



Avaya Solution & Interoperability Test Lab

Application Notes for Frame Relay VoIP Traffic Shaping between Enterasys Networks Xpedition Security Router (XSR), Matrix V2 Switch and Avaya™ X330W-2DS1 WAN Access Router Module for Small/Medium Branch Office Solutions - Issue 1.0

Abstract

These Application Notes describe the configuration steps required for Enterasys Networks Xpedition Security Router and Matrix V2 Switch to successfully interoperate with Avaya™ IP403 Office, Avaya™ S8300 Media Server with G700 Media Gateway, and Avaya™ X330WAN-2DS1 module in a Small/Medium Branch Office solution. Features and functionality were validated and performance testing was conducted in order to verify operation under load over a Frame Relay switched network. Information in these 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 compliance-tested configuration utilizing the Avaya™ S8300 Media Server, G700 Media Gateway, X330WAN-DS1 Module, P333T-PWR Switch, IP403 Office, Enterasys Networks Xpedition Security Router (XSR) and Matrix V2 Switch.

Together, the Enterasys Networks Xpedition Security Router series and Matrix V2 Switch series provide a cost effective solution for small and medium branch office deployments. The XSR router has comprehensive IP routing and QoS features needed to support VoIP in WAN environments. The Matrix V2 switch is equipped with 4 priority queues, which can be used to differentiate voice, signaling and traditional data traffic based on IEEE 802.1p. In addition, Matrix V2 switches can also provide L2/L3/L4 traffic classification based on MAC address, IP address, DSCP, TCP/UDP port number and Ethertype.

The Frame Relay Switch Configuration (**Figure 1**) depicts a Main Office and a Branch Office interconnected via a Frame Relay network. See **Table 1** for detailed port configurations. The steps provided to build this configuration include QoS provisioning, DHCP IP Telephone registration, IP Telephone with attached PC port and Frame Relay settings. This configuration was tested to validate that the QoS mechanism of the XSR router and Matrix V2 switch were compatible with Avaya™ Media Servers and Media Gateways and that Ethernet interfaces interoperated between the two vendors.

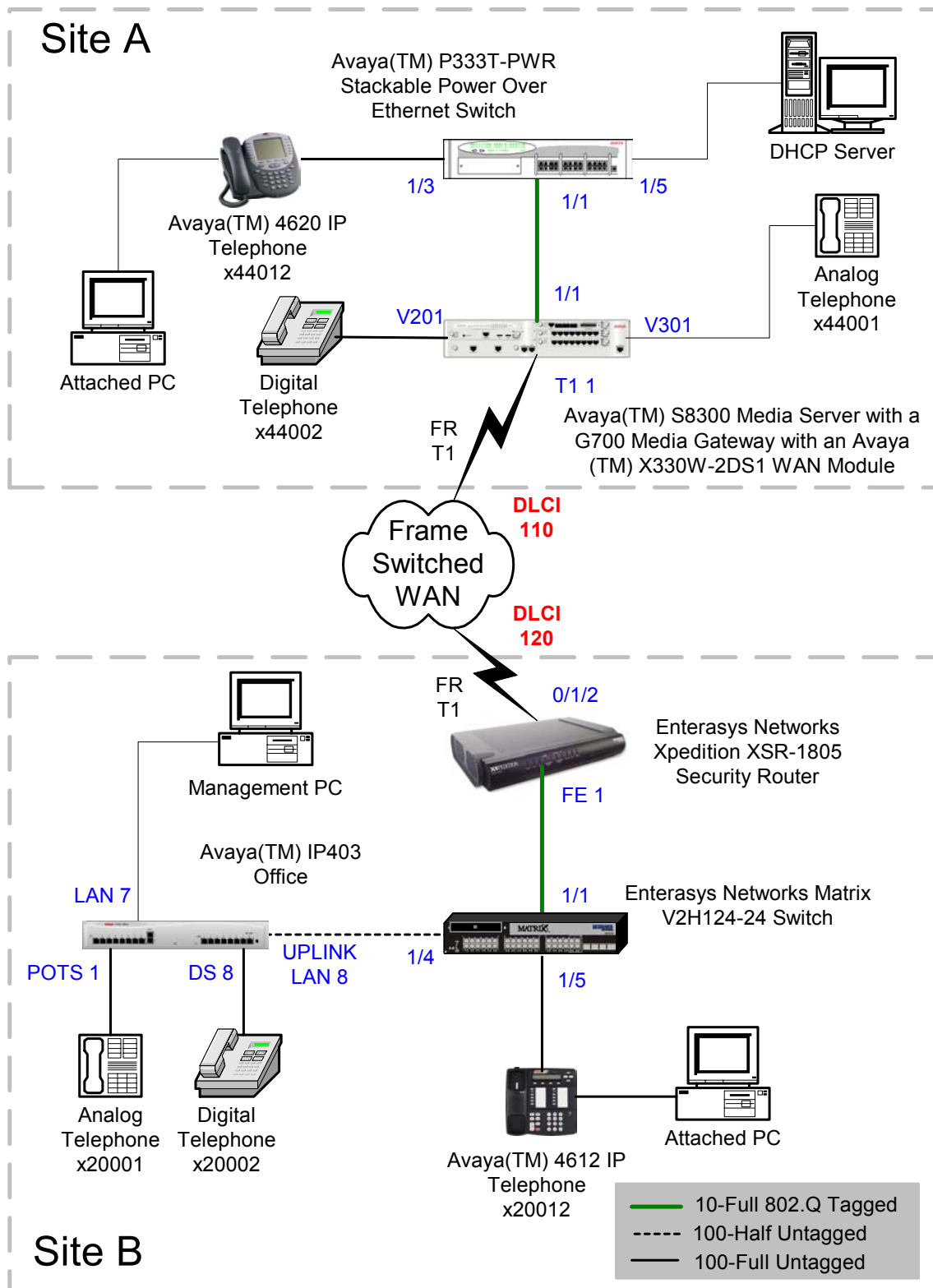


Figure 1: Frame Relay Switched Configuration

DUT	Port	PVID	Binding Mode	Trunk Mode	VLANs	IP Interface
P333T-PWR	1/1	11	static	dot1q	10,11	
P333T-PWR	1/3	11	static	off	10,11	
P333T-PWR	1/5	11	static	off	11	
P333T-PWR	inband	10				10.0.10.104/24
X330W-2DS1	Serial 1:0.1					100.100.100.2/24 OSPF area 0.0.0.0
X330W-2DS1	Fabric FE 1:10	10	static		10	10.0.10.1/24 OSPF area 0.0.0.0
X330W-2DS1	Fabric FE 1:11	11	static		11	11.0.11.1/24 OSPF area 0.0.0.0
S8300/ G700 Embedded P330 Switch	1/1	11	static	dot1q	10,11	inband 10.0.10.100/24 mgp 10.0.10.101/24 proc 10.0.10.102/24 voip-v0 10.0.10.103/24
DHCP Server						11.0.11.220/25
XSR-1805	Serial 1/2:0					100.100.100.1/25 OSPF area 0.0.0.0
XSR-1805	Eth 1.1	40		trunk		15.4.0.1/24
XSR-1805	Eth 1.2	41		trunk		15.4.1.1/25
V2H124-24	1/1	41	static	trunk	41 untag 40 tag	
V2H124-24	1/4	40	static	hybrid	40 tag	
V2H124-24	1/5	41	static	hybrid	41 untag 40 tag	
V2H124-24	VLAN 40	40				15.4.0.3/24
IP403 Office	Contrl.					15.4.0.130/24
MGMT PC						15.4.0.202/24

