



Avaya Solution & Interoperability Test Lab

Application Notes for Extreme Networks Summit X450-24T with Avaya C363T-PWR Stackable Switch in an Avaya IP Telephony Infrastructure - Issue 1.0

Abstract

These Application Notes present a sample configuration for using an Extreme Networks Summit X450-24T and an Avaya C363T-PWR Stackable Switch in an Avaya IP Telephony Infrastructure. The objective of the test was to evaluate interoperability of the products. Compliance testing emphasis was on Quality of Service. All test cases were completed successfully. 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.

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1. Introduction

These Application Notes present a sample configuration for using an Extreme Networks Summit X450-24T and an Avaya C363T-PWR Stackable Switch in an Avaya IP Telephony Infrastructure. Compliance testing emphasis was on Quality of Service (QoS).

The network diagram in **Figure 1** shows the Avaya S8500 Media Server, Avaya G650 Media Gateway, Avaya 4620SW IP Telephone and a DHCP server connected to the Extreme Networks Summit X450-24T. The Avaya IP Office 412, Avaya IP Office Manager PC and Avaya 4620SW IP Telephone are connected to the Avaya C363T-PWR Stackable Switch. The Summit X450-24T and the Avaya C363T-PWR are connected through a [100 Base-T] link set up as an 802.1Q trunk. An IP trunk is configured between Avaya Communication Manager and the Avaya IP Office. The voice and data traffic were separated onto different VLANs.

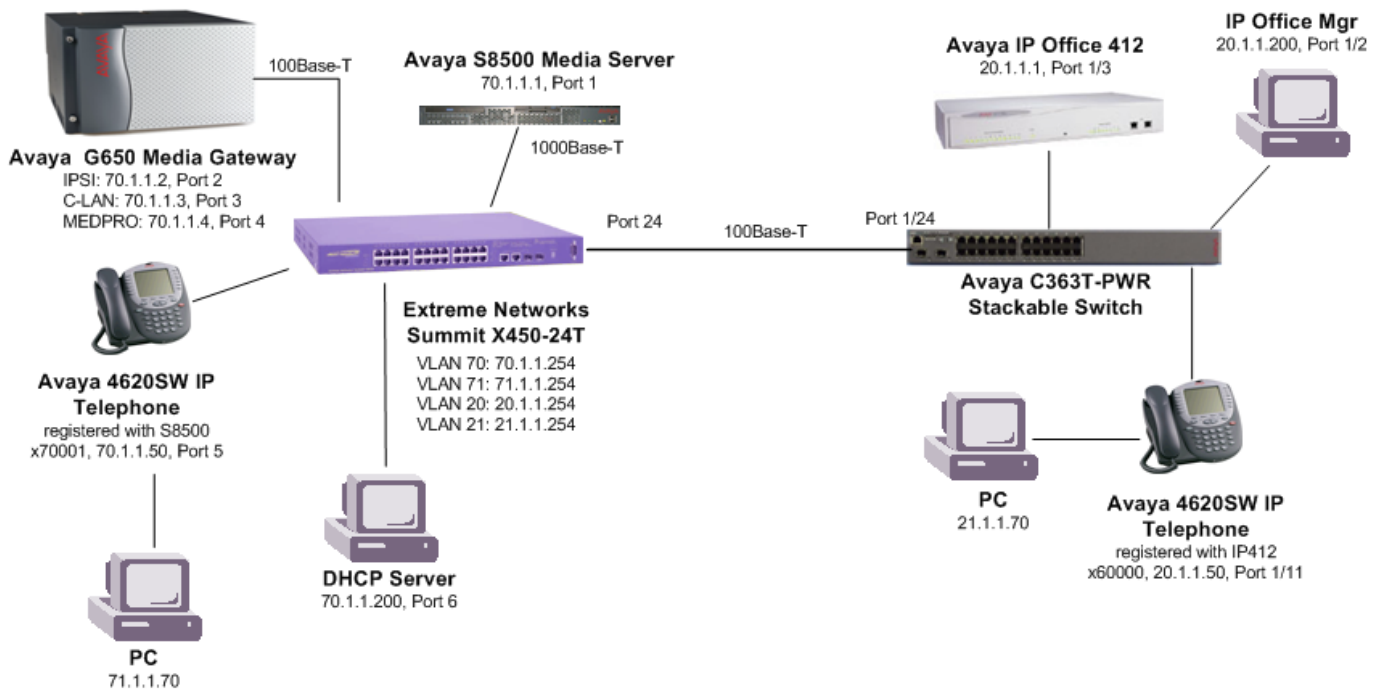


Figure 1: Network Configuration

2. Equipment and Software Validated

The following equipment and software were used for the test configuration provided:

