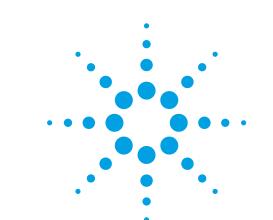


Agilent N2X Setup Multicast VPN Topology QuickTool

Application Note





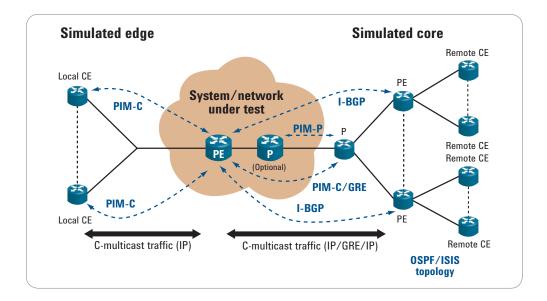


Introduction

The N2X Packets & Protocols software includes a QuickTool utility called *Setup Multicast VPN Topology* that allows emulation of large multicast VPN topologies by configuring both the control and data plane. The SUT must be a PE router that supports either draft-rosen-vpn-mcast-06 or draft-rosen-vpn-mcast-08.

The N2X simulates an edge network (IPv4/IPv6) with PIM sessions using sub-interfaces connected to separate VPN sites with CE routers. The N2X also simulates a core network with remotely connected PE routers and PIM-C instances tunneled over GRE. Each PIM-C instance represents a VRF (IPv4/IPv6) on a simulated PE router.

Up to thirty-two edge ports and thirty-two core ports may be used. Ethernet, ATM and Frame Relay ports are supported on both sides of the network. POS ports are supported only on the core side. The QuickTool configures BGP and PIM protocol parameters including Default and Data MDTs, traffic sources and an IPv4 provider network.



Preconditions

The Setup Multicast VPN Topology QuickTool requires configuration of the link layer for the ports, including any sub-interfaces on edge ports. Optionally, IGP topologies can also be created through the QuickTool or manually to be advertised from the core ports. Standard L3 VPNs may be added to the simulated topology, or a multicast VPN topology may be added to the existing unicast L3 VPN topology.

Required Software

The following Agilent software is needed:

- Agilent N2X Packets & Protocols, version 6.10 or later
- Setup Multicast VPN Topology QuickTool, version 3.05 or later

Summary Procedure

Note: Items underlined must be obtained from the routers/system under test (SUT):

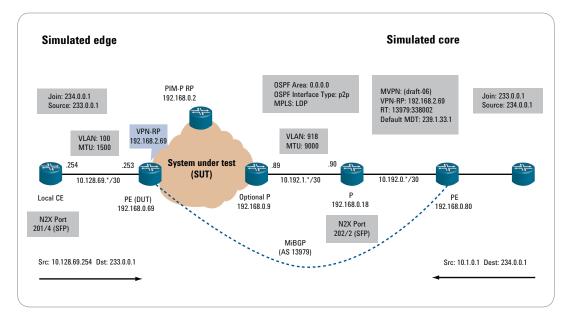
- Launch an N2X Packets & Protocols test session...
 - Select N2X test ports (minimum of two).
 - Set Physical and Link parameters, including N2X Tester and $\underline{\text{SUT IP}}$ address, and $\underline{\text{VLAN ID}}.$
 - (Optional) Enable Jumbo frames for MTU=9000.
- Launch the Setup Multicast VPN Topology QuickTool then complete the following tabs.
- Setup the "Common Parameters" tab...
 - Under "Port Selection" define the Edge port(s) and Core port(s).
 - Select the draft Version and AS number for the BGP core.
 - Specify SUT PE loopback address (may also be a BGP route reflector).
 - Select BGP options.
- Setup the "Local CEs" tab ...
 - Click "Setup Topology" to add Local CEs and specify the Edge port(s) and IP Version.
 - · Specify the Route Target (RT) for the first CE and the RT increment.
 - Enable and define the VPN RP address and specify if the RP is unique per VPN.
 - Specify whether E-BGP will be used with the CE.
- Setup the "Provider Core Topology" tab...
 - Click "Setup Topology" then specify the Core port.
 - Define the N2X Interface (IP) address and <u>SUT Neighbor address</u> for PIM and the IGP.
 - Specify the N2X PIM Instance Router ID and <u>PIM RP address</u> in the connected router(s).
 - Select the IGP (OSPF or ISIS) and set the Area ID.
 - Set the N2X Router ID/system ID for the IGP and Network type if using OSPF.
 - Enable MPLS signaling and select LDP or RSVP.