Table 1: Connectivity Matrix

2. Equipment and Software Validated

The following equipment and software were used for the configurations provided in **Figure 1**.

Equipment	Software
Avaya™ S8300 Media Server with a G700 Media Gateway	R011x.03.0.526.5
Avaya™ X330W-2DS1 Multiservice WAN Access Module	v3.12.10
Avaya™ P333T-PWR Stackable Layer 2 Switch with PoE	v4.0.17
Avaya™ 4600 Series IP Telephones	v1.8
Avaya™ IP403 Office Server	1.4(23)
Avaya™ Phone Manager	1.4.6
Avaya™ IP Softphone	R4.1.3.28
Enterasys Networks Xpedition Security Router XSR-1805	v6.0.0.0
Enterasys Networks Matrix V2 Switch V2H124-24	v1.0.4.0

3. Configure the G700 Gateway for Site A

The following configuration steps can be used to build the configuration depicted in **Figure 1**. The embedded switch of the G700 gateway provides two Fast Ethernet ports for uplinks to other devices in the LAN. In addition, it provides an internal switch fabric connection or bridge to any expansion module loaded into the G700 Media Gateway chassis expansion slot such as the X330WAN-2DS1 module. These steps can be generalized for most configurations.

Step	Description
1	Start a HyperTerminal session to the embedded P330 switch via the console port. ▪ Bits per second 9600 ▪ Data bits 8 ▪ Parity None ▪ Stop bits 1 ▪ Flow control None
2	Enter a valid user name and password.
3	Create VLAN 11 for data and VLAN 10 for voice. <pre>P330-1(super)# set vlan 10 name vlan10-voice P330-1(super)# set vlan 11 name vlan11-data</pre>
4	Configure the port connected to the P333T-PWR Switch. Change the default port priority to 1 for port 1/1. Then change the port VLAN for port 1/1 to the data VLAN 11. Configure the uplink to the P333T-PWR switch as 10-full. Note: All data traffic will be entering the switches without priority tags in the clear. In order to classify this traffic for LAN and WAN QoS treatment, all of the switch port priorities have been changed to 1 in order to put data in the lowest forwarding queue. By default the switch will enforce 802.1p priority based on tags received and physical port priority. <pre>P330-1(super)# set port level 1/1 7 P330-1(super)# set port vlan 10 1/1 P330-1(super)# set trunk 1/1 dot1q P330-1(super)# set port static-vlan 1/1 10 P330-1(super)# set port static-vlan 1/1 11 P330-1(super)# set port negotiations 1/1 disable P330-1(super)# set port speed 1/1 10MB P330-1(super)# set port duplex 1/1 full</pre>
5	Configure the inband management IP address for the switch and default route and reset the switch to enable the interface change. <pre>P330-1(super)# set interface inband 10 10.0.10.100 255.255.255.0 P330-1(super)# set ip route 0.0.0.0 10.0.10.1 P330-1(super)# reset</pre>

4. Configure the X330W-2DS1 Module for Site A

The following configuration steps can be used to build the configuration depicted in **Figure 1** over a frame relay switched WAN with DCE devices providing LMI signaling. These steps can be generalized for most configurations.

Step	Description
1	Start a HyperTerminal session to the WAN module. ▪ Bits per second 9600 ▪ Data bits 8 ▪ Parity None ▪ Stop bits 1 ▪ Flow control None
2	Enter a valid user name and password.
3	Go to configuration mode by typing config. <pre>X330WAN-2DS1-1 (super)# config</pre> The prompt will change. <pre>X330WAN-2DS1-1 (configure)#</pre>
4	Enable DHCP relay globally for the module. <pre>X330WAN-2DS1-1 (configure)# ip bootp-dhcp relay</pre>
5	Add Fabric Fast Ethernet interfaces for the voice and data VLANs 10 and 11 respectively. Note: The DHCP server for the sample configuration is located on the data VLAN 11 so no DHCP relay is required for the 11.0.11.0 network. However, the voice VLAN 10 interface will need to know which server to forward DHCP discovery broadcasts to coming from network 10.0.10.0 <pre>X330WAN-2DS1-1 (configure)# interface FabricFastEthernet 1:10 X330WAN-2DS1-1 (config-if:FastEthernet1:10)# ip address 10.0.10.1 255.255.255.0 X330WAN-2DS1-1 (config-if:FastEthernet1:10)# ip bootp-dhcp server 11.0.11.220 X330WAN-2DS1-1 (config-if:FastEthernet1:10)# exit X330WAN-2DS1-1 (configure)# interface FabricFastEthernet 1:11 X330WAN-2DS1-1 (config-if:FastEthernet1:11)# ip address 11.0.11.1 255.255.255.0 X330WAN-2DS1-1 (config-if:FastEthernet1:11)# exit</pre>
6	Configure the QoS policy. Configure the WAN module to use access-lists located in the configuration file as the source for QoS policy. Enable QoS such that VoIP signaling and audio are given the highest forwarding queues on the ingress and egress based on IP header Differential

