



**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.

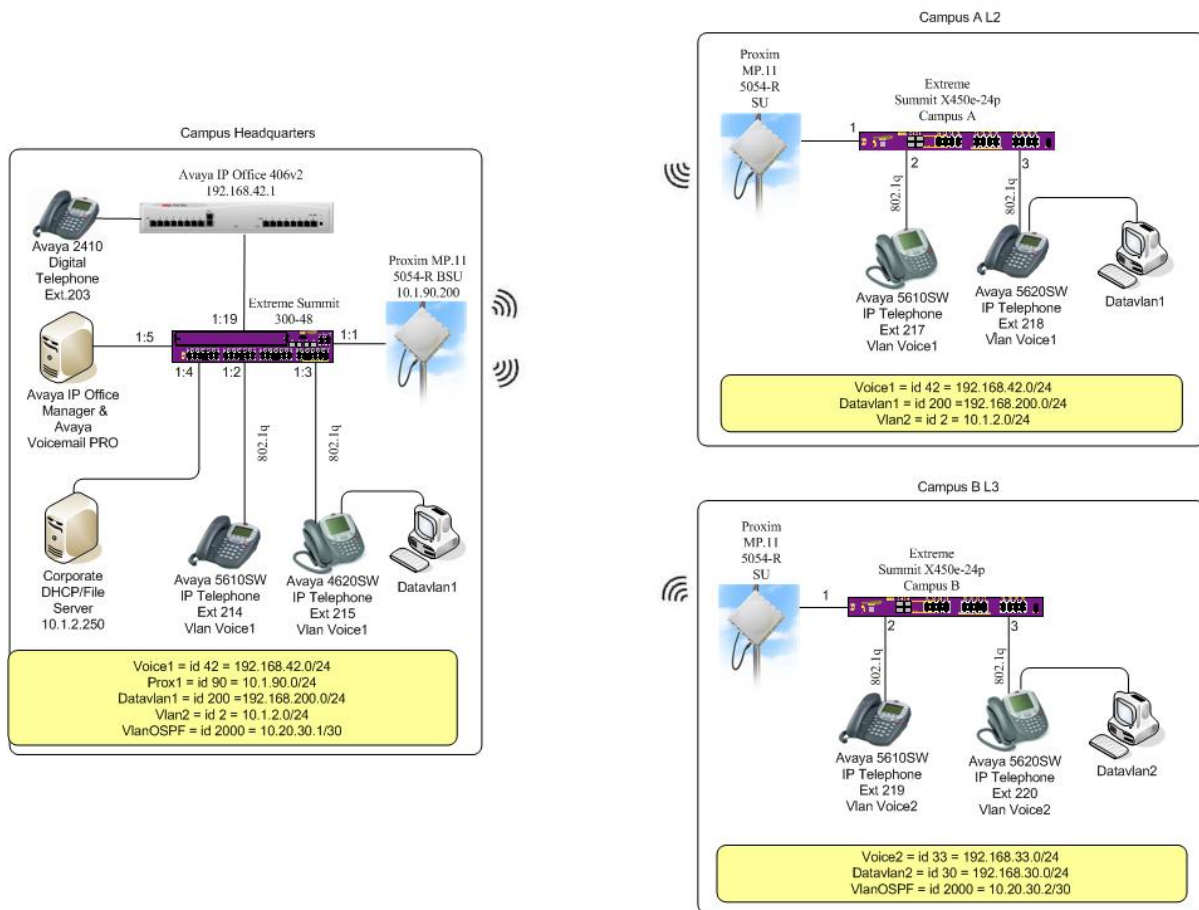


Figure 1: Network Configuration for Avaya IP Office and Proxim Tsunami MP.11 5054-R

2. Equipment and Software Validated

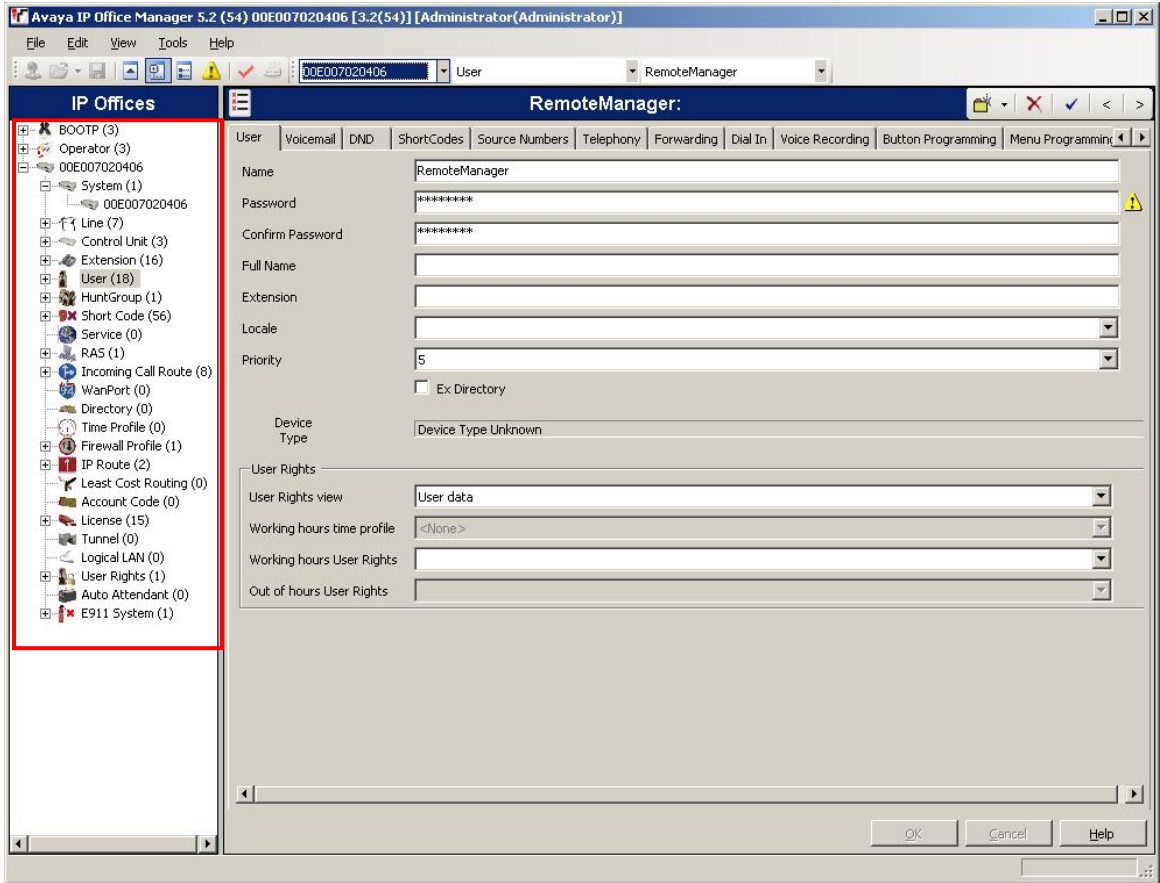
The following equipment and software/firmware were used for the sample configuration provided:

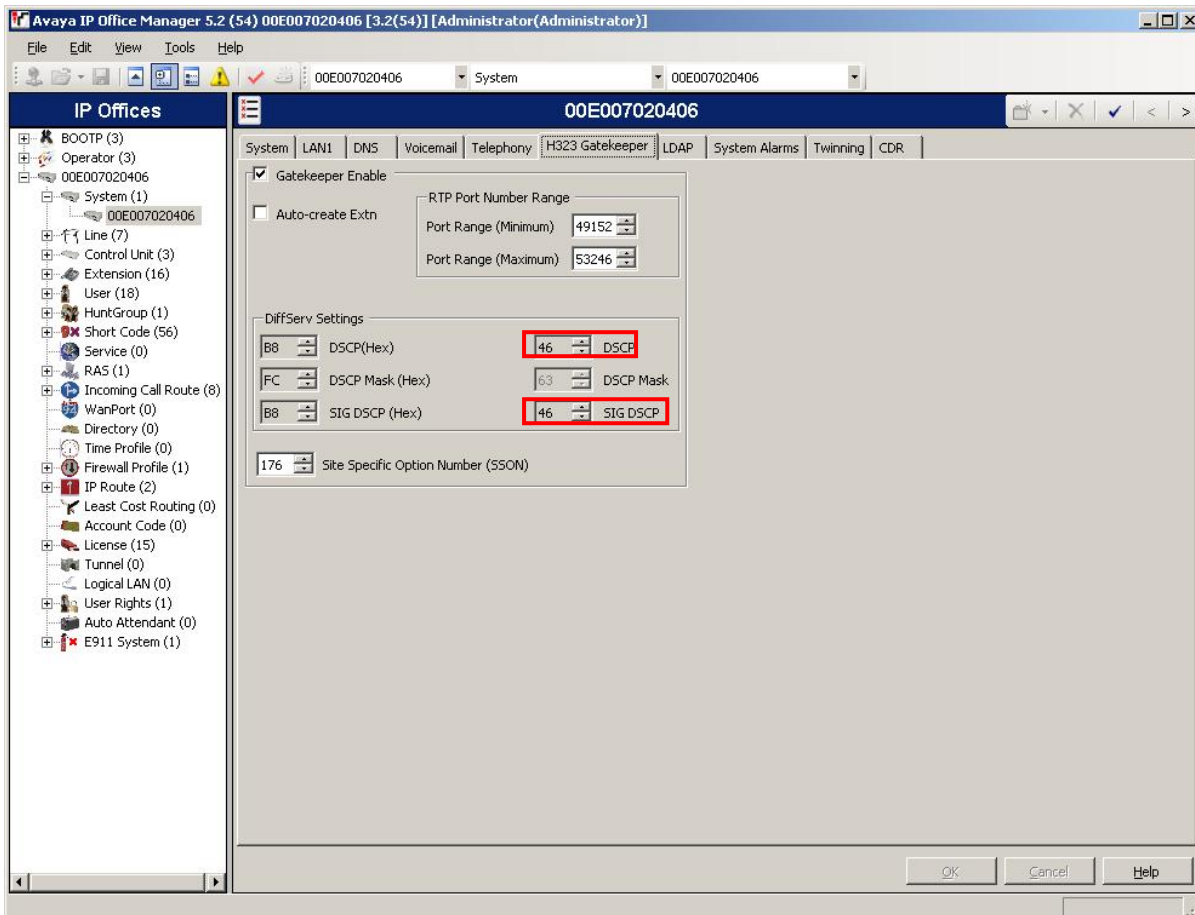
Equipment	Software/Firmware
Avaya IP Office IP406V2	3.2(54)
Avaya 4620SW IP Telephones (H.323)	2.3
Avaya 4610SW IP Telephones (H.323)	2.3
Avaya 5620SW Telephones (H.323)	2.3
Avaya 5610SW Telephones (H.323)	2.3
Avaya 2410 Digital Telephone	N/A
Avaya IP Office Manager	3.2(54)
Avaya Voicemail Pro	3.2(15)
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

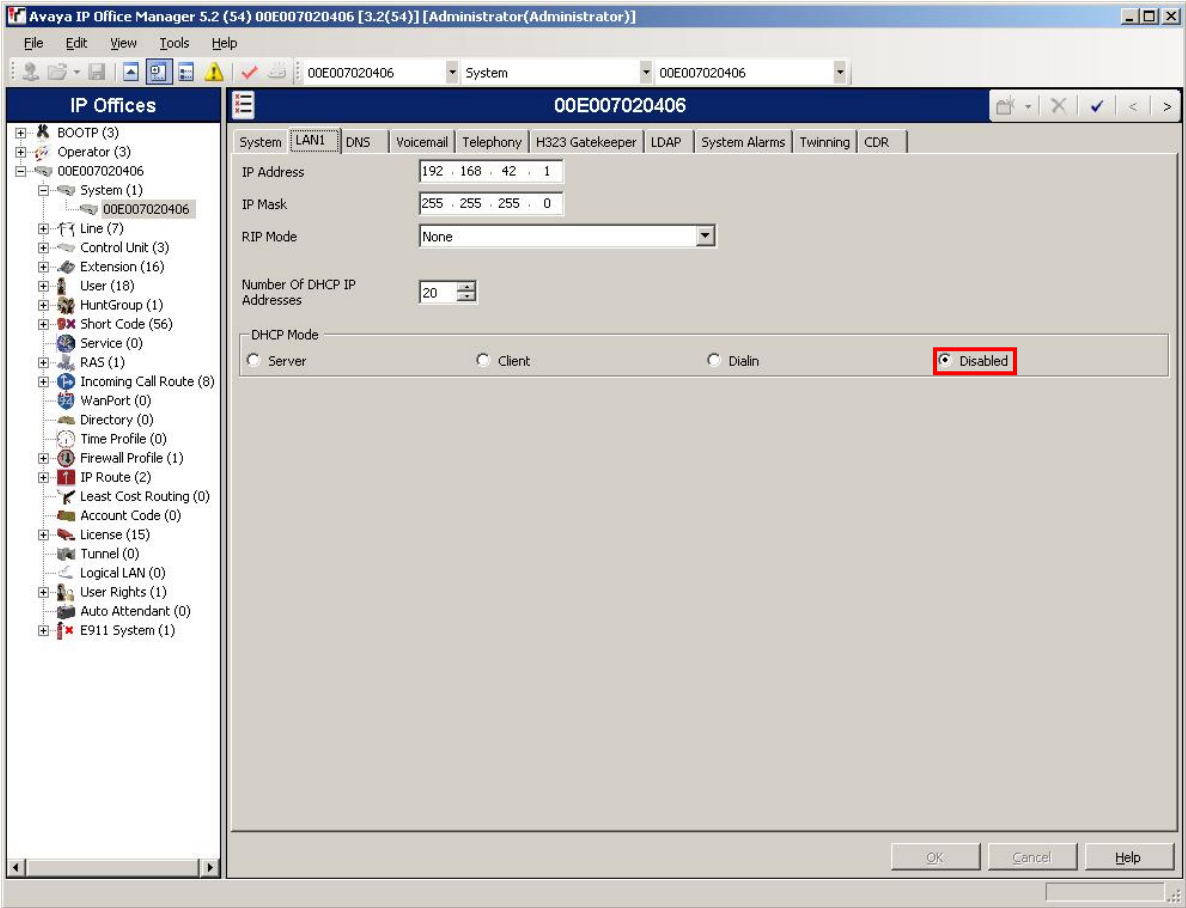
3. Avaya IP Office Settings

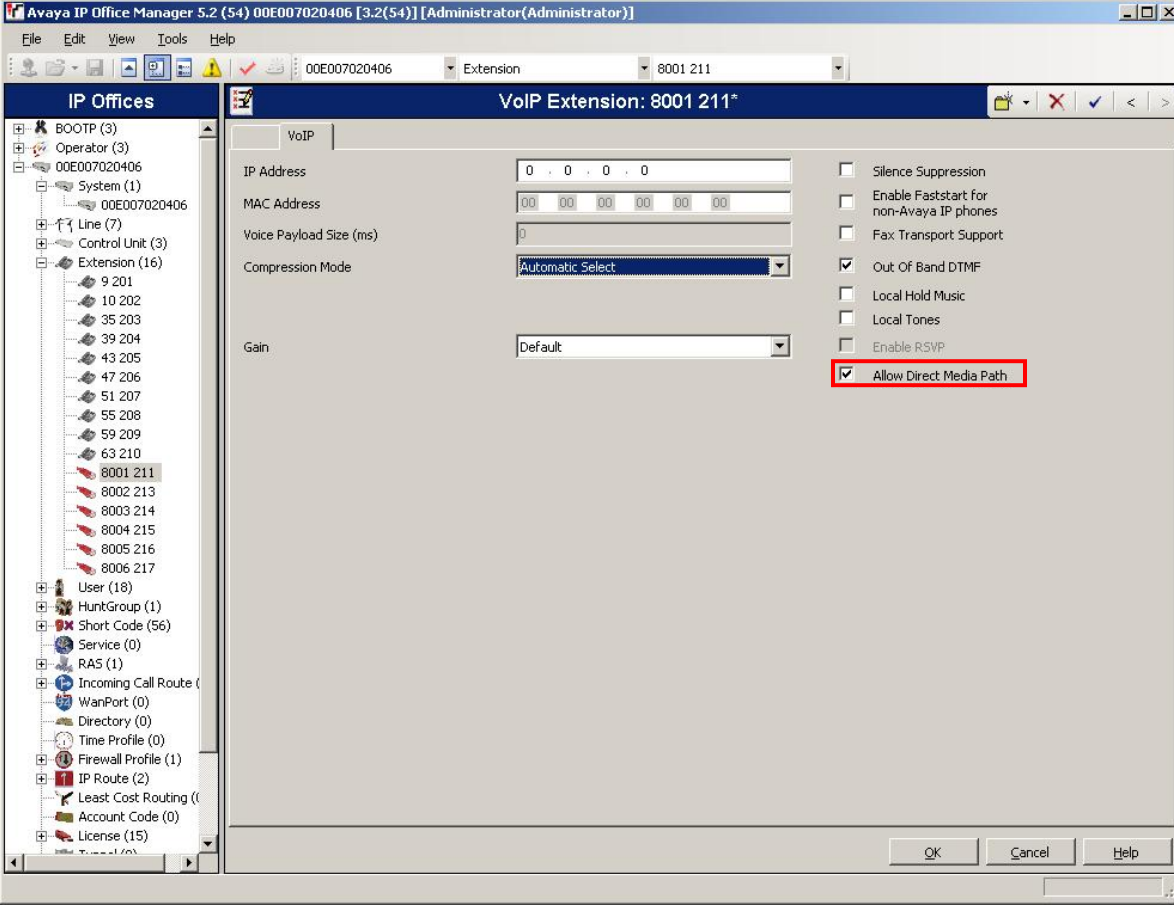
This section was included to verify that Avaya IP Office was configured correctly. Except where stated, the parameters in all steps are the default settings and are supplied for reference. For all other provisioning information such as provisioning of the trunks, call coverage, and extensions, please 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.	<p>IP Office Manager Window</p> <p>The main IP Office Manager window appears. The following steps refer to the Configuration Tree, which is in the left pane of the window.</p> 

