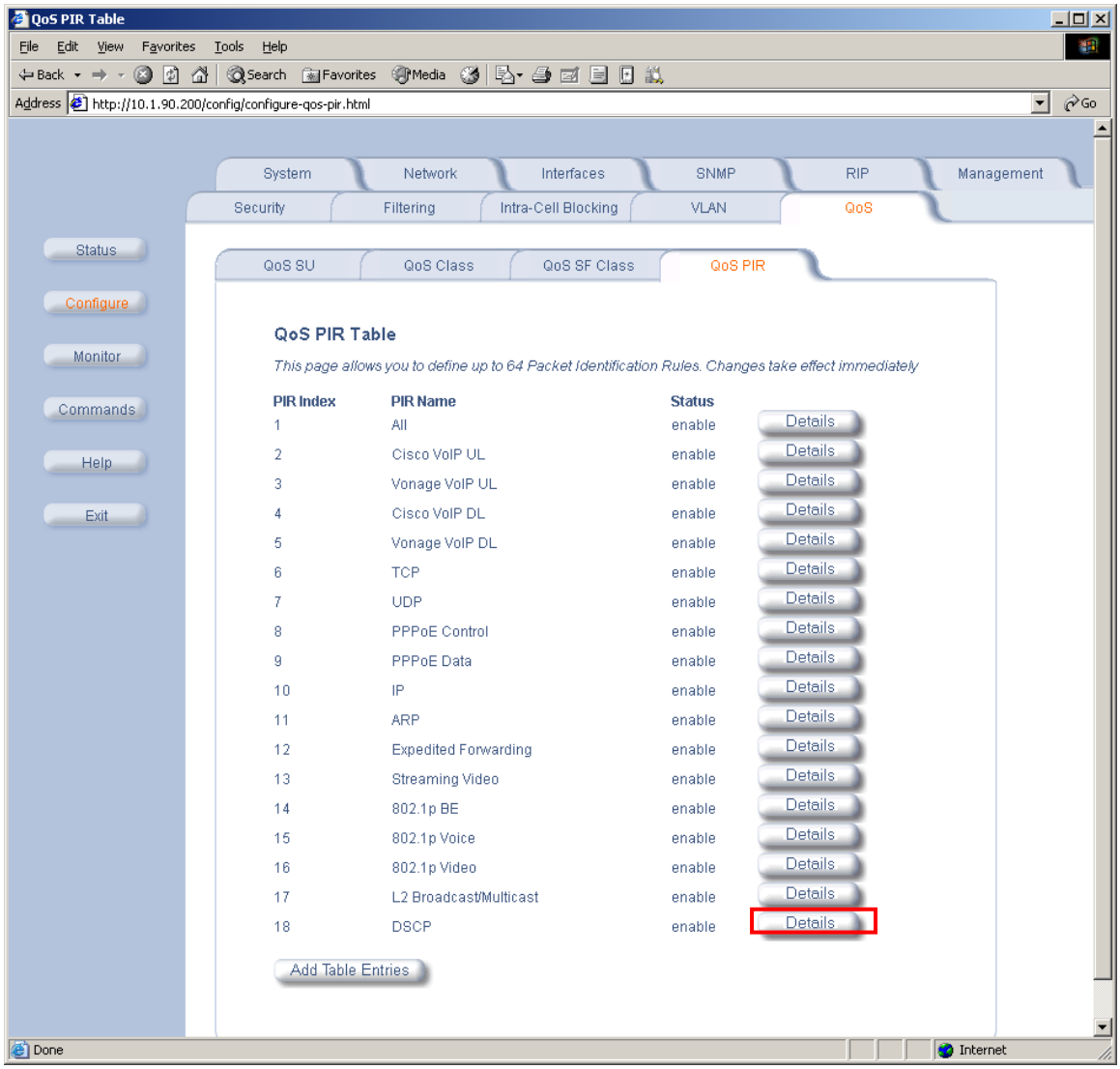
Step	Description
1.	**Logging into Proxim Tsunami MP.11 5054-R BSU** Connect to the Proxim Tsunami MP.11 5054-R BSU through a web browser. Log in using the appropriate Login ID and Password. Click on the **Status** button to view the **System Status** information. 

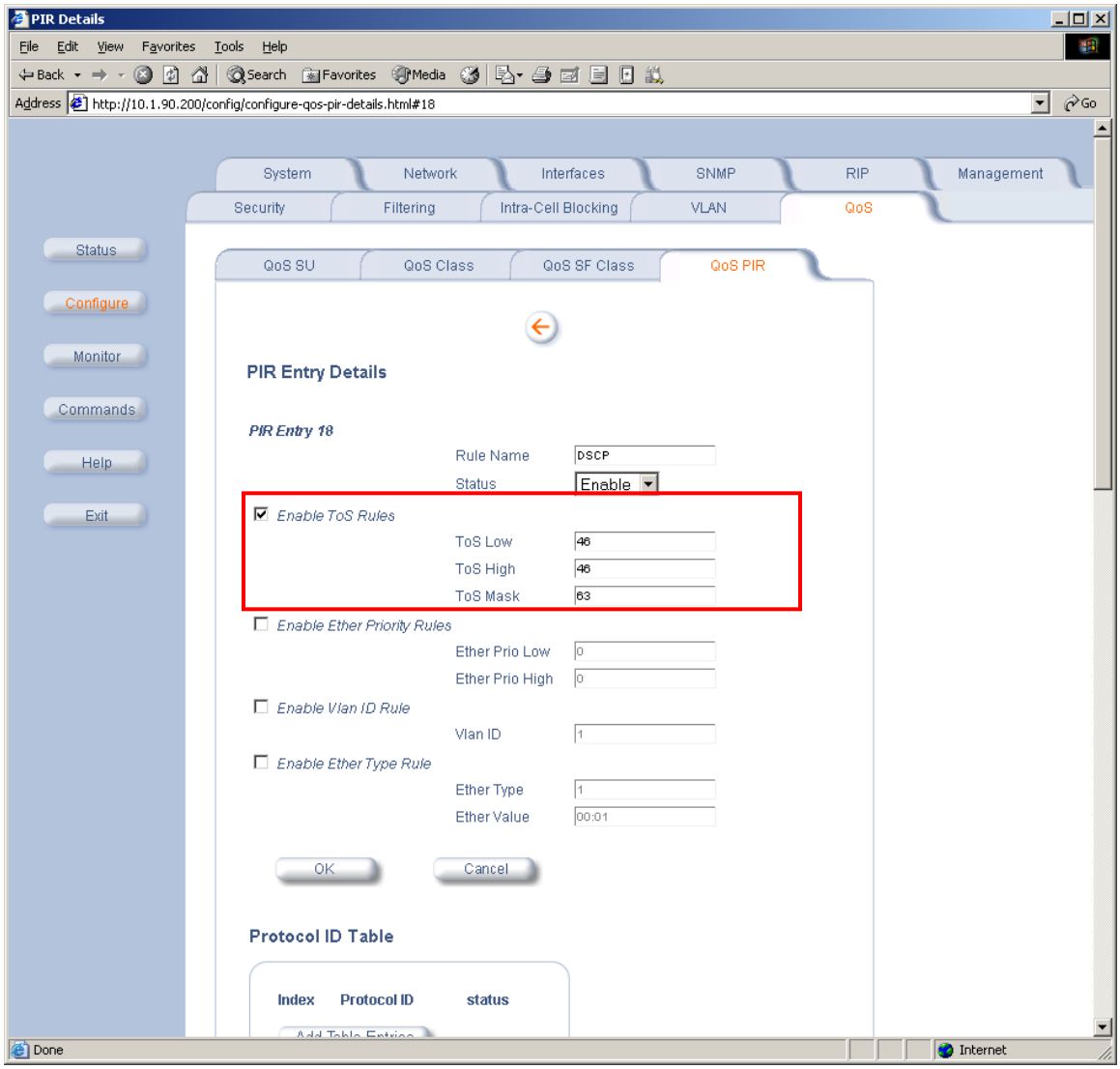
Step	Description
2.	**Configuring 802.1p QoS Parameters on the Proxim Tsunami MP.11 5054-R at the HQ** Select **Configure → QoS → QoS PIR.** Click the **Details** button next to the **802.1p Voice** PIR Name. 

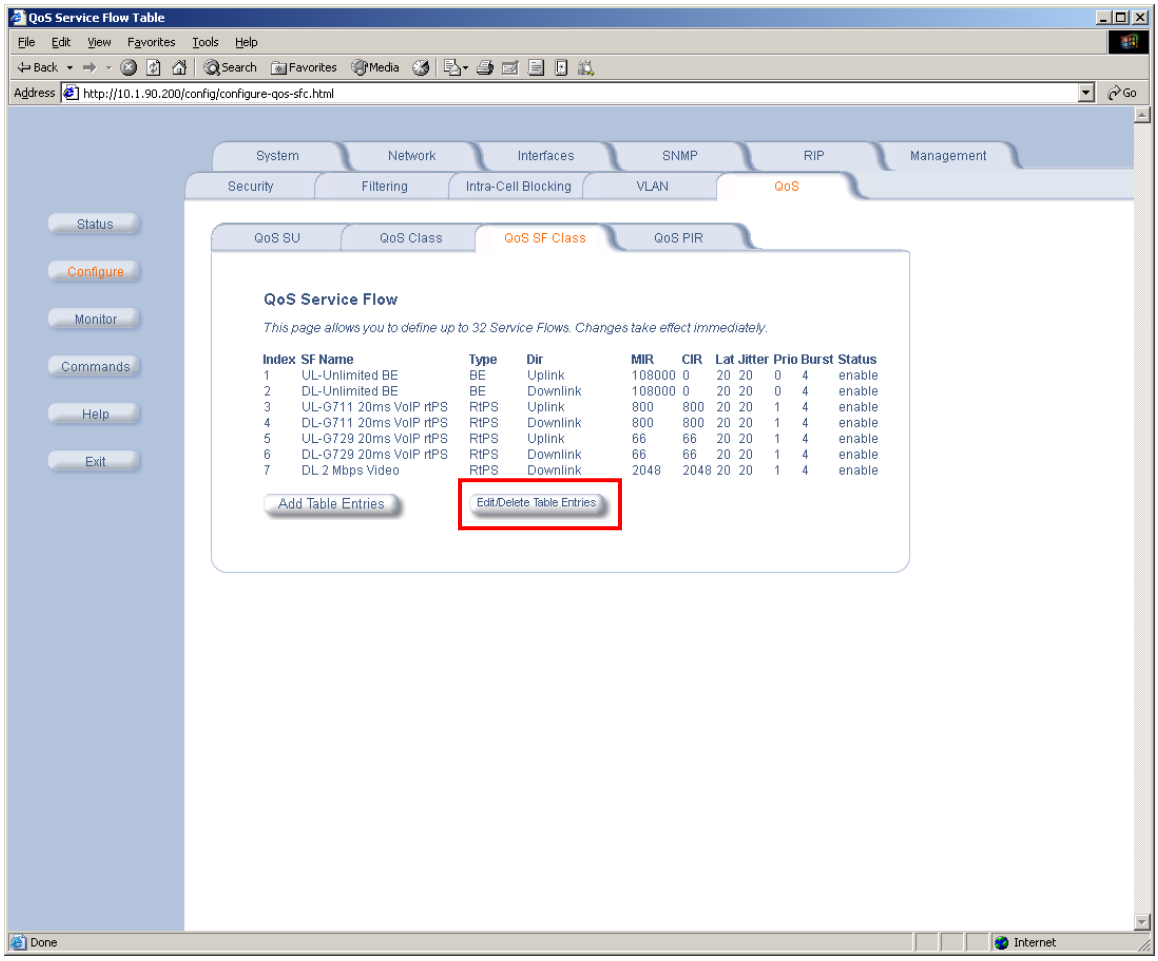
Step	Description
3.	Click the check box next to the **Enable Ether Priority Rules** field to add check mark. Ensure that the **Ether Prio Low** and **Ether Prio High** fields are set to **6.** Click the ← (arrow) button to continue. 

