Avaya Solution & Interoperability Test Lab

Application Notes for the Extreme Networks Summit 300-24, Summit 400-24P, and Summit 400-24T, Supporting Quality of Service and Power over Ethernet with Avaya Communication Manager, Avaya IP Office, and Avaya IP Telephones – Issue 1.0

Abstract

These Application Notes describe the procedures for configuring the Extreme Networks Summit 300-24 and Summit 400-24P Switches to provide inline Power over Ethernet (PoE) to Avaya 4600/5600 Series IP Telephones and Avaya Wireless Access Points. During compliance testing, Avaya IP Telephones and Wireless Access Points successfully obtained power and transferred data over standard Ethernet cables from the Extreme Summit Switches. These Application Notes also present a sample Quality of Service (QoS) configuration to support Voice over IP (VoIP) calls for the Avaya S8700 Media Server with Avaya G650 Media Gateways (IP Connect) through the Extreme Summit 300-24 Switch and Extreme 400-24P/400-24T (Stacked) in an Extreme network infrastructure. Topics covered include setting up end-to-end VoIP QoS using Layer 2 802.1p/Q and Layer 3 DiffServ priorities. 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

Power over Ethernet (PoE) allows both power and data to be simultaneously carried over standard Ethernet cables. PoE-enabled Ethernet switches can supply power directly to Ethernet devices, thereby simplifying installation and removing the need for separate power supplies for those devices. The IEEE 802.3af standard defines the mechanisms for Power Sourcing Equipment (PSE), such as PoE-enabled Ethernet switches, to detect, classify, and supply power to Powered Devices (PDs), such as PoE-enabled IP telephones and wireless access points. In the compliance-tested configuration described in these Application Notes, the Extreme Networks Summit 300-24 and Summit 400-24P Switches are configured to supply inline PoE to Avaya PDs, specifically Avaya 4600 Series IP Telephones, Avaya 5600 Series IP Telephones (in conjunction with the Avaya IP403 Office), and Avaya AP-4/5/6 Wireless Access Points.

As illustrated in **Figure 1**, the Avaya PDs covered in these Application Notes include the following:

- Avaya 4602SW IP Telephone
- Avaya 4610SW IP Telephone
- Avaya 4620/4620SW IP Telephones with and without EU24
- Avaya 4621SW IP Telephone with and without EU24BL
- Avaya 4622SW IP Telephone
- Avaya 4625SW IP Telephone
- Avaya 5602SW and 5610SW IP Telephones (which only work in conjunction with the Avaya IP Office)
- Avaya Gen-2 4606, 4612, and 4624 IP Telephones
- Avaya AP-4/5/6 Wireless Access Point

The Avaya "Generation 2" 4612 and 4624 IP Telephones are distinguishable by their model numbers. For example, "4612D0**2**A – 003" indicates Generation 2.

Figure 1: PoE Configuration

IP networks were originally designed to carry data on a best-effort delivery basis, which meant that all traffic had equal priority and an equal chance of being delivered in a timely manner. As a result, all traffic had an equal chance of being dropped when congestion occurred. To carry voice in this kind of network, Quality of Service (QoS) has to be implemented throughout the entire network.

In order to achieve good voice quality, the VoIP traffic must be classified. The Avaya S8700 Media Server, Avaya G650 Media Gateway and Avaya IP Telephones support both Layer 2 802.1.p/Q priority and Layer 3 Differentiated Services (DiffServ). The Extreme Summit 300-24 and 400-24P/40024T (Stacked) Switches can be configured to prioritize VoIP traffic based on these values.

The network diagram in **Figure 2** shows the network topology used to verify these Application Notes. A pair of redundant S8700 Media Servers controls one G650 Media Gateway. The Extreme Summit 400-24P and Summit 400-24T Switches are stacked. The Extreme Summit 300-24 Switch is then connected to the Extreme Summit 400-24P/400-24T (Stacked) Switch through a 10/100 Mbps port on the switches using a crossover Ethernet cable.

