Common Voice over IP Queuing Configurations Between an Avaya™ X330-2DS1 WAN Module and Cisco 7513 Router - Issue 1.0

Abstract

These Application Notes describe how to configure two common queuing techniques for Voice over IP (VoIP) between an Avaya™ X330-2DS1 WAN module that is inserted into the expansion port of an Avaya™ P333T Stackable Switch and a Cisco 7513 Router. These two queuing techniques are known as DiffServ (DSCP) and IP Real Time Protocol (RTP) Priority.

1. Introduction

The Avaya™ X330-2DS1 WAN module supports a robust set of queuing strategies. These Application Notes describe two of these queuing strategies, DiffServ (DSCP) and IP Real Time Protocol (RTP) Priority.

For the remainder of this document, the Avaya X330-2DS1 WAN module will also be referred to as the Avaya X330 WAN module, or simply the X330 WAN module.

The network administrator can use DiffServ Code Point (DSCP) marking when he or she has control of packet marking of the endpoints (i.e. Avaya IP telephones). For example, the network administrator coordinates with the PBX administrator to set the Avaya™ IP600 Call Server DSCP voice and signaling values for a preset standard for IP telephones throughout the organization. The values set in the PBX will propagate to all Avaya IP telephones in the organization to ensure the same DSCP values for Avaya IP endpoints within the network region. Once these values are known, each router hop in the network can now be standardized on these DSCP values to ensure good voice quality.

However, if this coordination between the PBX and network administrators is not possible, the network administrator may choose to implement IP RTP Priority, where the X330 WAN module can prioritize traffic based upon the IP traffic type and port range, instead of DSCP values designated within the IP packet header.

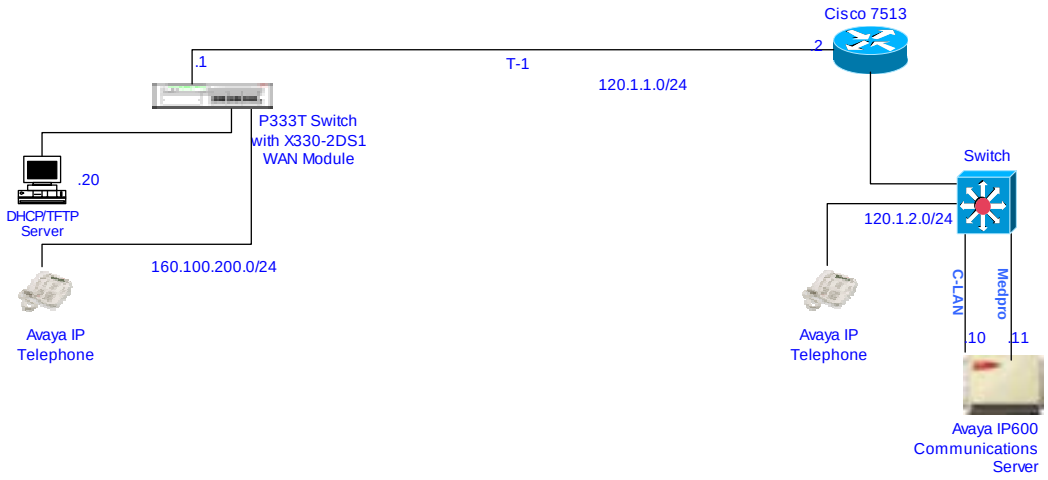

Figure 1: Network Diagram of an Avaya IP Telephony Solution interoperating with an Avaya X330 WAN Module and a Cisco 7513 Router

Efficient use of Quality of Service (QoS) enables the X330 WAN module to assign the proper priority to different incoming and outgoing traffic flows to minimize the effect of one flow on the other, and to prevent a low priority traffic flow from affecting a high priority traffic flow. To achieve this, the X330WAN module implements multiple receiving queues and configurable

transmitting queues (4 queues per interface). Priority queuing is implemented among the four queues on each interface:

• Voice (highest priority)
• High priority data
• Better than best effort
• Best effort (low priority)

To reduce the effect of one flow on the other, the following priority order (from highest to lowest) is always maintained:

• Transmit tasks - highest priority.
• Receive tasks - medium priority.
• Router tasks - lowest priority.