Step	Description
	Services Code Point (DSCP) marks. For the sample configuration provided the default values 46 for audio and 34 for signaling will be used. Provision the WAN module for maximum trust between 802.1p priority and DSCP. Note: The X330WAN module has a special voip-queue feature, which reduces the forwarding delay for audio packets. By default the voip-queue is optimized for audio packets using the G.729 codec. The voip-queue feature reduces the buffer of the audio to 25% that of the signaling so that voice packets are forwarded in a ~1/4 the time that it takes for signaling packets to be forwarded. The voip-queue requires that audio be forwarded with priority 6. Therefore, signaling DSCP 34 is set to FWD7 and audio DSCP 46 is set to FWD6 to take advantage of the buffer sizing. <pre> X330WAN-2DS1-1 (configure) # set qos policy-source local X330WAN-2DS1-1 (configure) # ip access-list-name 105 acl-voice X330WAN-2DS1-1 (configure) # ip access-list-dscp operation 105 34 fwd7 X330WAN-2DS1-1 (configure) # ip access-list-dscp operation 105 46 fwd6 X330WAN-2DS1-1 (configure) # ip access-list-dscp trust 105 trust-cos-dscp </pre>
7	Activating the Policy List for ingress traffic on the Fabric Fast Ethernet interfaces. <pre> X330WAN-2DS1-1 (configure) # interface FabricFastEthernet 1 X330WAN-2DS1-1 (config-if: FabricFastEthernet1) # ip access-group 105 in X330WAN-2DS1-1 (config-if: FabricFastEthernet1) # exit </pre>
8	Configure frame relay QoS parameters. Note: Some applications cannot support fragmentation. Only configure fragmentation if it does not impact existing networking applications. <pre> X330WAN-2DS1-1 (configure) # map-class frame-relay my-voip-class X330WAN-2DS1-1 (config-map-class) # be out 96000 X330WAN-2DS1-1 (config-map-class) # cir out 768000 X330WAN-2DS1-1 (config-map-class) # bc out 96000 X330WAN-2DS1-1 (config-map-class) # fragment 200 X330WAN-2DS1-1 (config-map-class) # exit </pre>
9	Configure the T1 physical parameters (<i>port = 1</i>). Configure the T1 to receive clock from the network. Configure channel-group 0 to use the entire T1 including timeslots 1-24 at 64Kbps each. <pre> X330WAN-2DS1-1 (configure) # controller t1 1 X330WAN-2DS1-1 (config-controller:1) # linecode b8zs X330WAN-2DS1-1 (config-controller:1) # framing esf X330WAN-2DS1-1 (config-controller:1) # clock source line X330WAN-2DS1-1 (config-controller:1) # channel-group 0 timeslots 1-24 X330WAN-2DS1-1 (config-controller:1) # speed 64 X330WAN-2DS1-1 (config-controller:1) # exit </pre>

Step	Description
10	Configure serial interface 1:0 (<i>port:channel-group</i>). Enable frame-relay traffic shaping along with the voip-queue feature. <pre> X330WAN-2DS1-1 (configure)# interface Serial 1:0 X330WAN-2DS1-1 (config-if:Serial1:0)# encapsulation frame-relay X330WAN-2DS1-1 (config-if:Serial1:0)# frame-relay traffic-shaping X330WAN-2DS1-1 (config-if:Serial1:0)# voip-queue X330WAN-2DS1-1 (config-if:Serial1:0)# exit </pre>
11	Create a point-to-point frame relay sub-interface on Serial 1:0.1 <pre> X330WAN-2DS1-1 (configure)# interface Serial 1:0.1 point-to-point X330WAN-2DS1-1 (config-subif:Serial1:0.1)# ip address 100.100.100.2 255.255.255.0 X330WAN-2DS1-1 (config-subif:Serial1:0.1)# frame-relay interface-dlci 120 X330WAN-2DS1-1 (config-subif:Serial1:0.1)# frame-relay class-dlci 120 my-voip-class X330WAN-2DS1-1 (config-subif:Serial1:0.1)# exit </pre>
12	Enable OSPF and add all interfaces to backbone area 0.0.0.0. Save the configuration and reset so that 10.0.10.1 becomes loaded as the primary management IP address. <pre> X330WAN-2DS1-1 (configure)# router ospf X330WAN-2DS1-1 (configure router:ospf)# network 100.100.100.0 0.0.0.255 area 0.0.0.0 X330WAN-2DS1-1 (configure router:ospf)# network 10.0.10.0 0.0.0.255 area 0.0.0.0 X330WAN-2DS1-1 (configure router:ospf)# network 11.0.11.0 0.0.0.255 area 0.0.0.0 X330WAN-2DS1-1 (configure router:ospf)# exit X330WAN-2DS1-1 (configure)# copy run start X330WAN-2DS1-1 (configure)# reset </pre>

5. Configure the P333T-PWR Switch for Site A

The following configuration steps can be used to build the configuration depicted in **Figure 1**. By default the P333T-PWR Layer 2 Power over Ethernet (PoE) switch will detect Avaya IP Telephones and provide power to them. These steps can be generalized for most configurations.

Step	Description
1	Start a HyperTerminal session to the P333T-PWR switch via the console port. ▪ Bits per second 9600 ▪ Data bits 8 ▪ Parity None ▪ Stop bits 1 ▪ Flow control None

Step	Description
2	Enter a valid user name and password.
3	Create VLAN 11 for data and VLAN 10 for voice. <pre>P333T-PWR-1 (super) # set vlan 10 name vlan10-voice P333T-PWR-1 (super) # set vlan 11 name vlan11-data</pre>
4	Configure the port to connect with the G700 Media Gateway. Bind both voice and data VLANs to the port. Note: All data traffic will be entering the switches without priority tags in the clear. In order to classify this traffic for LAN and WAN QoS treatment, all of the switch port priorities have been changed to 1 in order to put data in the lowest forwarding queue. By default the switch will enforce 802.1p priority based on tags received and physical port priority. <pre>P333T-PWR-1 (super) # set port level 1/1 7 P333T-PWR-1 (super) # set port vlan 10 1/1 P333T-PWR-1 (super) # set trunk 1/1 dot1q P333T-PWR-1 (super) # set port static-vlan 1/1 10 P333T-PWR-1 (super) # set port static-vlan 1/1 11 P333T-PWR-1 (super) # set port negotiations 1/1 disable P333T-PWR-1 (super) # set port speed 1/1 10MB P333T-PWR-1 (super) # set port duplex 1/1 full</pre>
5	Configure port static VLAN bindings for IP Telephony with attached PC's. Note: Statically bind the voice VLAN 10 to all ports, which will be supporting an IP Telephone and a PC simultaneously. When the IP Telephone boots it will first register with the DHCP server using the port VLAN 11 or data VLAN. The DHCP server will then assign the IP Telephone to VLAN 10 or voice VLAN and enable tagging using the L2Q and L2QVLAN strings from Site Specific Option Number (SSON) 176. The IP Telephone will release the data VLAN IP address and request a new IP address via a tagged DISCOVER request on VLAN 10. <pre>P333T-PWR-1 (super) # set port vlan 11 1/3 P333T-PWR-1 (super) # set port level 1/3 1 P333T-PWR-1 (super) # set port static-vlan 1/3 10</pre>
6	Configure a trunk to uplink to the S8300 Media Server and X330WAN module. Be sure to bind the voice VLAN to the port as well. <pre>P333T-PWR-1 (super) # set port static-vlan 1/1 10 P333T-PWR-1 (super) # set trunk 1/1 dot1q</pre>