Step	Description
3.	<p>Verify H323 Gatekeeper information</p> <p>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.</p> 

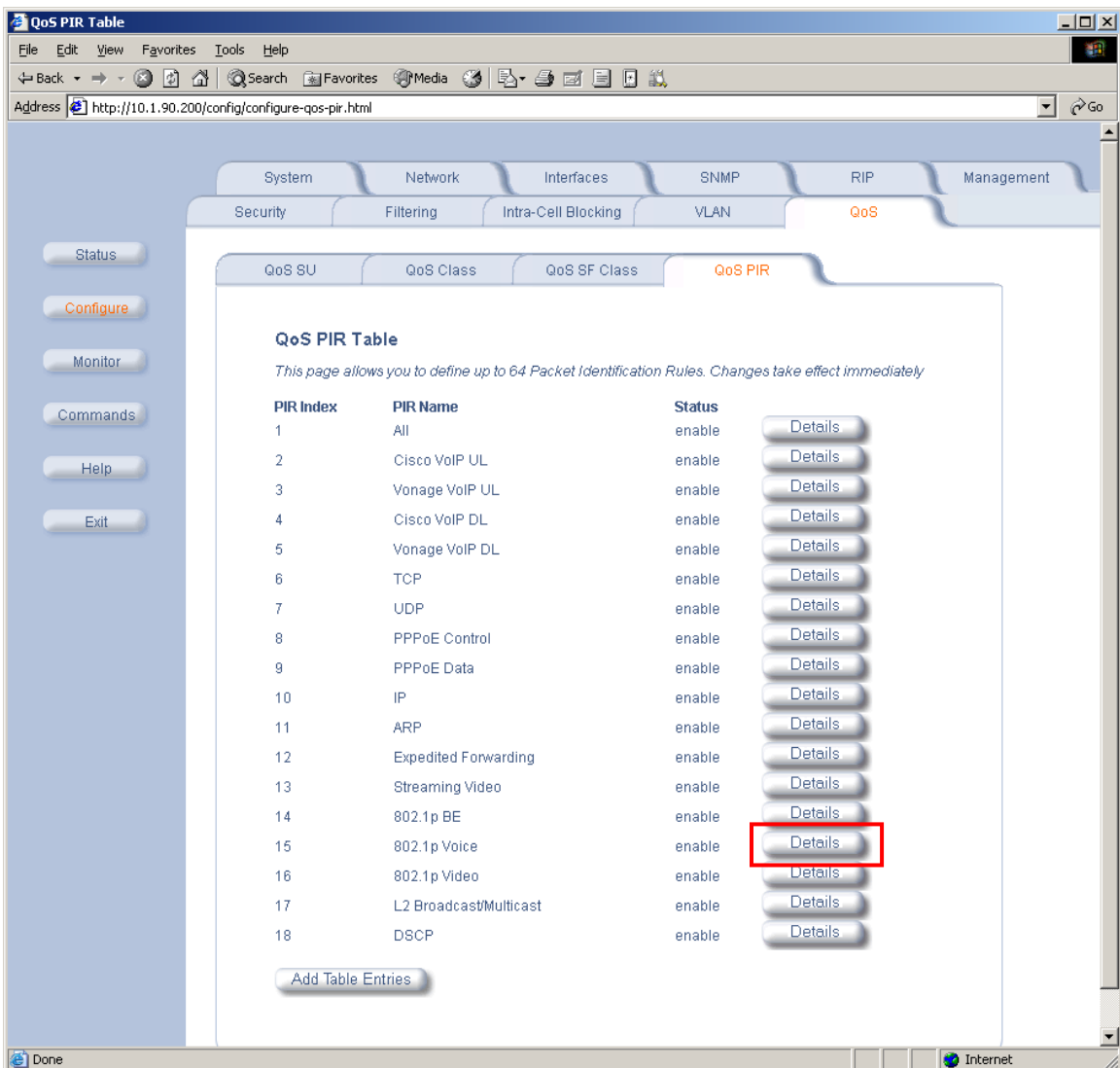
Step	Description
4.	<p>Disable DHCP server on Avaya IP Office</p> <p>Select the LAN1 tab. Set the DHCP Mode to Disabled. Click the OK button to continue.</p> <p>Note: The OK button remains grayed-out if no changes are required.</p>  <p>The screenshot shows the Avaya IP Office Manager 5.2 interface. The left pane displays a tree view of system components, with 'System (1)' selected under '00E007020406'. The right pane shows the configuration for the selected system, with the 'LAN1' tab active. The 'DHCP Mode' section has three radio buttons: 'Server', 'Client', and 'Disabled'. The 'Disabled' option is selected and highlighted with a red box. The 'Number Of DHCP IP Addresses' is set to 20. The 'IP Address' is 192.168.42.1 and the 'IP Mask' is 255.255.255.0. The 'RIP Mode' is set to 'None'. The 'OK' button is grayed-out.</p>

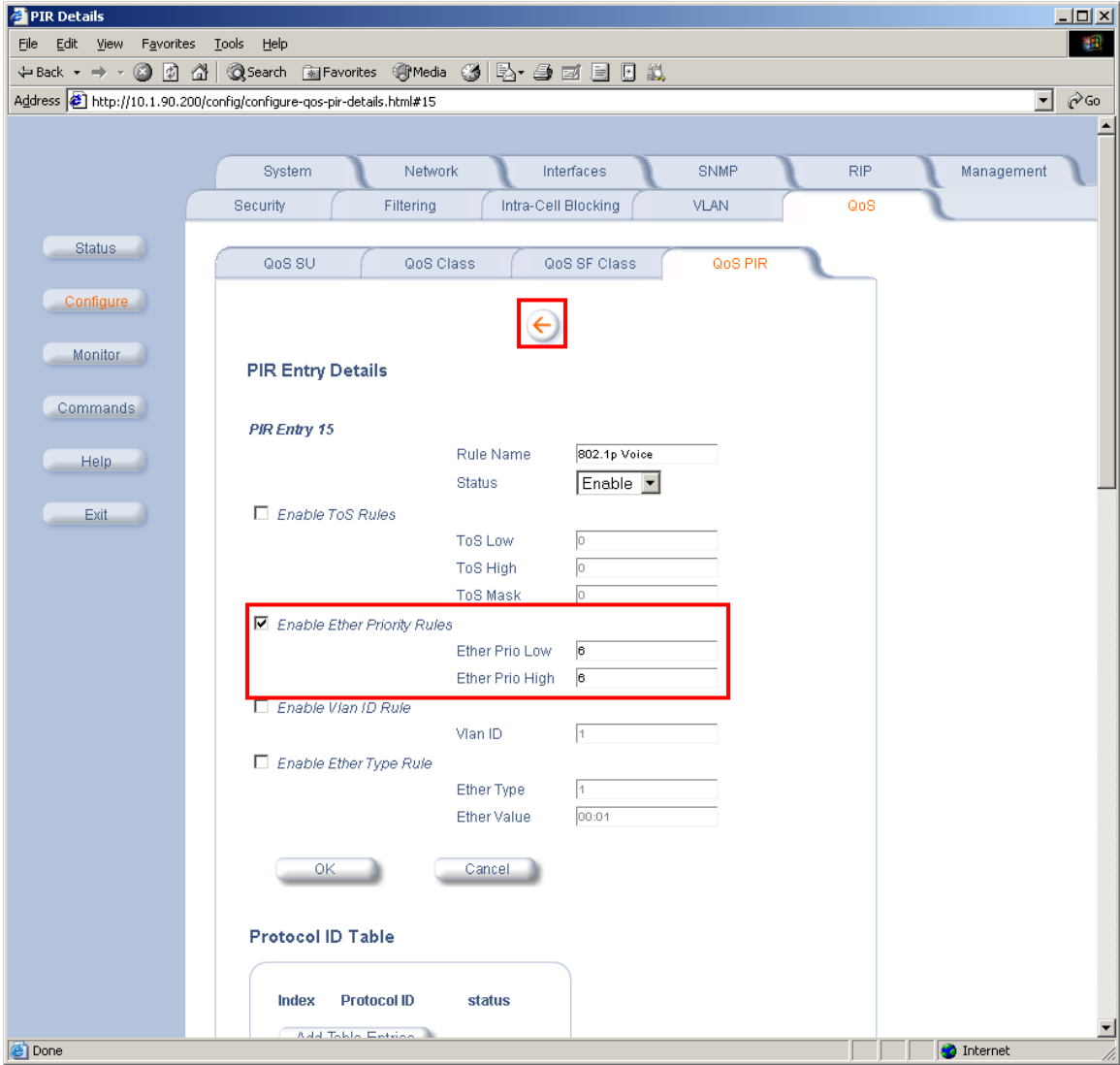
Step	Description
5.	<p data-bbox="302 289 646 321">Verify Direct Media Path</p> <p data-bbox="302 342 1469 447">From the Configuration Tree, select Extension. Double-click on the IP telephone extension to verify. Select the VoIP tab. Verify that Allow Direct Media Path is checked. Click the OK button to continue.</p>  <p>The screenshot shows the Avaya IP Office Manager 5.2 interface. On the left is the 'IP Offices' configuration tree, where 'Extension (16)' is expanded and '8001 211' is selected. The main window displays the 'VoIP Extension: 8001 211*' configuration page. The 'VoIP' tab is active, showing fields for IP Address, MAC Address, Voice Payload Size, Compression Mode, and Gain. On the right, a list of checkboxes includes 'Silence Suppression', 'Enable Faststart for non-Avaya IP phones', 'Fax Transport Support', 'Out Of Band DTMF', 'Local Hold Music', 'Local Tones', 'Enable RSVP', and 'Allow Direct Media Path'. The 'Allow Direct Media Path' checkbox is checked and highlighted with a red rectangular box. At the bottom right are 'OK', 'Cancel', and 'Help' buttons.</p>

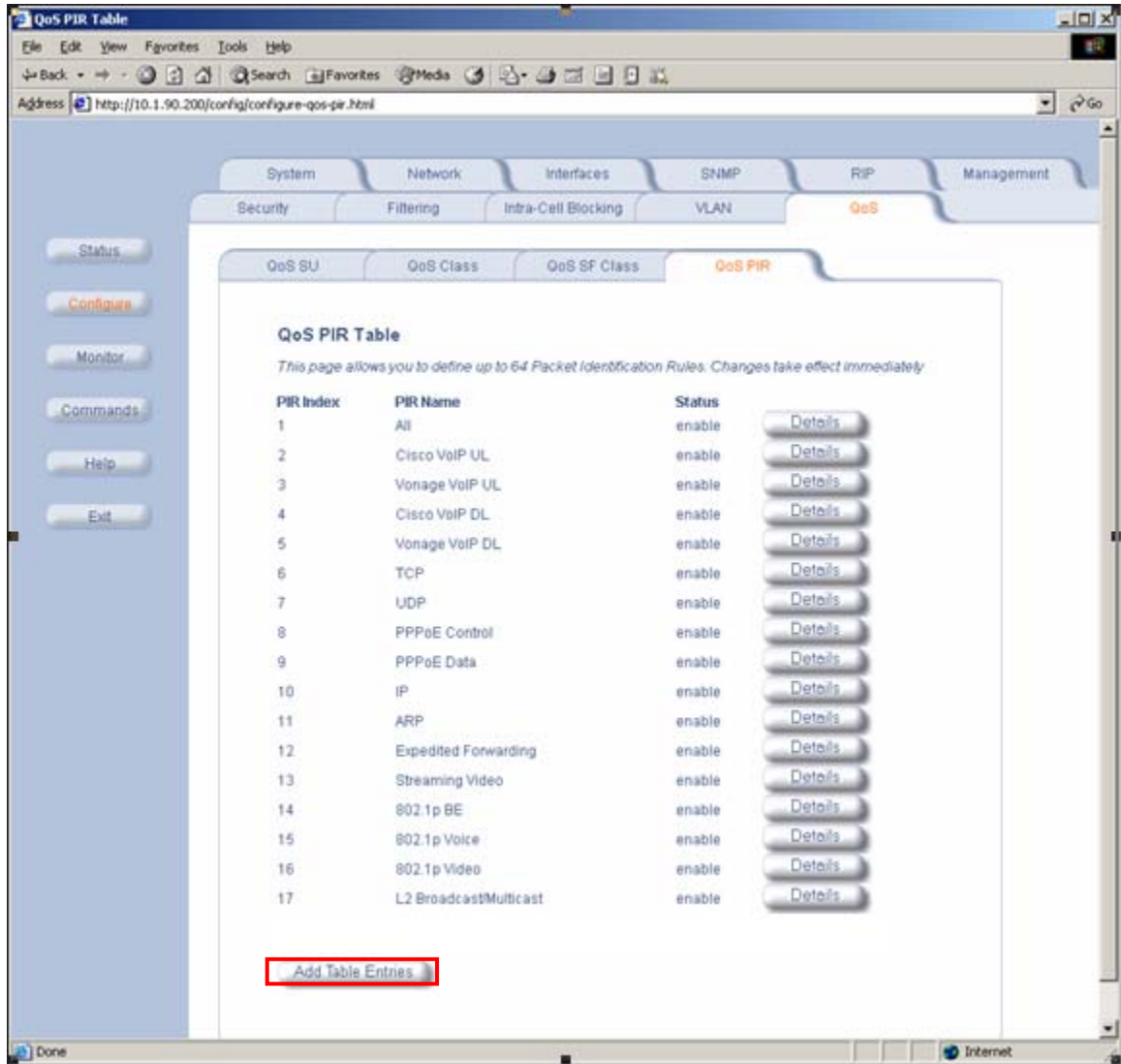
4. Configure Proxim Tsunami MP.11 5054-R Base Station at the Headquarters

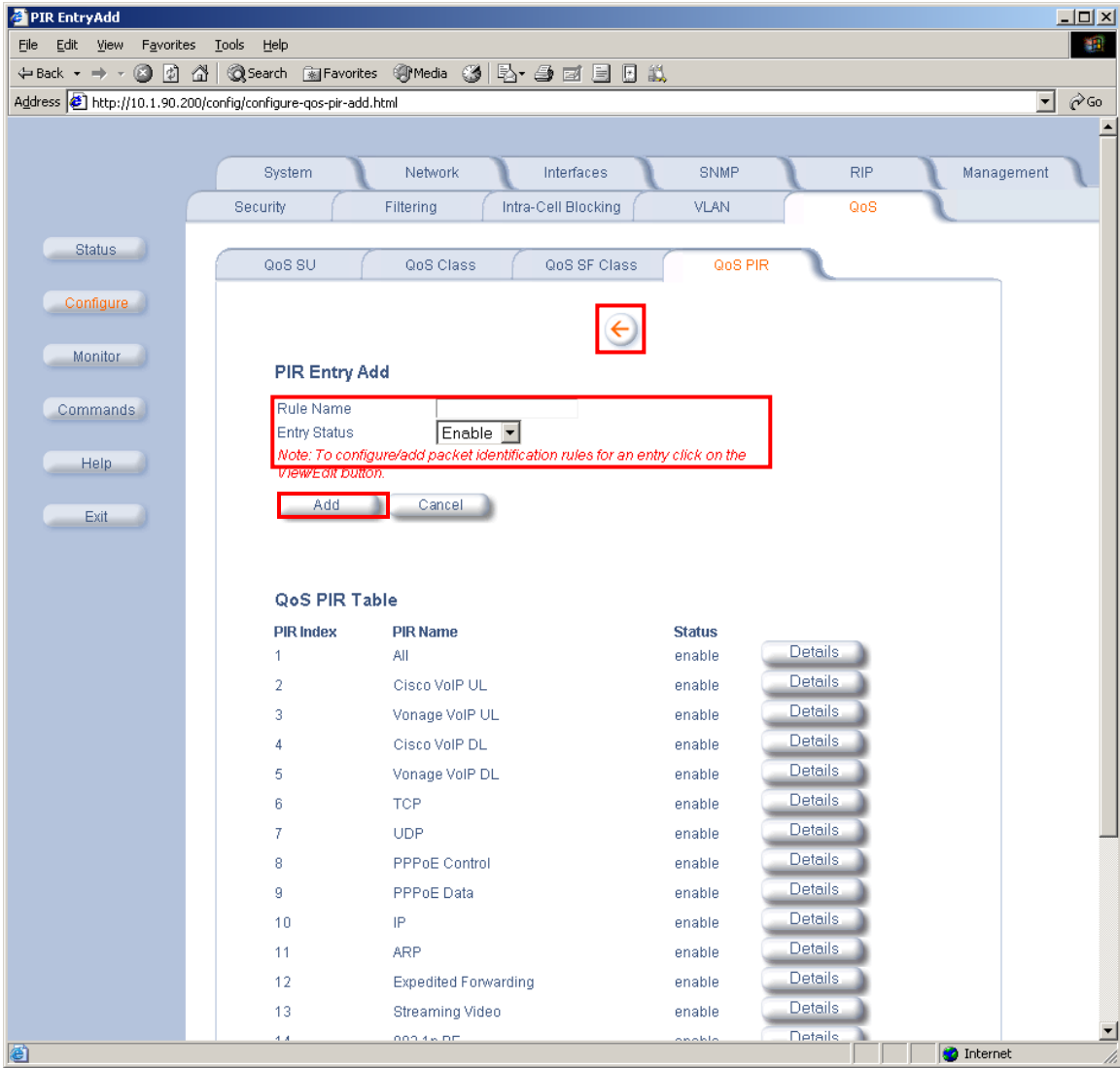
This section shows the necessary steps in configuring the Proxim Tsunami MP.11 5054-R base station at the headquarters as shown in the sample network. Except where stated the parameters in all steps are the default settings and are supplied for reference.