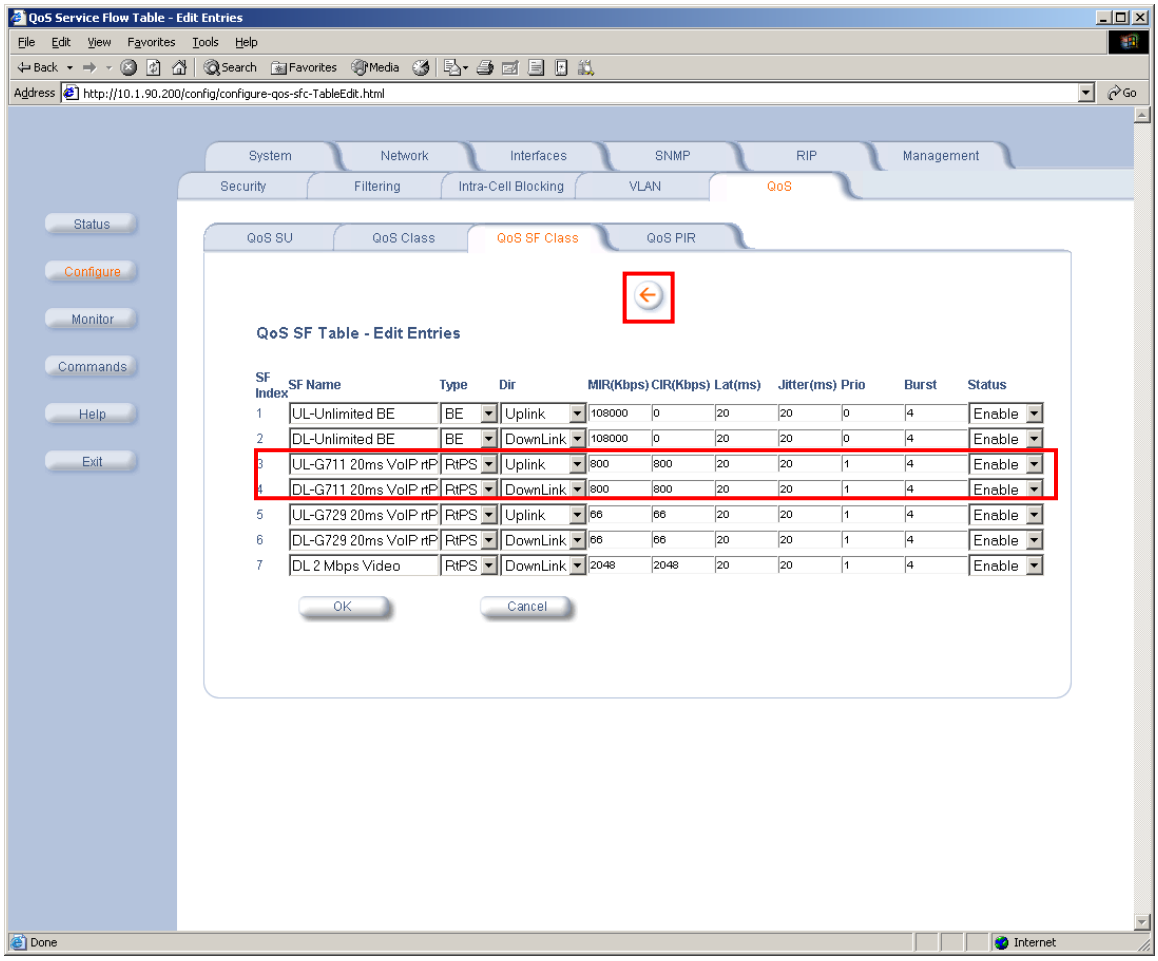
Step	Description
4.	**Creating a DSCP QoS Rule set** Select **Configure → QoS → QoS PIR.** Click the **Add Table Entries** button at the bottom of the page. 

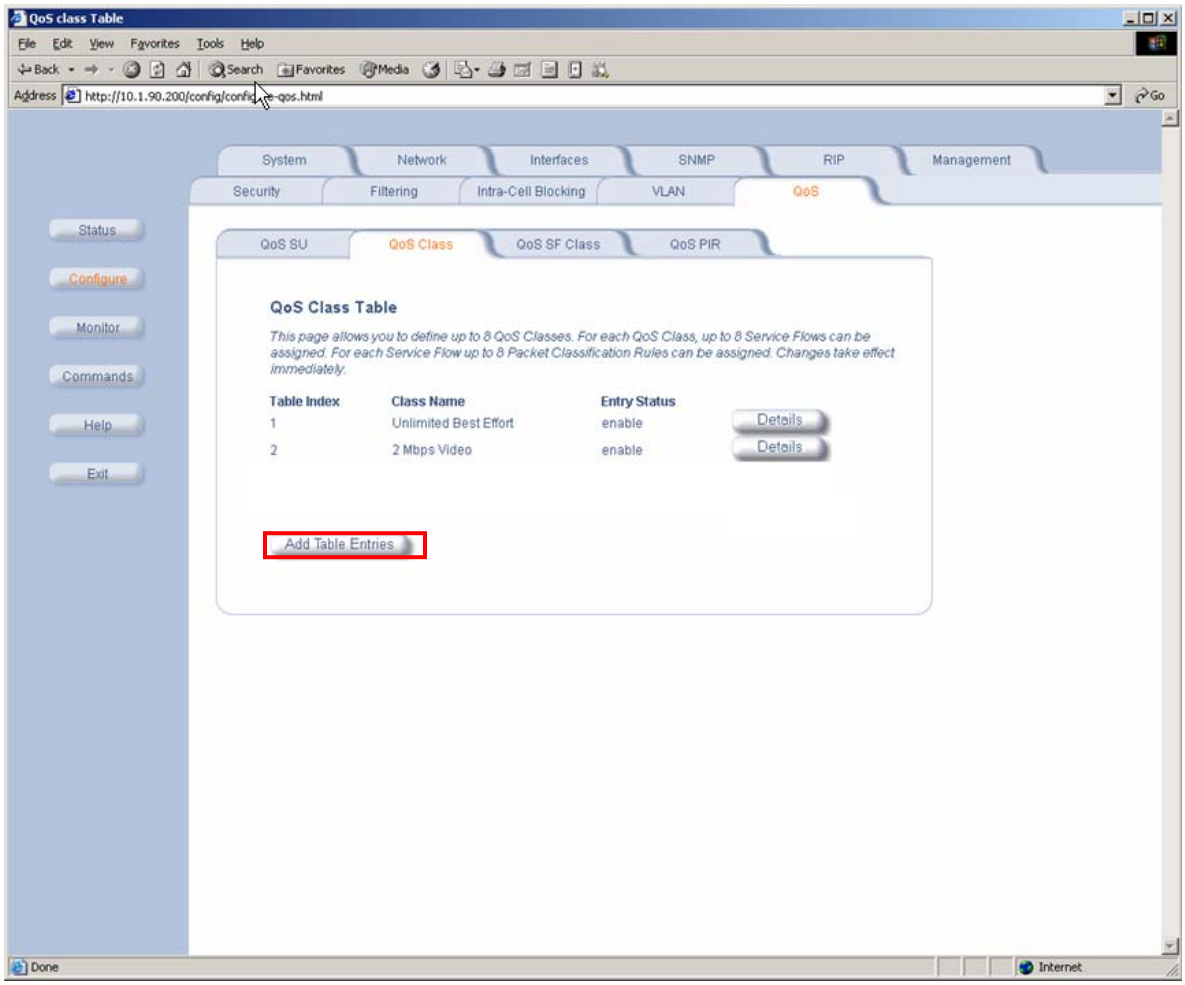
Step	Description
5.	Enter the following parameters for the DSCP table entry: • Enter **DSCP** in the **Rule Name** field. • Verify that the **Entry Status** field is set to **Enable**. • Click the **Add** button. Click the ← button to continue. 

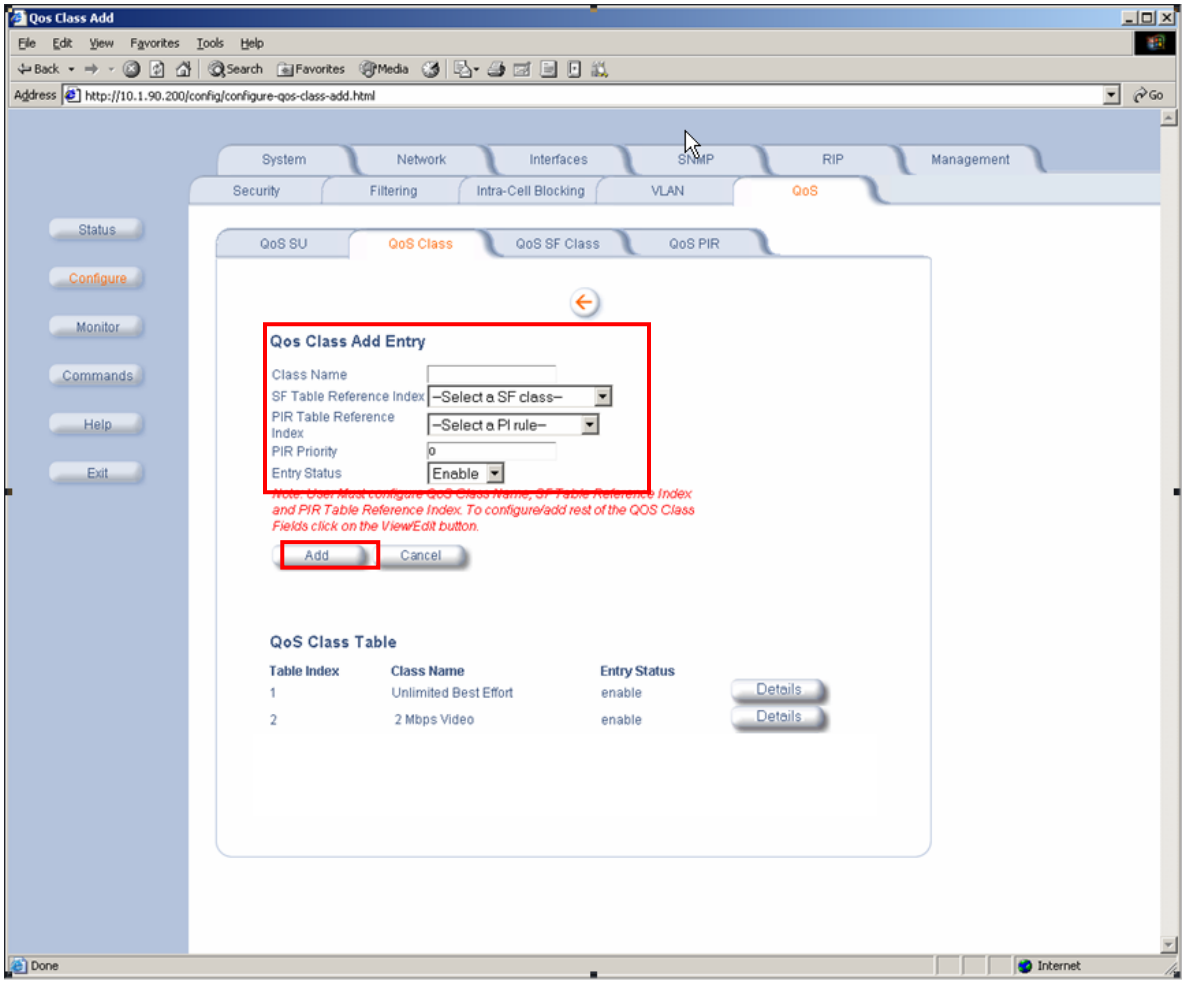
Step	Description
6.	**Creating and configuring DSCP QoS Parameters on the Proxim Tsunami MP.11 5054-R at the HQ location** Select **Configure → QoS → QoS PIR.** Click the **Details** button next to the **DSCP** PIR Name. 