Step	Description
7	Configure the inband management IP address for the switch and default route and reset the switch to enable the interface change. Note: Set interface commands: ----- Usage: set interface [name] [vlan] [ip_addr] [netmask] P333T-PWR-1 (super) # set interface inband 10 10.0.10.104 255.255.255.0 P333T-PWR-1 (super) # set ip route 0.0.0.0 10.0.10.1 P333T-PWR-1 (super) # reset

6. Configure the S8300 Media Server for Site A

These Application Notes address provisioning of the S8300 Media Server as it relates to integration of the Enterasys Networks data infrastructure components. For all other provisioning information such as provisioning of trunks, extensions, etc., please refer to the Communication Manager product documentation or other already published Application Notes.

Configure IP Network Region 1 with proper QoS parameters.

From the SAT, enter `change ip-network-region 1` and program region 1 (**Figure 2**) to use DSCP values 34 and 46 for signaling and audio respectively. Configure 802.1p values, 7 for call control and 6 for audio. Disable Inter-region IP-IP Direct Audio.

change ip-network-region 1		Page 1 of 3
IP NETWORK REGION		
Region: 1	Name: IP Telephony Region	
Location:	Intra-region IP-IP Direct Audio: yes	
AUDIO PARAMETERS	Inter-region IP-IP Direct Audio: no	
Codec Set: 1	IP Audio Hairpinning? y	
UDP Port Range	RTCP Reporting Enabled? n	
Min: 2048		
Max: 3029		
DIFFSERV/TOS PARAMETERS		
Call Control PHB Value: 34		
Audio PHB Value: 46		
AUDIO RESOURCE RESERVATION PARAMETERS		
RSVP Enabled? n		
802.1P/Q PARAMETERS		
Call Control 802.1p Priority: 7		
Audio 802.1p Priority: 6		

Figure 2: IP Network Region Form

7. Configure the XSR-1805 Router for Site B

The following configuration steps can be used to configure the XSR-1805 router depicted in **Figure 1**. These steps can be generalized for most configurations.

Step	Description
1	Start a HyperTerminal session to the XSR-1805 router. ▪ Bits per second 9600 ▪ Data bits 8 ▪ Parity None ▪ Stop bits 1 ▪ Flow control None
2	Enter a valid user name and password.
3	Enter enable mode and then enter to configuration mode by typing config. <pre>XSR-1805> enable The prompt will change. XSR-1805# configure The prompt will change XSR-1805(config)#</pre>
4	Configure the Fast Ethernet link between the Matrix V2 and the XSR-1805 to be 10-full. By setting the uplink to 10-full, the Matrix V2 is now responsible for queuing high priority traffic and reducing low priority traffic at the LAN level based on 802.1p priority before the router begins observing DSCP values. This helps offload some of the CPU intensive DSCP lookup operations from the router onto the switch. <pre>XSR-1805(config)# interface FastEthernet 1 XSR-1805(config-if<F1>)# speed 10 XSR-1805(config-if<F1>)# duplex full XSR-1805(config-if<F1>)# no shutdown XSR-1805(config-if<F1>)# exit</pre>
5	Configure the Fast Ethernet IP interfaces for the voice VLAN 40 and data VLAN 41. The sample configuration in these application notes makes use of a centralized DHCP server at the Main Office. In order for IP Telephone at the remote branch to register with the DHCP server, an ip helper-address must be added to each VLAN interface. <pre>XSR-1805(config)# interface FastEthernet 1.1 XSR-1805(config-if<F1.1>)# description vlan40-voice XSR-1805(config-if<F1.1>)# vlan 40 XSR-1805(config-if<F1.1>)# ip address 15.4.0.1 255.255.255.0 XSR-1805(config-if<F1.1>)# ip helper-address 11.0.11.220 XSR-1805(config-if<F1.1>)# no shutdown XSR-1805(config-if<F1.1>)# exit XSR-1805(config)# interface FastEthernet 1.2</pre>

Step	Description
	<pre> XSR-1805(config-if<F1.2>)# description vlan41-data XSR-1805(config-if<F1.2>)# vlan 41 XSR-1805(config-if<F1.2>)# ip address 15.4.1.1 255.255.255.0 XSR-1805(config-if<F1.2>)# ip helper-address 11.0.11.220 XSR-1805(config-if<F1.2>)# no shutdown XSR-1805(config-if<F1.2>)# exit </pre>
6	Configure the QoS policy to match on voice and audio based on received DSCP values. The following commands give preferential treatment to voice and signaling on the egress based on IP header Differential Services Code Point (DSCP) marks. For the sample configuration provided, the default values 46 for audio and 34 for signaling were used. In order to reduce delay and guarantee bandwidth for VoIP calls, Enterasys Networks recommends the use of strict priority queues for voice. The example below guarantees that voice will have a maximum of 300 kbps at any given time, including heavy congestion, and will be forwarded using the high priority queue. There are 4 queues available: high, medium, normal and low. Signaling will be allocated 10 kbps using the medium priority queue. <pre> XSR-1805(config)# class-map c-voice XSR-1805(config-cmap<c-voice>)# match ip dscp 46 XSR-1805(config-cmap<c-voice>)# exit XSR-1805(config)# class-map c-sig XSR-1805(config-cmap<c-sig>)# match ip dscp 34 XSR-1805(config-cmap<c-sig>)# exit XSR-1805(config)# policy-map p-voice XSR-1805(config-pmap<p-voice>)# class c-voice XSR-1805(config-pmap-c<c-voice>)# priority high 300 XSR-1805(config-pmap-c<c-voice>)# exit XSR-1805(config-pmap<p-voice>)# class c-sig XSR-1805(config-pmap-c<c-sig>)# priority medium 10 XSR-1805(config-pmap-c<c-sig>)# exit XSR-1805(config-pmap<p-voice>)# exit </pre>
7	Configure frame relay QoS parameters. <pre> XSR-1805(config)# map-class frame-relay m-voice XSR-1805(config-map-class<m-voip>)# frame-relay be out 96000 XSR-1805(config-map-class<m-voip>)# frame-relay cir out 768000 XSR-1805(config-map-class<m-voip>)# frame-relay bc out 96000 XSR-1805(config-map-class<m-voip>)# frame-relay fragment 200 XSR-1805(config-map-class<m-voip>)# service-policy output p-voice XSR-1805(config-map-class<m-voip>)# exit </pre>