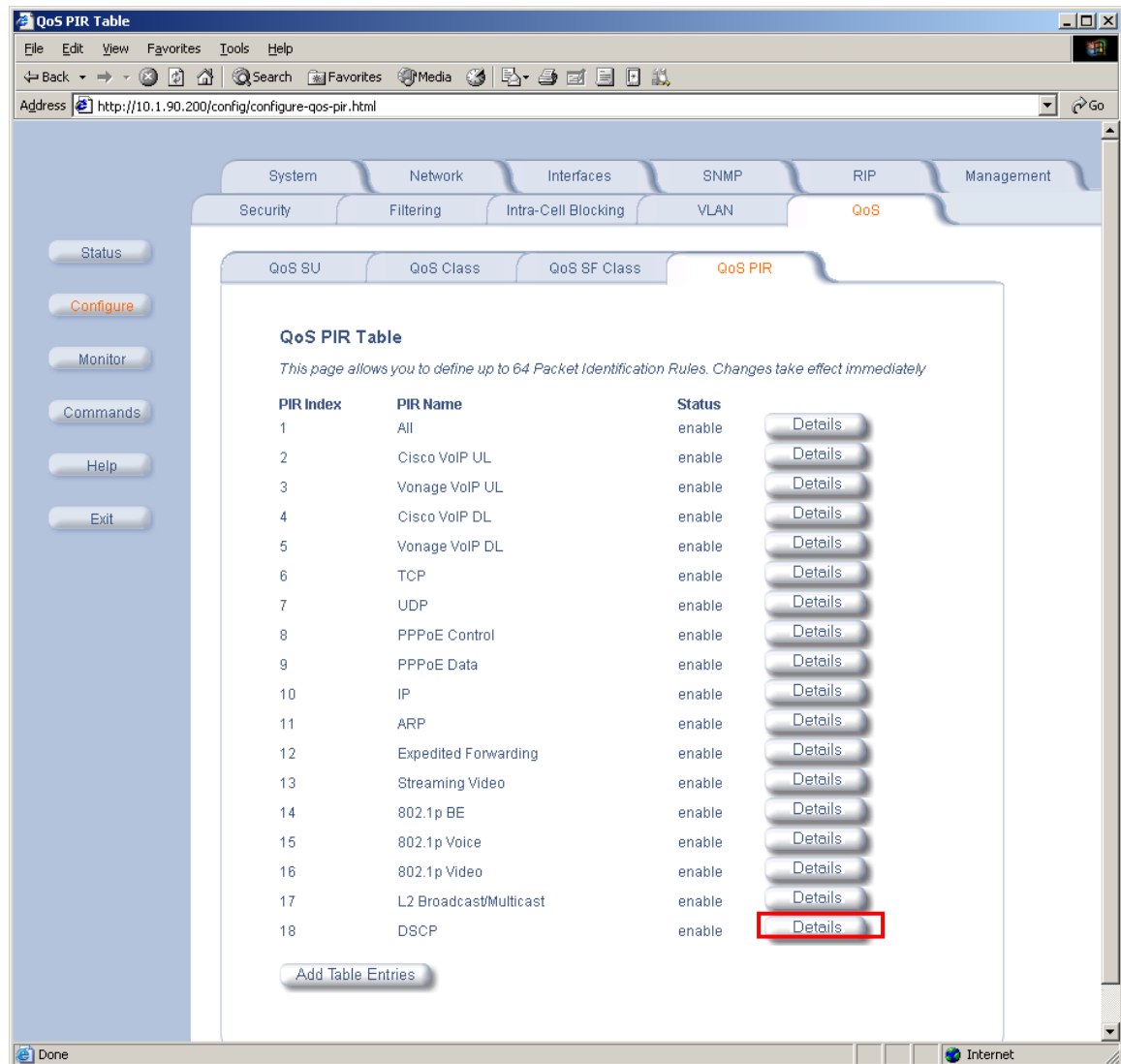
Step	Description
1.	<div><h3>Logging into Proxim Tsunami MP.11 5054-R BSU</h3><p>Connect to the Proxim Tsunami MP.11 5054-R BSU through a web browser. Log in using the appropriate Login ID and Password. Click on the Status button to view the System Status information.</p><div><div><div>System Status</div><div><div>File Edit View Favorites Tools Help</div><div><div>Back Forward Stop Reload Home Search Favorites Media Print Copy Paste</div><div>Address http://10.1.90.200/status.html Go</div></div></div><div><div><div>Status</div><div>Configure</div><div>Monitor</div><div>Commands</div><div>Help</div><div>Exit</div></div><div><div><div>StatusEvent Log</div><div><div>System Status</div><div>Tsunami MP.11 5054-R v2.5.3(221) SN-06UT15600206</div><div><div><div>IP Address10.1.90.200</div><div>NameTsunami MP.11 5054-R</div><div>Object ID1.3.6.1.4.1.11898.2.4.9</div></div><div><div>ContactLocation</div><div>Up Time (DD:HH:MM:SS)00:01:57:05</div></div><div>Click here to view event log messages. This page may take a minute to load.</div></div><div><div>System Traps</div><div><div>Select AllDeselect All</div><div><div><div><div><div><div>DescriptionSeverityTime Stamp</div><div><div><div><input type="checkbox"/> OR Cold Started.</div><div>Informational</div><div>0 days 0 hrs 0 m 0 s</div></div><div><div><div><input type="checkbox"/> Link Up.</div><div>Informational</div><div>0 days 0 hrs 0 m 5 s</div></div><div><div><div><input type="checkbox"/> Link Up.</div><div>Informational</div><div>0 days 0 hrs 0 m 7 s</div></div></div></div><div>Delete</div></div></div></div></div></div></div></div></div></div></div></div></div></div></div></div>

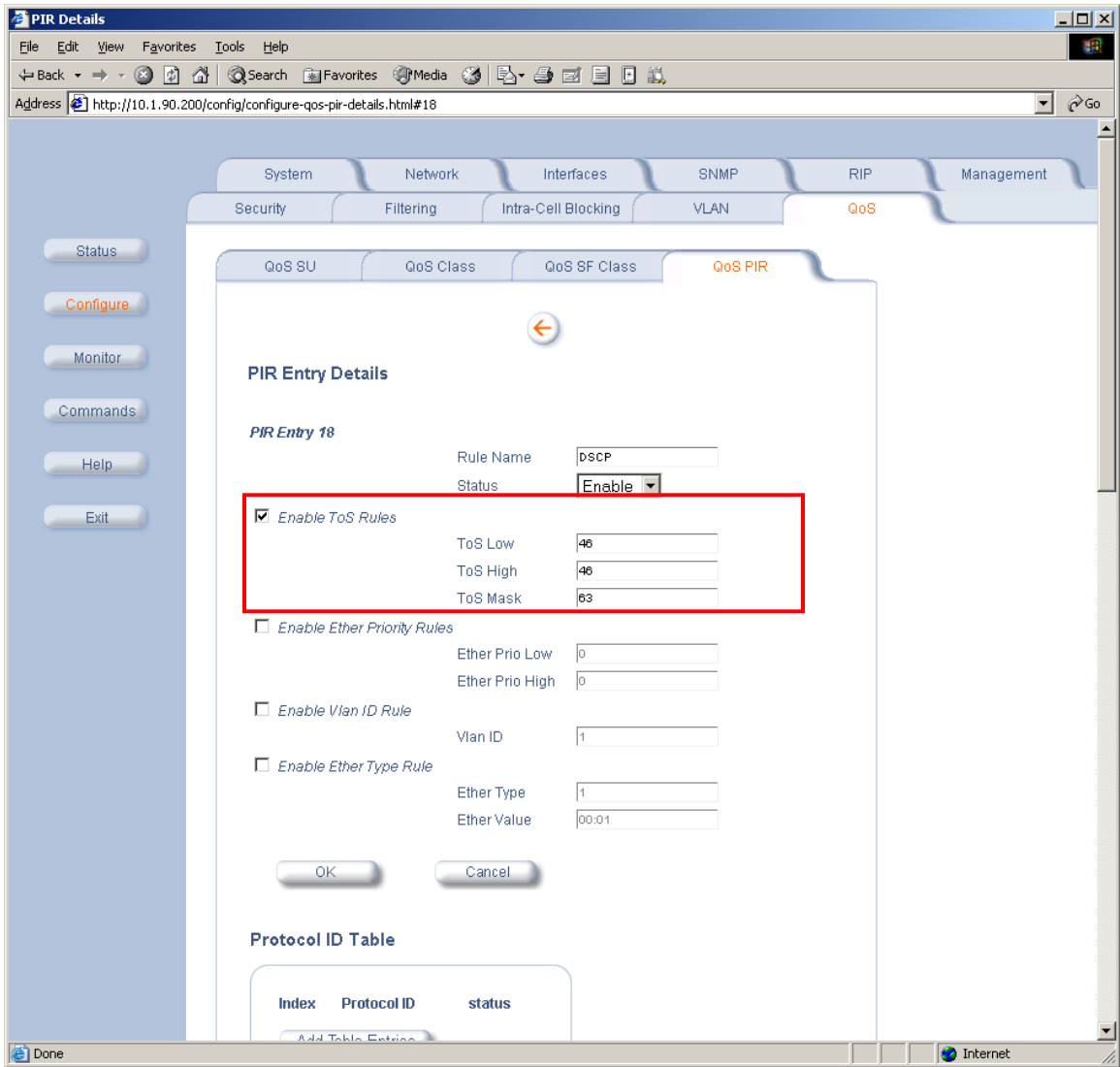
Step	Description																																																																												
2.	<p>Configuring 802.1p QoS Parameters on the Proxim Tsunami MP.11 5054-R at the HQ</p> <p>Select Configure → QoS → QoS PIR. Click the Details button next to the 802.1p Voice PIR Name.</p>  <p>The screenshot shows a web browser window titled 'QoS PIR Table' with the address 'http://10.1.90.200/config/configure-qos-pir.html'. The browser has a menu bar (File, Edit, View, Favorites, Tools, Help) and a toolbar. The page content includes a navigation pane on the left with buttons for Status, Configure, Monitor, Commands, Help, and Exit. The main area has tabs for System, Network, Interfaces, SNMP, RIP, Management, Security, Filtering, Intra-Cell Blocking, VLAN, and QoS. Under the QoS tab, there are sub-tabs for QoS SU, QoS Class, QoS SF Class, and QoS PIR. The QoS PIR tab is active, showing a table titled 'QoS PIR Table' with the subtitle 'This page allows you to define up to 64 Packet Identification Rules. Changes take effect immediately'. The table has three columns: PIR Index, PIR Name, and Status. There are 18 rows of data. The 'Details' button for the '802.1p Voice' entry (PIR Index 15) is highlighted with a red box. Below the table is an 'Add Table Entries' button.</p> <table><tr><th>PIR Index</th><th>PIR Name</th><th>Status</th><th>Details</th></tr><tr><td>1</td><td>All</td><td>enable</td><td>Details</td></tr><tr><td>2</td><td>Cisco VoIP UL</td><td>enable</td><td>Details</td></tr><tr><td>3</td><td>Vonage VoIP UL</td><td>enable</td><td>Details</td></tr><tr><td>4</td><td>Cisco VoIP DL</td><td>enable</td><td>Details</td></tr><tr><td>5</td><td>Vonage VoIP DL</td><td>enable</td><td>Details</td></tr><tr><td>6</td><td>TCP</td><td>enable</td><td>Details</td></tr><tr><td>7</td><td>UDP</td><td>enable</td><td>Details</td></tr><tr><td>8</td><td>PPPoE Control</td><td>enable</td><td>Details</td></tr><tr><td>9</td><td>PPPoE Data</td><td>enable</td><td>Details</td></tr><tr><td>10</td><td>IP</td><td>enable</td><td>Details</td></tr><tr><td>11</td><td>ARP</td><td>enable</td><td>Details</td></tr><tr><td>12</td><td>Expedited Forwarding</td><td>enable</td><td>Details</td></tr><tr><td>13</td><td>Streaming Video</td><td>enable</td><td>Details</td></tr><tr><td>14</td><td>802.1p BE</td><td>enable</td><td>Details</td></tr><tr><td>15</td><td>802.1p Voice</td><td>enable</td><td>Details</td></tr><tr><td>16</td><td>802.1p Video</td><td>enable</td><td>Details</td></tr><tr><td>17</td><td>L2 Broadcast/Multicast</td><td>enable</td><td>Details</td></tr><tr><td>18</td><td>DSCP</td><td>enable</td><td>Details</td></tr></table>	PIR Index	PIR Name	Status	Details	1	All	enable	Details	2	Cisco VoIP UL	enable	Details	3	Vonage VoIP UL	enable	Details	4	Cisco VoIP DL	enable	Details	5	Vonage VoIP DL	enable	Details	6	TCP	enable	Details	7	UDP	enable	Details	8	PPPoE Control	enable	Details	9	PPPoE Data	enable	Details	10	IP	enable	Details	11	ARP	enable	Details	12	Expedited Forwarding	enable	Details	13	Streaming Video	enable	Details	14	802.1p BE	enable	Details	15	802.1p Voice	enable	Details	16	802.1p Video	enable	Details	17	L2 Broadcast/Multicast	enable	Details	18	DSCP	enable	Details
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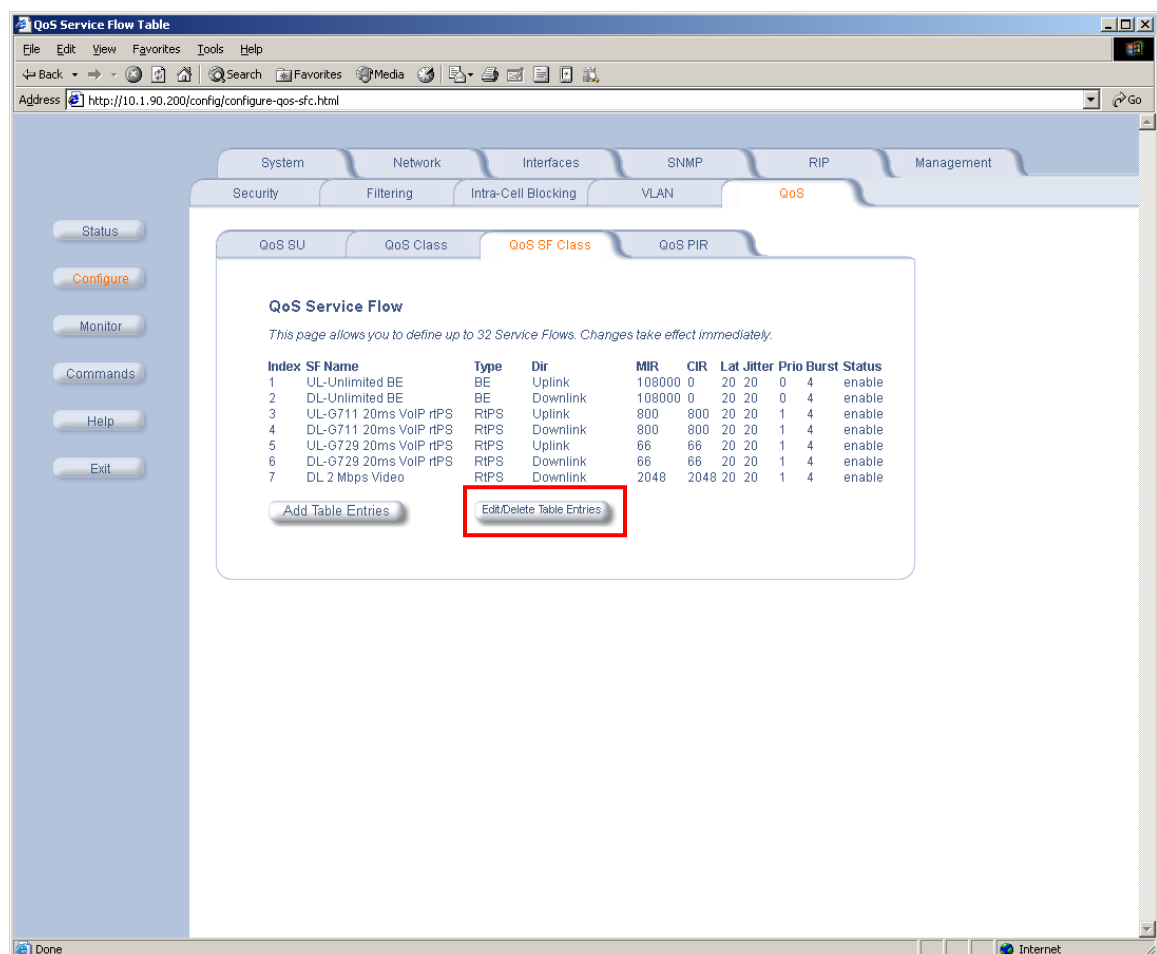
Step	Description
3.	<p>Click the check box next to the Enable Ether Priority Rules field to add check mark. Ensure that the Ether Prio Low and Ether Prio High fields are set to 6. Click the ← (arrow) button to continue.</p> 