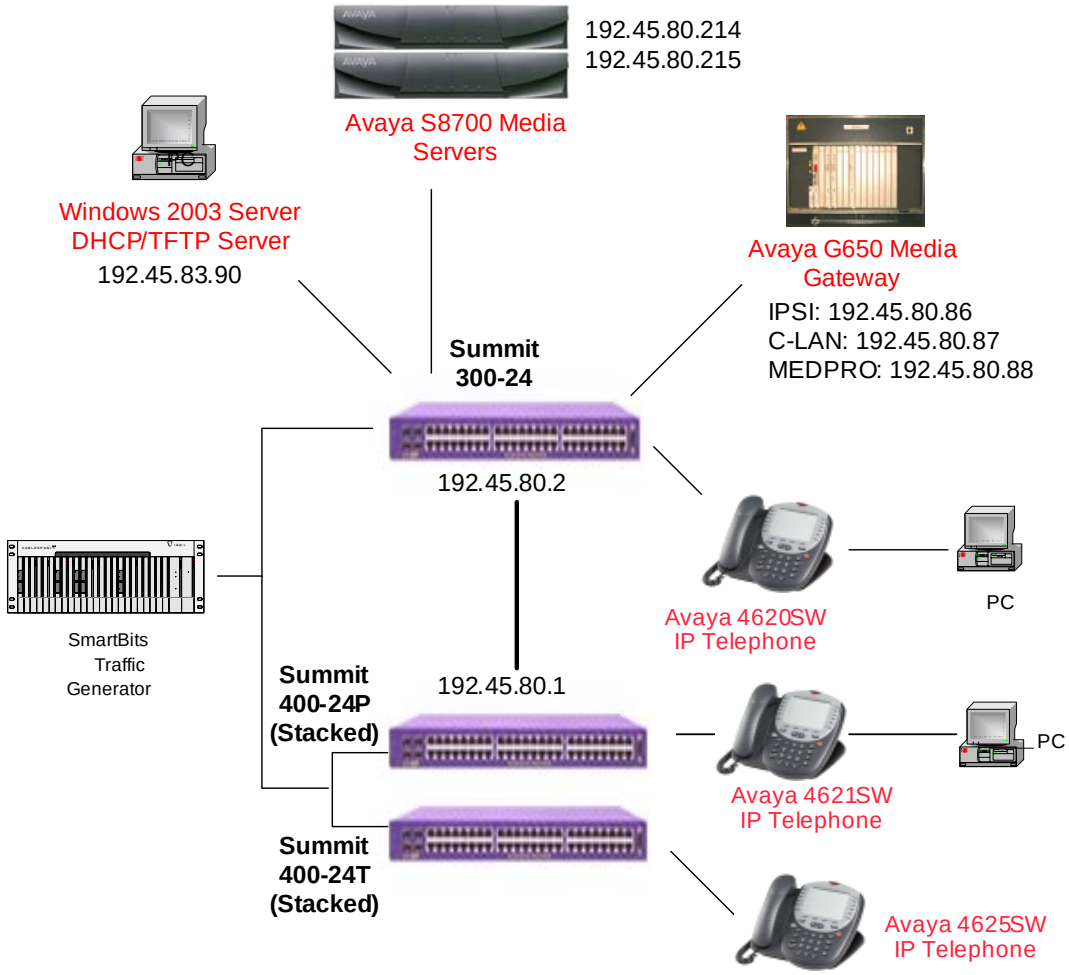


Figure 2: Network Configuration for the Avaya-Extreme Network Infrastructure

2. Software and Hardware Validated

This configuration was based on the following versions:

Equipment	Version
Avaya 4602SW IP Telephone	1.8.2
Avaya 4606 IP Telephone	1.8.3
Avaya 4610SW IP Telephone	2.1
Avaya 4612/4624 Gen-2 IP Telephone	1.8.3
Avaya 4620/4620SW IP Telephone	2.1
Avaya 4621SW IP Telephone	2.1
Avaya 4622SW IP Telephone	2.1
Avaya 4625SW IP Telephone	2.5
Avaya 5602SW IP Telephone	1.8.6
Avaya 5610SW IP Telephone	2.1
Avaya EU24/ EU24BL Extension Unit	--
Avaya IP Softphone	5.1.4.6
Avaya AP-4/5/6	2.4.5
Avaya IP Office 403	3.0
Avaya S8700 Media Server	3.0
Avaya IP Service Interface	HW11 FW012
Avaya C-LAN	HW01 FW012
Avaya MEDPRO	HW20 FW95
Extreme Networks Summit 300-24 PoE Switch	7.4e.0.30
Extreme Networks Summit 400-24P PoE Switch	7.4e.0.30
Extreme Networks Summit 400-24T PoE Switch	7.4e.0.30

3. Configure PoE on the Extreme Summit 300-24 and Summit 400-24 Switches

Inline Power over Ethernet (PoE) is supported on the Extreme Summit 300-24 and Summit 400-24P Switches. By default, PoE support is enabled on the system and on all ports. The following commands can be used to explicitly enable PoE support on both the system and a port.

```
enable inline-power
enable inline-power port 5
```

Each PoE-capable port automatically detects 802.3af-compliant Powered Devices (PDs) and may be configured to also supply power to detected PDs. The following command allows ports 1 through 16 to detect and supply power to PDs.

```
configure inline-power detection auto ports 1-16
```

Inline power budgeting in the Extreme Summit 300-24 and Summit 400-24P PoE Switches is based on allocated power, not actual power consumption. For example, a detected PD may be allocated 15.4 Watts even though it may actually consume less than that. The Summit 300-24 and Summit 400-24P Switches can be configured to allocate power on a PoE-capable port based on the 802.3af class of the detected PD, the configured maximum power on the port, the greater of the class power and configured maximum power on the port, or the maximum allowed power on the port (20 Watts). The following commands configure both switches to allocate power based on the detected PD's advertised class for ports 1 through 16, and enable PoE support on those ports (by default, PoE support is enabled on all PoE-capable ports).

```
configure inline-power violation-precedence advertise-class ports 1-16
enable inline-power ports 1-16
```

Alternatively, if the actual power range drawn on a PoE-capable port is known, then the Summit Switches may be configured to allocate power based on the actual maximum rather than the 802.3af power class of the detected PD on the port. The following commands set the "operator-limit" on port 17 to 5 Watts and instruct the Summit 300-24 and Summit 400-24P to allocate power based on the operator-limit value on port 17. Note that any PD that draws more than 5 Watts will be denied power if connected to that port. Therefore, the operator-limit should be set to a value that accurately represents the actual power required by PDs expected to connect to that port.

```
configure inline-power operator-limit 5000 ports 17
configure inline-power violation-precedence operator-limit ports 17
enable inline-power ports 17
```

Enter the command **show inline-power configuration ports <portlist>** to verify that PoE support is enabled on a slot and ports on a slot, respectively.