Note: The network administrator can adjust the queue length for different needs. The queue length should always be kept as small as possible, while still maintaining a flow. It is recommended to always use the default queue length, as this is the optimal calculated length.

The X330 WAN module has four queues and eight queuing profiles. The queuing profiles are called fwd0 through fwd7. The assignment of the profiles is as follows:

Fwd0-1	Best effort
Fwd2-3	Better than best effort
Fwd4-5	High Priority
Fwd6-7	Voice

The Cisco 7513 uses software queues. When configuring the Cisco router, the network administrator chooses a matching criterion (i.e. DSCP values or RTP port ranges) and then reserves priority bandwidth for the criterion. Any traffic not matching the criterion gets placed into a default queue. The default queue could either be a First-in First-out (FIFO) queue or a weighted fair queue.

2. Equipment and Software Validated

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

Equipment	Software
Avaya™ IP600 Internet Protocol Communication Server	R010r.01.0.032.0.
Avaya™ IP Telephone	1.61
Avaya™ P333T Switch	2.9.4
Avaya™ X330-2DS1 WAN Module	2.9.7
Cisco 7513 Router	IOS 12.2

3. Configure the Avaya WAN module for DSCP Priority

Sections 3, 4 and 5 explain how to configure the network to prioritize traffic based upon DSCP values. Cisco routinely uses the value ranges from **40** to **47** for VoIP DSCP to be implemented throughout the network. In these Application Notes, the DSCP point value of **40** was used.

The QoS configuration lines are written in **bold** to set them apart from the standard configuration lines, and user comments are written next to them starting with "!!"

```
! version 3.9.7
set time server 63.216.3.129
set timezone EST -5
set system location ""
set system name ""
set system contact ""
!
ip access-list-name 105 "trustdscp"  !! Assign Access list "trustdscp" to 105
!
 ip access-list-dscp operation 105 40 "fwd7"  !!Send IP packets with DSCP
!                                             !!mark of 40 to highest
!                                             !!queuing profile of 7
!
 ip access-list-dscp trust 105 trust-dscp     !!Trust incoming DSCP values
!
set qos policy-source local                   !!Use access-lists within this
!                                             !!script
!
ds-mode t1
!
controller T1 1
 linecode b8zs
 framing esf
 clock source internal
 channel-group 0 timeslots 1-24 speed 64
!
controller T1 2
!
interface FabricFastEthernet 1
!
interface FabricFastEthernet 1:1
 ip address 160.100.200.1   255.255.255.0
 ip routing-mode rt_primary_mgmt
!
!
interface FastEthernet 1
 shutdown
!
interface Serial 1:0
 encapsulation ppp
 ip access-group 105 out      !!Apply policy outbound
!
 voip-queue                   !!Shortens the priority queue depth to Avaya
!                             !!recommended defaults for voice in order to
!                             !!reduce latency.
```

```
!
 ip address 120.1.1.1       255.255.255.0
!
ip bootp-dhcp relay
!
router ospf
 network 120.1.1.0       0.0.0.255       area 0.0.0.0
 network 160.100.200.0   0.0.0.255       area 0.0.0.0
!
interface Console
```

4. Configure the Cisco 7513 Router for DSCP Priority

Below is an example configuration for the Cisco 7513 Router. In this example, the LLQ mechanism is enabled and prioritizes IP packets that have the DSCP value of 40. 128Kbps is reserved for the priority queue.

The class map is defined for a particular traffic type. In this case the class map **voip** is defined to match traffic that is marked as DSCP **40**

In turn, the policy-map defines what to do with the traffic that meets the class map parameters. In this case, policy map **llq** reserves 128 Kbps of priority bandwidth for the **voip,** and all other traffic the rest of the bandwidth on a non-priority basis.

The **llq** policy map is applied to the interface by using the **service-policy** command. It is normally applied outbound to the lowest-speed interface; in this case the serial interface.