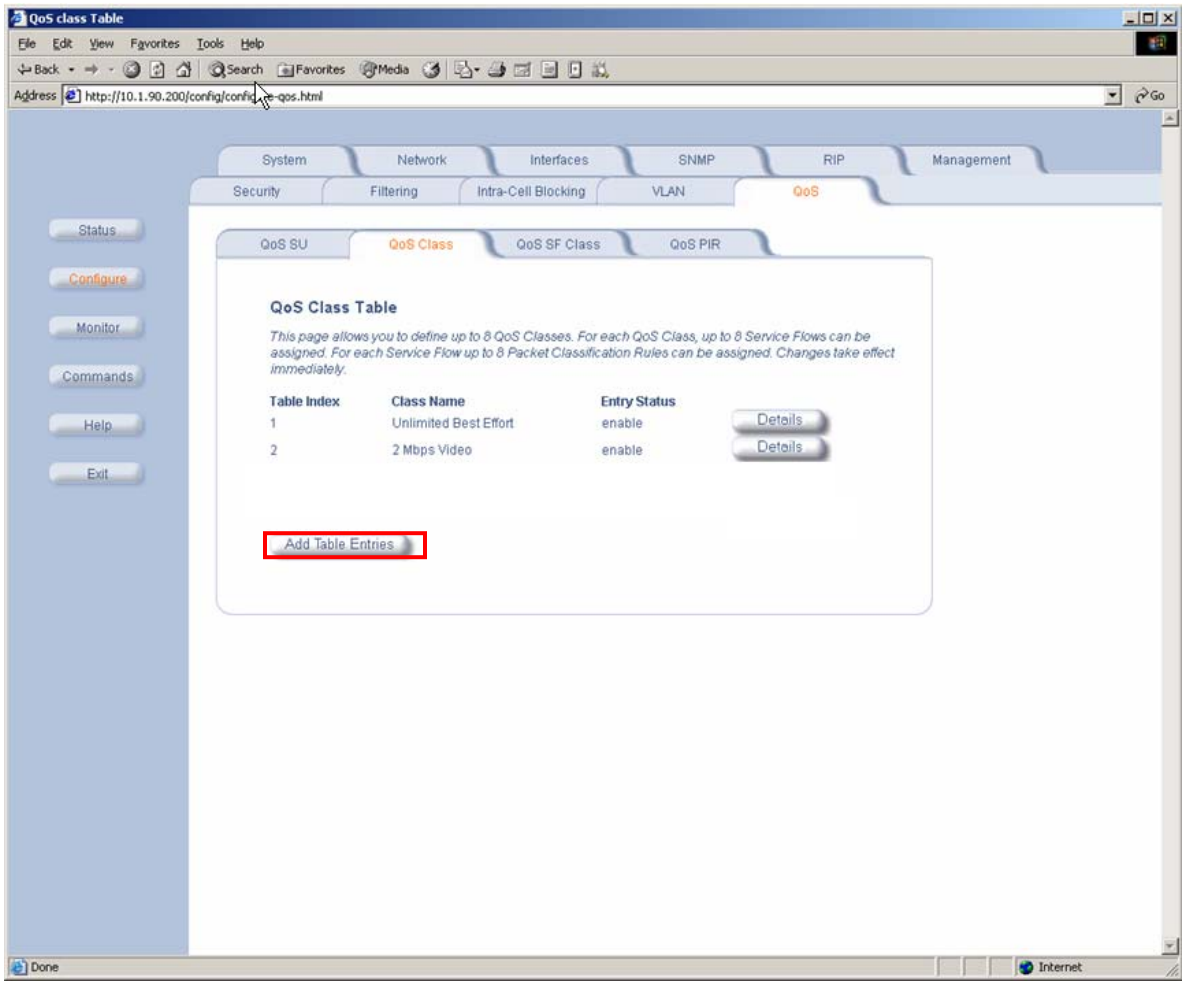
Step	Description
7.	Enter the following parameters for the DSCP QoS entry: • Click the check box next to the **Enable ToS Rules** field to add check mark. • Set the **ToS Low** and **ToS high** fields to **46** and the **ToS Mask** field to **63**. Click the ← button to continue. 

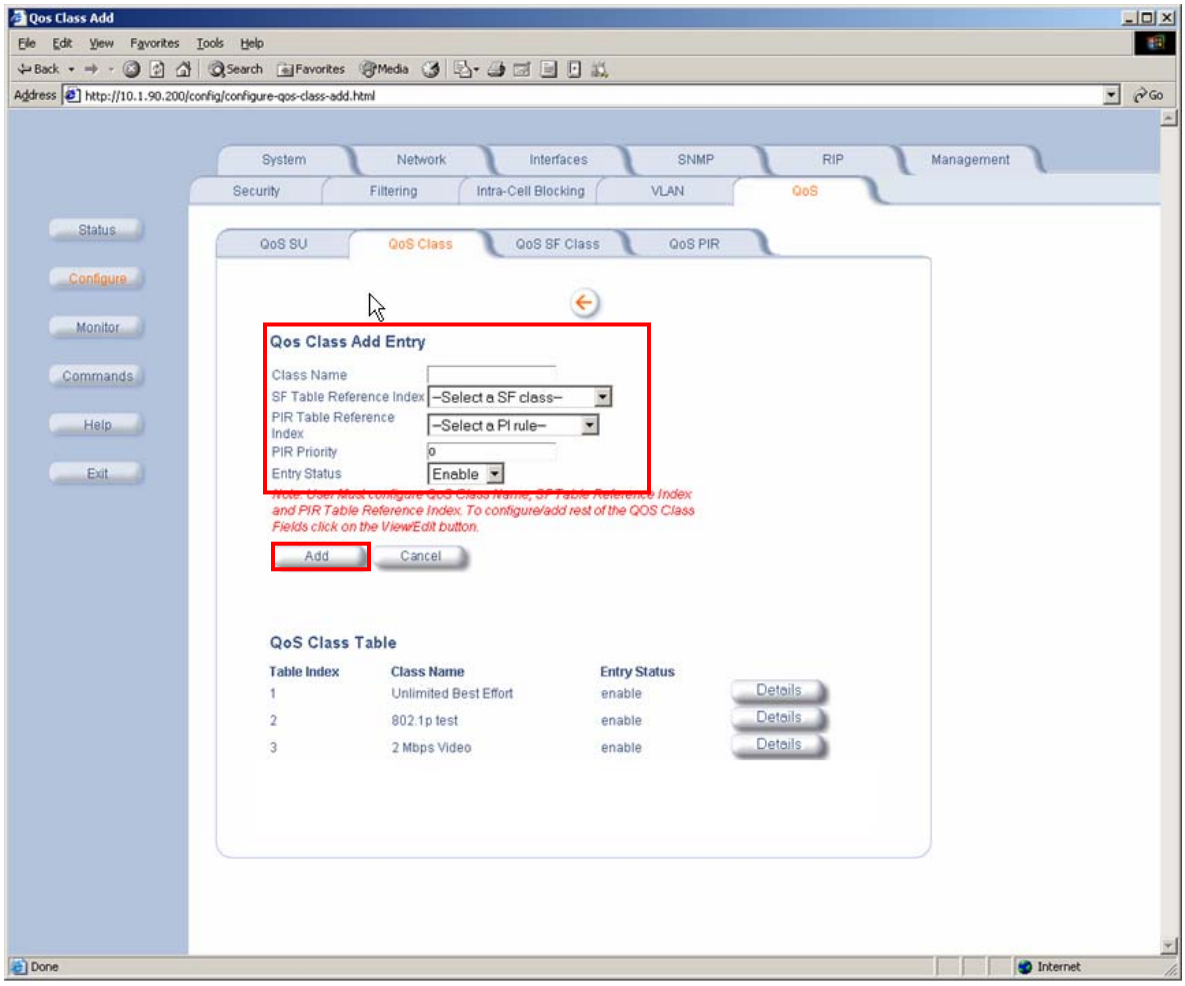
Step	Description
8.	**Editing the QoS SF information UL-G711 20ms VoIP rtPS and DL-G711 20ms VoIP rtPS index CIR(Kbps) and MIR(Kbps)** Select **Configure → QoS → QoS SF Class**. Click on the **Edit/Delete Table Entries** button. 