On the Summit 300-24 Switch:

```
* Summit300-24:95 # show inline config ports 3
Port   Config   Oper Lmt  Viol Prec           Label
   3   enabled   15.4    max-class-operator
* Summit300-24:96 # show inline config ports 3-10
Port   Config   Oper Lmt  Viol Prec           Label
   3   enabled   15.4    max-class-operator
   4   enabled   15.4    max-class-operator
   5   enabled   15.4    max-class-operator
   6   enabled   15.4    max-class-operator
   7   enabled   15.4    max-class-operator
   8   enabled   15.4    max-class-operator
   9   enabled   15.4    max-class-operator
  10   enabled   15.4    max-class-operator
```

On the Summit 400-24P Switch:

```
* Summit400-24p:96 # show inline-power configur port 13
Port   Config   Oper Lmt  Viol Prec           Label
  13   enabled   15.4    max-class-operator
* Summit400-24p:97 # show inline-power config ports 13-24
Port   Config   Oper Lmt  Viol Prec           Label
  13   enabled   15.4    max-class-operator
  14   enabled   15.4    max-class-operator
  15   enabled   15.4    max-class-operator
  16   enabled   15.4    max-class-operator
  17   enabled   15.4    max-class-operator
  18   enabled   15.4    max-class-operator
  19   enabled   15.4    max-class-operator
  20   enabled   15.4    max-class-operator
  21   enabled   15.4    max-class-operator
  22   enabled   15.4    max-class-operator
  23   enabled   15.4    max-class-operator
```

Enter the command **show inline-power** to view the inline power information for the Summit 300-24 or Summit 400-24P system.

On the Summit 300-24:

```
* Summit300-24:98 # show inline-power

                Inline-Power System Information
System maximum internal inline-power: 376 watts
Power Usage Threshold: 90% (338 watts)
Internal PSU:  ON
External PSU:   NOT PRESENT
System inline-power admin state: Enabled
Legacy Support: Disabled

                Common Power
    Configured   Allocated      Measured usage
    376000mW      15400mW         3400mW


                INLINE-POWER STATISTICS

PoE firmware status  : Operational
PoE firmware revision: 400.0
PoE device revision  : 2

Total ports powered: 1
Total ports waiting for power: 0
Total ports faulted: 0
Total ports disabled: 0
```

On the Summit 400-24P:

```
* Summit400-24p:98 # show inline-power

                Inline-Power System Information
System maximum internal inline-power: 376 watts
Power Usage Threshold: 70% (263 watts)
Internal PSU:  ON
External PSU:   NOT PRESENT
System inline-power admin state: Enabled
Legacy Support: Disabled

                Common Power
    Configured   Allocated      Measured usage
    376000mW      15400mW         3200mW


                INLINE-POWER STATISTICS

PoE firmware status  : Operational
PoE firmware revision: 400.0
PoE device revision  : 2

Total ports powered: 1
Total ports waiting for power: 0
Total ports faulted: 0
Total ports disabled: 0
```

Enter the command **show inline-power info ports <portlist>** to obtain inline power information for one or more ports. The output of the command displays the inline power state, detected 802.3af class, actual power consumption, and fault state on each specified port.

On the Summit 300-24:

```
* Summit300-24:104 # show inline-power info ports 3-10
Port  State         Class      Volts   Curr     Power     Fault
                                       (mA)    (Watts)
3     delivering    class2     50.6    64        3.20           None
4     searching     ------      0.0     0        0.00           None
5     searching     ------      0.0     0        0.00           None
6     searching     ------      0.0     0        0.00           None
7     searching     ------      0.0     0        0.00           None
8     searching     ------      0.0     0        0.00           None
9     searching     ------      0.0     0        0.00           None
10    searching     ------      0.0     0        0.00           None
```

On the Summit 400-24P:

```
* Summit400-24p:114 # show inline-power info ports 13-24
Port  State         Class      Volts   Curr     Power     Fault
                                       (mA)    (Watts)
13    delivering    class2     50.6    65        3.30           None
14    searching     ------      0.0     0        0.00           None
15    searching     ------      0.0     0        0.00           None
16    searching     ------      0.0     0        0.00           None
17    searching     ------      0.0     0        0.00           None
18    searching     ------      0.0     0        0.00           None
19    searching     ------      0.0     0        0.00           None
20    searching     ------      0.0     0        0.00           None
21    searching     ------      0.0     0        0.00           None
22    searching     ------      0.0     0        0.00           None
23    searching     ------      0.0     0        0.00           None
24    searching     ------      0.0     0        0.00           None
```

For more detailed inline power information for one or more ports, enter the command **show inline-power info detail ports <portlist>**.

4. Configure QoS in Avaya Communication Manager and Extreme Network Switches

The Extreme Summit 300-24 and Summit 400-24P/400-24T Switches support 8 strict priority queues. If it is configured to trust 802.1p/Q priority, 802.1p/Q priority 6 and 7 are mapped to the highest priority queue by default. If it is configured to trust DiffServ, DiffServ values between 48 and 63 are mapped to the highest priority queue by default.

In order to put VoIP traffic into the highest priority queue on the Extreme Summit 300-24 Switch and the Extreme Summit 400-24P/400-24T (Stacked) Switch, QoS must be enabled on the following Avaya VoIP components with Ethernet 802.1p/Q priority 6 (or 7) and DiffServ 48 (or greater) for signaling and media :

- IP Server Interface (IPSI) boards
- Avaya S8700 Media Servers
- MEDPRO and C-LAN boards
- IP Telephones

Sections 4.1 through 4.4 show detailed steps of the above configurations. Sections 4.5 to 4.6 show how to configure the Extreme Summit 300-24 Switch and the Extreme Summit 400-24P/400-24T (Stacked) Switch to use these QoS values to prioritize VoIP traffic.

4.1. IPSI QoS Configuration

The following procedures show how to configure the IPSI for QoS.