The QoS configuration lines are written in **bold** to set them apart from the standard configuration lines, and user comments are written next to them starting with "!!"

```
version 12.2

ip cef distributed
!
class-map match-all voip
  match ip dscp 40                  !!Match DSCP 40
!
!
policy-map llq
  class voip
    priority 128                    !!Reserve 128Kbps for priority
  class class-default
   fair-queue
!
!controller T1 0/1/0
 framing esf
 linecode b8zs
 channel-group 0 timeslots 1-24
!
controller T1 0/1/1
 framing esf
 linecode b8zs
```

```
!
controller T1 0/1/2
 framing esf
 linecode b8zs
!
interface Serial0/1/0:0
 ip address 120.1.1.2 255.255.255.0
 encapsulation ppp
 service-policy output llq          !!Apply policy outbound on the serial
!                                   !!interface.
!
interface FastEthernet4/0/0
 ip address 120.1.2.1 255.255.255.0
 ip helper-address 160.100.200.20
 half-duplex
 no cdp enable
!
router ospf 1
 network 120.1.1.0 0.0.0.255 area 0.0.0.0
 network 120.1.2.0 0.0.0.255 area 0.0.0.0
!
```

5. Configure DSCP for the Avaya™ IP600 Server

Log into the Avaya IP600 Server, enter **change ip-network-region X** (**Note**: X refers to a number. In this example, X is a 1). Tab down to the **DiffServ PHB Value**: line as shown in the figure below, and enter **40**.

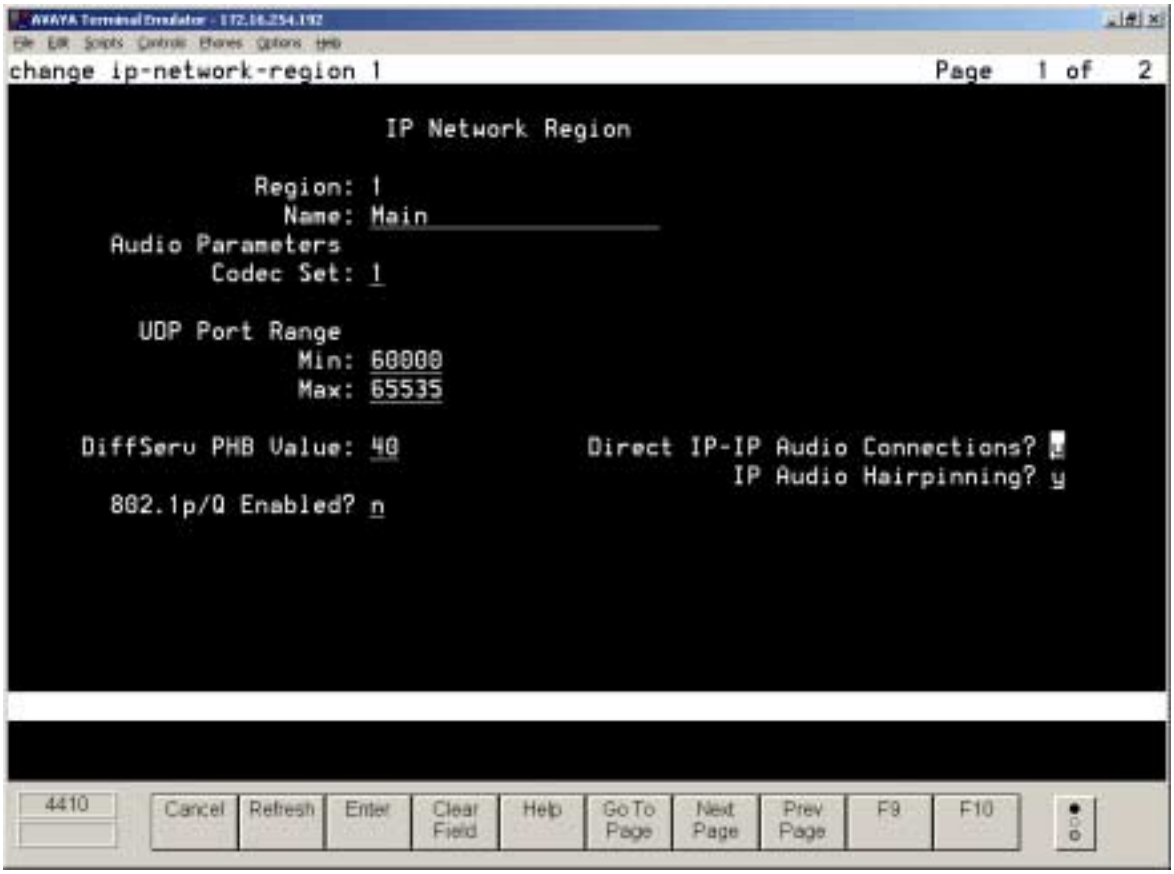

Figure 2: Avaya™ IP600 Server Configuration

6. Configure the Avaya X330 WAN Module for IP RTP Priority

Sections 6, 7 and 8 explain how to configure IP RTP Priority between the Avaya X330 WAN module and the Cisco 7513 Router. For this example, port address ranges from 60000 to 65535 are chosen.