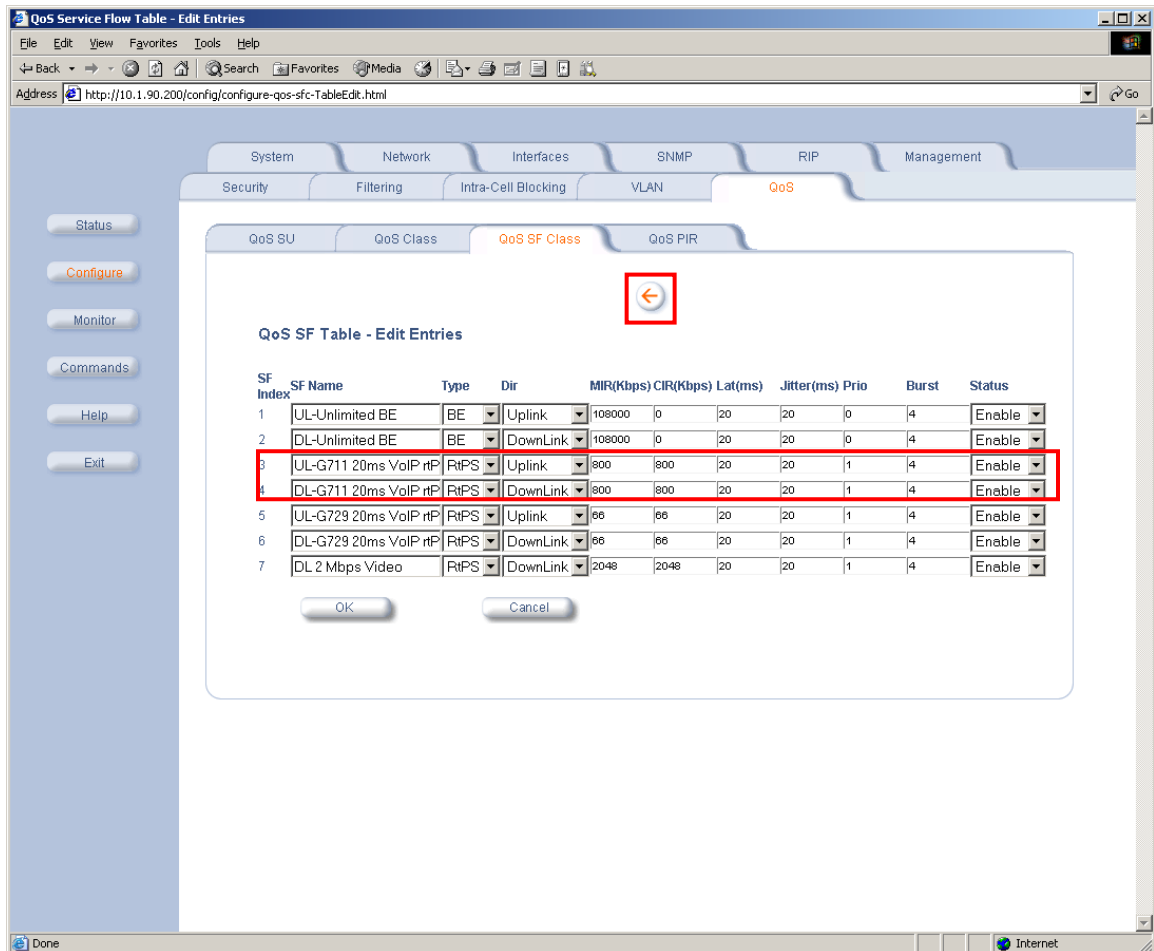
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4.	<p>Creating a DSCP QoS Rule set</p> <p>Select Configure → QoS → QoS PIR. Click the Add Table Entries button at the bottom of the page.</p>  <p>The screenshot shows a web browser window titled 'QoS PIR Table' with the address 'http://10.1.90.200/config/configure-qos-pe.html'. The browser has a menu bar (File, Edit, View, Favorites, Tools, Help) and a toolbar with navigation buttons. The page content includes a sidebar with buttons for Status, Configure, Monitor, Commands, Help, and Exit. The main area has tabs for System, Network, Interfaces, SNMP, RIPv, Management, Security, Filtering, Intra-Cell Blocking, VLAN, and QoS. Under the QoS tab, there are sub-tabs for QoS SU, QoS Class, QoS SF Class, and QoS PIR. The QoS PIR tab is active, showing a table titled 'QoS PIR Table' with the subtitle 'This page allows you to define up to 64 Packet Identification Rules. Changes take effect immediately'. The table has three columns: PIR Index, PIR Name, and Status. There are 17 rows of data, each with a 'Details' button to its right. At the bottom of the table, there is a button labeled 'Add Table Entries' which is highlighted with a red box.</p> <table><tr><th>PIR Index</th><th>PIR Name</th><th>Status</th></tr><tr><td>1</td><td>All</td><td>enable</td></tr><tr><td>2</td><td>Cisco VoIP UL</td><td>enable</td></tr><tr><td>3</td><td>Vonage VoIP UL</td><td>enable</td></tr><tr><td>4</td><td>Cisco VoIP DL</td><td>enable</td></tr><tr><td>5</td><td>Vonage VoIP DL</td><td>enable</td></tr><tr><td>6</td><td>TCP</td><td>enable</td></tr><tr><td>7</td><td>UDP</td><td>enable</td></tr><tr><td>8</td><td>PPPoE Control</td><td>enable</td></tr><tr><td>9</td><td>PPPoE Data</td><td>enable</td></tr><tr><td>10</td><td>IP</td><td>enable</td></tr><tr><td>11</td><td>ARP</td><td>enable</td></tr><tr><td>12</td><td>Expedited Forwarding</td><td>enable</td></tr><tr><td>13</td><td>Streaming Video</td><td>enable</td></tr><tr><td>14</td><td>802.1p BE</td><td>enable</td></tr><tr><td>15</td><td>802.1p Voice</td><td>enable</td></tr><tr><td>16</td><td>802.1p Video</td><td>enable</td></tr><tr><td>17</td><td>L2 Broadcast/Multicast</td><td>enable</td></tr></table>	PIR Index	PIR Name	Status	1	All	enable	2	Cisco VoIP UL	enable	3	Vonage VoIP UL	enable	4	Cisco VoIP DL	enable	5	Vonage VoIP DL	enable	6	TCP	enable	7	UDP	enable	8	PPPoE Control	enable	9	PPPoE Data	enable	10	IP	enable	11	ARP	enable	12	Expedited Forwarding	enable	13	Streaming Video	enable	14	802.1p BE	enable	15	802.1p Voice	enable	16	802.1p Video	enable	17	L2 Broadcast/Multicast	enable
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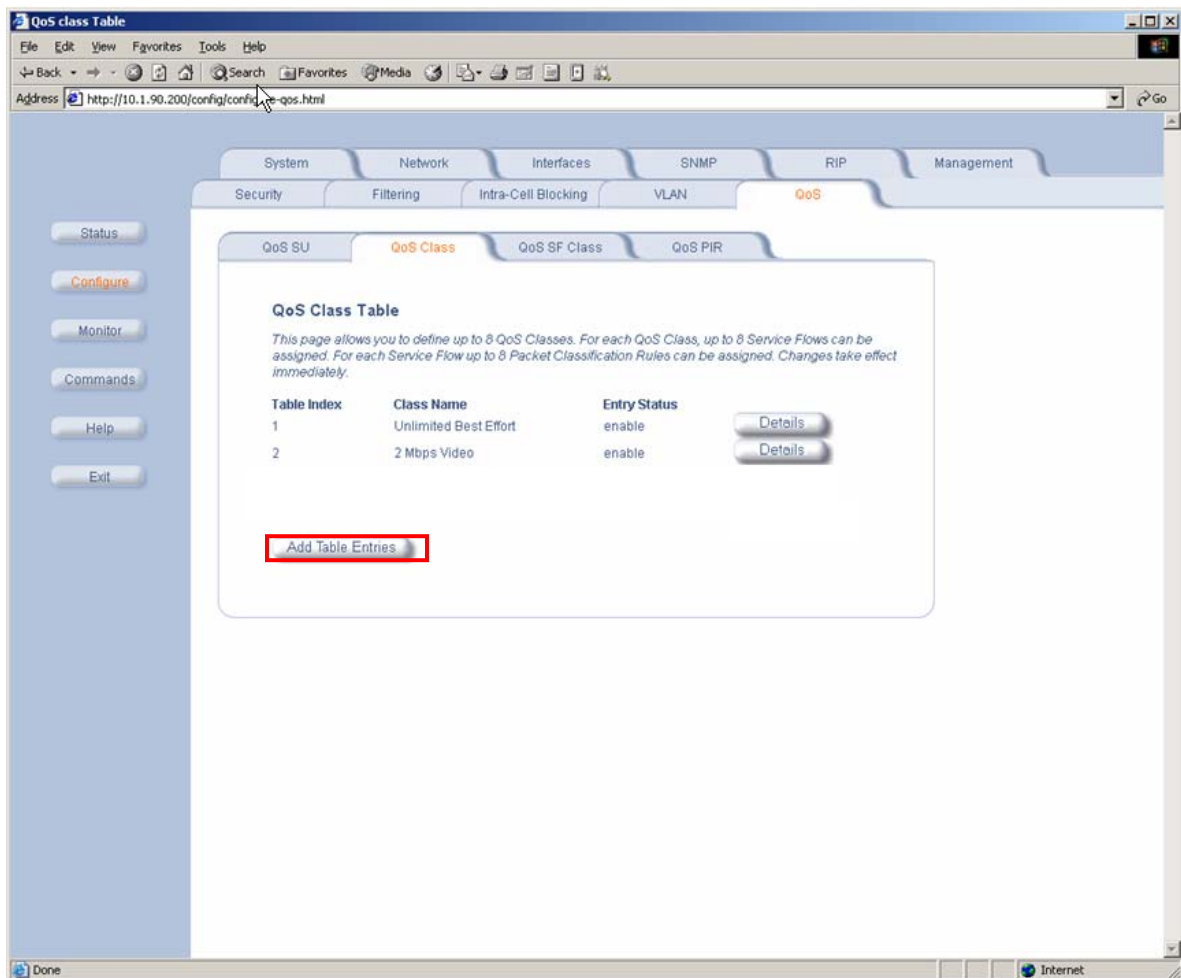
Step	Description
5.	<p>Enter the following parameters for the DSCP table entry:</p> <ul style="list-style-type: none"> • Enter DSCP in the Rule Name field. • Verify that the Entry Status field is set to Enable. • Click the Add button. <p>Click the ← button to continue.</p> 

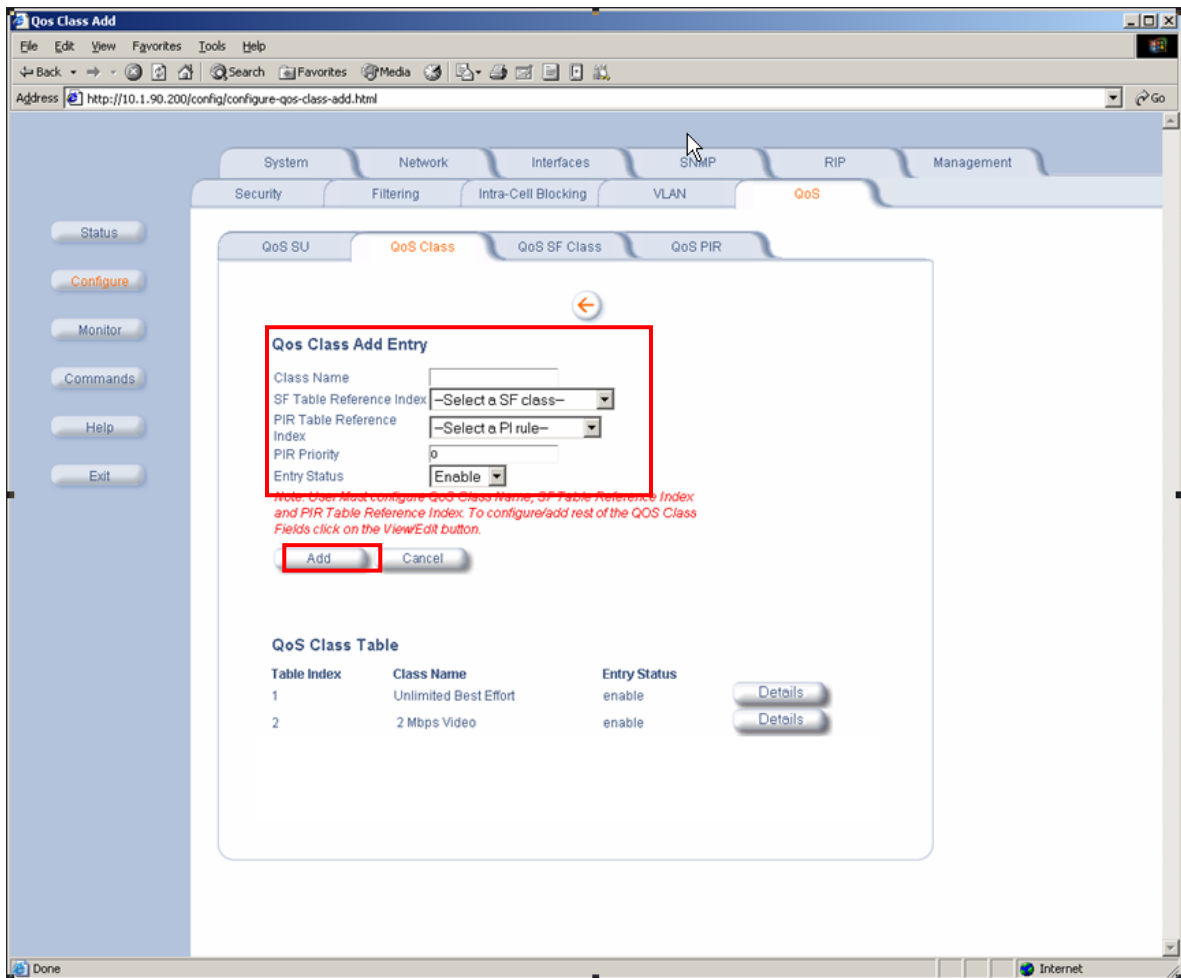
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6.	<p>Creating and configuring DSCP QoS Parameters on the Proxim Tsunami MP.11 5054-R at the HQ location</p> <p>Select Configure → QoS → QoS PIR. Click the Details button next to the DSCP PIR Name.</p>  <p>The screenshot shows a web browser window titled 'QoS PIR Table' with the address 'http://10.1.90.200/config/configure-qos-pir.html'. The navigation menu includes System, Network, Interfaces, SNMP, RIP, Management, Security, Filtering, Intra-Cell Blocking, VLAN, and QoS. The QoS PIR section is active, showing a table of 18 entries. The 'Details' button for the 'DSCP' entry is highlighted with a red rectangle.</p> <table><tr><th>PIR Index</th><th>PIR Name</th><th>Status</th><th>Action</th></tr><tr><td>1</td><td>All</td><td>enable</td><td>Details</td></tr><tr><td>2</td><td>Cisco VoIP UL</td><td>enable</td><td>Details</td></tr><tr><td>3</td><td>Vonage VoIP UL</td><td>enable</td><td>Details</td></tr><tr><td>4</td><td>Cisco VoIP DL</td><td>enable</td><td>Details</td></tr><tr><td>5</td><td>Vonage VoIP DL</td><td>enable</td><td>Details</td></tr><tr><td>6</td><td>TCP</td><td>enable</td><td>Details</td></tr><tr><td>7</td><td>UDP</td><td>enable</td><td>Details</td></tr><tr><td>8</td><td>PPPoE Control</td><td>enable</td><td>Details</td></tr><tr><td>9</td><td>PPPoE Data</td><td>enable</td><td>Details</td></tr><tr><td>10</td><td>IP</td><td>enable</td><td>Details</td></tr><tr><td>11</td><td>ARP</td><td>enable</td><td>Details</td></tr><tr><td>12</td><td>Expedited Forwarding</td><td>enable</td><td>Details</td></tr><tr><td>13</td><td>Streaming Video</td><td>enable</td><td>Details</td></tr><tr><td>14</td><td>802.1p BE</td><td>enable</td><td>Details</td></tr><tr><td>15</td><td>802.1p Voice</td><td>enable</td><td>Details</td></tr><tr><td>16</td><td>802.1p Video</td><td>enable</td><td>Details</td></tr><tr><td>17</td><td>L2 Broadcast/Multicast</td><td>enable</td><td>Details</td></tr><tr><td>18</td><td>DSCP</td><td>enable</td><td>Details</td></tr></table> <p>Buttons on the left: Status, Configure, Monitor, Commands, Help, Exit.</p> <p>Buttons at the bottom: Add Table Entries.</p>	PIR Index	PIR Name	Status	Action	1	All	enable	Details	2	Cisco VoIP UL	enable	Details	3	Vonage VoIP UL	enable	Details	4	Cisco VoIP DL	enable	Details	5	Vonage VoIP DL	enable	Details	6	TCP	enable	Details	7	UDP	enable	Details	8	PPPoE Control	enable	Details	9	PPPoE Data	enable	Details	10	IP	enable	Details	11	ARP	enable	Details	12	Expedited Forwarding	enable	Details	13	Streaming Video	enable	Details	14	802.1p BE	enable	Details	15	802.1p Voice	enable	Details	16	802.1p Video	enable	Details	17	L2 Broadcast/Multicast	enable	Details	18	DSCP	enable	Details
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4	Cisco VoIP DL	enable	Details																																																																										
5	Vonage VoIP DL	enable	Details																																																																										
6	TCP	enable	Details																																																																										
7	UDP	enable	Details																																																																										
8	PPPoE Control	enable	Details																																																																										
9	PPPoE Data	enable	Details																																																																										
10	IP	enable	Details																																																																										
11	ARP	enable	Details																																																																										
12	Expedited Forwarding	enable	Details																																																																										
13	Streaming Video	enable	Details																																																																										
14	802.1p BE	enable	Details																																																																										
15	802.1p Voice	enable	Details																																																																										
16	802.1p Video	enable	Details																																																																										
17	L2 Broadcast/Multicast	enable	Details																																																																										
18	DSCP	enable	Details																																																																										