Equipment	Version
Avaya C363T-PWR Stackable Switch	4.3.12
Avaya S8500 Media Server	2.2
Avaya G650 Media Gateway	

Equipment	Version
<ul style="list-style-type: none"> • IPSI (TN2312AP HW02) • C-LAN (TN799DP HW01) • MEDPRO (TN2302AP HW03) 	FW009 FW012 FW093
Avaya IP Office 412	3.0(40)
Avaya IP Office Manager	5.0(40)
Avaya 4620SW IP Telephone	2.1.3
Extreme Networks Summit X450-24T	11.2.4.2
Microsoft DHCP Server (Windows 2000 Server)	5.00.2195 SP4

Table 1 - Network Component Software Versions

3. QoS Configuration Employed

In order to simplify the Quality of Service (QoS) configuration, the ports used on the Extreme Networks Summit X450-24T are configured for 802.1p priority examination. In order to preserve 802.1p/Q priority from the Extreme Networks Summit X450-24T to the Avaya C363T-PWR Stackable Switch, the inter-switch link is configured to support tagged VLANs. The C-LAN port on the Extreme Networks Summit X450-24T is assigned QoS profile QP7, which is mapped to 802.1p/Q priority 6 and has both 802.1p and DiffServ replacement enabled. This ensures that traffic from the C-LAN is properly marked with an 802.1p priority and DiffServ value for routers further downstream.

All the Avaya VoIP components including the Avaya S8500 Media Server, the IP cards in the Avaya G650 Media Gateway, Avaya IP telephones and Softphones are configured with DiffServ value 46. In order to support an IP telephone and attached PC in different VLANs, 802.1Q must be enabled on the IP telephone. The Avaya IP telephones are configured with 802.1p/Q priority 6. Since Extreme Networks switches treat VLAN 0 as clear traffic (untagged VLAN), it does not matter if 802.1Q is enabled on the Avaya S8500 Media Server and the IPSI of the Avaya G650 Media Gateway.

The Avaya C363T-PWR Stackable Switch trusts 802.1p/Q priority for Layer 2 traffic. The Avaya C363T-PWR will preserve 802.1p/Q priority from the Avaya IP telephones to the Extreme Networks Summit X450-24T.

Table 2 summarizes the QoS configuration used for the Avaya equipment, and the directly connected Extreme Networks Summit X450-24T. The detailed commands to implement this configuration on each product are provided in the forthcoming sections.

Avaya Equipment	802.1p/Q and DiffServ Configuration	Summit X450-24T Port Configuration
IP telephones	IP phone tags with VLAN ID received from the DHCP server. 802.1p/Q priority and DiffServ value are received from the IP network region configured in Avaya Communication Manager.	Tagged VLAN on the port for the IP telephone. Untagged VLAN for the PC attached to the phone.

Avaya Equipment	802.1p/Q and DiffServ Configuration	Summit X450-24T Port Configuration
	(IP telephones are mapped to an IP network region based on source IP addresses)	
IPSI on Avaya G650 Media Gateway	Using IPSI administration from IPSI services port to set DiffServ value to 46.	Untagged VLAN
C-LAN and MEDPRO on Avaya G650 Media Gateway	DiffServ value is received from the IP network region configured in Avaya Communication Manager.	Untagged VLAN
Avaya S8500 Media Server	Use change ip-services interface to set DiffServ value to 46.	Untagged VLAN

Table 2 – QoS and Port Configuration Summary

4. Configure Avaya Communication Manager

The configuration information provided in these Application Notes relates to steps necessary for testing QoS. For information on how to set up an H.323 IP trunk between Avaya Communication Manager and Avaya IP Office, please refer to the Solution and Interoperability Application Notes entitled, “How to configure an H.323 IP trunk between an Avaya IP600 Internet Protocol Communication Server and Avaya IP Office Server – Issue 1.2.”