- There are two Ethernet ports on each IPSI card; the upper one is the Service port with the pre-configured IP address 192.11.13.6/255.255.255.252 and the lower one is the network control port. The network control port can be configured through the Service port. Configure a laptop's IP address to 192.11.13.5/255.255.255.252 and connect its Ethernet interface to the service port with a crossover Ethernet cable.
- Telnet to the service port IP address 192.11.13.6 and type "**ipsilogin**" at the IPSI prompt. Log in to the IPSI with the default login and password.

The following screenshot shows how to configure QoS and VLAN tagging for the Media Server from the IPSI. After issuing the configuration commands, reset the IPSI and log in again to verify that the settings are in effect.

```
TN2312 IPSI IP Admin Utility
Copyright Avaya Inc, 2003, All Rights Reserved
[IPSI]: ipsilogin
Login: craft
Password:
[IPADMIN]: set diffserv 46
[IPADMIN]: set user priority 6
[IPADMIN]: set VLAN tagging on
[IPADMIN]: reset
```

The next screenshot shows the new (and now current) QoS settings after the reset. Please note that the VLAN ID is set to 0 by default and cannot be changed.

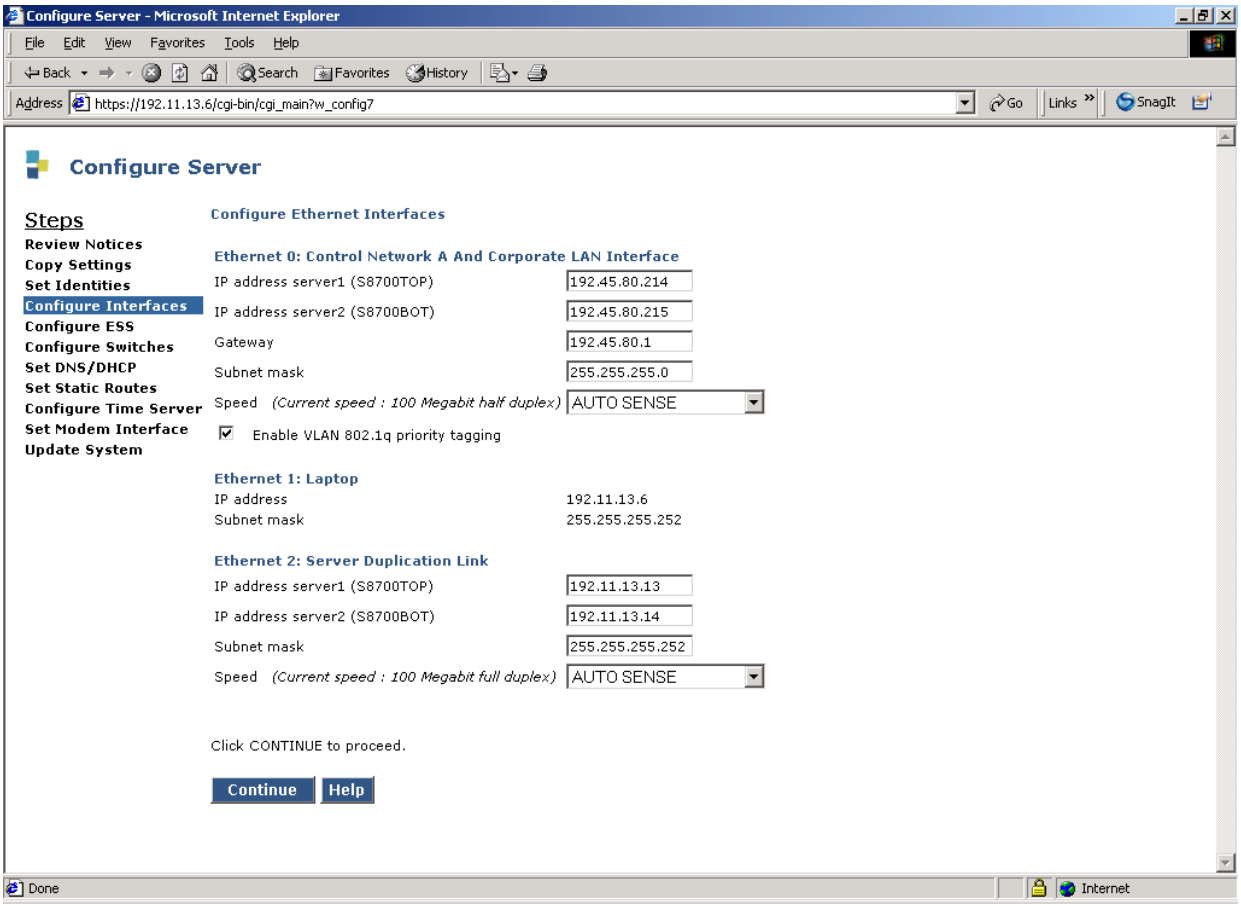
```
[IPADMIN]: show qos
 QoS values currently in use:
  VLAN tagging       :      on
  VLAN id            :      0
  VLAN user priority :      6
  Diffserv value     :      46
QoS values to be used after next reset:
  VLAN tagging       :      on
  VLAN id            :      0
  VLAN user priority :      6
  Diffserv value     :      46
```

4.2. Avaya S8700 Media Server QoS Configuration

There are two steps involved in configuring QoS on the servers and to support communication with the IPSIs. Configuration must be done via the web interface to enable 802.1p/Q tagging, and also via the System Access Terminal (SAT) interface to specify the appropriate priorities at Layer 2 and 3. Remember to save translations after completing the administration commands.