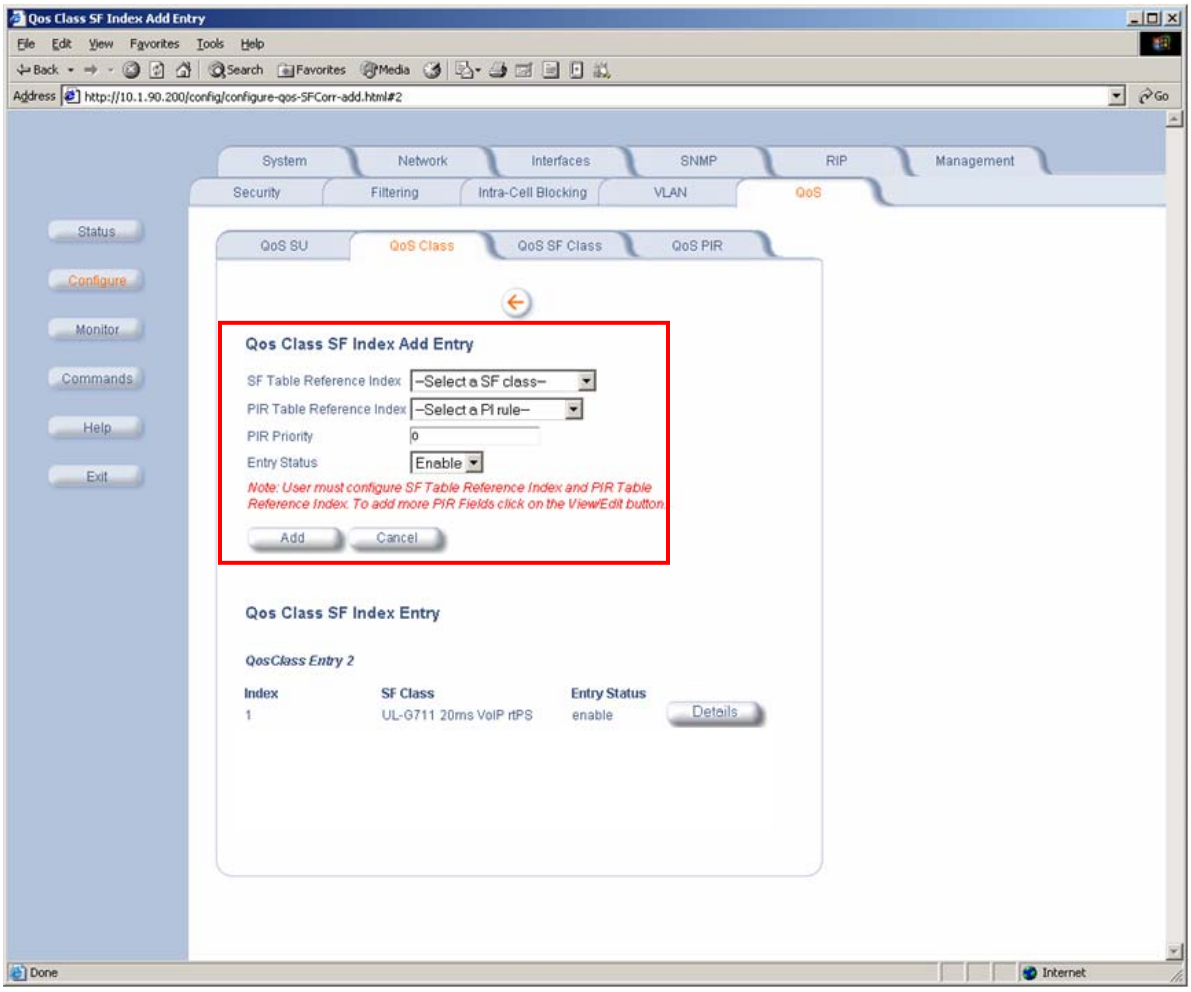
Step	Description
9.	For the **UL-G711 20ms VoIP rtPS** and **DL-G711 20ms VoIP rtPS** entries (**SF Index 3** & **4**) change the **CIR(Kbps)** and **MIR(Kbps**) fields to **800** (the number of calls planed). Click the **OK** button and then the ← button to continue. **Note:** The "**UL-G711 20ms VoIP rtPS**" and "**DL-G711 20ms VoIP rtPS**" entries in the **SF Name** field are just the default descriptive labels and can be modified as desired. These labels remain as default in these Application Notes. 

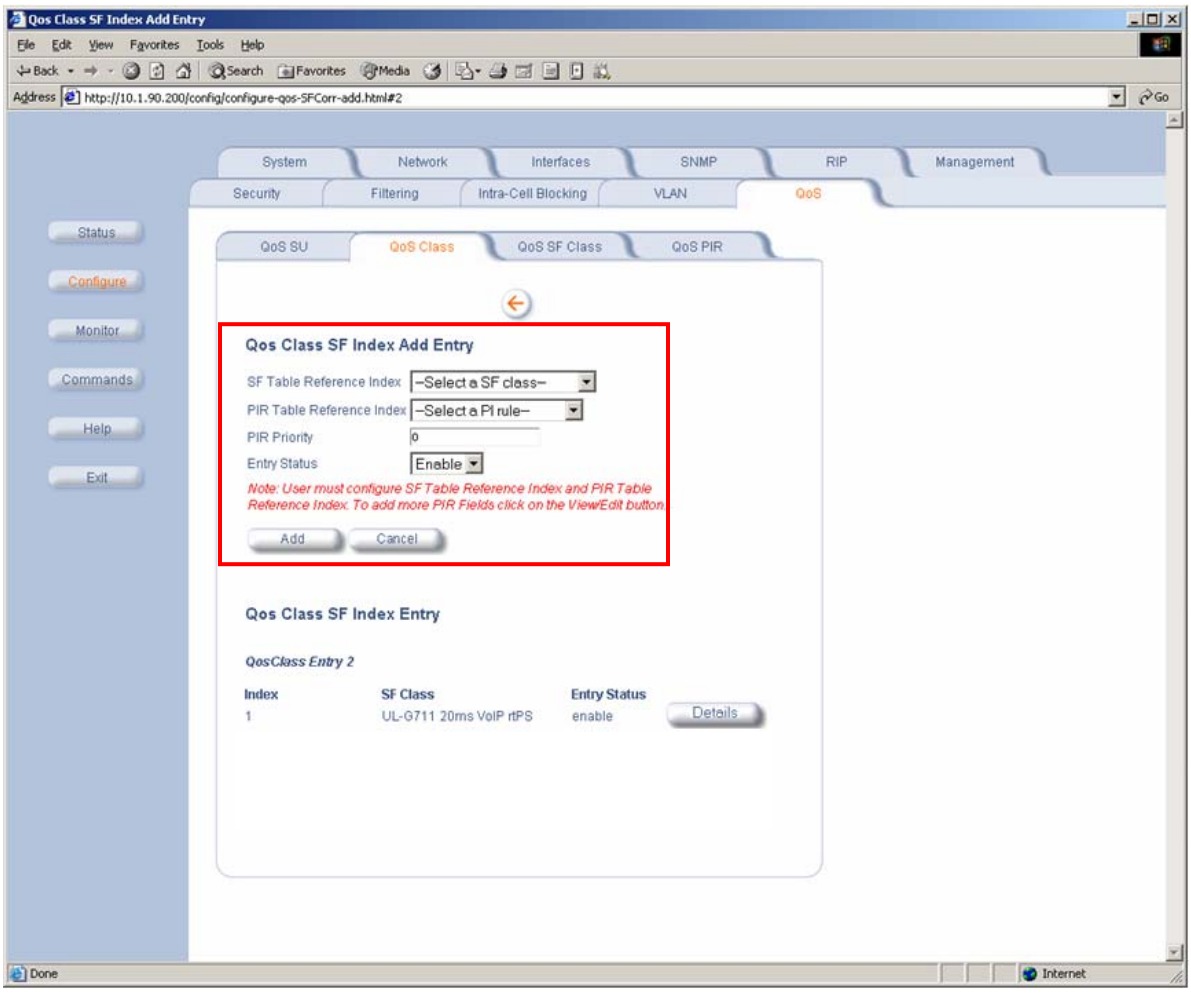
Step	Description
10.	**Adding the QoS Class information for 802.1p test** Select **Configure → QoS → QoS Class.** Click the **Add Table Entries** button. 

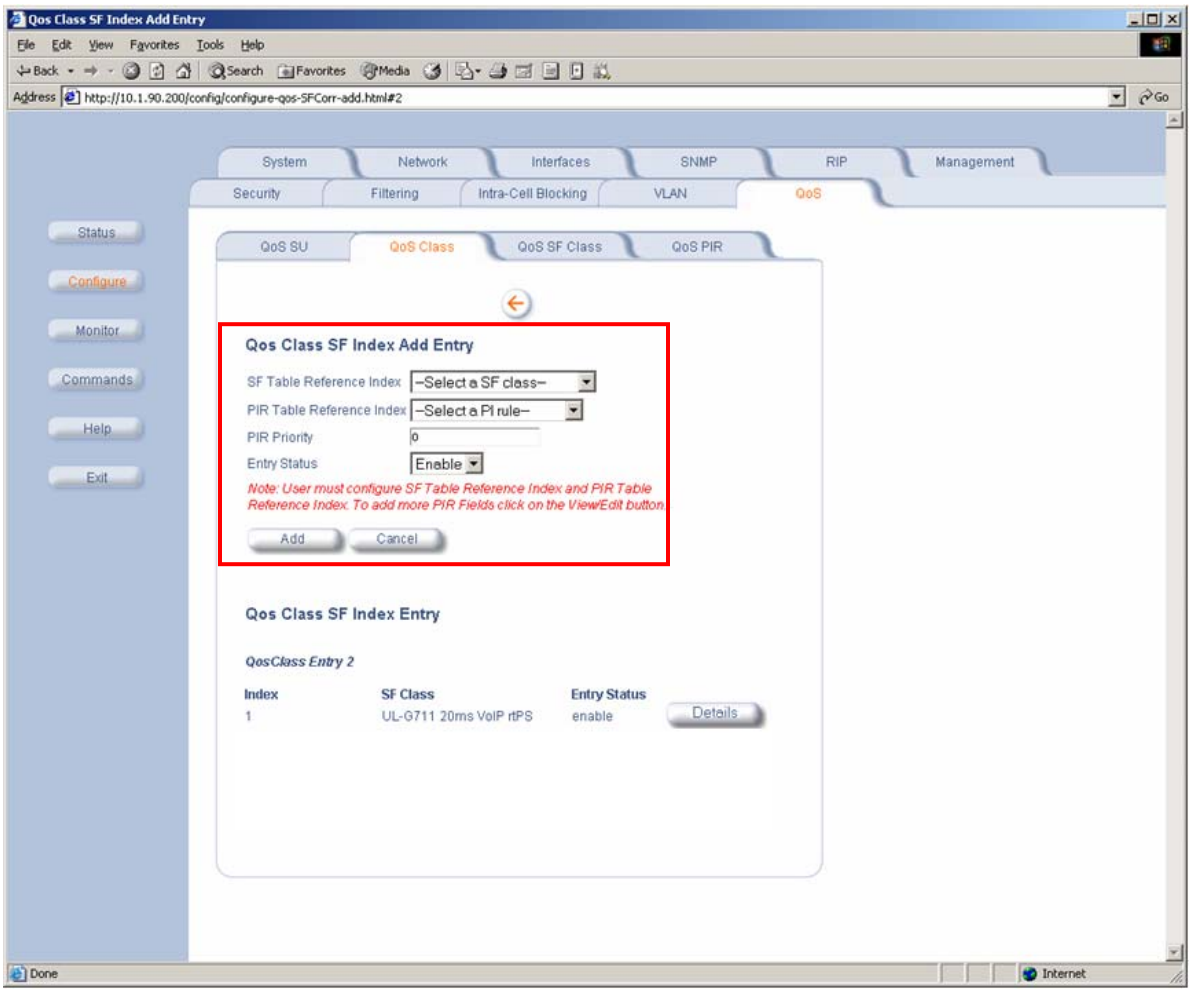
Step	Description
11.	**Creating the QoS Class information for 802.1p high priority traffic** Configure the following parameters: • Enter **802.1p test** in the **Class Name** field. • For the **SF Table Reference Index** field, select **UL-G711 20ms VoIP rtPS** for the SF class. • For the **PIR Table Reference Index** field, select **802.1p Voice** for the Pt rule. • Set the **PIR Priority** field to **7**. Click the **Add** button. 