The QoS configuration lines are written in **bold** to set them apart from the standard configuration lines, and user comments are written next to them starting with "!!"

```
! version 3.9.7

ip access-list-name 101 "udppri"  !!Assigns Access list 101 to "udppri"

 ip access-list 101   10 fwd7 udp  any any gt 60000   !!Any UDP greater than
!                                                     !!60000 gets the high
!                                                     !!priority queue
!                                                     !!profile
!
set qos policy-source local
!
ds-mode t1
!
controller T1 1
```

```
 linecode b8zs
 framing esf
 clock source internal
 channel-group 0 timeslots 1-24 speed 64
!
controller T1 2
!
interface FabricFastEthernet 1
!
interface FabricFastEthernet 1:1
ip routing-mode rt_primary_mgmt
 ip bootp-dhcp server 200.100.200.40
!
!
interface Serial 1:0
 encapsulation ppp
 ip access-group 101 out      !!Assigns the access group to the outbond
!                             !!interface.
!
voip-queue                    !!Shortens the priority queue depth to Avaya
!                             !!recommended defaults for voice in order to
!                             !!reduce latency.
!
 ip address 120.1.1.1       255.255.255.0
!
ip bootp-dhcp relay
!
router ospf
 network 120.1.1.0       0.0.0.255       area 0.0.0.0
 network 160.100.200.0   0.0.0.255       area 0.0.0.0
!
```

7. Configure the Cisco 7513 Router for IP RTP Priority

Below is an example configuration for the Cisco 7513 Router. In this, example the LLQ mechanism is enabled and prioritizes IP packets that have RTP port ranges from 60000 to 65535. Please note that syntax is `match ip rtp <base port number> <offset>.`

The class map is defined for a particular traffic type. In this case the class map **voip** is defined to match traffic for IP RTP port ranges from 60000 to 65535.

In turn, the policy-map defines what to do with the traffic that meets the class map parameters. In this case, policy map **llq** reserves 128 Kbps of priority bandwidth for the **voip** class map.

The **llq** policy map is applied to the interface by using the **service-policy** command. It is normally applied outbound to the lowest speed interface; in this case the serial interface.

The QoS configuration lines are written in **bold** to set them apart from the standard configuration lines, and user comments are written next to them starting with "!!"

```
version 12.2
!
```

```
ip cef distributed
!
class-map match-all voip
  match ip rtp 60000 5535           !!Match RTP port range starting at 60000
!                                   !!with and offset of 5535.  This will
!                                   !!bring top range to 65535
!
!
policy-map llq
  class voip
    priority 128                    !!Reserve 128Kbps for priority traffic
  class class-default
  fair-queue
!
!
controller T1 0/1/0
 framing esf
 linecode b8zs
 channel-group 0 timeslots 1-24
!
controller T1 0/1/1
 framing esf
 linecode b8zs
!
interface Serial0/1/0:0
 ip address 120.1.1.2 255.255.255.0
 encapsulation ppp
 service-policy output llq          !!Apply the policy outbound on the serial
!                                   !!interface
!
!
interface FastEthernet4/0/0
 ip address 120.1.2.1 255.255.255.0
 ip helper-address 160.100.200.20

 half-duplex
 no cdp enable
!
router ospf 1
 log-adjacency-changes
 network 120.1.1.0 0.0.0.255 area 0.0.0.0
 network 120.1.2.0 0.0.0.255 area 0.0.0.0
!
```

8. Configure UDP Port Ranges for the Avaya IP600 Server

The UDP port range refers to both the Avaya IP600 Server and the Avaya IP Telephone RTP traffic. After logging into the Avaya IP600 Server, enter **change ip-network-region X** (**Note**: X refers to a number. In this example, X is a 1). Tab down to the **UDP Port Range** line as shown in the figure below, and enter the **Min** and **Max** UDP port ranges to affect the RTP packets.