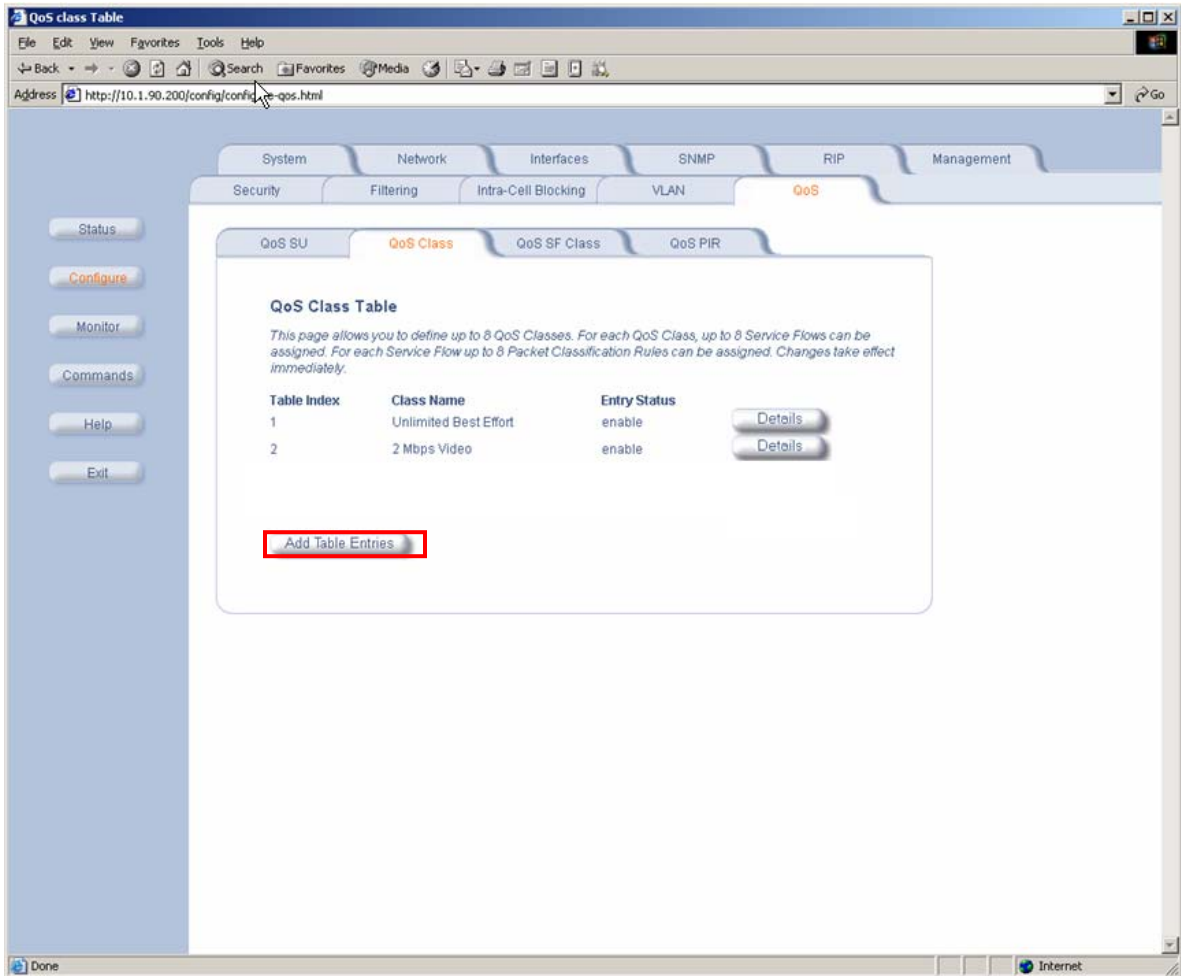
Step	Description
7.	<p>Enter the following parameters for the DSCP QoS entry:</p> <ul style="list-style-type: none"> Click the check box next to the Enable ToS Rules field to add check mark. Set the ToS Low and ToS high fields to 46 and the ToS Mask field to 63. <p>Click the ← button to continue.</p> 

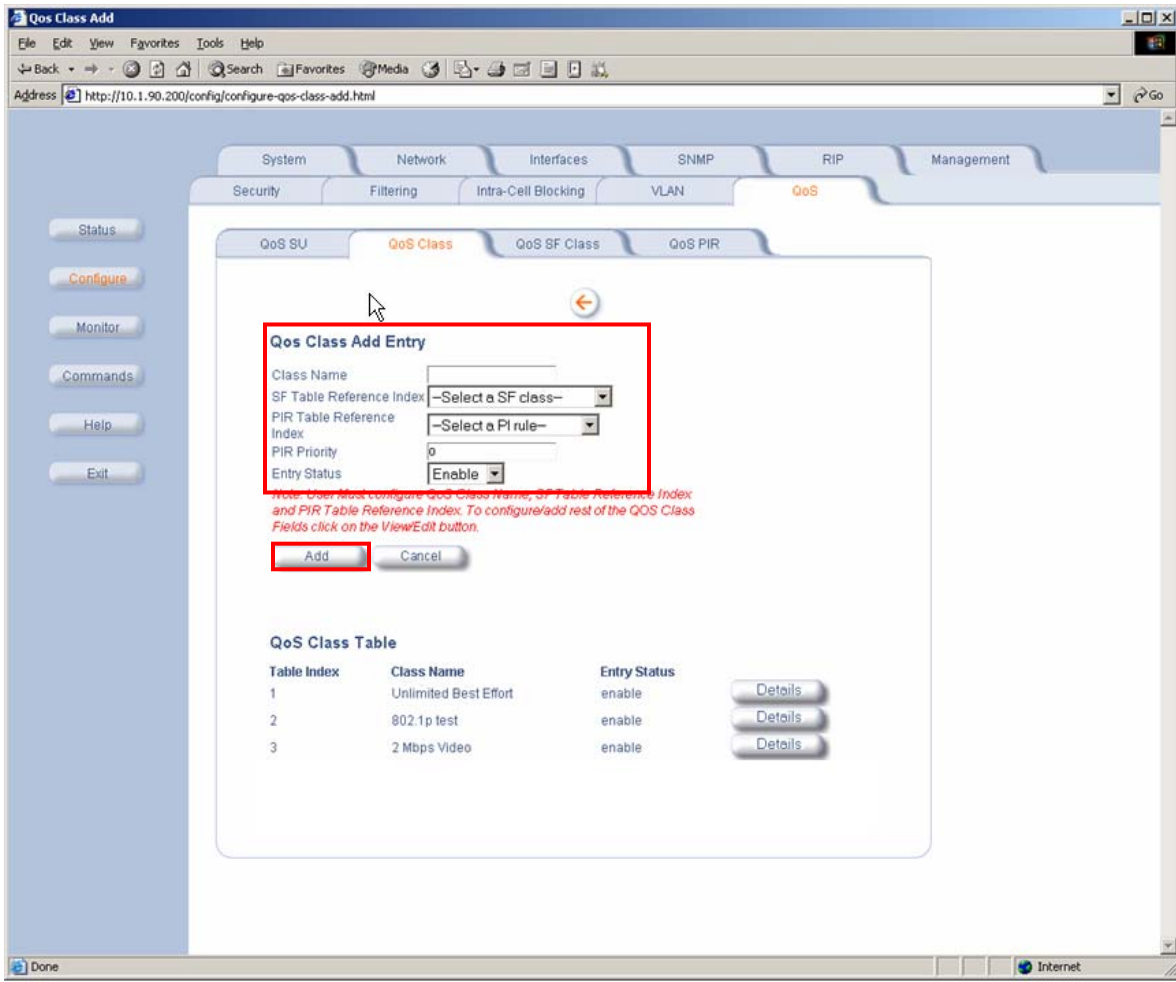
Step	Description
8.	<p>Editing the QoS SF information UL-G711 20ms VoIP rtPS and DL-G711 20ms VoIP rtPS index CIR(Kbps) and MIR(Kbps)</p> <p>Select Configure → QoS → QoS SF Class. Click on the Edit/Delete Table Entries button.</p> 

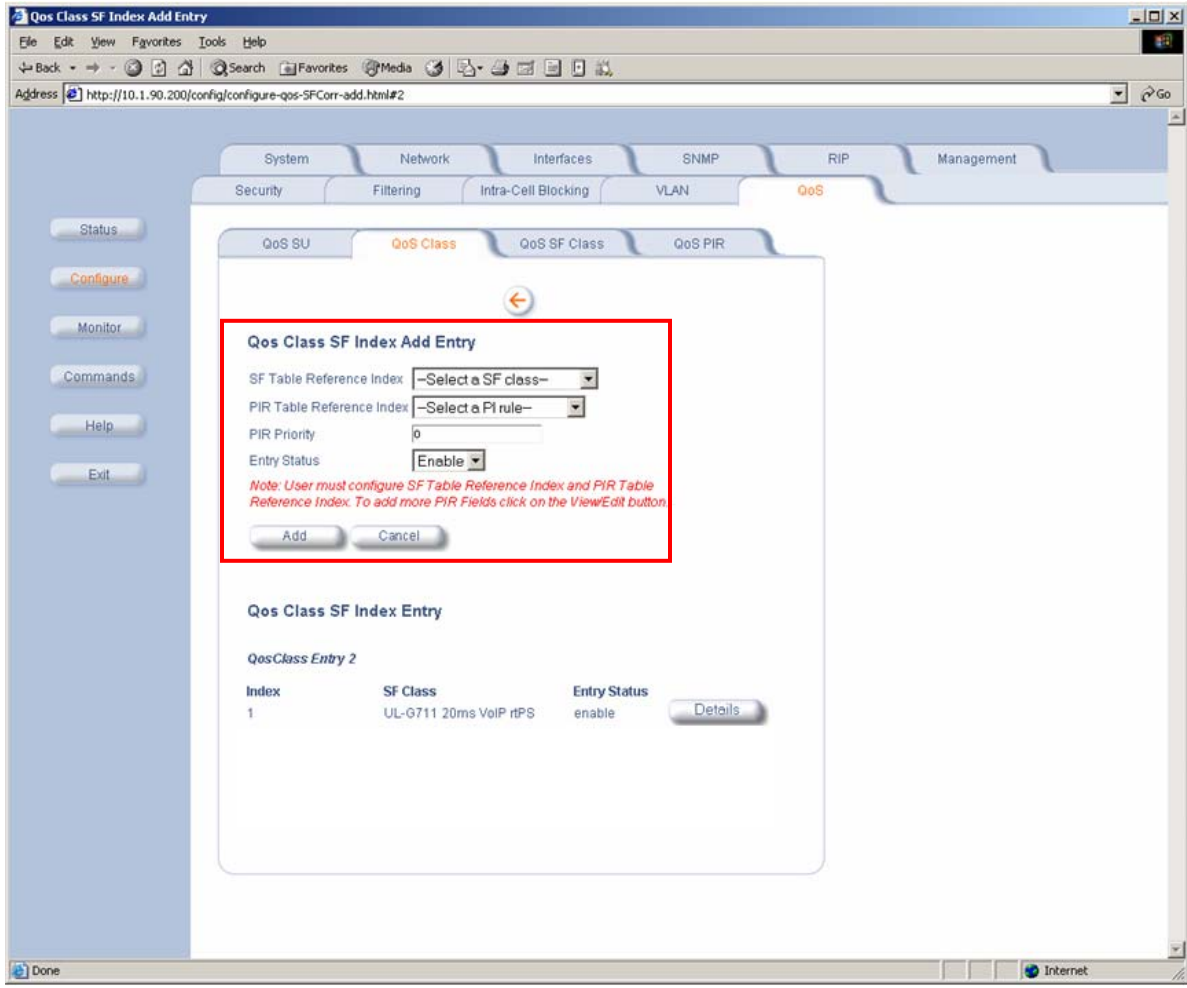
Step	Description																																																																																								
9.	<p>For the UL-G711 20ms VoIP rtPS and DL-G711 20ms VoIP rtPS entries (SF Index 3 & 4) change the CIR(Kbps) and MIR(Kbps) fields to 800 (the number of calls planed). Click the OK button and then the ← button to continue.</p> <p>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.</p>  <p>The screenshot shows the 'QoS Service Flow Table - Edit Entries' web interface. The table lists 7 service flow entries. Entry 3, 'UL-G711 20ms VoIP rtPS', and Entry 4, 'DL-G711 20ms VoIP rtPS', are highlighted with a red box. A red circle with a left arrow points to the back button above the table.</p> <table><tr><th>SF Index</th><th>SF Name</th><th>Type</th><th>Dir</th><th>MIR(Kbps)</th><th>CIR(Kbps)</th><th>Lat(ms)</th><th>Jitter(ms)</th><th>Prio</th><th>Burst</th><th>Status</th></tr><tr><td>1</td><td>UL-Unlimited BE</td><td>BE</td><td>Uplink</td><td>108000</td><td>0</td><td>20</td><td>20</td><td>0</td><td>4</td><td>Enable</td></tr><tr><td>2</td><td>DL-Unlimited BE</td><td>BE</td><td>DownLink</td><td>108000</td><td>0</td><td>20</td><td>20</td><td>0</td><td>4</td><td>Enable</td></tr><tr><td>3</td><td>UL-G711 20ms VoIP rtP</td><td>RtPS</td><td>Uplink</td><td>800</td><td>800</td><td>20</td><td>20</td><td>1</td><td>4</td><td>Enable</td></tr><tr><td>4</td><td>DL-G711 20ms VoIP rtP</td><td>RtPS</td><td>DownLink</td><td>800</td><td>800</td><td>20</td><td>20</td><td>1</td><td>4</td><td>Enable</td></tr><tr><td>5</td><td>UL-G729 20ms VoIP rtP</td><td>RtPS</td><td>Uplink</td><td>66</td><td>66</td><td>20</td><td>20</td><td>1</td><td>4</td><td>Enable</td></tr><tr><td>6</td><td>DL-G729 20ms VoIP rtP</td><td>RtPS</td><td>DownLink</td><td>66</td><td>66</td><td>20</td><td>20</td><td>1</td><td>4</td><td>Enable</td></tr><tr><td>7</td><td>DL 2 Mbps Video</td><td>RtPS</td><td>DownLink</td><td>2048</td><td>2048</td><td>20</td><td>20</td><td>1</td><td>4</td><td>Enable</td></tr></table>	SF Index	SF Name	Type	Dir	MIR(Kbps)	CIR(Kbps)	Lat(ms)	Jitter(ms)	Prio	Burst	Status	1	UL-Unlimited BE	BE	Uplink	108000	0	20	20	0	4	Enable	2	DL-Unlimited BE	BE	DownLink	108000	0	20	20	0	4	Enable	3	UL-G711 20ms VoIP rtP	RtPS	Uplink	800	800	20	20	1	4	Enable	4	DL-G711 20ms VoIP rtP	RtPS	DownLink	800	800	20	20	1	4	Enable	5	UL-G729 20ms VoIP rtP	RtPS	Uplink	66	66	20	20	1	4	Enable	6	DL-G729 20ms VoIP rtP	RtPS	DownLink	66	66	20	20	1	4	Enable	7	DL 2 Mbps Video	RtPS	DownLink	2048	2048	20	20	1	4	Enable
SF Index	SF Name	Type	Dir	MIR(Kbps)	CIR(Kbps)	Lat(ms)	Jitter(ms)	Prio	Burst	Status																																																																															
1	UL-Unlimited BE	BE	Uplink	108000	0	20	20	0	4	Enable																																																																															
2	DL-Unlimited BE	BE	DownLink	108000	0	20	20	0	4	Enable																																																																															
3	UL-G711 20ms VoIP rtP	RtPS	Uplink	800	800	20	20	1	4	Enable																																																																															
4	DL-G711 20ms VoIP rtP	RtPS	DownLink	800	800	20	20	1	4	Enable																																																																															
5	UL-G729 20ms VoIP rtP	RtPS	Uplink	66	66	20	20	1	4	Enable																																																																															
6	DL-G729 20ms VoIP rtP	RtPS	DownLink	66	66	20	20	1	4	Enable																																																																															
7	DL 2 Mbps Video	RtPS	DownLink	2048	2048	20	20	1	4	Enable																																																																															

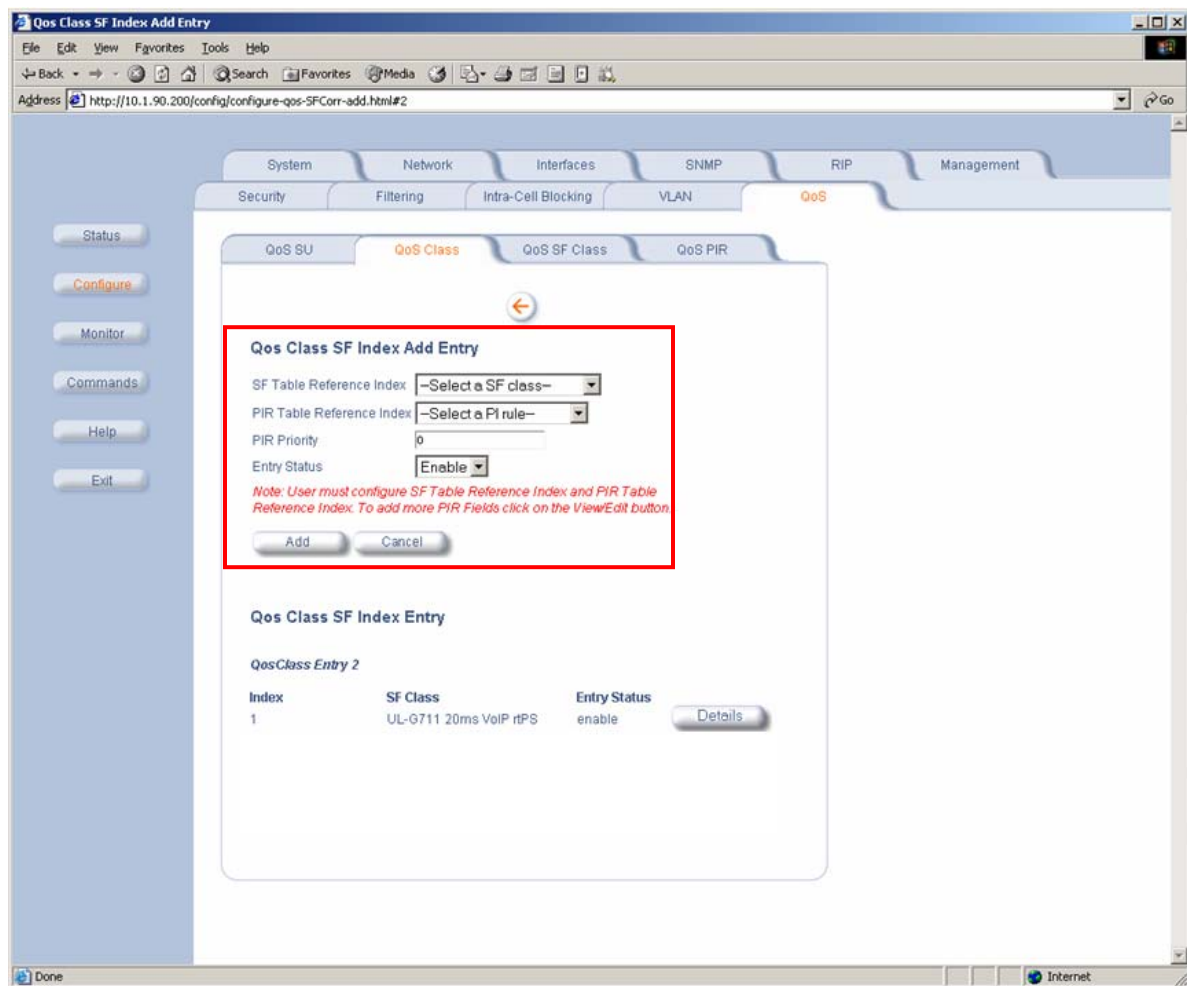
Step	Description
10.	<p>Adding the QoS Class information for 802.1p test</p> <p>Select Configure → QoS → QoS Class. Click the Add Table Entries button.</p> 