4.2.1. Web Interface

Launch an Internet browser and type the active server's IP address in the URL field. Select the **Configure Server** option and check **Enable VLAN 802.1q priority tagging**, as shown in the following screenshot. Continue through the configuration steps, finishing at the "Update System" step. Repeat these steps for the other server.



4.2.2. SAT Interface

Telnet into the active Avaya S8700 Media Server and start the SAT with the command **sat**, supplying the proper login/password. Use the command **change ipserver-interface <cabinet number>** to set the 802.1p and DiffServ value, as shown in the following screenshot. The command **change ipserver-interface 1** will set the 802.1p and DiffServ values on tagged traffic for this IPSI. VLAN ID is set to 0 by default and cannot be changed.

```
change ipserver-interface 1                                    Page   1 of   1
             IP SERVER INTERFACE (IPSI) ADMINISTRATION - PORT NETWORK 1

                                  IP Control? y            Socket Encryption? y
    Ignore Connectivity in Server Arbitration? n                  Enable QoS? y


    Primary IPSI                                          QoS Parameters
    ------------                                          --------------
     Location:  1A01                                        Call Control 802.1p: 6
         Host: 192.45.80.86                               Call Control DiffServ: 46
      DHCP ID: ipsi-A01a
```

4.3. C-LAN, MEDPRO, and IP Telephones QoS Configuration

The following screenshot displays how to configure the network region. The Diffserv and 802.1p/Q values configured here will be downloaded to the IP Telephones within this network region as they register.

```
change ip-network-region 1                                    Page   1 of  19
                             IP NETWORK REGION
  Region: 1
Location:         Authoritative Domain:
    Name:
                               Intra-region IP-IP Direct Audio: yes
MEDIA PARAMETERS               Inter-region IP-IP Direct Audio: yes
      Codec Set: 1                       IP Audio Hairpinning? y
   UDP Port Min: 2048
   UDP Port Max: 3028                  RTCP Reporting Enabled? y
DIFFSERV/TOS PARAMETERS          RTCP MONITOR SERVER PARAMETERS
 Call Control PHB Value: 46       Use Default Server Parameters? y
        Audio PHB Value: 46
        Video 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
```

The following screenshot displays how to configure the IP-Network Map. As IP Telephones register, if their IP Address is within the range specified here, they will be assigned to Network Region 1, and VLAN 80.

```
change ip-network-map                                          Page   1 of  32
                         IP ADDRESS MAPPING

                                                                 Emergency
                                       Subnet                    Location
 From IP Address  (To IP Address   or Mask)  Region    VLAN     Extension
 192.45 .80 .0    192.45 .80 .255     24       1        80
    .   .   .        .   .   .                          n
    .   .   .        .   .   .                          n
    .   .   .        .   .   .                          n
    .   .   .        .   .   .                          n
    .   .   .        .   .   .                          n
    .   .   .        .   .   .                          n
    .   .   .        .   .   .                          n
    .   .   .        .   .   .                          n
    .   .   .        .   .   .                          n
    .   .   .        .   .   .                          n
    .   .   .        .   .   .                          n
    .   .   .        .   .   .                          n
    .   .   .        .   .   .                          n
    .   .   .        .   .   .                          n
    .   .   .        .   .   .                          n
```

The following screenshot displays how to assign a VLAN and Network Region to the MEDPRO.

```
change ip-interface 1a02                                      Page   1 of   1
                                 IP INTERFACES


                  Type: MEDPRO
                  Slot: 01A02
          Code/Suffix: TN2302
            Node Name: MEDPRO
           IP Address: 192.45 .80 .88
          Subnet Mask: 255.255.255.0
      Gateway Address: 192.45 .80 .1
  Enable Ethernet Port? y
        Network Region: 1
                  VLAN: 80


                               ETHERNET OPTIONS
                  Auto? n
                 Speed: 100Mbps
                Duplex: Full
```

The following screenshot displays how to assign a VLAN and Network Region to the C-LAN.

```
change ip-interface 1a03                                      Page   1 of   1
                                 IP INTERFACES


                  Type: C-LAN
                  Slot: 01A03
          Code/Suffix: TN799  D
            Node Name: CLAN
           IP Address: 192.45 .80 .87
          Subnet Mask: 255.255.255.0
      Gateway Address: 192.45 .80 .1
  Enable Ethernet Port? y
        Network Region: 1
                  VLAN: 80

Number of CLAN Sockets Before Warning: 400

                               ETHERNET OPTIONS
                  Auto? n
                 Speed: 100Mbps
                Duplex: Full
```

4.4. Avaya IP Telephones QoS Configuration

The IP Telephones were configured for DHCP and the 802.1p/Q and DiffServ priorities will be downloaded by Avaya Communication Manager when the IP Telephone registers, based on the configuration in the ip-network-region form.

4.5. Extreme Summit 300-24 Switch Configuration

The Layer 2 802.1p/Q prioritization is automatically implemented by the switch. Layer 2 (L2) QoS tags are analyzed and acted on by default. Layer 3 (L3) Diffserv QoS controls need to be configured. The user can access the console port of the switch using a terminal emulator. Use the following settings: 9600 Bits/second, 8 Data Bits, No Parity, 1 Stop Bit, and the Flow Control should be set to "None".