Step	Description
8	Configure and enable the T-1 interface controller. <pre> XSR-1805(config)# controller t1 0/1/2 The next four commands are optional as they are the defaults for the controller. XSR-1805(config-controller<T1-1/2>)# linecode b8zs XSR-1805(config-controller<T1-1/2>)# framing esf XSR-1805(config-controller<T1-1/2>)# clock source line XSR-1805(config-controller<T1-1/2>)# channel-group 0 timeslots 1-24 speed 64 XSR-1805(config-controller<T1-1/2>)# no shutdown XSR-1805(config-controller<T1-1/2>)# exit </pre>
9	Configure serial interface 1/2:0 (<i>card/port:channel-group</i>). Enable frame-relay traffic shaping along with the voip-queue feature. <pre> XSR-1805(config)# interface Serial 1/2:0 XSR-1805(config-if<S1/2:0>)# encapsulation frame-relay XSR-1805(config-if<S1/2:0>)# frame-relay traffic-shaping XSR-1805(config-if<S1/2:0>)# frame-relay class m-voice XSR-1805(config-if<S1/2:0>)# no shutdown XSR-1805(config-if<S1/2:0>)# exit </pre>
10	Create a point-to-point frame relay sub-interface on Serial 1/2:0.1. <pre> XSR-1805(config)# interface Serial 1/2:0.1 point-to-point XSR-1805(config-if<S1/2:0.1>)# ip address 100.100.100.1 255.255.255.0 XSR-1805(config-if<S1/2:0.1>)# frame-relay interface-dlci 110 XSR-1805(config-fr-dlci<S1/2:0.1-110>)# class m-voice XSR-1805(config-fr-dlci<S1/2:0.1-110>)# exit XSR-1805(config-if<S1/2:0.1>)# no shutdown XSR-1805(config-if<S1/2:0.1>)# exit </pre>
11	Enable OSPF and add all interfaces to backbone area 0.0.0.0 then save the configuration. <pre> XSR-1805(config)# router ospf 1 XSR-1805(config-router)# network 100.100.100.0 0.0.0.255 area 0.0.0.0 XSR-1805(config-router)# network 10.0.10.0 0.0.0.255 area 0.0.0.0 XSR-1805(config-router)# network 11.0.11.0 0.0.0.255 area 0.0.0.0 XSR-1805(config-router)# exit XSR-1805(configure)# exit XSR-1805# copy run start </pre>

8. Configure the Matrix V2 Switch for Site B

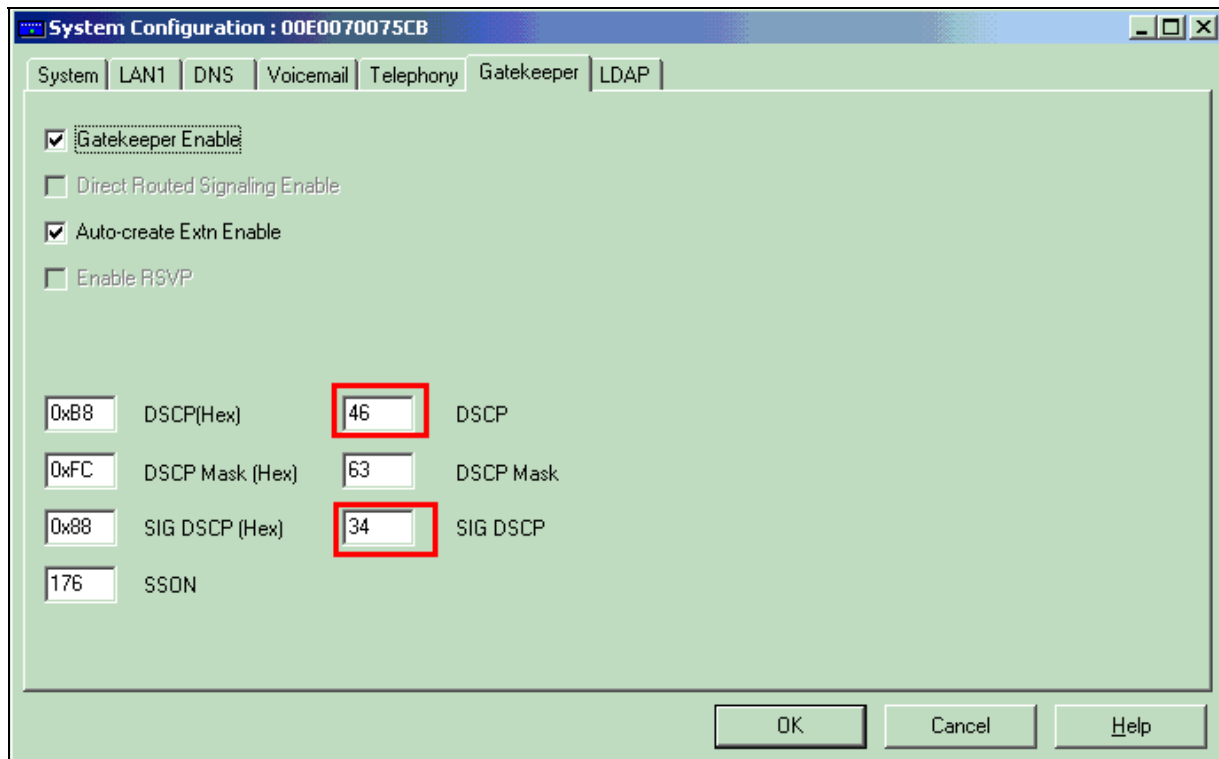
Step	Description
1	Start a HyperTerminal session to the WAN module. ▪ Bits per second 9600 ▪ Data bits 8 ▪ Parity None ▪ Stop bits 1 ▪ Flow control None
2	Enter a valid user name and password.
3	Enter the configuration mode by typing configure at the console prompt. Console# configure The prompt will change. Console(config)#
4	Create the voice VLAN 40 and data VLAN 41 on the Matrix V2 Switch Console(config)# vlan database Console(config-vlan)# vlan 40 name vlan40-voice media Ethernet state active Console(config-vlan)# vlan 41 name vlan41-data media Ethernet state active Console(config-vlan)# exit
5	Configure the Fast Ethernet link between the Matrix V2 and the XSR-1805 to be 10-full. Note: By setting the uplink to 10-full the Matrix V2 is now responsible for queuing high priority traffic and reducing low priority traffic at the LAN level based on 802.1p priority before the router begins observing DSCP values. This helps offload some of the CPU intensive DSCP lookup operations from the router onto the switch. Console(config)# interface ethernet 1/1 Console(config-if)# no negotiation Console(config-if)# speed-duplex 10full Console(config-if)# exit
6	Change the port VLAN for the entire switch to be 41 except for the port 1/4 connected to IP Office. Give the port for IP Office priority 7 with VLAN 40 as the port VLAN. Change the native VLAN for all other ports to be VLAN 41 or the data VLAN. Console(config)# interface ethernet 1/1-3 Console(config-if)# switchport native vlan 41 Console(config-if)# switchport priority default 1 Console(config-if)# exit Console(config)# interface ethernet 1/5-24 Console(config-if)# switchport native vlan 41 Console(config-if)# switchport priority default 1 Console(config-if)# exit