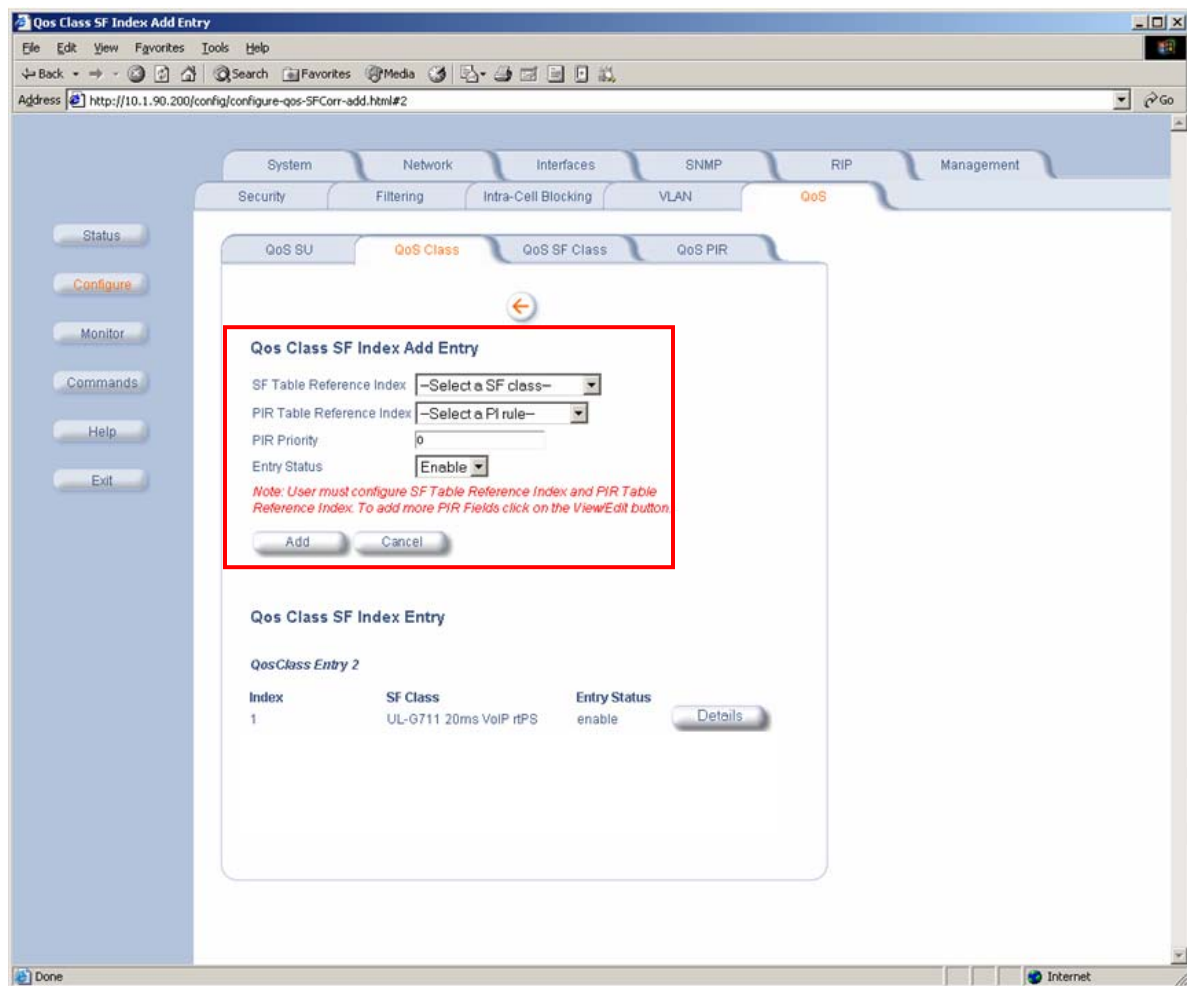
Step	Description												
11.	<h3>Creating the QoS Class information for 802.1p high priority traffic</h3> <p>Configure the following parameters:</p> <ul style="list-style-type: none">• Enter 802.1p test in the Class Name field.• For the SF Table Reference Index field, select UL-G711 20ms VoIP rtPS 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. <p>Click the Add button.</p>  <p>QoS Class Add Entry</p> <p>Class Name <input type="text"/></p> <p>SF Table Reference Index <input type="text" value="--Select a SF class--"/></p> <p>PIR Table Reference Index <input type="text" value="--Select a PI rule--"/></p> <p>PIR Priority <input type="text" value="0"/></p> <p>Entry Status <input type="text" value="Enable"/></p> <p>Add Cancel</p> <p>QoS Class Table</p> <table><thead><tr><th>Table Index</th><th>Class Name</th><th>Entry Status</th><th></th></tr></thead><tbody><tr><td>1</td><td>Unlimited Best Effort</td><td>enable</td><td>Details</td></tr><tr><td>2</td><td>2 Mbps Video</td><td>enable</td><td>Details</td></tr></tbody></table>	Table Index	Class Name	Entry Status		1	Unlimited Best Effort	enable	Details	2	2 Mbps Video	enable	Details
Table Index	Class Name	Entry Status											
1	Unlimited Best Effort	enable	Details										
2	2 Mbps Video	enable	Details										

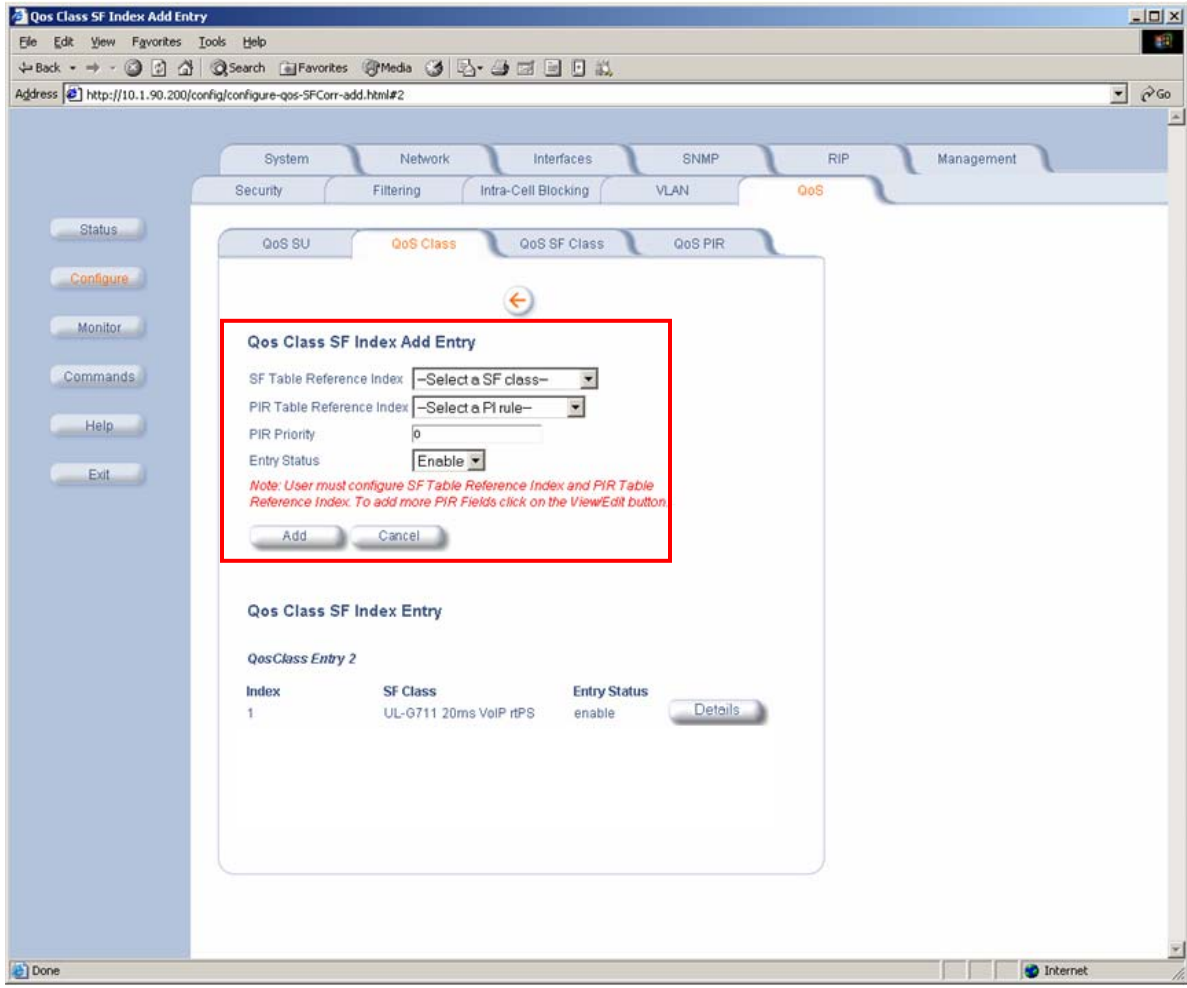
Step	Description
12.	<p>Adding the QoS Class information for DSCP</p> <p>Select Configure → QoS → QoS Class. Click the Add Table Entries button.</p> 

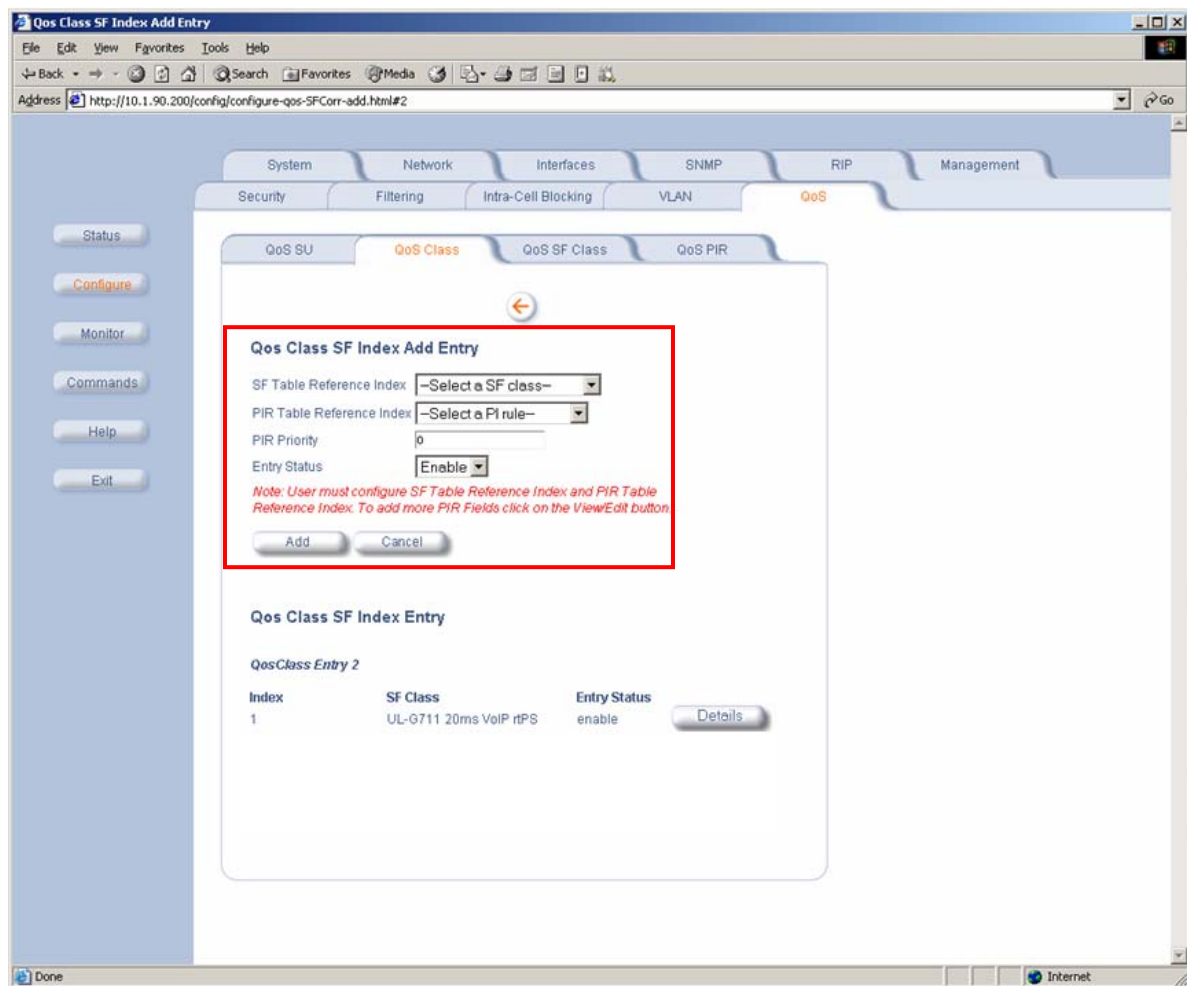
Step	Description																
13.	<p>Creating the QoS Class information for DSCP priority traffic.</p> <p>Configure the following parameters:</p> <ul style="list-style-type: none">• Enter DSCP test for the Class Name field.• For the SF Table Reference Index field, select UL-G711 20ms VoIP rtPS for the SF class.• For the PIR Table Reference Index field, select DSCP for the Pt rule.• Set the PIR Priority field to 7. <p>Click the Add button.</p>  <p>QoS Class Add Entry</p> <p>Class Name <input type="text"/></p> <p>SF Table Reference Index <input type="text" value="--Select a SF class--"/></p> <p>PIR Table Reference Index <input type="text" value="--Select a PI rule--"/></p> <p>PIR Priority <input type="text" value="0"/></p> <p>Entry Status <input type="text" value="Enable"/></p> <p>Add Cancel</p> <p><small>Note: User must configure QoS Class Name, SF Table Reference Index and PIR Table Reference Index. To configure/add rest of the QoS Class Fields click on the View/Edit button.</small></p> <p>QoS Class Table</p> <table><tr><th>Table Index</th><th>Class Name</th><th>Entry Status</th><th></th></tr><tr><td>1</td><td>Unlimited Best Effort</td><td>enable</td><td>Details</td></tr><tr><td>2</td><td>802.1p test</td><td>enable</td><td>Details</td></tr><tr><td>3</td><td>2 Mbps Video</td><td>enable</td><td>Details</td></tr></table>	Table Index	Class Name	Entry Status		1	Unlimited Best Effort	enable	Details	2	802.1p test	enable	Details	3	2 Mbps Video	enable	Details
Table Index	Class Name	Entry Status															
1	Unlimited Best Effort	enable	Details														
2	802.1p test	enable	Details														
3	2 Mbps Video	enable	Details														

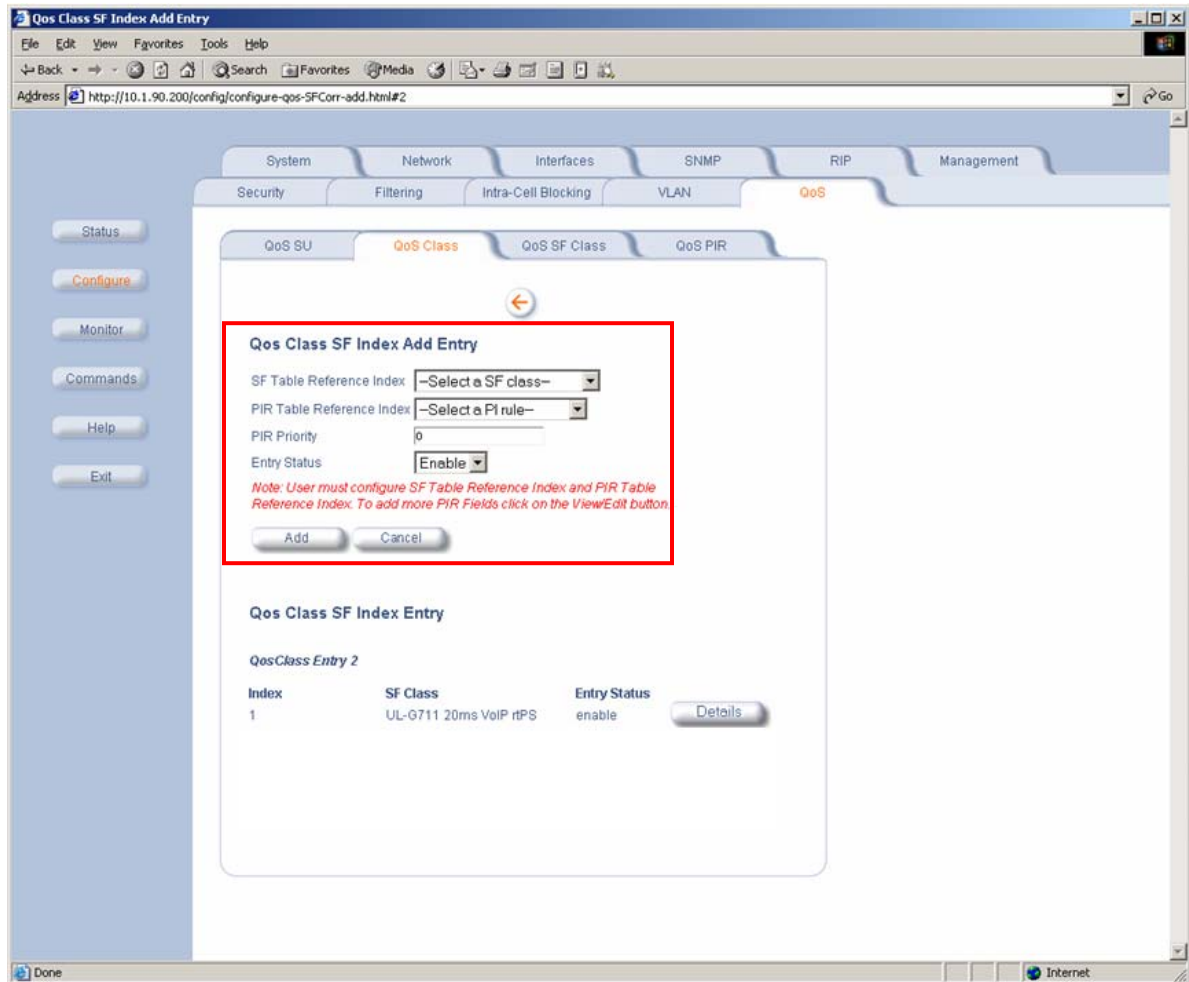
Step	Description
14.	<p>Configuring the QoS Class information, DL-G711 20ms VoIP rtPS QoS SF Class for 802.p test</p> <p>Select Configure → QoS → QoS Class. Click on the Details button for 802.p test under QoS Class Table (not shown).</p> <p>Configure the following parameters:</p> <ul style="list-style-type: none"> 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. <p>Click the Add button.</p>  <p>The screenshot shows a web-based configuration interface for QoS. The main window is titled 'Qos Class SF Index Add Entry'. It has a navigation bar with tabs for System, Network, Interfaces, SNMP, RIP, and Management. Under the Network tab, there are sub-tabs for Security, Filtering, Intra-Cell Blocking, VLAN, and QoS. The QoS tab is selected, and within it, the 'QoS Class' sub-tab is active. The configuration form contains the following fields: 'SF Table Reference Index' (a dropdown menu showing 'DL-G711 20ms VoIP rtPS'), 'PIR Table Reference Index' (a dropdown menu showing '802.1p'), 'PIR Priority' (a text input field containing '7'), and 'Entry Status' (a dropdown menu showing 'Enable'). A red rectangular box highlights these four fields. Below the form, there is a note: 'Note: User must configure SF Table Reference Index and PIR Table Reference Index. To add more PIR Fields click on the ViewEdit button.' At the bottom of the form are 'Add' and 'Cancel' buttons. Below the form, there is a section titled 'Qos Class SF Index Entry' which contains a table with one entry: Index 1, SF Class UL-G711 20ms VoIP rtPS, Entry Status enable, and a 'Details' button next to it.</p>