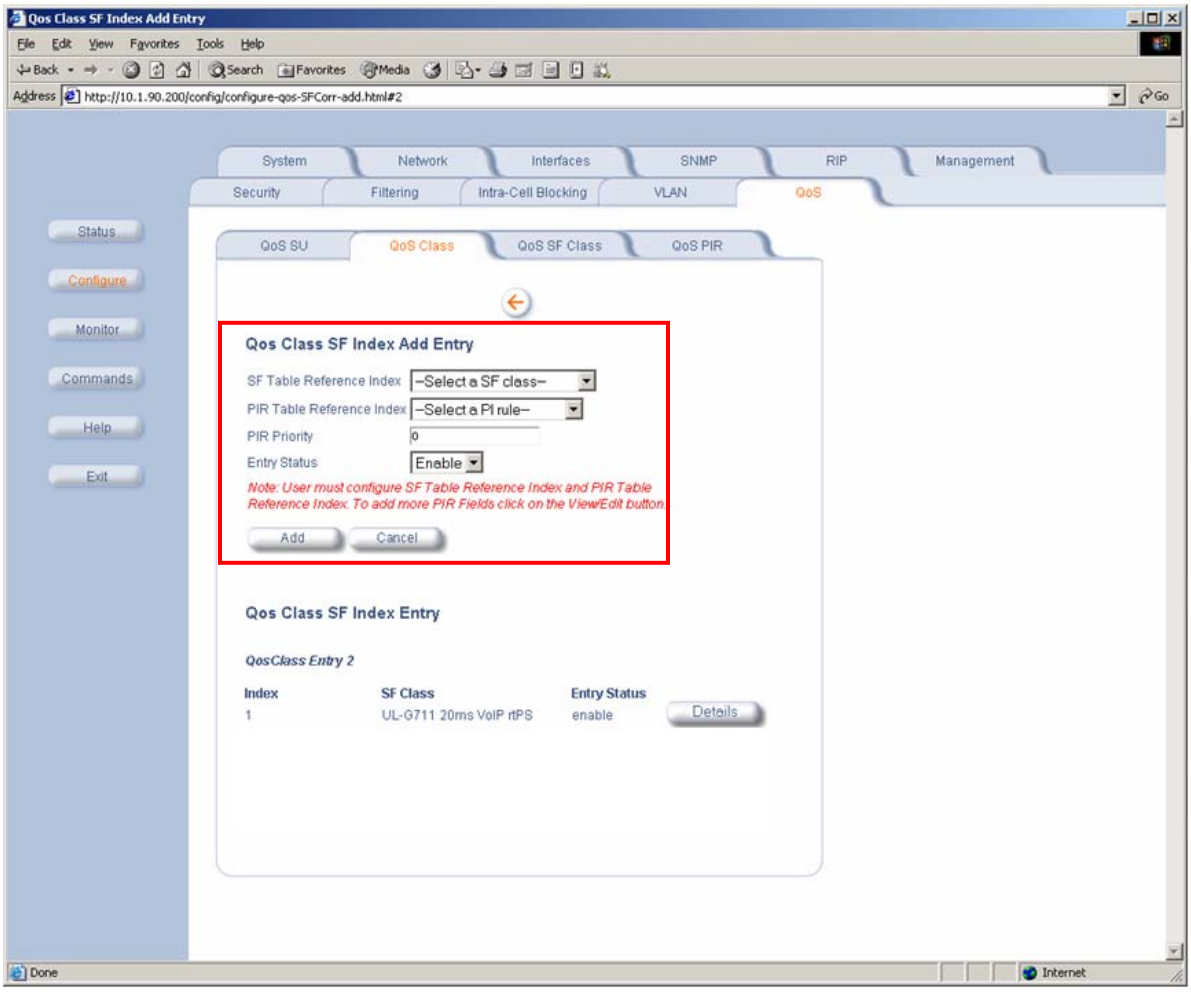
Step	Description
12.	**Adding the QoS Class information for DSCP** Select **Configure → QoS → QoS Class.** Click the **Add Table Entries** button. 

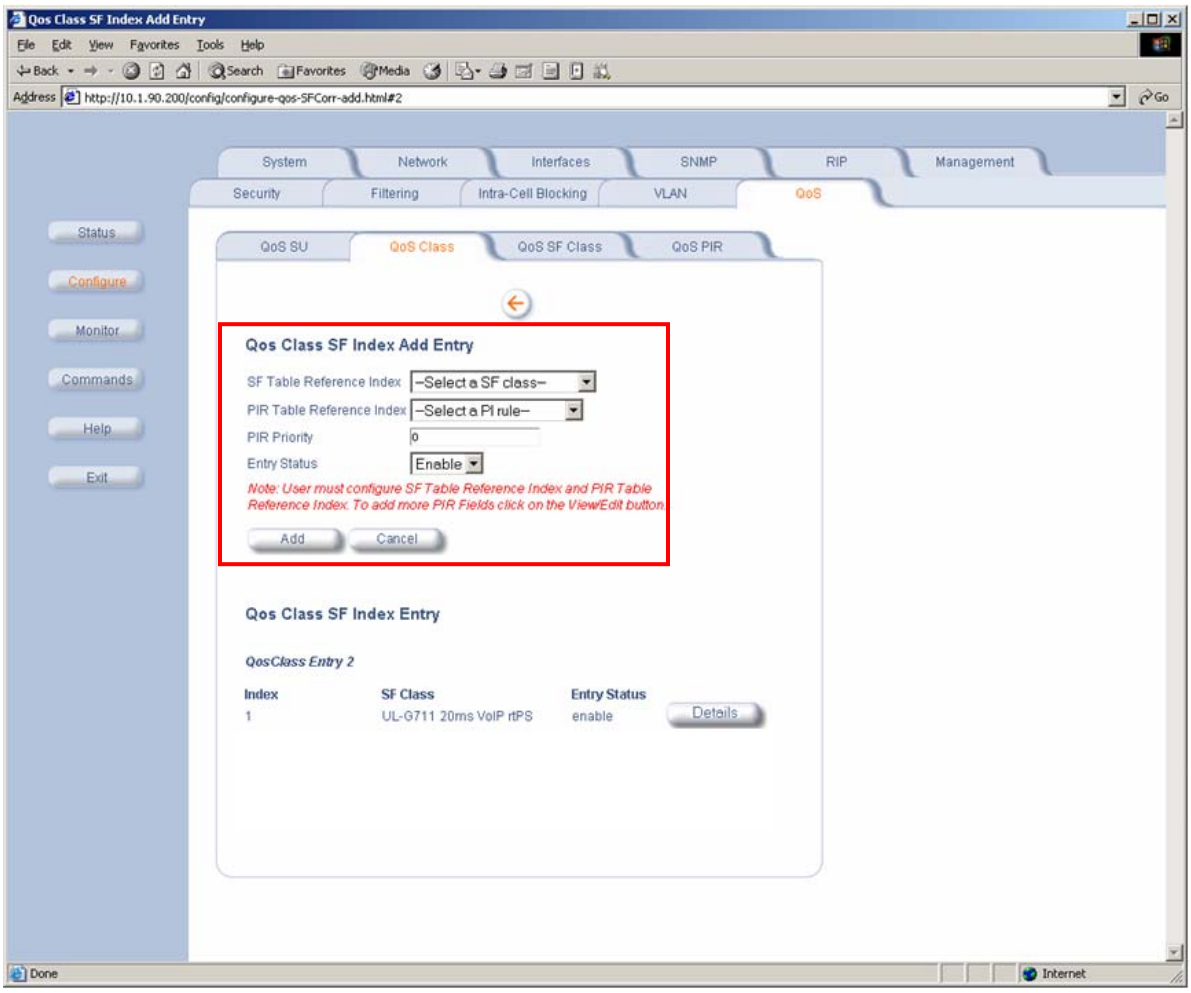
Step	Description
13.	**Creating the QoS Class information for DSCP priority traffic.** Configure the following parameters: • Enter **DSCP test** for the **Class Name** field. • For the **SF Table Reference Index** field, select **UL-G711 20ms VoIP rtPS** for the SF class. • For the **PIR Table Reference Index** field, select **DSCP** for the Pt rule. • Set the **PIR Priority** field to **7**. Click the **Add** button. 

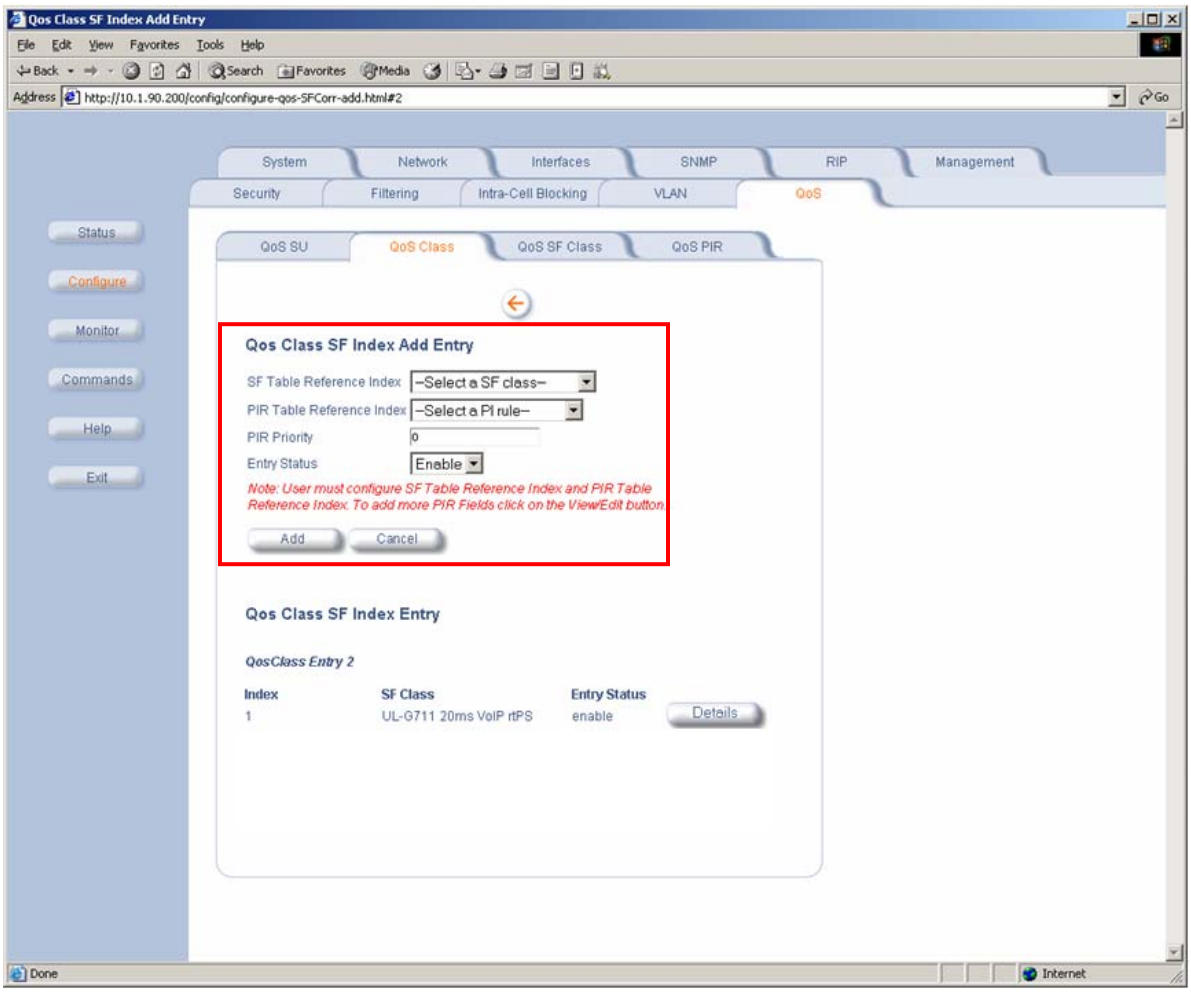
Step	Description
14.	**Configuring the QoS Class information, DL-G711 20ms VoIP rtPS QoS SF Class for 802.p test** Select **Configure → QoS → QoS Class**. Click on the **Details** button for **802.p test** under **QoS Class Table** (not shown)**.** Configure the following parameters: • For the **SF Table Reference Index** field, select **DL-G711 20ms VoIP rtPS** for the SF class. • For the **PIR Table Reference Index** field, select **802.1p** for the Pt rule. • Set the **PIR Priority** field to **7**. Click the **Add** button. 