Step	Description
	<pre> Console(config)# interface ethernet 1/4 Console(config-if)# switchport native vlan 40 Console(config-if)# switchport priority default 7 Console(config-if)# exit </pre>
7	Configure a trunk to uplink to the XSR router. Be sure that both the voice and data VLANs are allowed on the trunk. <pre> Console(config)# interface ethernet 1/1 Console(config-if)# switchport mode trunk Console(config-if)# exit </pre>
8	Configure port static VLAN bindings for IP Telephony with attached PC's. Note: This will cause the native VLAN for port 1/5 to be VLAN 41 or the data VLAN and allow tagged VLAN 40 voice traffic as well. This allows an IP Telephone and a PC to share a common port inline. <pre> Console(config)# interface ethernet 1/5 Console(config-if)# switchport allowed vlan add 40 tagged Console(config-if)# exit </pre>
9	Configure a Management IP interface on VLAN 40 for the Matrix V2 switch. Configure the default-gateway address as well. Save the configuration when complete. <pre> Console(config)# interface vlan 40 Console(config-if)# ip address 15.4.0.3 255.255.255.0 Console(config-if)# exit Console(config)# ip default-gateway 15.4.0.1 Console(config)# exit Console# copy run start </pre>

9. Configure the IP403 Office for Site B

These Application Notes address provisioning of the Avaya™ IP403 Office as it relates to integration of the Enterasys Networks data infrastructure components. For all other provisioning information such as provisioning of trunks, extensions, etc., please refer to the Avaya™ IP Office product documentation or other already published Application Notes.

Verify that the IP Office default DSCP values for audio and signaling are 46 and 34 respectively. See **Figure 3**.



System Configuration : 00E0070075CB

System | LAN1 | DNS | Voicemail | Telephony | Gatekeeper | LDAP

☒ Gatekeeper Enable

☐ Direct Routed Signaling Enable

☒ Auto-create Extn Enable

☐ Enable RSVP

0x88 DSCP(Hex) 46 DSCP

0xFC DSCP Mask (Hex) 63 DSCP Mask

0x88 SIG DSCP (Hex) 34 SIG DSCP

176 SSON

OK Cancel Help

Figure 3: IP Office Gatekeeper Screen with DSCP Values

10. Configure the DHCP Server

The DHCP Server 11.0.11.220 located in Site A needs to have several scopes defined.

This scope instructs Avaya™ IP Telephones attempting to boot on the native data VLAN 11 at Site A that they must tag for the voice VLAN 10 and rediscover via DHCP.

```
Scope [11.0.11.0] Site B Data
Address Pool:
Start Address = 11.0.11.140
End Address = 11.0.11.150
Option 003 Router = 11.0.11.1
Option 176 Avaya IP Telephones = L2Q=1,L2QVLAN=10
```

This scope instructs Avaya™ IP Telephones located in Site A that they must register with the Avaya™ S8300 Media Server located in that site:

```
Scope [10.0.10.0] Site A Voice
Address Pool:
Start Address = 10.0.10.140
End Address = 10.0.10.150
Option 003 Router = 10.0.10.1
Option 176 Avaya IP Telephones = MCIPADD=10.0.10.102,MCPORT=1719
```

This scope instructs Avaya™ IP Telephones attempting to boot on the native data VLAN 41 at Site B that they must tag for the voice VLAN 40 and rediscover via DHCP.

```
Scope [15.4.1.0] Site A Data
Address Pool
Start Address = 15.4.1.140
End Address = 15.4.1.150
Option 003 Router = 15.4.1.1
Option 176 IP Telephone = L2Q=1,L2QVLAN=40
```

This scope instructs Avaya™ IP Telephones located in Site B that they must register with the Avaya™ IP 403 Office located in that site:

```
Scope [15.4.0.0] Site A Voice
Address Pool:
Start Address = 15.4.0.140
End Address = 15.4.0.150
Option 003 Router = 15.4.0.1
Option 176 IP Telephone =
MCIPADD=15.4.0.130,MCPORT=1719,L2QSIG=7,L2QAUD=6
```

11. Interoperability Compliance Testing

This Interoperability Compliance Test included feature, functionality and performance testing. Feature and functionality testing examined the XSR router and Matrix V2 switches ability to forward Voice over IP (VoIP) signaling and audio and data without any impact on voice quality, support IP telephone registration via DHCP relay and support IP telephones with attached PCs simultaneously. Performance tests verified that the configuration continued operating under load.

11.1. General Test Approach

Feature functionality was performed manually using point-to-point call scenarios. Calls were made between stations registered with the Avaya IP403 Office Server and the Avaya S8300 Media Server with G700 Media Gateway. While calls were being made, an Agilent Advisor was used to monitor call signaling and audio flows to ensure that proper QoS markers at Layer 2 and Layer 3 were being relayed. Performance testing was done using an IXIA 1600T Performance Analyzer/Traffic Generator and Abacus advanced bulk call generator to stress the QoS functionality of the devices over time.

11.2. Test Results

All feature functionality, and performance test cases passed successfully. A 1-hour test was conducted with 10Mbps of 64-byte UDP traffic saturating the 1.544Mbps WAN link. Two analog stations were configured to continuously place 30-second calls over an IP trunk during the 1-hour period under data load with no call loss.

12. Verification Steps

Perform the following steps to ensure that the configuration is working properly.