The administrator needs to decide if the switch will use L2 or L3 for QoS, it cannot use both at the same time. No special configuration is needed if L2 QoS is used. For L3, DiffServ examination cannot be enabled for all ports with the command **enable diffserv examination ports <number/all>**, due to limitations with the number of ports supported. On the Summit 300-24 switch, 256 rules are shared among a block of 8 10/100 ports, so for each block of 8 ports the switch can enable a maximum of 3 ports for DiffServ examination. Although 4 ports take 256 rules, some of the 256 rules are used by ExtremeWare system rules, so the switch can only make use of 3 ports per block of 8. A recommended implementation is to create an Access List (ACL) that examines only the first 3 bits of the DiffServ codepoint, that is, the formal TOS bit. First an Access Mask must be created in order to create the Access Lists, using the **create access-mask <name>** command. Then the Access Lists can be created by using the **create access-list <name> <access-mask name> tos <TOS Value> permit <qosprofile number>** command. This will result in 8 rules per port. It must also be noted that when this is enabled, the Layer 2 802.1p/Q prioritization on the switch is disabled.

The following screenshot is an example of how to enable Diffserv examination on one port by creating an Access-Mask and then the subsequent Access-Lists:

```
* Summit300-24:279 # cr access-mask to_ex tos ports precedence 10
* Summit300-24:280 # cr access-list to_ex_0_1 to_ex tos 0 ports 4 permit QP1
* Summit300-24:281 # cr access-list to_ex_1_1 to_ex tos 1 ports 4 permit QP2
* Summit300-24:282 # cr access-list to_ex_2_1 to_ex tos 2 ports 4 permit QP3
* Summit300-24:283 # cr access-list to_ex_3_1 to_ex tos 3 ports 4 permit QP4
* Summit300-24:284 # cr access-list to_ex_4_1 to_ex tos 4 ports 4 permit QP5
* Summit300-24:285 # cr access-list to_ex_5_1 to_ex tos 5 ports 4 permit QP6
* Summit300-24:286 # cr access-list to_ex_6_1 to_ex tos 6 ports 4 permit QP7
* Summit300-24:287 # cr access-list to_ex_7_1 to_ex tos 7 ports 4 permit QP8
```

To verify that the Access-Mask and Access-List have been created, the **show access-mask** and **show access-list** commands can be used. The following screenshot is an example of how to use the **show access-mask** and **show access-list** commands.

```
* Summit300-24:366 #   show access-mask
Access-mask   DstIP/mask:L4p   SrcIP/mask:L4p   Pre    Flags
       to_ex  -.-.-.-/--:----  -.-.-.-/--:----  10     T-IP
Access-mask usage: user(1)

Flags: (C) Code Point, (D4) Dest L4 Port, (DI) Dest IP, (DM) Dest MAC
       (E) Permit Established, (EP) Egress Port, (ET) Ether Type
       (I) IP Protocol, (IP) Ingress Ports, (MC) ICMP Code, (MT) ICMP Type
       (S4) Src L4 Port, (SI) Src IP, (SM) Src MAC, (T) TOS, (V) Vlan
       (VP) Vlan Priority, (VP2) Vlan Pri First 2 Bits, (-) not set, (*) set

* Summit300-24:367 # show access-list
Access-List  Access-mask  Vlan         QoS Flags
   to_ex_7_4        to_ex              QP8 T-P-IP
   to_ex_6_4        to_ex              QP7 T-P-IP
   to_ex_5_4        to_ex              QP6 T-P-IP
   to_ex_4_4        to_ex              QP5 T-P-IP
   to_ex_3_4        to_ex              QP4 T-P-IP
   to_ex_2_4        to_ex              QP3 T-P-IP
   to_ex_1_4        to_ex              QP2 T-P-IP
   to_ex_0_4        to_ex              QP1 T-P-IP

Flags: (C) Code Point, (D) Deny, (D4) Dest L4 Port, (DI) Dest IP
       (DM) Dest MAC, (E) Permit Established, (EP) Egress Port
       (ET) Ether Type, (I) IP Protocol, (IP) Ingress Port, (MC) ICMP Code
       (MT) ICMP Type, (P) Permit, (Q) Qosprofile, (SC) Set Code-Point
       (SD) Set Dot1p, (S4) Src L4 Port, (SI) Src IP, (SM) Src MAC, (T) TOS
       (V) Vlan, (VP) Vlan Priority, (VP2) Vlan Pri First 2 Bits
```

4.6. Extreme Summit 400-24P/400-24T (Stacked) Switch Configuration

Access to the Summit 400-24P/400-24T (Stacked) Switch can be attained using a terminal emulator. Use the following settings: 9600 Bits/second, 8 Data Bits, No Parity, 1 Stop Bit, and the Flow Control should be set to "None".

The administrator needs to decide if the switch will use L2 or L3 for QoS, it cannot use both at the same time. No special configuration is needed if L2 QoS is used. For L3, DiffServ examination cannot be enabled for all ports with the command **enable diffserv examination ports <number/all>**, due to limitations with the number of ports supported. On the Summit 400-24P/400-24T switches, 256 rules are shared among a block of 8 10/100 ports, so for each block of 8 ports the switch can enable a maximum 3 ports for DiffServ examination. Although 4 ports take 256 rules, some of the 256 rules are used by ExtremeWare system rules, so the switch can only make use of 3 ports per block of 8. A recommended implementation is to create an ACL (Access List) that examines only the first 3 bits of the DiffServ codepoint, that is, the formal TOS bit. First an Access Mask must be created in order to create the Access Lists, using the **create access-mask <name>** command. Then the Access Lists can be created by using the **create access-list <name> <access-mask name> tos <TOS Value> permit <qosprofile number>** command. This will result in 8 rules per port. It must also be noted that when this is enabled, the Layer 2 802.1p/Q prioritization on the switch is disabled.