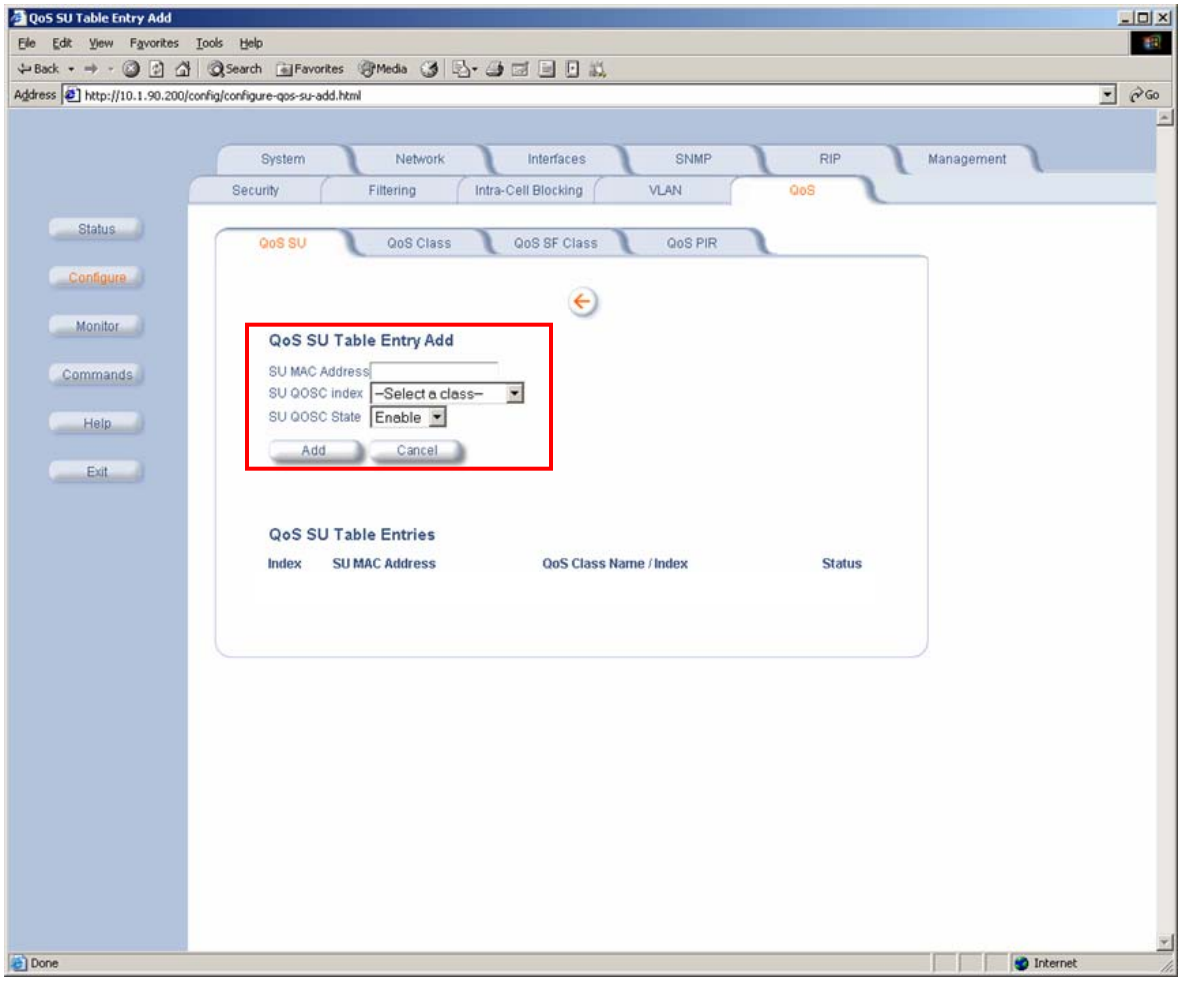
Step	Description
15.	**Configuring the QoS Class information, UL-Unlimited BE QoS SF Class for 802.p test** Select **Configure → QoS → QoS Class**. Click on the **Details** button for **802.p test** under **QoS Class Table** (not shown). Configure the following parameters: • For the **SF Table Reference Index** field, select **UL-Unlimited BE** for the SF class. • For the **PIR Table Reference Index** field, select **All** for the Pt rule. • Set the **PIR Priority** field to **0**. Click the **Add** button. 

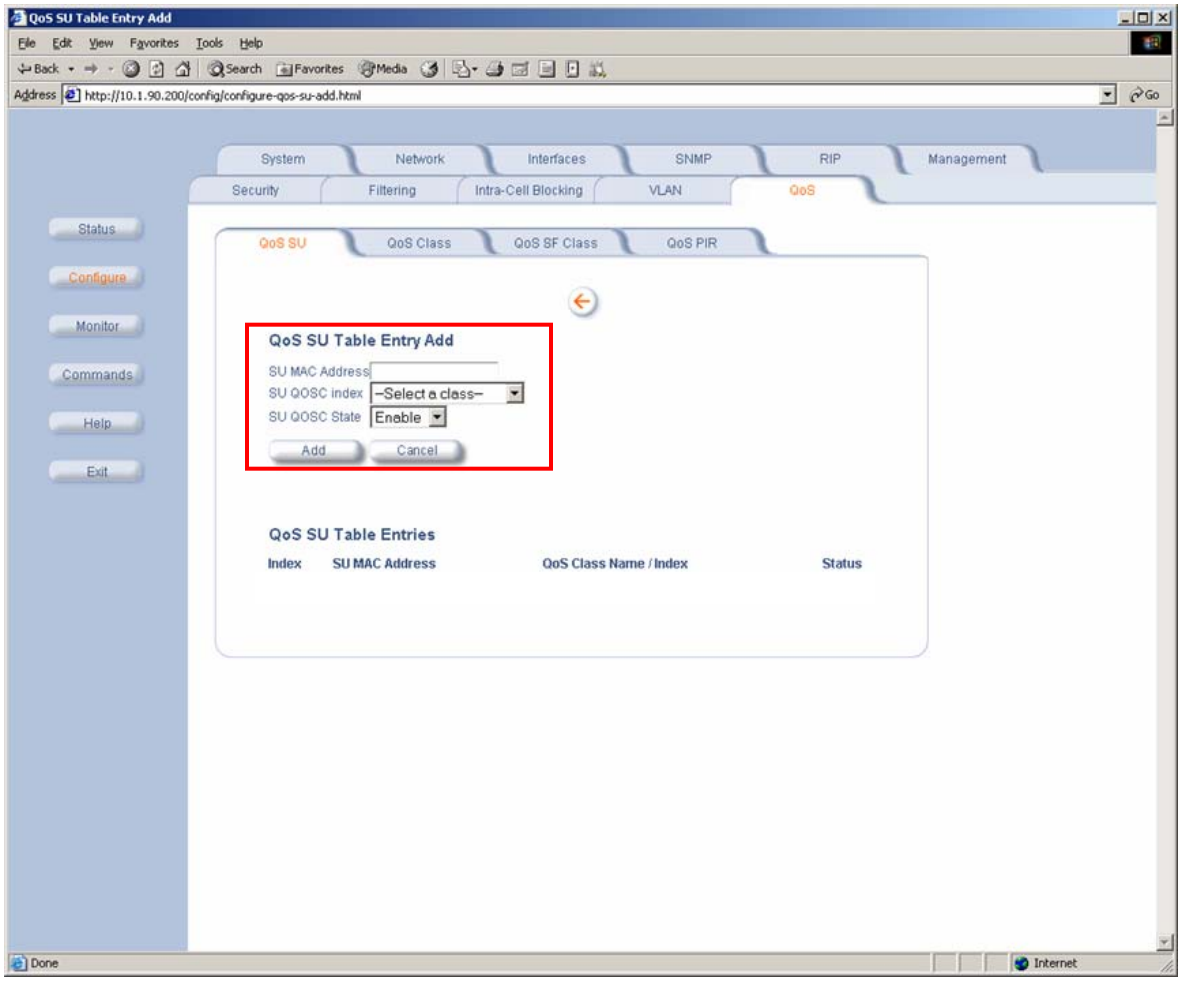
Step	Description
16.	**Configuring the QoS Class information, DL-Unlimited BE QoS SF Class for 802.p test** Select **Configure → QoS → QoS Class**. Click on the **Details** button for **802.p test** under **QoS Class Table** (not shown). Configure the following parameters: • For the **SF Table Reference Index field,** select **DL-Unlimited BE** for the SF class. • For the **PIR Table Reference Index,** select **All** for the Pt rule. • Set the **PIR Priority** field to **0**. Click the **Add** button. 

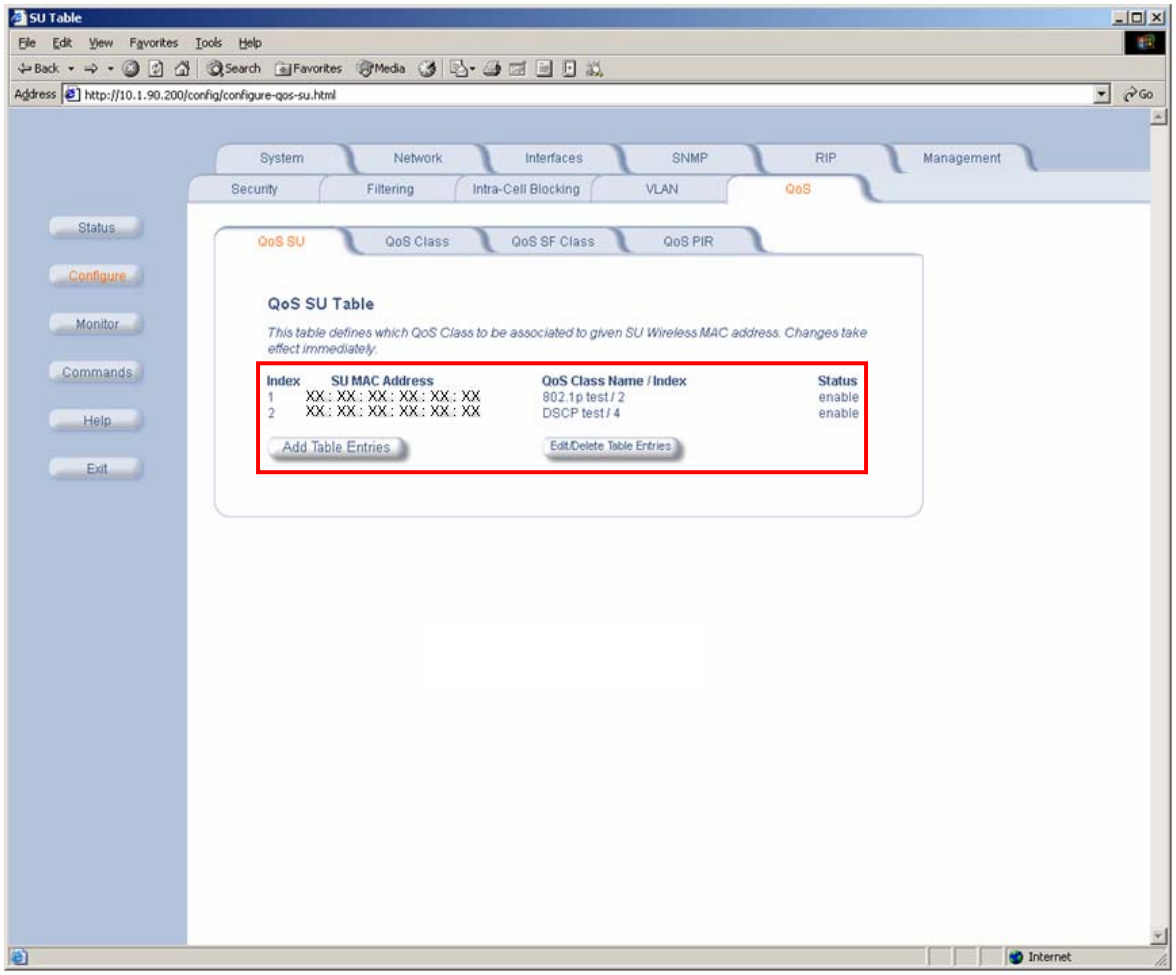
Step	Description
17.	**Configuring the QoS Class information, DL-G711 20ms VoIP rtPS QoS SF Class for DSCP test** Select **Configure → QoS → QoS Class**. Click on the **Details** button for **DSCP test** under **QoS Class Table** (not shown). Configure the following parameters: • For the **SF Table Reference Index** field, select **DL-G711 20ms VoIP rtPS** for the SF class. • For the **PIR Table Reference Index** field, select **DSCP** for the Pt rule. • Set the **PIR Priority field** to **7**. Click the **Add** button. 