Step	Description
1	Check the physical layer of the T1 interface on the XSR router to ensure that there are no problems. Check that no frame loss is occurring. <pre>XSR-1805> show controller t1 0/1/2</pre> T1 0/1/2 is Admin Up and Oper Up. T1 with CSU Interface. Applique type is Full-rate T1. Loopback is set as none. Cablelength long and short 0. Framing is esf, Line Encoding is b8zs, Clock Source is line. Description: None Alarms Detected: None Rx signal level -0.0DB (Accuracy:+/-3DB) high noise floor Channel 0: 64kbps Base rate Data in current interval (397 seconds elapsed): 0 Line Code Violations 0 Path Code Violations 0 Slip Seconds 0 Frame Loss Seconds 0 Line Error Seconds 0 Degraded Minutes 0 Errored Seconds 0 Bursty Error Seconds 0 Severely Error Seconds 0 Unavailable Seconds Total Data (Last 21 hours and 15 minutes): 1 Line Code Violations 0 Path Code Violations 1 Slip Seconds 0 Frame Loss Seconds 1 Line Error Seconds 0 Degraded Minutes 0 Errored Seconds 0 Bursty Error Seconds 0 Severely Error Seconds
2	Check the XSR serial interface. Verify that the line protocol is up and the proper LMI type has been automatically detected.

Step	Description
	<pre> XSR-1805# show interface serial 1/2:0 ***** Serial Interface Stats ***** Serial 1/2:0 is Admin Up / Oper Up Internet address is not assigned Frame Relay Port Statistics: line Protocol = UP Encapsulation FRAME-RELAY IETF, FRAME-RELAY DTE, LMI = AUTO (ANSI) Num PVCs = 1, Total LMI Tx = 7681, LMI Rx = 7680 TX: Packets = 17315, Bytes = 806009 PPS = 0 RX: Packets = 16483, Bytes = 738319 PPS = 0 Approximate Speed = 1536 Kbps Discarded Packets TX/RX = 0/3 Sub Interface 1 State: Admin UP / Oper UP, Num Stations = 1 Configured DLCIs: 110 The name of this device is t1e1 0/1/2:0. Number queued packets 0/32 Other Interface Statistics: ifindex 0 ifType 18 ifAdminStatus 1 ifOperStatus 1 ifInOctets 771285 ifInUcastPkts 16483 ifInNUcastPkts 0 ifInDiscards 0 ifInErrors 0 ifInUnknownProtos 0 ifOutOctets 806009 ifOutUcastPkts 17315 ifOutNUcastPkts 0 ifOutDiscards 0 ifOutErrors 0 ifOutQLen 32 </pre>
3	Check the sub-interface of the serial interface and verify that it is up and operational on the correct DLCI. <pre> XSR-1805# show interface serial 1/2:0.1 Serial 1/2:0.1 is Admin Up Description: Internet address is 100.100.100.1, subnet mask is 255.255.255.0 Sub Interface 1 State: Admin UP / Oper UP, Num Stations = 1 Configured DLCIs: 110 </pre>

Step	Description
4	Verify that the correct QoS policy on the XSR-1805 router. Check that the DLCI mapping is being enforced and check that no tail-drops are occurring for the High and Medium priority queues. XSR-1805# show policy-map interface serial 1/2:0.1 dlci 120 <pre> Serial 1/2:0.1 : DLCI 120 output: p-voice Class c-voice Priority High Bandwidth 300 (kbps)Actual bandwidth 0 (kbps), Policer Drops: 0 Max Qsize: 64, Qsize: 0, Tail drops 0 Tx/NoBuff/Error (544878/0/0) Class PROC Priority Medium Bandwidth 10 (kbps)Actual bandwidth 0 (kbps), Policer Drops: 0 Max Qsize: 64, Qsize: 0, Tail drops 0 Tx/NoBuff/Error (1360/0/0) Class class-default Weighted Fair Queuing Bandwidth 100 (%) Actual bandwidth 0 (kbps), Max Qsize: 64, Qsize: 0, Tail drops 2872150607 Tx/NoBuff/Error (770466495/0/0) Priority Queue for Control Packets : Actual bandwidth 0 (kbps) Max Qsize: 16, Qsize: 0, Tail drops 0 Tx/NoBuff/Error (0/0/0) Fair Queue for Control Packets : Actual bandwidth 0 (kbps) Max Qsize: 32, Qsize: 0, Tail drops 0 Tx/NoBuff/Error (204302/0/0) </pre>
4	Check the routing table in the XSR-1805 router and verify that routes from the X330 WAN module have been learned over the frame relay network. XSR-1805# show ip route <pre> Codes: C-connected, S-static, R-RIP, O-OSPF, IA-OSPF interarea N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2 E1 - OSPF external type 1, E2 - OSPF external type 2 * - candidate default, D - default route originated from default net O 100.100.100.1/32 [108/0129] via 100.100.100.2, Serial 1/2:0.1 C 100.100.100.0/24 [0/0001] directly connected, Serial 1/2:0.1 C 15.4.1.0/24 [0/0001] directly connected, FastEthernet 1.2 C 15.4.0.0/24 [0/0001] directly connected, FastEthernet 1.1 O 10.0.10.0/24 [108/0065] via 100.100.100.2, Serial 1/2:0.1 O 11.0.11.0/24 [108/0065] via 100.100.100.2, Serial 1/2:0.1 </pre>
5	Check the physical layer of the T1 interface on the X330 WAN router module to ensure that there are no problems. Check that there is no frame loss.

Step	Description
	X330WAN-2DS1-1 (super) # show controller 1 T1 1 is up. Cablelength is long gain26 0db. No alarms detected. Framing is ESF, Line Code is B8ZS, Clock Source is Line. channel-group 0 timeslots 1-24 speed 64 Data in current interval (702 seconds elapsed): Line Code Violations, 0 Path Code Violations 0 Slip Secs, 0 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins 0 Errored Secs, 0 Bursty Err Secs, 0 Severely Err Secs, 0 Unavail Secs
6	Check the serial interface to verify that it is up and DTE LMI signaling is functioning. Verify that the correct LMI type was autosensed. X330WAN-2DS1-1 (super) # show interface serial 1:0 Serial 1:0 is up, line protocol is up MTU 1500 bytes, Bandwidth 1536 Kbit Reliability 255/255 txLoad 1/255 rxLoad 1/255 Encapsulation FRAME-RELAY IETF Link status trap disabled LMI enq sent 9651, LMI stat recvd 8400, LMI upd recvd 48, DTE LMI up LMI DLCI 0, LMI type is ANSI Annex D (Auto Detected), frame relay DTE Last input 00:00:00, Last output 00:00:00 Last clearing of 'show interface' counters never. VoIP mode enabled. 5 minute input rate 115 bits/sec, 0 packets/sec 5 minute output rate 94 bits/sec, 0 packets/sec 0 input drops, 0 output drops, 0 unknown protocols 18168 packets input, 850692 bytes 0 broadcasts received, 1 giants 940 input errors, 940 CRC, 234 abort 18963 packets output, 798570 bytes 0 output errors, 0 collisions
7	Check the status of the serial sub-interface. Verify that the serial sub-interface is up and line protocol is up. X330WAN-2DS1-1 (super) # show interface serial 1:0.1 Serial 1:0.1 is up, line protocol is up Internet address is 100.100.100.2, mask is 255.255.255.0 MTU 1500 bytes, Bandwidth 1536 Kbit Encapsulation FRAME-RELAY IETF Link status trap disabled Last input 00:00:04, Last output 00:00:08 Last clearing of 'show interface' counters never. 0 input drops, 0 output drops, 0 unknown protocols 9776 packets input, 726806 bytes 0 broadcasts received, 0 giants 0 input errors, 0 CRC, 0 abort 9318 packets output, 664594 bytes 0 output errors, 0 collisions