The following is an example of how to enable Diffserv examination on two ports by creating an Access-Mask and then subsequent Access-Lists:

```
* Stk Master:254 # cr access-mask to_ex tos ports precedence 10
* Stk Master:255 # cr access-list to_ex_0_1 to_ex tos 0 ports 1:17 permit QP1
* Stk Master:256 # cr access-list to_ex_1_1 to_ex tos 1 ports 1:17 permit QP2
* Stk Master:257 # cr access-list to_ex_2_1 to_ex tos 2 ports 1:17 permit QP3
* Stk Master:258 # cr access-list to_ex_3_1 to_ex tos 3 ports 1:17 permit QP4
* Stk Master:259 # cr access-list to_ex_4_1 to_ex tos 4 ports 1:17 permit QP5
* Stk Master:260 # cr access-list to_ex_5_1 to_ex tos 5 ports 1:17 permit QP6
* Stk Master:261 # cr access-list to_ex_6_1 to_ex tos 6 ports 1:17 permit QP7
* Stk Master:262 # cr access-list to_ex_7_1 to_ex tos 7 ports 1:17 permit QP8
* Stk Master:263 # cr access-list to_ex_0_2 to_ex tos 0 ports 2:17 permit QP1
* Stk Master:264 # cr access-list to_ex_1_2 to_ex tos 1 ports 2:17 permit QP2
* Stk Master:265 # cr access-list to_ex_2_2 to_ex tos 2 ports 2:17 permit QP3
* Stk Master:266 # cr access-list to_ex_3_2 to_ex tos 3 ports 2:17 permit QP4
* Stk Master:267 # cr access-list to_ex_4_2 to_ex tos 4 ports 2:17 permit QP5
* Stk Master:268 # cr access-list to_ex_5_2 to_ex tos 5 ports 2:17 permit QP6
* Stk Master:269 # cr access-list to_ex_6_2 to_ex tos 6 ports 2:17 permit QP7
* Stk Master:270 # cr access-list to_ex_7_2 to_ex tos 7 ports 2:17 permit QP8
```

Note that the ports are on the two different switches on the Summit 400-24P/400-24T (Stacked) Switches. One Diffserv examination is created on the Summit 400-24P and another on the Summit 400-24T Switch.

To verify that the Access-Mask and Access-List have been created, the **show access-mask** and **show access-list** commands can be used. The following screenshot is an example of how to use the **show access-mask** and **show access-list** commands.

```
Stk Master:271 # show access-mask
Access-mask   DstIP/mask:L4p   SrcIP/mask:L4p   Pre    Flags
       to_ex  -.-.-.-/--:----  -.-.-.-/--:----  10     T-IP
Access-mask usage: user(1)

Flags: I Code Point, (D4) Dest L4 Port, (DI) Dest IP, (DM) Dest MAC
       (E) Permit Established, (EP) Egress Port, (ET) Ether Type
       (I) IP Protocol, (IP) Ingress Ports, (MC) ICMP Code, (MT) ICMP Type
       (S4) Src L4 Port, (SI) Src IP, (SM) Src MAC, (T) TOS, (V) Vlan
       (VP) Vlan Priority, (VP2) Vlan Pri First 2 Bits, (-) not set, (*) set

Stk Master:272 # show access-list
Access-List  Access-mask  Vlan         QoS Flags
   to_ex_0_2        to_ex              QP1 T-P-IP
   to_ex_1_2        to_ex              QP2 T-P-IP
   to_ex_3_2        to_ex              QP4 T-P-IP
   to_ex_4_2        to_ex              QP5 T-P-IP
   to_ex_5_2        to_ex              QP6 T-P-IP
   to_ex_6_2        to_ex              QP7 T-P-IP
   to_ex_2_2        to_ex              QP3 T-P-IP
   to_ex_7_2        to_ex              QP8 T-P-IP
   to_ex_7_1        to_ex              QP8 T-P-IP
   to_ex_6_1        to_ex              QP7 T-P-IP
   to_ex_5_1        to_ex              QP6 T-P-IP
   to_ex_4_1        to_ex              QP5 T-P-IP
   to_ex_3_1        to_ex              QP4 T-P-IP
   to_ex_2_1        to_ex              QP3 T-P-IP
   to_ex_1_1        to_ex              QP2 T-P-IP
   to_ex_0_1        to_ex              QP1 T-P-IP

Flags: I Code Point, (D) Deny, (D4) Dest L4 Port, (DI) Dest IP
       (DM) Dest MAC, (E) Permit Established, (EP) Egress Port
       (ET) Ether Type, (I) IP Protocol, (IP) Ingress Port, (MC) ICMP Code
       (MT) ICMP Type, (P) Permit, (Q) Qosprofile, (SC) Set Code-Point
       (SD) Set Dot1p, (S4) Src L4 Port, (SI) Src IP, (SM) Src MAC, (T) TOS
       (V) Vlan, (VP) Vlan Priority, (VP2) Vlan Pri First 2 Bits
```

5. Interoperability Compliance Testing

The interoperability compliance testing focused on verifying PoE and QoS interoperability between the Extreme Networks Summit 300-24 and Summit 400-24P Switches and Avaya 4600/5600 Series IP Telephones and Avaya AP-4/5/6 Wireless Access Point.

6. General Test Approach

The general test approach was to connect the Avaya PDs (Avaya 4600/5600 Series IP Telephones and Avaya AP-4/5/6 Wireless Access Points) to PoE-enabled ports on the Summit Switches and verify that the PDs successfully boot. To test repeatability, PoE was then disabled and enabled again on the connected ports. Lastly, to verify that power and data can be simultaneously carried on the PoE connections, phone calls were made from the IP Telephones and an IP Softphone on a wireless laptop accessing the network via the AP-4/5/6.