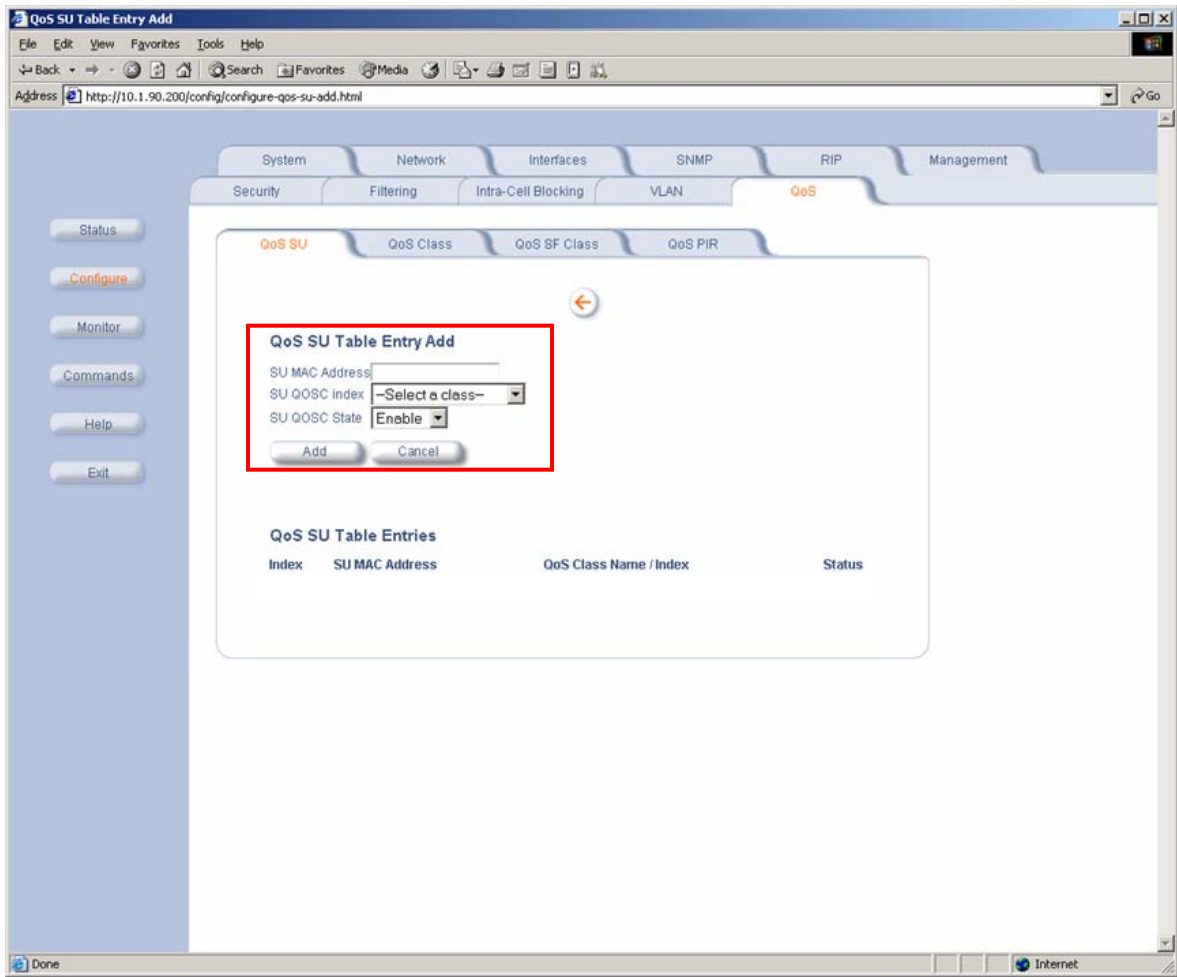
Step	Description																
15.	<p>Configuring the QoS Class information, UL-Unlimited BE QoS SF Class for 802.p test</p> <p>Select Configure → QoS → QoS Class. Click on the Details button for 802.p test under QoS Class Table (not shown).</p> <p>Configure the following parameters:</p> <ul style="list-style-type: none">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. <p>Click the Add button.</p>  <p>The screenshot shows the 'Qos Class SF Index Add Entry' window. The configuration fields are as follows:</p> <table><tr><th>Field</th><th>Value</th></tr><tr><td>SF Table Reference Index</td><td>UL-G711 20ms VoIP rTPS</td></tr><tr><td>PIR Table Reference Index</td><td>All</td></tr><tr><td>PIR Priority</td><td>0</td></tr><tr><td>Entry Status</td><td>Enable</td></tr></table> <p>Below the configuration fields, a table displays the 'QosClass Entry 2' configuration:</p> <table><tr><th>Index</th><th>SF Class</th><th>Entry Status</th></tr><tr><td>1</td><td>UL-G711 20ms VoIP rTPS</td><td>enable</td></tr></table>	Field	Value	SF Table Reference Index	UL-G711 20ms VoIP rTPS	PIR Table Reference Index	All	PIR Priority	0	Entry Status	Enable	Index	SF Class	Entry Status	1	UL-G711 20ms VoIP rTPS	enable
Field	Value																
SF Table Reference Index	UL-G711 20ms VoIP rTPS																
PIR Table Reference Index	All																
PIR Priority	0																
Entry Status	Enable																
Index	SF Class	Entry Status															
1	UL-G711 20ms VoIP rTPS	enable															

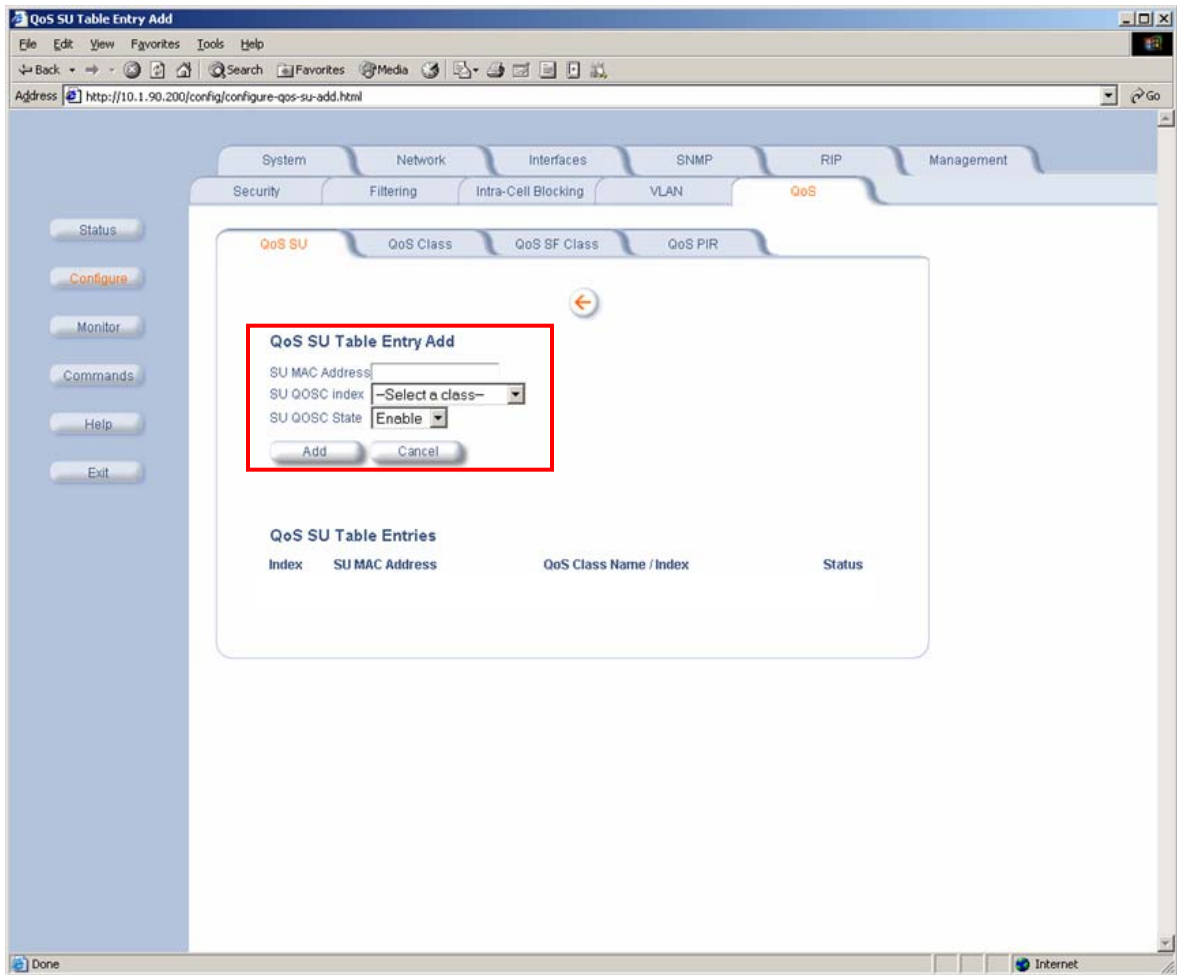
Step	Description						
16.	<p>Configuring the QoS Class information, DL-Unlimited BE QoS SF Class for 802.p test</p> <p>Select Configure → QoS → QoS Class. Click on the Details button for 802.p test under QoS Class Table (not shown).</p> <p>Configure the following parameters:</p> <ul style="list-style-type: none">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. <p>Click the Add button.</p>  <p>The screenshot shows the 'Qos Class SF Index Add Entry' window. The 'SF Table Reference Index' is set to 'DL-Unlimited BE', 'PIR Table Reference Index' is set to 'All', 'PIR Priority' is set to '0', and 'Entry Status' is set to 'Enable'. A red box highlights these fields. Below the fields is a table showing the configured entry:</p> <table><tr><th>Index</th><th>SF Class</th><th>Entry Status</th></tr><tr><td>1</td><td>UL-G711 20ms VoIP rTPS</td><td>enable</td></tr></table>	Index	SF Class	Entry Status	1	UL-G711 20ms VoIP rTPS	enable
Index	SF Class	Entry Status					
1	UL-G711 20ms VoIP rTPS	enable					

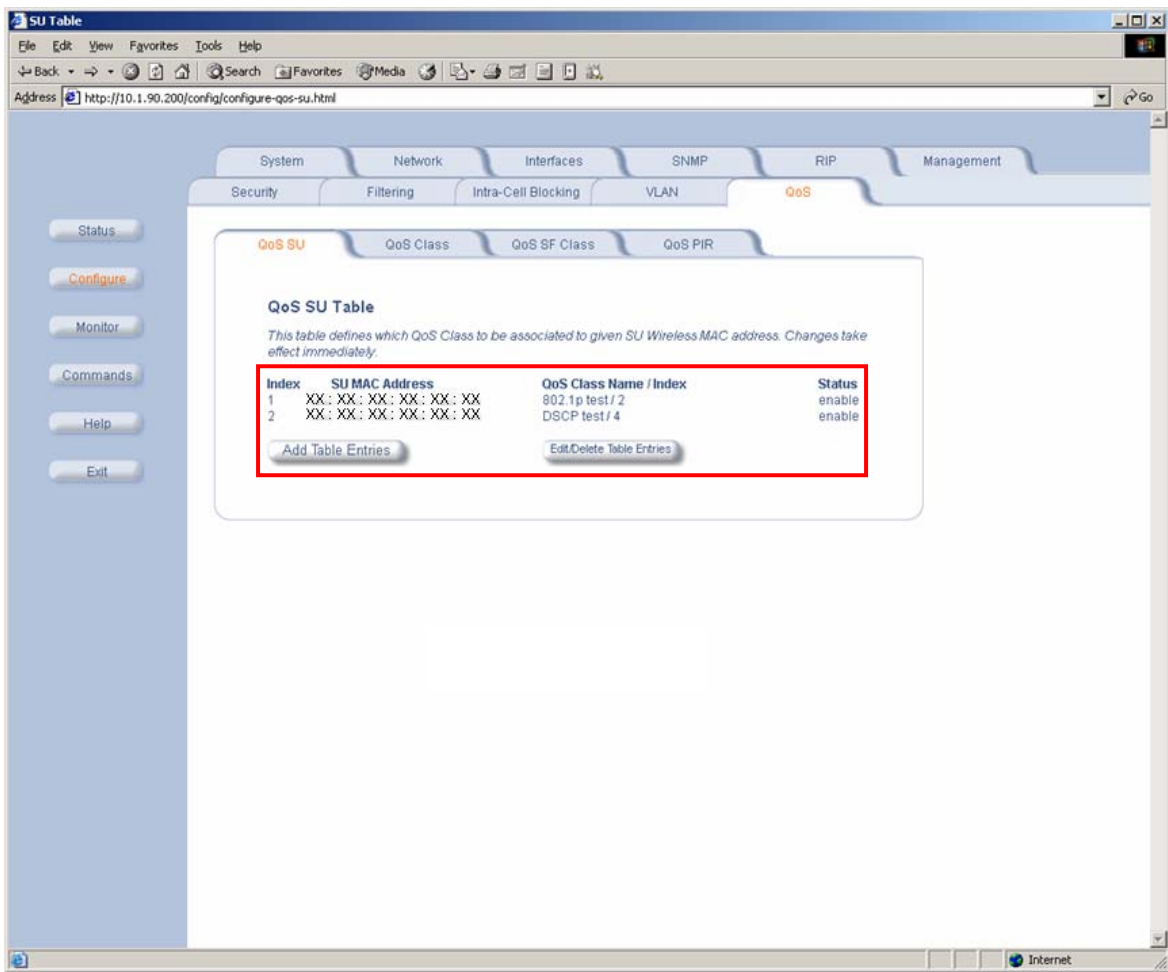
Step	Description
17.	<p>Configuring the QoS Class information, DL-G711 20ms VoIP rtPS QoS SF Class for DSCP test</p> <p>Select Configure → QoS → QoS Class. Click on the Details button for DSCP test under QoS Class Table (not shown).</p> <p>Configure the following parameters:</p> <ul style="list-style-type: none"> 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. <p>Click the Add button.</p>  <p>The screenshot shows a web-based configuration interface for QoS. The main window is titled 'Qos Class SF Index Add Entry'. It has a navigation bar with tabs for System, Network, Interfaces, SNMP, RIP, and Management. Under the Network tab, there are sub-tabs for Security, Filtering, Intra-Cell Blocking, VLAN, and QoS. The QoS tab is selected, and within it, the 'QoS Class' sub-tab is active. The configuration form includes the following fields: 'SF Table Reference Index' (a dropdown menu showing 'DL-G711 20ms VoIP rtPS'), 'PIR Table Reference Index' (a dropdown menu showing 'DSCP'), 'PIR Priority' (a text input field containing '7'), and 'Entry Status' (a dropdown menu showing 'Enable'). A red rectangular box highlights these four fields. Below the form, there is a note: 'Note: User must configure SF Table Reference Index and PIR Table Reference Index. To add more PIR Fields click on the ViewEdit button.' At the bottom of the form are 'Add' and 'Cancel' buttons. Below the form, there is a section titled 'Qos Class SF Index Entry' which contains a table with one entry: Index 1, SF Class UL-G711 20ms VoIP rtPS, Entry Status enable, and a 'Details' button next to it.</p>