Step	Description																																																	
8	Check the status of the PVC on the X330 WAN router module. Make sure that the PVC is active on the correct DLCI. X330WAN-2DS1-1 (super) # show frame-relay pvc Showing 1 PVC PVC Statistics for interface Serial 1:0 (Frame Relay DTE) <table><tr><td></td><td>Active</td><td>Inactive</td><td>Deleted</td><td>Static</td></tr><tr><td>Local</td><td>1</td><td>0</td><td>0</td><td>0</td></tr><tr><td>Unused</td><td>0</td><td>0</td><td>0</td><td>0</td></tr></table> DLCI = 120, USAGE = LOCAL , PVC STATUS = ACTIVE, INTERFACE = Serial 1:0.1 ROLE = Primary , PRIORITY CLASS = None input pkts 9939, output pkts 9290, dropped pkts 0 in bytes 724612, out bytes 662950 in FECN pkts 0 in BECN pkts 0 in DE pkts 0, out DE pkts 0 pvc create time 1d0h, last time pvc status changed 02:25:31 traffic-shaping map-class: my-voip-class cir 768000, bc 96000, be 96000 interval 125 pkts 9290, delayed pkts 0, dropped pkts 0 bytes 662950, delayed byts 0, dropped byts 0 de pre mark is off end-to-end fragmentation is on, fragment size is 200		Active	Inactive	Deleted	Static	Local	1	0	0	0	Unused	0	0	0	0																																		
	Active	Inactive	Deleted	Static																																														
Local	1	0	0	0																																														
Unused	0	0	0	0																																														
9	Check the route table on the X330 WAN router module and verify that routes from the XSR router are showing up via OSPF. X330WAN-2DS1-1 (super) # show ip route Showing 6 rows <table><tr><th>Network</th><th>Mask</th><th>Interface</th><th>Next-Hop</th><th>Cost</th><th>TTL</th><th>Source</th></tr><tr><td>10.0.10.0</td><td>24</td><td>Fabric 1:10</td><td>10.0.10.1</td><td>1</td><td>n/a</td><td>LOCAL</td></tr><tr><td>11.0.11.0</td><td>24</td><td>Fabric 1:11</td><td>11.0.11.1</td><td>1</td><td>n/a</td><td>LOCAL</td></tr><tr><td>15.4.0.0</td><td>24</td><td>Serial 1:0.1</td><td>100.100.100.1</td><td>75</td><td>n/a</td><td>OSPF</td></tr><tr><td>15.4.1.0</td><td>24</td><td>Serial 1:0.1</td><td>100.100.100.1</td><td>75</td><td>n/a</td><td>OSPF</td></tr><tr><td>100.100.100.0</td><td>24</td><td>Serial 1:0.1</td><td>100.100.100.2</td><td>1</td><td>n/a</td><td>LOCAL</td></tr><tr><td>100.100.100.1</td><td>32</td><td>Serial 1:0.1</td><td>100.100.100.2</td><td>65</td><td>n/a</td><td>OSPF</td></tr></table>	Network	Mask	Interface	Next-Hop	Cost	TTL	Source	10.0.10.0	24	Fabric 1:10	10.0.10.1	1	n/a	LOCAL	11.0.11.0	24	Fabric 1:11	11.0.11.1	1	n/a	LOCAL	15.4.0.0	24	Serial 1:0.1	100.100.100.1	75	n/a	OSPF	15.4.1.0	24	Serial 1:0.1	100.100.100.1	75	n/a	OSPF	100.100.100.0	24	Serial 1:0.1	100.100.100.2	1	n/a	LOCAL	100.100.100.1	32	Serial 1:0.1	100.100.100.2	65	n/a	OSPF
Network	Mask	Interface	Next-Hop	Cost	TTL	Source																																												
10.0.10.0	24	Fabric 1:10	10.0.10.1	1	n/a	LOCAL																																												
11.0.11.0	24	Fabric 1:11	11.0.11.1	1	n/a	LOCAL																																												
15.4.0.0	24	Serial 1:0.1	100.100.100.1	75	n/a	OSPF																																												
15.4.1.0	24	Serial 1:0.1	100.100.100.1	75	n/a	OSPF																																												
100.100.100.0	24	Serial 1:0.1	100.100.100.2	1	n/a	LOCAL																																												
100.100.100.1	32	Serial 1:0.1	100.100.100.2	65	n/a	OSPF																																												
10	Verify that IP Telephones correctly register with their associated gatekeeper based on DHCP Server options.																																																	
11	Place calls between all station endpoints over the WAN connection.																																																	

13. Support

Customers should contact Enterasys Networks Technical Support for problems related to the Xpedition Security Router (XSR) or Matrix V2 switch. Enterasys Networks will then determine the nature of the problem and recommend the best plan of action to the customer, whether it is to:

- ❑ Walk the customer through a fix.
- ❑ Fix the problem through remote access.
- ❑ Dispatch, at Enterasys Networks' discretion, on-site technical support.

For technical support on Enterasys Networks XSR Routers and Matrix V2 Switches, contact Enterasys Technical Support at 800-872-8440 or support@enterasys.com.

14. Conclusion

These Application Notes describe the required configuration steps for the Enterasys Networks XSR router and Matrix V2 switch to successfully interoperate with the Avaya™ IP403 Office server, Avaya™ X330WAN module, and Avaya™ S8300 Media Server and G700 Media Gateway in a Small/Medium Branch Office solution. The Enterasys Networks XSR router and Matrix V2 switch were successfully compliance tested.

15. Additional References

Please reference the following documents available at <http://support.avaya.com>

- Installation and Configuration Guide, Avaya P333T-PWR – Power over Ethernet Stackable Switch, Version 4.0
- User's Guide, Avaya X330WAN Multiservice WAN Access Router Module, Software Version 3.12

Please reference the following documents available at <http://www.enterasys.com>

- XSR-1805 User's Guide, Version 6.0
- XSR-1805 CLI Reference Guide, Version 6.0
- Matrix V-Series V2H124-24 Fast Ethernet Switch User Guide

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