4.1. Configure the Avaya S8500 Media Server

In the test configuration, the C-LAN and MEDPRO are configured to network region 1. Use the command **change ip-interface** to configure the C-LAN and the MEDPRO of the Avaya G650 Media Gateway. The following two screens display the configurations of the C-LAN (01A03) and the MEDPRO (01A04). Note that the C-LAN and MEDPRO are assigned to Network Region 1 without VLAN tagging.

```
change ip-interface 01a03

                                IP INTERFACES

                                Type: C-LAN
                                Slot: 01A03
                                Code/Suffix: TN799 D
                                Node Name: CLAN-01a03
                                IP Address: 70 .1 .1 .3
                                Subnet Mask: 255.255.255.0
                                Gateway Address: 70 .1 .1 .254
                                Enable Ethernet Port? y
                                Network Region: 1
                                VLAN: n

                                ETHERNET OPTIONS
                                Auto? y

Number of CLAN Sockets Before Warning: 400
```

```
change ip-interface 01a04
```

```
IP INTERFACES
```

```

Type: MEDPRO
Slot: 01A04
Code/Suffix: TN2302
Node Name: MEDPRO-01a04
IP Address: 70 .1 .1 .4
Subnet Mask: 255.255.255.0
Gateway Address: 70 .1 .1 .254
Enable Ethernet Port? y
Network Region: 1
VLAN: n
ETHERNET OPTIONS
Auto? y
```

Use the command **change ip-network-region** to configure QoS and other parameters for a network region. It is recommended to enable IP direct for intra-region and inter-region connections. RSVP is not used and is disabled by default. The Avaya components including C-LAN, MEDPRO, IP Telephones, and Softphones will receive QoS values (802.1p priority 6 and DiffServ 46) and other parameters from network region 1 in the test configuration. By configuring IP Codec set 1 to Network Region 1, all intra-region calls in Network Region 1 will use IP Codec set 1.

```
change ip-network-region 1
```

```
Page 1 of 19
```

```
IP NETWORK REGION
```

```

Region: 1
Location:
Name:
Home Domain:
Intra-region IP-IP Direct Audio: yes
Inter-region IP-IP Direct Audio: yes
IP Audio Hairpinning? y
AUDIO PARAMETERS
Codec Set: 1
UDP Port Min: 2048
UDP Port Max: 3028
RTCP Reporting Enabled? y
RTCP MONITOR SERVER PARAMETERS
Use Default Server Parameters? y
DIFFSERV/TOS PARAMETERS
Call Control PHB Value: 46
Audio PHB Value: 46
802.1P/Q PARAMETERS
Call Control 802.1p Priority: 6
Audio 802.1p Priority: 6
AUDIO RESOURCE RESERVATION PARAMETERS
H.323 IP ENDPOINTS
RSVP Enabled? n
H.323 Link Bounce Recovery? y
Idle Traffic Interval (sec): 20
Keep-Alive Interval (sec): 5
Keep-Alive Count: 5
```

Since **Figure 1** is a LAN infrastructure, IP Codec 1 is configured to G.711MU for high voice quality and is used for the calls in network region 1.

```
change ip-codec-set 1 Page 1 of 2

                                IP Codec Set

Codec Set: 1

Audio      Silence      Frames      Packet
Codec      Suppression  Per Pkt    Size(ms)
1: G.711MU      n          2          20
2:
3:
4:
5:
6:
7:
```

4.2. Configure IPSI on Avaya G650 Media Gateway

To configure the IPSI board, connect the computer (configured with IP address 192.11.13.5 with subnet mask 255.255.255.252) to the services port of the IPSI. Telnet to 192.11.13.6 and supply appropriate login credentials. The following screenshot illustrates the appropriate commands.