Step	Description
18.	**Configuring the QoS Class information, UL-Unlimited BE QoS SF Class for DSCP test** Select **Configure → QoS → QoS Class,** click on the **Details** button for **DSCP test** under **QoS Class Table** (not shown). Configure the following parameters: • For the **SF Table Reference Index** field, select **UL-Unlimited BE** for the SF class. • For the **PIR Table Reference Index** field, select **All** for the Pt rule. • Set the **PIR Priority** field to **0**. Click the **Add** button. 

Step	Description
19.	**Configuring the QoS Class information, DL-Unlimited BE QoS SF Class for DSCP test:** Select **Configure → QoS → QoS Class,** click on the **Details** tab for **DSCP test** under **QoS Class Table.** Configure the following parameters: • For the **SF Table Reference Index** field, select **DL-Unlimited BE** for the SF class. • For the **PIR Table Reference Index** field, select **All** for the Pt rule. • Set the **PIR Priority** field to **0**. Click the **Add** button. 

Step	Description
20.	**Adding 802.1p QoS SU addresses for Campus A** Select **Configure → QoS → QoS SU**. Configure the following parameters: • For the **SU MAC Address** field, enter the MAC address of the SU at Campus A. • For the **SU QOSC index** field, select **802.1p test** for the class. • For the **SU QOSC State** field, select **Enable**. Click the **Add** button. 

Step	Description
21.	**Adding DSCP QoS SU addresses for Campus B** Select **Configure → QoS → QoS SU**. Configure the following parameters: • For the **SU MAC Address** field, enter the MAC address of the SU at Campus B. • For the **SU QOSC index** field, select **DSCP test** for the class. • For the **SU QOSC State** field, select **Enable**. Click the **Add** button. 

Step	Description
22.	**Verifying the QoS SU Table** Select **Configure → QoS → QoS SU**. To verify the information in the **QoS SU Table**, click the **Edit/Delete Table Entries** button. 

5. Configure Proxim Tsunami MP.11 5054-R Subscriber Units at Campus A & Campus B

When the Proxim Tsunami MP.11 5054-R Subscriber Units for Campus A & B connect to the Base Station at the Headquarters, the SUs receive the configured QoS policy information. Therefore, there are no configuration steps required.

6. Configure the Extreme Summit 300-48 Switch

This section shows the necessary steps in configuring the Extreme Summit 300-48 as shown in the sample network.

The Extreme Summit 300-48 will be used as the core router and will run Layer 2 and Layer 3, enforce QoS policies and run OSPF.

Step	Description

1.	Connect to the Extreme Summit 300-48 Switch. Log in using the appropriate Login ID and Password.
	`Login:`
	`Password:`
	`Summit300-48:1 #`

2.	Ensure the ports are not already configured. Use the **show port <port> info detail** command to check the current configuration for the port. `Summit300-48:1 # show port 1:1 info detail` Repeat for ports 1:2, 1:3, 1:4, 1:5 and 19.

3.	If any of the ports are configured with VLAN information, delete the information on the port or look for one that is not in use, use the **configure vlan <VLAN NAME> delete ports <port>** command to delete the port information or the **show port <port> info detail** command to find another one.
	`Summit300-48:1 # configure vlan <VLAN NAME> delete ports <port>`
	`Summit300-48:1 # show port <port> info detail`

4.	Create the VLAN VlanOSPF.
	`Summit300-48:1 #  create vlan VlanOSPF`
	`Summit300-48:1 #  configure VlanOSPF tag 2000`

5.	Add an IP address for VLAN VlanOSPF, and enable IP forwarding.
	`Summit300-48:1 # configure VlanOSPF ipaddress 10.20.30.1/30`
	`Summit300-48:1 # enable ipforwarding VlanOSPF`

6.	Assign ports to VLAN VlanOSPF. `Summit300-48:1 # configure VlanOSPF add ports 1:1 tag`

Step	Description
7.	Enable OSPF. `Summit300-48:1 # enable ospf`

8.	Configure OSPF for VlanOSPF.
	`Summit300-48:1 # configure ospf VlanOSPF area 0.0.0.0`
	`Summit300-48:1 # configure ospf add VlanOSPF area 0.0.0.0`

9.	Enable OSPF to forward information for directly connected interfaces. `Summit300-48:1 # enable ospf export direct cost 2 type ase-type-2`

10.	Create VLAN Voice1.
	`Summit300-48:1 #  create vlan Voice1`
	`Summit300-48:1 #  configure Voice1 tag 42`

11.	Add an IP address for VLAN **Voice1**, and enable IP forwarding.
	`Summit300-48:1 # configure Voice1 ipaddress 192.168.42.254/24`
	`Summit300-48:1 # enable ipforwarding Voice1`

12.	Assign ports to VLAN Voice1.
	`Summit300-48:1 # configure Voice1 add ports  1:1, 1:2, 1:3 tagged`
	`Summit300-48:1 # configure Voice1 add ports  1:5`

13.	Assign a port to VLAN Voice1 for the Avaya IP Office 406v2**.** `Summit300-48:1 # configure Voice1 add ports 1:19`
14.	Enable DiffServ examination on port 1:19. `Summit300-48:1 # enable diffserv examination ports 1:19`
15.	Add QoS profile to port 1:19. `Summit300-48:1 # configure port 1:19 qosprofile qp7`

16.	Set all ingress traffic on port **1:19** to **priority 6**.
	`Summit300-48:1 # create access-mask port19pri6 port`
	`Summit300-48:1 # create access-list pri19 access-mask port19pri6 port 1:19 permit set dot1p 6`

Step	Description

17.	Create VLAN Datavlan1.
	`Summit300-48:1 # create vlan Datavlan1`
	`Summit300-48:1 # configure Datavlan1 tag 200`

18.	Add Datavlan1 to QoS profile qp1 (best effort). `Summit300-48:1 # configure Datavlan1 qosprofile qp1`

19.	Add an IP address for VLAN Datavlan1, and enable IP forwarding.
	`Summit300-48:1 # configure Datavlan1 ipaddress 192.168.200.254/24`
	`Summit300-48:1 # enable ipforwarding Datavlan1`

20.	Assign ports to VLAN Datavlan1.
	`Summit300-48:1 # configure Datavlan1 add ports 1:1 tagged`
	`Summit300-48:1 # configure Datavlan1 add ports 1:2, 1:3`

21.	Create VLAN Vlan2.
	`Summit300-48:1  create vlan Vlan2`
	`Summit300-48:1  configure Vlan2 tag 2`

22.	Add an IP address for VLAN Vlan2, and enable IP forwarding.
	`Summit300-48:1 # configure Vlan2 ipaddress 10.1.2.1/24`
	`Summit300-48:1 # enable ipforwarding Vlan2`

23.	Assign ports to VLAN Vlan2. `Summit300-48:1 # configure Vlan2 add ports 1:4`

24.	Create VLAN Prox1.
	`Summit300-48:1  create vlan Prox1`
	`Summit300-48:1  configure Prox1 tag 90`

25.	Add an IP address for VLAN Prox1, and enable IP forwarding.
	`Summit300-48:1 # configure Prox1 ipaddress 10.1.90.1/24`
	`Summit300-48:1 # enable ipforwarding Prox1`

26.	Assign ports to VLAN Prox1. `Summit300-48:1 # configure Prox1 add ports 1:1 tag`

Step	Description

27.	Enable DHCP relay.
	`Summit300-48:1 **enable bootprelay**`
	`Summit300-48:1 **configure bootprelay add 10.1.2.250**`

28.	Save the running configuration to the startup configuration. `Summit300-48:1 # **save**`

7. Configuration of the Extreme Summit X450e-24p Switch for Campus A

This section addresses configuring the Extreme Summit X450e-24p Switch for Campus A. The Extreme Summit X450e-24p Switch will run Layer 2 VLANs, enforce QoS policies and supply PoE to the Avaya IP Telephones.

Step	Description

1.	Log into the Extreme Summit X450e-24p Switch for Campus A.
	Connect to the Extreme Summit X450e-24p Switch. Log in using the appropriate Login ID and Password.
	`Login:`
	`Password:`
	`X450e-24p:1 #`

2.	Ensure the ports are not already configured. Use the **show port <port> info detail** command to check the current configuration for the port. `X450e-24p:1 # **show port 1 info detail**` Repeat for ports 2 and 3.

3.	Verify ports are not configured with VLAN information, delete the information on the port or look for one that is not in use, use the **configure vlan <VLAN NAME> delete ports <port>** command to delete the port information or the **show port <port> info detail** command to find another one.
	`X450e-24p:1# **configure vlan <VLAN NAME> delete ports <port>**`
	`X450e-24p:1# **show port <port> info detail**`

Step	Description

4.	Create VLAN Voice1.
	`X450e-24p:1 #  create vlan Voice1`
	`X450e-24p:1 #  configure Voice1 tag 42`

5.	Assign ports to VLAN Voice1 for the interfaces. `X450e-24p:1 # configure Voice1 add ports  1, 2, 3 tagged`

6.	Create VLAN Datavlan1.
	`X450e-24p:1 # create vlan Datavlan1`
	`X450e-24p:1 # configure Datavlan1 tag 200`

7.	Add Datavlan1 to QoS profile qp1 (best effort). `X450e-24p:1 # configure Datavlan1 qosprofile qp1`
8.	Assign ports to VLAN Datavlan1. `X450e-24p:1 # configure Datavlan1 add ports 1, 2, 3 tagged`
9.	Save the running configuration to the startup configuration. `X450e-24p:1 # save`

8. Configuration of the Extreme Summit X450e-24p Switch for Campus B

This section addresses configuring the Extreme Summit X450e-24p Switch. The Summit X450e-24p Switch will run Layer 2 and Layer 3, enforces QoS policies, run OSPF, and supply PoE to the Avaya IP Telephones.