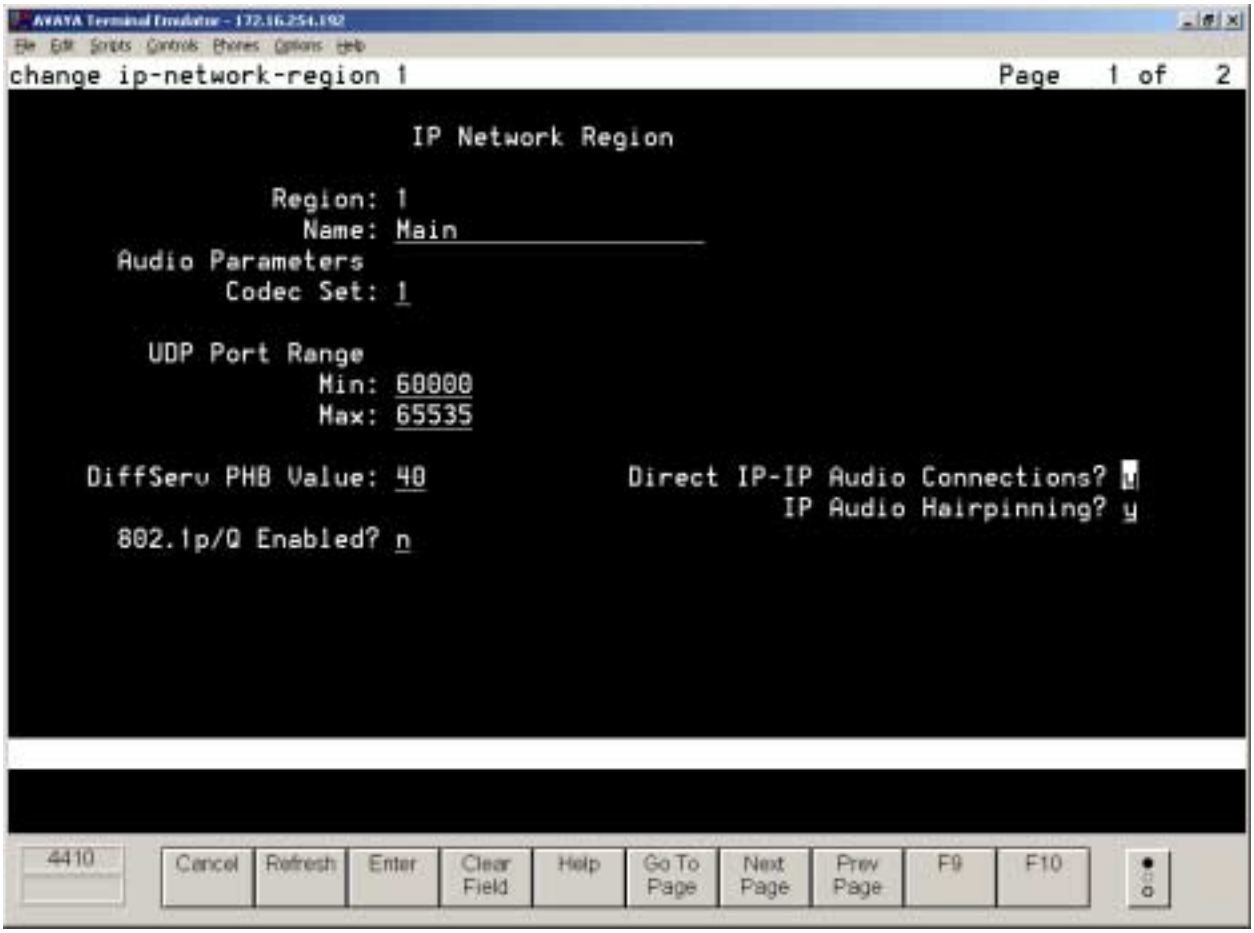

Figure 3: Avaya™ IP600 Server UDP Port Range Configuration

9. Conclusion

In summary, several queuing priority methods are available on the X330-2DS1 WAN module and can interoperate in a Cisco infrastructure for optimizing voice traffic over IP networks. When properly configured for Voice over IP, the enterprise has a robust choice of queuing priority methods, transports, speeds and convergence types.

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 Solution & Interoperability Test Lab at interoplabnotes@list.avaya.com