The IPSI IP address is configured to 70.1.1.2 with default gateway 70.1.1.254. Note that VLAN tagging is disabled and DiffServ value is configured to 46.

```
TN2312 IPSI IP Admin Utility
Copyright Avaya Inc, 2000, 2001, All Rights Reserved
[IPSI]: ipsilogin
Login: craft
Password:
[IPADMIN]: set control interface 70.1.1.2 255.255.255.0
WARNING!! The control network interface will change upon exiting IPADMIN
[IPADMIN]: set control gateway 70.1.1.254
WARNING!! The control network interface will change upon exiting IPADMIN
[IPADMIN]: set vlan tag off
[IPADMIN]: set diffserv 46
[IPADMIN]: show control interface

Control Network IP Address = 70.1.1.2
Control Network Subnetmask = 255.255.255.0
Control Network Default Gateway = 70.1.1.254
IPSI is not configured for DHCP IP address administration

[IPADMIN]: show qos

QoS values currently in use:
VLAN tagging      :      off
VLAN id          :      0
VLAN user priority :      6
Diffserv value    :      46
```

5. Configure Extreme Networks Summit X450-24T

5.1. Configure VLAN and Port

The following commands configure a VLAN “s8500-voice” corresponding to the 70.1.1.0 network. This VLAN is configured as an untagged VLAN on the ports for the S8500 Media Server and the IPSI, C-LAN and MEDPRO of the Avaya 650 Media Gateway and as a tagged VLAN on all ports that may connect to IP telephones (in this case, port 5).

```
create vlan s8500-voice
configure vlan s8500-voice tag 70
configure vlan s8500-voice add ports 1-4,6 untagged #S8500,IPSI,C-LAN,MEDPRO
configure vlan s8500-voice add ports 5 tagged
```

The following commands establish a VLAN “s8500-data” corresponding to the 71.1.1.0 network, which is used for computers and workstations, including PCs running the Avaya IP Softphone application. The “s8500-data” is configured as an untagged VLAN on all ports that may connect to computers or workstations. Note that these are the same physical ports as the IP telephones, since a computer may optionally be attached directly to an Avaya IP telephone.

```
create vlan s8500-data
configure vlan s8500-data tag 71
configure vlan s8500-data add port 5 untagged
```

Since the C363T-PWR used in the test configuration was licensed for only Layer 2 functionality, the following commands establish VLANs “ipoffice-voice” and “ipoffice-data” corresponding to the 20.1.1.0 and 21.1.1.0 networks for the IP Office voice and data traffic in the configuration.

```
create vlan "ipoffice-voice"
configure vlan ipoffice-voice tag 20
create vlan "ipoffice-data"
configure vlan ipoffice-data tag 21
```

The port connecting the C363T-PWR to the X450-24T is configured as tagged for VLANs s8500-voice (70), s8500-data (71), ipoffice-voice (20) and ipoffice-data (21).

```
configure vlan s8500-voice add port 24 tagged
configure vlan s8500-data add port 24 tagged
configure vlan ipoffice-voice add port 24 tagged
configure vlan ipoffice-data add port 24 tagged
```

The following commands configure s8500-voice, s8500-data, ipoffice-voice and ipoffice-data with their IP addresses. Since the Extreme Networks Summit X450-24T disables IP forwarding for all the configured VLANs by default, IP forwarding must be enabled on the VLANs that require routing between VLANs.


```
# Configure IP addresses
configure vlan s8500-voice ipaddress 70.1.1.254 255.255.255.0
configure vlan s8500-data ipaddress 71.1.1.254 255.255.255.0
configure vlan ipoffice-voice ipaddress 20.1.1.254 255.255.255.0
configure vlan ipoffice-data ipaddress 21.1.1.254 255.255.255.0

#Enable IP forwarding
enable ipforwarding vlan s8500-voice
enable ipforwarding vlan s8500-data
enable ipforwarding vlan ipoffice-voice
enable ipforwarding vlan ipoffice-data
```

5.2. Configure QoS

The following commands establish the QoS configuration. The hardware queue scheduling is set to strict priority. The 802.1p value 6 is classified to QoS profile QP7 and is assigned to the C-LAN port. 802.1p and DiffServ replacement are enabled on the C-LAN port. 802.1p examination is used to classify traffic on the ports used in the test configuration.

```
configure qoscheduler strict-priority
create qosprofile "QP7"
configure dot1p type 6 qosprofile QP7
configure ports 3 qosprofile qp7
configure diffserv replacement qosprofile qp7 code-point 46
enable diffserv replacement port 3
enable dot1p replacement port 3
enable dot1p examination inner-tag port 1-6,24
```

5.3. Configure BOOTP (DHCP) Relay

A DHCP server was physically connected to the Extreme Networks Summit X450-24T in the main office. The IP address of this DHCP server is 70.1.1.200. Use the following commands to enable and configure DHCP Relay.

```
enable bootprelay
configure bootprelay add 70.1.1.200
```

6. Configure Avaya C363T-PWR Stackable Switch

6.1. Configure VLAN and Port

In the test configuration, the C363T-PWR Stackable Switch is configured as a Layer 2 Switch with VLANs 20, 21, 70 and 71.