Step	Description						
18.	<p>Configuring the QoS Class information, UL-Unlimited BE QoS SF Class for DSCP test</p> <p>Select Configure → QoS → QoS Class, click on the Details button for DSCP test under QoS Class Table (not shown).</p> <p>Configure the following parameters:</p> <ul style="list-style-type: none">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. <p>Click the Add button.</p>  <p>The screenshot shows the 'Qos Class SF Index Add Entry' window. The 'SF Table Reference Index' is set to 'UL-G711 20ms VoIP rTPS', 'PIR Table Reference Index' is set to 'All', 'PIR Priority' is set to '0', and 'Entry Status' is set to 'Enable'. A red box highlights these fields. Below the fields is a table titled 'Qos Class SF Index Entry' with one entry:</p> <table><tr><th>Index</th><th>SF Class</th><th>Entry Status</th></tr><tr><td>1</td><td>UL-G711 20ms VoIP rTPS</td><td>enable</td></tr></table>	Index	SF Class	Entry Status	1	UL-G711 20ms VoIP rTPS	enable
Index	SF Class	Entry Status					
1	UL-G711 20ms VoIP rTPS	enable					

Step	Description						
19.	<p>Configuring the QoS Class information, DL-Unlimited BE QoS SF Class for DSCP test:</p> <p>Select Configure → QoS → QoS Class, click on the Details tab for DSCP test under QoS Class Table.</p> <p>Configure the following parameters:</p> <ul style="list-style-type: none">• 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. <p>Click the Add button.</p>  <p>The screenshot shows the 'Qos Class SF Index Add Entry' window. The 'SF Table Reference Index' is set to 'DL-Unlimited BE', 'PIR Table Reference Index' is set to 'All', 'PIR Priority' is set to '0', and 'Entry Status' is set to 'Enable'. A red box highlights these fields. Below the fields is a table showing the configured entry:</p> <table><tr><th>Index</th><th>SF Class</th><th>Entry Status</th></tr><tr><td>1</td><td>UL-G711 20ms VoIP rTPS</td><td>enable</td></tr></table>	Index	SF Class	Entry Status	1	UL-G711 20ms VoIP rTPS	enable
Index	SF Class	Entry Status					
1	UL-G711 20ms VoIP rTPS	enable					

Step	Description
20.	<p>Adding 802.1p QoS SU addresses for Campus A</p> <p>Select Configure → QoS → QoS SU.</p> <p>Configure the following parameters:</p> <ul style="list-style-type: none"> 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. <p>Click the Add button.</p>  <p>The screenshot shows a web-based configuration interface for QoS SU Table Entry Add. The interface includes a navigation menu on the left with buttons for Status, Configure, Monitor, Commands, Help, and Exit. The main content area has tabs for System, Network, Interfaces, SNMP, RIP, Management, Security, Filtering, Intra-Cell Blocking, VLAN, and QoS. Under the QoS tab, there are sub-tabs for QoS SU, QoS Class, QoS SF Class, and QoS PIR. The QoS SU sub-tab is active, showing a form with the following fields: SU MAC Address (text input), SU QOSC index (dropdown menu with '-Select a class-' selected), and SU QOSC State (dropdown menu with 'Enable' selected). Below these fields are 'Add' and 'Cancel' buttons. A red box highlights the 'Add' button. At the bottom, there is a table titled 'QoS SU Table Entries' with columns for Index, SU MAC Address, QoS Class Name / Index, and Status.</p>

Step	Description
21.	<p>Adding DSCP QoS SU addresses for Campus B</p> <p>Select Configure → QoS → QoS SU.</p> <p>Configure the following parameters:</p> <ul style="list-style-type: none"> 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. <p>Click the Add button.</p>  <p>The screenshot shows a web-based configuration interface for QoS SU. The main window is titled 'QoS SU Table Entry Add'. It has a sidebar with buttons: Status, Configure (highlighted), Monitor, Commands, Help, and Exit. The main content area has tabs for System, Network, Interfaces, SNMP, RIP, Management, Security, Filtering, Intra-Cell Blocking, VLAN, and QoS (selected). Under the QoS tab, there are sub-tabs for QoS SU (selected), QoS Class, QoS SF Class, and QoS PIR. The QoS SU sub-tab contains a form with the following fields: SU MAC Address (text input), SU QOSC index (dropdown menu showing '-Select a class-'), and SU QOSC State (dropdown menu showing 'Enable'). Below these fields are 'Add' and 'Cancel' buttons. A red rectangle highlights the 'Add' button. At the bottom of the window, there is a table titled 'QoS SU Table Entries' with columns: Index, SU MAC Address, QoS Class Name / Index, and Status.</p>

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

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.	<p>Connect to the Extreme Summit 300-48 Switch. Log in using the appropriate Login ID and Password.</p> <pre>Login: Password: Summit300-48:1 #</pre>
2.	<p>Ensure the ports are not already configured. Use the show port <port> info detail command to check the current configuration for the port.</p> <pre>Summit300-48:1 # show port 1:1 info detail</pre> <p>Repeat for ports 1:2, 1:3, 1:4, 1:5 and 19.</p>
3.	<p>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.</p> <pre>Summit300-48:1 # configure vlan <VLAN NAME> delete ports <port> Summit300-48:1 # show port <port> info detail</pre>
4.	<p>Create the VLAN VlanOSPF.</p> <pre>Summit300-48:1 # create vlan VlanOSPF Summit300-48:1 # configure VlanOSPF tag 2000</pre>
5.	<p>Add an IP address for VLAN VlanOSPF, and enable IP forwarding.</p> <pre>Summit300-48:1 # configure VlanOSPF ipaddress 10.20.30.1/30 Summit300-48:1 # enable ipforwarding VlanOSPF</pre>
6.	<p>Assign ports to VLAN VlanOSPF.</p> <pre>Summit300-48:1 # configure VlanOSPF add ports 1:1 tag</pre>

Step	Description
7.	<p>Enable OSPF.</p> <pre>Summit300-48:1 # enable ospf</pre>
8.	<p>Configure OSPF for VlanOSPF.</p> <pre>Summit300-48:1 # configure ospf VlanOSPF area 0.0.0.0 Summit300-48:1 # configure ospf add VlanOSPF area 0.0.0.0</pre>
9.	<p>Enable OSPF to forward information for directly connected interfaces.</p> <pre>Summit300-48:1 # enable ospf export direct cost 2 type ase-type-2</pre>
10.	<p>Create VLAN Voice1.</p> <pre>Summit300-48:1 # create vlan Voice1 Summit300-48:1 # configure Voice1 tag 42</pre>
11.	<p>Add an IP address for VLAN Voice1, and enable IP forwarding.</p> <pre>Summit300-48:1 # configure Voice1 ipaddress 192.168.42.254/24 Summit300-48:1 # enable ipforwarding Voice1</pre>
12.	<p>Assign ports to VLAN Voice1.</p> <pre>Summit300-48:1 # configure Voice1 add ports 1:1, 1:2, 1:3 tagged Summit300-48:1 # configure Voice1 add ports 1:5</pre>
13.	<p>Assign a port to VLAN Voice1 for the Avaya IP Office 406v2.</p> <pre>Summit300-48:1 # configure Voice1 add ports 1:19</pre>
14.	<p>Enable DiffServ examination on port 1:19.</p> <pre>Summit300-48:1 # enable diffserv examination ports 1:19</pre>
15.	<p>Add QoS profile to port 1:19.</p> <pre>Summit300-48:1 # configure port 1:19 qosprofile qp7</pre>
16.	<p>Set all ingress traffic on port 1:19 to priority 6.</p> <pre>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</pre>

Step	Description
17.	<p>Create VLAN Datavlan1.</p> <pre>Summit300-48:1 # create vlan Datavlan1 Summit300-48:1 # configure Datavlan1 tag 200</pre>
18.	<p>Add Datavlan1 to QoS profile qpl (best effort).</p> <pre>Summit300-48:1 # configure Datavlan1 qosprofile qpl</pre>
19.	<p>Add an IP address for VLAN Datavlan1, and enable IP forwarding.</p> <pre>Summit300-48:1 # configure Datavlan1 ipaddress 192.168.200.254/24 Summit300-48:1 # enable ipforwarding Datavlan1</pre>
20.	<p>Assign ports to VLAN Datavlan1.</p> <pre>Summit300-48:1 # configure Datavlan1 add ports 1:1 tagged Summit300-48:1 # configure Datavlan1 add ports 1:2, 1:3</pre>
21.	<p>Create VLAN Vlan2.</p> <pre>Summit300-48:1 create vlan Vlan2 Summit300-48:1 configure Vlan2 tag 2</pre>
22.	<p>Add an IP address for VLAN Vlan2, and enable IP forwarding.</p> <pre>Summit300-48:1 # configure Vlan2 ipaddress 10.1.2.1/24 Summit300-48:1 # enable ipforwarding Vlan2</pre>
23.	<p>Assign ports to VLAN Vlan2.</p> <pre>Summit300-48:1 # configure Vlan2 add ports 1:4</pre>
24.	<p>Create VLAN Prox1.</p> <pre>Summit300-48:1 create vlan Prox1 Summit300-48:1 configure Prox1 tag 90</pre>
25.	<p>Add an IP address for VLAN Prox1, and enable IP forwarding.</p> <pre>Summit300-48:1 # configure Prox1 ipaddress 10.1.90.1/24 Summit300-48:1 # enable ipforwarding Prox1</pre>
26.	<p>Assign ports to VLAN Prox1.</p> <pre>Summit300-48:1 # configure Prox1 add ports 1:1 tag</pre>

Step	Description
27.	<p>Enable DHCP relay.</p> <pre>Summit300-48:1 enable bootprelay Summit300-48:1 configure bootprelay add 10.1.2.250</pre>
28.	<p>Save the running configuration to the startup configuration.</p> <pre>Summit300-48:1 # save</pre>

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.	<p>Log into the Extreme Summit X450e-24p Switch for Campus A.</p> <p>Connect to the Extreme Summit X450e-24p Switch. Log in using the appropriate Login ID and Password.</p> <pre>Login: Password: X450e-24p:1 #</pre>
2.	<p>Ensure the ports are not already configured. Use the show port <port> info detail command to check the current configuration for the port.</p> <pre>X450e-24p:1 # show port 1 info detail</pre> <p>Repeat for ports 2 and 3.</p>
3.	<p>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.</p> <pre>X450e-24p:1# configure vlan <VLAN NAME> delete ports <port> X450e-24p:1# show port <port> info detail</pre>

Step	Description
4.	<p>Create VLAN Voice1.</p> <pre>X450e-24p:1 # create vlan Voice1 X450e-24p:1 # configure Voice1 tag 42</pre>
5.	<p>Assign ports to VLAN Voice1 for the interfaces.</p> <pre>X450e-24p:1 # configure Voice1 add ports 1, 2, 3 tagged</pre>
6.	<p>Create VLAN Datavlan1.</p> <pre>X450e-24p:1 # create vlan Datavlan1 X450e-24p:1 # configure Datavlan1 tag 200</pre>
7.	<p>Add Datavlan1 to QoS profile qp1 (best effort).</p> <pre>X450e-24p:1 # configure Datavlan1 qosprofile qp1</pre>
8.	<p>Assign ports to VLAN Datavlan1.</p> <pre>X450e-24p:1 # configure Datavlan1 add ports 1, 2, 3 tagged</pre>
9.	<p>Save the running configuration to the startup configuration.</p> <pre>X450e-24p:1 # save</pre>

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

Step	Description
2.	<p>Ensure the ports are not already configured. Use the show port <port> info detail command to check the current configuration for the port.</p> <pre>X450e-24p.1 # show port 1 info detail</pre> <p>Repeat for ports 2 and 3.</p>
3.	<p>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.</p> <pre>X450e-24p.1# configure vlan <VLAN NAME> delete ports <port> X450e-24p.1# show port <port> info detail</pre>
4.	<p>Enable DiffServ examination on port 1.</p> <pre>X450e-24p.1 # enable diffserv examination ports 1</pre>
5.	<p>Create QoS profile qp7</p> <pre>X450e-24p.1 # create qosprofile qp7</pre>
6.	<p>Assign DiffServ DSCP replacement value for qp7 to 46.</p> <pre>X450e-24p.1 # configure diffserv replacement qp7 code-point 46</pre>
7.	<p>Create VLAN VlanOSPF.</p> <pre>X450e-24p.1 # create vlan VlanOSPF X450e-24p.1 # configure VlanOSPF tag 2000</pre>
8.	<p>Add an IP address for VLAN VlanOSPF and enable IP forwarding.</p> <pre>X450e-24p.1 # configure VlanOSPF ipaddress 10.20.30.2/30 X450e-24p.1 # enable ipforwarding VlanOSPF</pre>
9.	<p>Assign ports to VLAN VlanOSPF.</p> <pre>X450e-24p.1 # configure VlanOSPF add ports 1 tag</pre>
10.	<p>Enable OSPF</p> <pre>X450e-24p.1 # enable ospf</pre>

Step	Description
11.	Configure OSPF for VlanOSPF. <pre>X450e-24p.1 # configure ospf VlanOSPF area 0.0.0.0 X450e-24p.1 # configure ospf add VlanOSPF area 0.0.0.0</pre>
12.	Enable OSPF to forward information for directly connected interfaces. <pre>X450e-24p.1 # enable ospf export direct cost 2 type ase-type-2</pre>
13.	Create VLAN Voice2. <pre>X450e-24p.1 # create vlan Voice2 X450e-24p.1 # configure Voice2 tag 33</pre>
14.	Add an IP address for VLAN Voice2 and enable IP forwarding. <pre>X450e-24p.1 # configure Voice2 ipaddress 192.168.33.254/24 X450e-24p.1 # enable ipforwarding Voice2</pre>
15.	Assign ports to VLAN Voice2. <pre>X450e-24p.1 # configure Voice2 add ports 1, 2, 3 tagged</pre>
16.	Create VLAN Datavlan2. <pre>X450e-24p.1 # create vlan Datavlan2 X450e-24p.1 # configure Datavlan2 tag 30</pre>
17.	Add Datavlan2 to QoS profile qp1 (best effort). <pre>X450e-24p.1 # configure Datavlan2 qosprofile qp1</pre>
18.	Add an IP address for VLAN Datavlan2 and enable IP forwarding. <pre>X450e-24p.1 # configure Datavlan2 ipaddress 192.168.30.254/24 X450e-24p.1 # enable ipforwarding Datavlan2</pre>
19.	Assign ports to VLAN Datavlan2. <pre>X450e-24p.1 # configure Datavlan2 add ports 2, 3</pre>
20.	Enable DHCP relay. <pre>X450e-24p.1 # enable bootprelay X450e-24p.1 # configure bootprelay add 10.1.2.250</pre>

Step	Description
21.	<p>Save the running configuration to the startup configuration.</p> <pre>x450e-24p.1 # save</pre>

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:

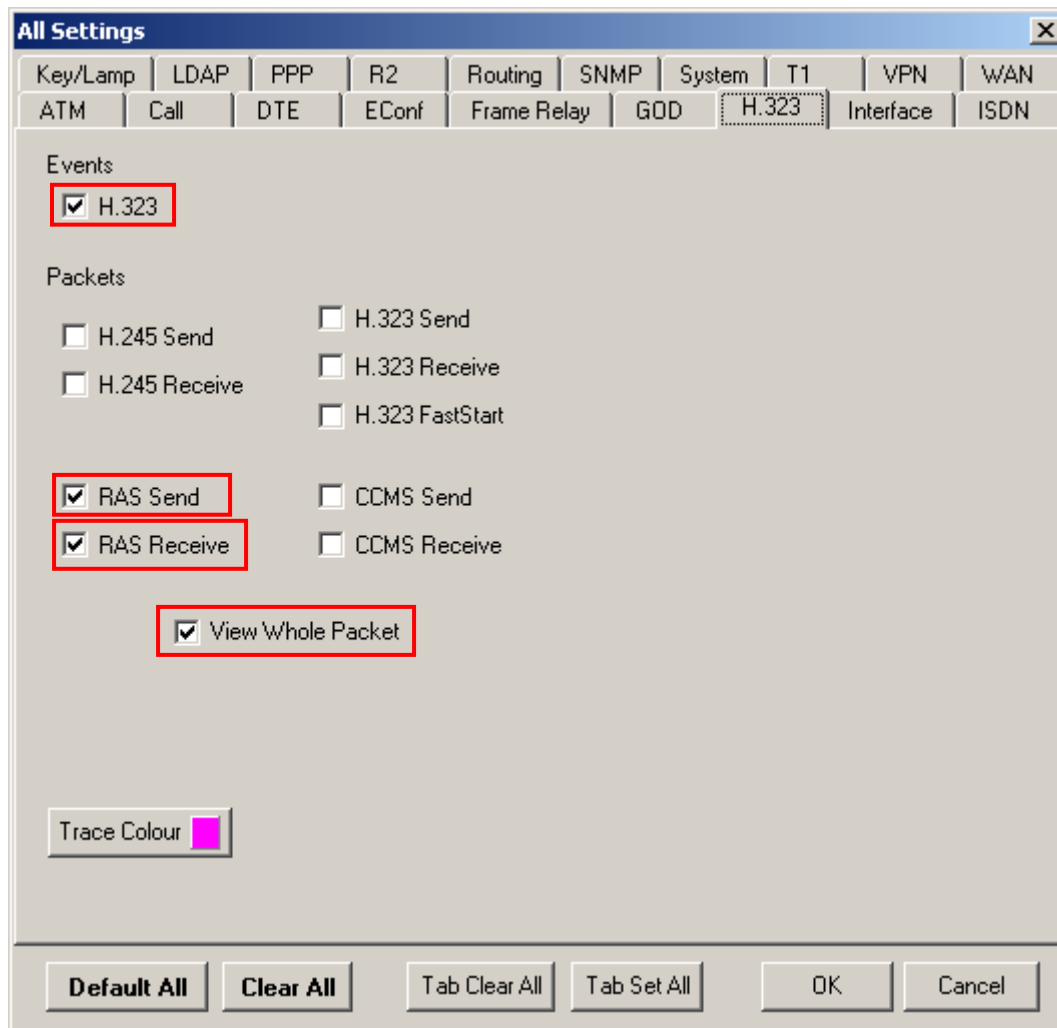
- Verify that the DHCP relay is functioning by confirming that the Avaya IP Telephones receive their IP addresses from the DHCP server connected to the network
- Check that the Avaya IP Telephones have successfully registered using the Avaya IP Office System Monitor. See **Section 11.1**.
- Place calls 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>

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