Step	Description

1.	Log into the Extreme Summit X450e-24p Switch.
	Connect to the Extreme X450e-24p Switch. Log in using the appropriate Login ID and Password.
	`Login:`
	`Password:`
	`X450e-24p.1 #`

Step	Description
2.	Ensure the ports are not already configured. Use the **show port <port> info detail** command to check the current configuration for the port. `X450e-24p.1 # show port 1 info detail` Repeat for ports 2 and 3.

3.	Verify ports are not configured with VLAN information, delete the information on the port or look for one that is not in use, use the **configure vlan <VLAN NAME> delete ports <port>** command to delete the port information or the **show port <port> info detail** command to find another one.
	`X450e-24p:1# configure vlan <VLAN NAME> delete ports <port>`
	`X450e-24p:1# show port <port> info detail`

4.	Enable DiffServ examination on port 1. `X450e-24p.1 # enable diffserv examination ports 1`
5.	Create QoS profile qp7 `X450e-24p.1 # create qosprofile qp7`
6.	Assign DiffServ DSCP replacement value for qp7 to 46. `X450e-24p.1 # configure diffserv replacement qp7 code-point 46`

7.	Create VLAN VlanOSPF.
	`X450e-24p.1 #  create vlan VlanOSPF`
	`X450e-24p.1 #  configure VlanOSPF tag 2000`

8.	Add an IP address for VLAN VlanOSPF and enable IP forwarding.
	`X450e-24p.1 # configure VlanOSPF ipaddress 10.20.30.2/30`
	`X450e-24p.1 # enable ipforwarding VlanOSPF`

9.	Assign ports to VLAN VlanOSPF. `X450e-24p.1 # configure VlanOSPF add ports 1 tag`
10.	Enable OSPF `X450e-24p.1 # enable ospf`

Step	Description

11.	Configure OSPF for VlanOSPF.
	`X450e-24p.1 # configure ospf VlanOSPF area 0.0.0.0`
	`X450e-24p.1 # configure ospf add VlanOSPF area 0.0.0.0`

12.	Enable OSPF to forward information for directly connected interfaces. `X450e-24p.1 # enable ospf export direct cost 2 type ase-type-2`

13.	Create VLAN Voice2.
	`X450e-24p.1 #  create vlan Voice2`
	`X450e-24p.1 #  configure Voice2 tag 33`

14.	Add an IP address for VLAN Voice2 and enable IP forwarding.
	`X450e-24p.1 # configure Voice2 ipaddress 192.168.33.254/24`
	`X450e-24p.1 # enable ipforwarding Voice2`

15.	Assign ports to VLAN Voice2. `X450e-24p.1 # configure Voice2 add ports  1, 2, 3 tagged`

16.	Create VLAN Datavlan2.
	`X450e-24p.1 # create vlan Datavlan2`
	`X450e-24p.1 # configure Datavlan2 tag 30`

17.	Add Datavlan2 to QoS profile qp1 (best effort). `X450e-24p.1 # configure Datavlan2 qosprofile qp1`

18.	Add an IP address for VLAN Datavlan2 and enable IP forwarding.
	`X450e-24p.1 # configure Datavlan2 ipaddress 192.168.30.254/24`
	`X450e-24p.1 # enable ipforwarding Datavlan2`

19.	Assign ports to VLAN Datavlan2. `X450e-24p.1 # configure Datavlan2 add ports 2, 3`

20.	Enable DHCP relay.
	`X450e-24p.1 # enable bootprelay`
	`X450e-24p.1 # configure bootprelay add 10.1.2.250`

Step	Description
21.	Save the running configuration to the startup configuration. `X450e-24p.1 # save`

9. Interoperability Compliance Testing

Interoperability compliance testing covered feature functionality, serviceability, and performance testing.

For feature functionality testing, emphasis was placed on verifying voice quality in a multi-site converged VoIP and data network scenario. Specifically, compliance testing verified that when the Proxim Tsunami MP.11 interfaces were oversubscribed with low priority data traffic, the higher priority VoIP media and signaling traffic still is allowed through with good voice quality. Prioritization of voice traffic was achieved by implementing Layer 3 DiffServ and Layer 2 priority (802.1p) QoS. Voice and data traffic were segmented in the enterprise network using VLANs.

QoS and performance testing were verified by making voice calls while a traffic generator generated low priority data traffic. At the end of the performance test, it was verified that the network devices continued to operate successfully.

Serviceability testing was conducted to verify the ability of the Avaya/Proxim VoIP solution to recover from adverse conditions, such as power cycling Avaya IP Office, Proxim Wireless devices and disconnecting cables between the LAN interfaces. In all cases, the Avaya IP Office and Proxim Wireless devices recovered without intervention.

9.1. General Test Approach

All feature functionality test cases were performed manually. The general test approach entailed verifying the following:

- LAN connectivity between the Avaya and Proxim products
- Registration of Avaya IP Telephones with Avaya IP Office
- Verification of the DHCP relay configuration
- VoIP calls over Layer 2 and Layer 3 connections
- Inter-office calls using G.711 mu-law & G.729 codecs, direct media, conferencing, and sending low priority data traffic over the LAN
- Verifying that QoS directed the voice signaling and voice media to the higher priority egress queue based on the packets' DSCP value
- Layer-2, Layer-3, port based and VLAN based Quality of Service
- Chariot was used to verify voice quality

The performance tests were performed by oversubscribing the network interfaces with low priority data traffic and verifying that good voice quality was achieved when calls were made over the routed and switched interfaces.

9.2. Test Results

All feature functionality, serviceability, and performance test cases passed. The Proxim Wireless implementation yielded good voice quality. The stability of the Avaya/Proxim solution was successfully verified through performance and serviceability testing.

10. Verification Steps

This section provides the steps for verifying end-to-end network connectivity and QoS. In general, the verification steps include:

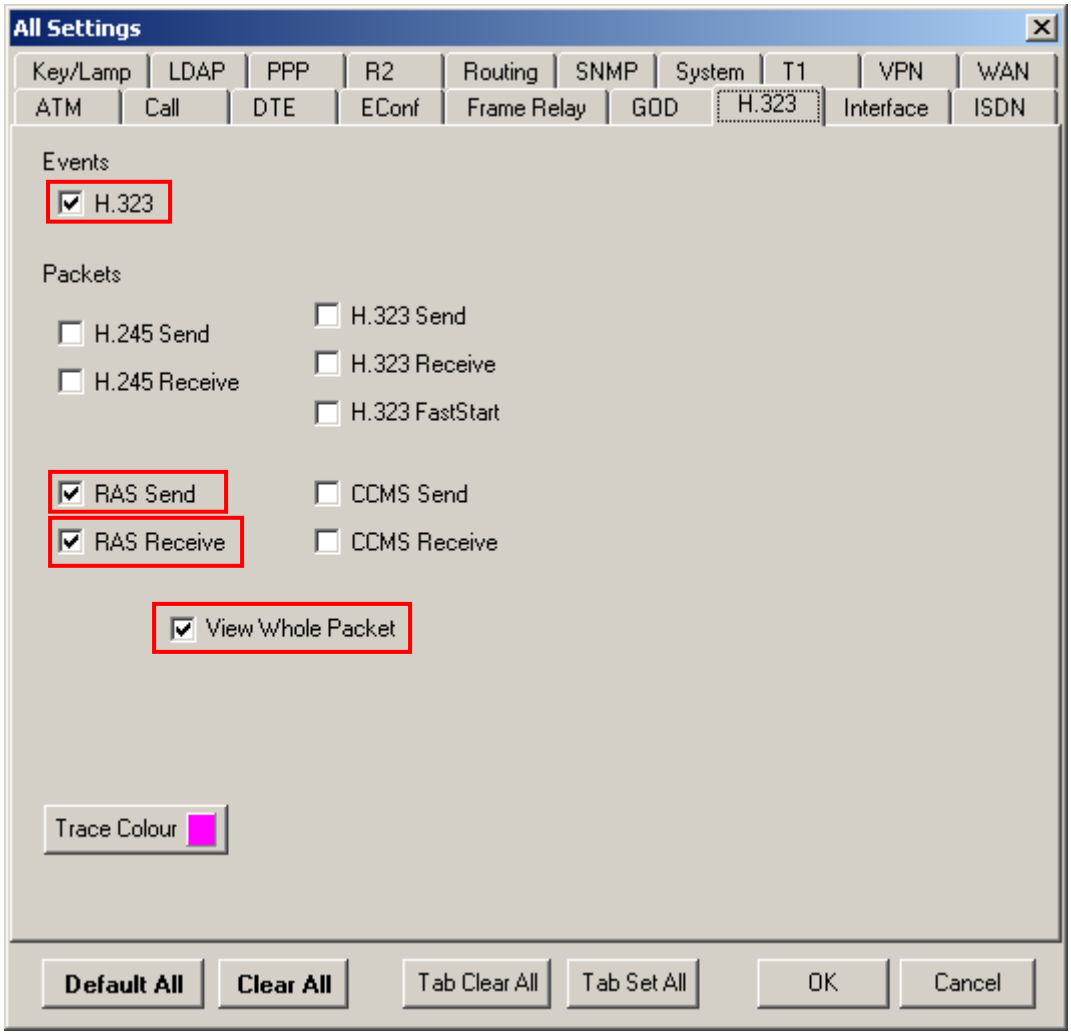
- Verify that the DHCP relay is functioning by confirming that the Avaya IP Telephones receive their IP addresses from the DHCP server connected to the network
- Check that the Avaya IP Telephones have successfully registered using the Avaya IP Office System Monitor. See **Section 11.1.**
- Place calls between the Avaya 2410 Digital Telephone and Avaya IP Telephones.
- Verify good voice quality using a Chariot server and clients.

11. Troubleshooting

11.1. Avaya IP Office Troubleshooting

Troubleshooting can be performed on Avaya IP Office via the Avaya IP Office System Monitor application. Log into the IP Office Monitor PC and select **Start → Programs → IP Office → Monitor** to launch the IP Office System Monitor application. Log into the application using the appropriate credentials.

To see the registration messages going to and from Avaya IP Office, select **Trace Options** under the **Filters** Menu. Select the **H.323** tab and configure as illustrated below. Click the **OK** button.



11.2. Proxim Wireless Troubleshooting

- If the voice quality is poor, check **Sections 4** thru **6** for QoS options.
- If any of the endpoints are unable to communicate with any of the aforementioned IP devices and interfaces, check the VLAN configuration, routing and status of the Ethernet and LAN interfaces on the switches and the BSU and SU.

12. Conclusion

These Application Notes describe the configuration steps required for integrating Proxim Base Stations and Subscriber Units into an Avaya IP Office infrastructure. For the configuration described in these Application Notes, the Proxim MP.11 Base stations and subscriber units were responsible for enforcing QoS policies using Layer 3 Differentiated Services and Layer 2 (802.1p). Good voice quality was successfully achieved in the Avaya/Proxim configuration described herein.

13. Additional References

This section references the Avaya and Proxim product documentation that are relevant to these Application Notes.

The Avaya IP Office product documentation can be found at:
http://marketingtools.avaya.com/knowledgebase/

The Proxim product documentation can be found at:
http://www.proxim.com