Create VLANs 20, 21, 70 and 71. In the test configuration, the IP Office, IP Office Manager PC and IP telephones are on VLAN 20 and computers are on VLAN 21. Ports connecting to IP

telephones with computers directly connected to them are configured as trunk ports with VLAN 21 as the native VLAN and VLAN 20 as a static-VLAN (see port 1/11).

```
C360-1(super)# set vlan 20 name ipoffice-voice
C360-1(super)# set vlan 21 name ipoffice-data
C360-1(super)# set vlan 70 name s8500-voice
C360-1(super)# set vlan 71 name s8500-data

C360-1(super)# set port vlan 20 1/2-3

C360-1(super)# set port vlan 21 1/11
C360-1(super)# set trunk 1/11 dot1q
C360-1(super)# set port static-vlan 1/11 20
```

The port connecting the C363T-PWR to the X450-24T is configured with 802.1q with vlan-binding-mode to the configured VLANs.

```
C360-1(super)# set port vlan 20 1/24
C360-1(super)# set trunk 1/24 dot1q
C360-1(super)# set port vlan-binding-mode 1/24 bind-to-configured
```

6.2. Configure QoS

The Avaya C363T-PWR Stackable Switch supports four hardware queues. The 802.1p/Q or Class of Service (CoS) to queue assignment is as follows:

	Q1	Q2	Q3	Q4
CoS	0,1	2,3	4,5	6,7

In the test configuration, the Avaya C363T-PWR Stackable Switch is used as a Layer 2 Switch. The Avaya C363T-PWR Stackable Switch will mark all traffic from the IP Office with 802.1p/Q priority value 6 and will prioritize VoIP traffic for the Avaya IP telephones based on 802.1p/Q priority. In the test configuration, the 802.1p/Q priority value 6 from the IP telephones will be mapped to the highest priority queue. The Avaya C363T-PWR Stackable Switch supports weighted round robin or strict priority queuing scheme. The strict priority queuing scheme is used in the test configuration.

```
C360-1(super)# set port level 1/3 6
C360-1(super)# set queuing scheme strict
```

If the Avaya C363T-PWR Stackable Switch needs to be configured as a Layer 3 router, QoS must be enabled for Layer 3. The C363T-PWR Stackable Switch can be configured to trust 802.1p/Q priority (CoS) or DSCP or both for Layer 3 traffic. The following shows how to configure the C363T-PWR Stackable Switch to trust CoS and DSCP. This QoS rule would still need to be applied to a Layer 3 interface. Layer 3 routing is not used in these Application Notes.

```

C360-1# session router
Router-1 (super)# ip access-list 101 1 permit ip any any
Router-1 (super)# ip access-list-dscp trust 101 trust-cos-dscp
Router-1(super)# ip access-group 101

```

DSCP to CoS mapping are configurable for an access list. The default mapping is shown in **Table 3**. The DSCP value 56 will be mapped to fwd7, which corresponds to the highest priority queue.

DSCP	Action	Precedence	Name
-----	-----	-----	-----
0 - 7	fwd0	mandatory	DSCP#0 - DSCP#7
8 - 15	fwd1	mandatory	DSCP#8 - DSCP#15
16- 23	fwd2	mandatory	DSCP#16 - DSCP#23
24 - 31	fwd3	mandatory	DSCP#24 - DSCP#31
32 - 39	fwd4	mandatory	DSCP#32 - DSCP#39
40 - 47	fwd5	mandatory	DSCP#40 - DSCP#47
48 - 55	fwd6	mandatory	DSCP#48 - DSCP#55
56 - 63	fwd7	mandatory	DSCP#56 - DSCP#63

Table 3 – Avaya C363T-PWR Stackable Switch Default DSCP-CoS Mapping

7. Interoperability Compliance Testing

This Interoperability Compliance Test included QoS testing between the Extreme Networks Summit X450-24T, the Avaya C363T-PWR Stackable Switch, the Avaya S8500 Media Server, the Avaya G650 Media Gateway, the Avaya IP Office 412 and the Avaya 4600 Series IP Telephones. Basic feature functionality was performed as part of the compliance testing.