In order to test Quality of Service (QoS), the Avaya PDs were connected to ports on the Summit Switches while a SmartBits Traffic Generator was connected between the switches. QoS was first disabled and calls were made from the IP Telephones while the SmartBits Traffic Generator sent data packets at a high rate causing the phones to have no dial tone or very poor voice quality. QoS was then enabled to prioritize voice traffic allowing calls to be made with optimal voice quality from the IP Telephones while the SmartBits Traffic Generator continued to send data packets at a high rate.

7. Test Results

All test cases completed successfully. The Summit 300-24 and Summit 400-24P Switches successfully provided inline power to the Avaya PDs as shown in **Figure 1**. The switches also supported QoS with the configuration shown in **Figure 2**.

Table 1 lists the 802.3af class, allocated power, and measured power of the Avaya PDs when connected to the Extreme Summit 300-24 Switch. **Table 2** lists the 802.3af class, allocated power, and measured power of the Avaya PDs when connected to the Extreme Summit 400-24P Switch. All of the IP Telephones were in idle/on-hook states.

Avaya Powered Devices	Class	Power consumption (Watts)
Avaya 4602SW	2	3.20
Avaya 4606	0	4.90
Avaya 4610 SW	2	3.40
Avaya 4612 Gen-2	0	4.90
Avaya 4620 with EU24	3	6.20
Avaya 4620SW	3	3.80
Avaya 4620SW	2	3.90
Avaya 4621SW with EU24BL	2	6.40
Avaya 4622SW	2	5.10
Avaya 4624 Gen-2	0	4.70
Avaya 4625SW	3	8.00
Avaya 5602SW	1	3.30
Avaya 5610SW	2	3.40
Avaya AP4/5/6	0	4.70

Table 1: 802.3af Class and Measured Power with the Extreme Networks Summit 300-24.

Avaya Powered Devices	Class	Power consumption (Watts)
Avaya 4602SW	2	3.30
Avaya 4606	0	5.30
Avaya 4610 SW	2	3.40
Avaya 4612 Gen-2	0	4.80
Avaya 4620 with EU24	3	7.90
Avaya 4620SW	3	3.80
Avaya 4620SW	2	3.90
Avaya 4621SW with EU24BL	2	6.30
Avaya 4622SW	2	5.00
Avaya 4624 Gen-2	0	4.70
Avaya 4625SW	3	8.00
Avaya 5602SW	1	3.20
Avaya 5610SW	2	3.40
Avaya AP4/5/6	0	4.70

Table 2: 802.3af Class and Measured Power with the Extreme Networks Summit 400-24P.

Table 3 below summarizes the 802.3af classes.

Class	PSE Output Max. Power (W)
0	15.4
1	4.0
2	7.0
3	15.4
4	Treat as Class 0

Table 3: IEEE 802.3af Power Classifications

8. Verification

The following steps may be used to verify the configuration for Power over Ethernet:

1. Ensure that PoE has been enabled on the system or the ports that serve the PDs.
2. Connect the Avaya PD to a PoE enabled port on the Extreme Summit Switch and verify that the PD powers on successfully. If the PD does not power on, enter the command **show inline-power info detail ports <portlist>**.
3. If the output shows that the "Inline Power State" is "discovered", then disable inline-power on the port, enter the command **configure inline-power detection auto ports <portlist>**, and re-enable inline-power on the port.
4. If the output shows that the "Inline Power State" is "denied", then there is insufficient available power to power the PD.

5. For the Avaya 4600/5600 Series IP Telephone, verify that it successfully registers with Avaya IP Office and completes phone calls to other phones (assumes the IP telephone has been configured with the correct IP and call control information).
6. For the Avaya Wireless Access Point, verify that an Avaya IP Softphone running on a wireless laptop accessing the network via the Access Point successfully registers with Avaya Communication Manager and completes phone calls to other phones (assumes the IP softphone has been configured with the correct IP and call control information).

In order for end-to-end QoS for VoIP to work, all the related components must be configured as detailed in Section 4. Make a phone call and use the **status station** command to verify that the appropriate codec is used. Place calls and verify the voice quality is good, even when the network is saturated with data traffic. If poor voice quality is experienced, verify the configuration as detailed in Section 4.

9. Support

For technical support on Extreme Networks products, consult the support pages at http:///www.extremenetworks.com/services or contact the Extreme Networks Worldwide TAC at:

- Toll free: 800-998-2408
- Phone: 408-579-2826
- E-mail: support@extremenetworks.com

10. Conclusion

These Application Notes describe the steps for configuring the Extreme Networks Summit 300-24 and Summit 400-24P Switches to provide inline Power over Ethernet (PoE) to the Avaya PDs, namely Avaya 4600 Series IP Telephones, Avaya 5600 Series IP Telephones (in conjunction with the Avaya IP403 Office), and Avaya Wireless Access Points. Secondly, as illustrated in these Application Notes, QoS based on 802.1p/Q priority and DiffServ can be successfully configured for the Avaya S8700 Media Server with the Avaya G650 Media Gateway, Avaya IP Telephones, Extreme Summit 300-24 Switch, and Extreme Summit 400-24P/400-24T (Stacked) Switch.

11. Additional References

Product documentation for Avaya products may be found at http://support.avaya.com.

Product documentation for Extreme Networks products may be found at: http://www.extremenetworks.com/services/documentation.

Please e-mail any questions or comments pertaining to these Application Notes along with the full title name and filename, located in the lower right corner, directly to the Avaya Developer*Connection* Program at devconnect@avaya.com.