7.1. General Test Approach

Connectivity and QoS test cases were performed manually. During QoS testing, a traffic generator was used to generate low priority traffic. When the 100 Base-T link was overloaded, high quality VoIP calls can still be made between the Avaya Communication Manager and the Avaya IP Office.

7.2. Test Results

All the related test cases passed successfully. No errors were detected. QoS features based on 802.1p/Q priority on the Extreme Networks Summit X450-24T worked well with the Avaya C363T-PWR Stackable Switch, Avaya S8500 Media Server, Avaya G650 Media Gateway, Avaya IP Office 412, and Avaya IP telephones.

8. Verification Steps

The following are verification steps for these Applications Notes:

- Verify that the IP telephones register with the C-LAN of the Avaya G650 Media Gateway. Use mute “767#” (“QoS”#) on the Avaya IP telephones to verify the QoS configuration.
- Verify that an IP telephone and the PC attached to the telephone are on different VLANs.
- Verify that the calls use G.711 Codec (use the command **status station <extension>** to verify which Codec is used on the Avaya S8500 Media Server for an active call).
- While generating data traffic between the X450-24T and the C363T-PWR to overload the 100 Base-T link, make a call between the Avaya Communication Manager and the Avaya IP Office. Verify that voice quality is acceptable.

9. Support

Customers should call Extreme Networks Worldwide TAC when having problems related to Extreme Networks switches. Technical support is also available at the Extreme Networks web site at <http://www.extremenetworks.com/services/wwtac/>.

10. Conclusion

Extreme Networks Summit X450-24T Switch was compliance-tested with the Avaya S8500 Media Server, Avaya G650 Media Gateway, Avaya IP Office, Avaya C363T-PWR Stackable Switch and Avaya IP telephones. All feature functionality and QoS test cases completed successfully.

11. Additional References

Avaya Application Notes can be downloaded via www.avaya.com.

[1] How to configure an H.323 IP trunk between an Avaya IP600 Internet Protocol Communication Server and Avaya IP Office Server – Issue 1.2.

Product documentation for Extreme Networks can be downloaded via web at www.extremenetworks.com/services/documentation

[2] ExtremeWare XOS Command Reference Guide, Software Version 11.2

[3] ExtremeWare XOS Concepts Guide, Software Version 11.2

12. Appendix

12.1. Appendix A – Default 802.1p to QP mapping on the Extreme Networks Summit X450-24T

```
SummitX450-24t.2 # show dot1p
 802.1p Priority Value      QOS Profile
      0                    QP1
      1                    QP1
      2                    QP1
      3                    QP1
      4                    QP1
      5                    QP1
      6                    QP1
      7                    QP8
```

12.2. Appendix B – Default DiffServ to QP mapping on the Extreme Networks Summit X450-24T

```
SummitX450-24t.3 # show diffserv examination
CodePoint->QOSProfile mapping:
 00->QP1 01->QP1 02->QP1 03->QP1 04->QP1 05->QP1 06->QP1 07->QP1
 08->QP1 09->QP1 10->QP1 11->QP1 12->QP1 13->QP1 14->QP1 15->QP1
 16->QP1 17->QP1 18->QP1 19->QP1 20->QP1 21->QP1 22->QP1 23->QP1
 24->QP1 25->QP1 26->QP1 27->QP1 28->QP1 29->QP1 30->QP1 31->QP1
 32->QP1 33->QP1 34->QP1 35->QP1 36->QP1 37->QP1 38->QP1 39->QP1
 40->QP1 41->QP1 42->QP1 43->QP1 44->QP1 45->QP1 46->QP1 47->QP1
 48->QP1 49->QP1 50->QP1 51->QP1 52->QP1 53->QP1 54->QP1 55->QP1
 56->QP8 57->QP8 58->QP8 59->QP8 60->QP8 61->QP8 62->QP8 63->QP8
```

12.3. Appendix C – Default DiffServ replacement mapping (QP → DiffServ) on the Extreme Networks Summit X450-24T

```
SummitX450-24t.4 # show diffserv replacement
QOSProfile->CodePoint mapping:
  QP1->00
  QP8->56
```

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