Summary Procedure

(Continued)

- Setup the "Simulated PEs & Remote CEs" tab...
 - Click "Add PE Routers" to add PEs and Remote CEs, then specify the Core port.
 - Define the number of peers (PEs) and the first PE IP address
 - Define the first IGP link address to be added into the IGP grid in the N2X.
 - In the "VPNv4 VRFs" tab, specify the <u>number of VRFs</u>.
 - Define the Local Pref and first Route Target and RT increment.
 - Specify the First unicast VPN route, increment and if routes are unique.
 - Define <u>VPN RP address</u> and if RPs are unique per VPN.
 - In the "VPNv4 Default MDTs" tab, specify the First default MDT.
 - Select PIM-SM, or PIM-SSM and specify source addresses.
 - (Optional) Set parameters in "VPNv4 Data MDTs".
- Setup the "Local Traffic Sources" tab...
 - Click "Add Sources", specify the Edge port, enable traffic destinations, then select transmit CEs.
 - Specify Source addresses and define Groups addresses.
 - Define StreamGroup parameters
- Setup the "Remote Traffic Sources" tab...
 - Click "Add Sources", specify the Core port, select transmit PEs, and specify transmit options.
 - Specify Groups addresses and groups per VRF options.
 - Define StreamGroup parameters
- Setup the "Join PIM Group pools" tab...
 - Define Local CE Edge ports, VRFs, Group addresses to join, and join options.
 - Define Remote CE Core ports, VRFs, Group addresses to join, and joinoptions.
- Start routing engine on main N2X GUI
- Join/Leave PIM groups (from main N2X GUI)
- Start/stop traffic and run tests...

Basic MVPN Topology



Required Parameters (Basic MVPN Topology)

Parameters listed in **bold** are required while other parameters are shown un-bold or left blank.

Table 1. N2X port parameters

N2X port parameters			
Edge port(s): 201/4	Tester IP: 10.128.69.254/30	SUT IP: 10.128.69.253/30	VLAN: 100
Core port(s): 202/2	Tester IP: 10.192.1.90/30	SUT IP: 10.192.1.89/30	VLAN: 918
(Ontional): Jumboframes (Y/N): (checked) (for Core nort 202/2)			

(Optional): Jumboframes (Y/N): (checked) (for Core port 202/2)

MVPN QuickTool parameters			
Common			
Edge ports: 201/4		Core ports: 202/2	
IP Version: IPv4		Draft version: draft-06	
AS Number: 13979		SUT PE loopback (or RR): 192	168.0.69
Advertise VRF via iBGP (Y/N): (checked)		Use Type 2 2-Byte ASN (Y/N): (checked)	
If draft-08 \rightarrow Advertise MDT in BGP open (Y/N):		AFI:	SAFI:
Local CEs			
Edge port: 201/4	First route target: 13979:33800	2	Increment:
Define VPN RP address (Y/N): (checked)		Unique RP (Y/N):	
First RP address: 192.168.2.69		Increment:	
Define unicast addresses advertised by E-BGP (from CE) (Y/N):		′N):	
First unicast VPN route:		Increment:	
Number of routes per VPN:		Unique routes per VPN (Y/N):	
First tester AS number		Unique tester AS per VPN (Y/	(N):

Table 2. Provider core topology

Provider core topology					
Core port : 202/2					
Interface address (N2X): 10.192	1.90	Neighbor address (S	SUT): 10.192. 1	1.89	
PIM-P router ID (N2X): 10.192.1	90	PIM-P RP address (S	SUT): 192.168	B.O.2	
Use IGP (Y/N): (checked)	OSPF -or- ISIS: OSPF	Area ID: 0.0.0.0			
SUT router ID (SUT): 192.168.0.9		Tester router ID (N2	X): 10.192.1.	90	
OSPF network type: Point-To-Pe	pint				
Use MPLS (Y/N): (checked)		LDP -or- RSVP: LDP			
	Simulated PEs an	nd remote CEs			
Core port: 202/2		Number of peers (Pl	Es) : 1		
First IP address (PE): 192.168.0.	80	Increment:			
First IGP link address (OSPF): 12	2.1.1.0	Increment:			
S	imulated PEs and remot	e CEs → VPNv4 V	′RFs		
Number of VRFs: 1		Local pref PA:			
First route target: 13979:338002		Increment:			
First unicast VPN route: 10.1.0.1		Increment:			
Unique VPN routes (Y/N):		Increment per VPN:			
Define VPN RP address (Y/N): (checked)		First RP address: 192.168.2.69			
Unique RP each VPN (Y/N):		Increment per VPN:			
Simulated PEs and remote CEs \rightarrow VPNv4 default MDTs					
First default MDT: 239.1.33.1 Increment:					
Join default MDT group (Y/N): (checked)	PIM-SM -or- PIM-SS	SM: PIM-SM	(selected)	
PIM-SSM: Use SUT IP address as source -or- Use IP address as source or- Manually configure IP source addresses					
Simulated PEs and remote CEs \rightarrow VPNv4 data MDTs					
Define data MDTs (Y/N):	First Data MDT range:			Incremen	t:
Data MDTs per VRF:					
Enable data MDT (S,G) group po	ol (Y/N):	Join data MDT (S,G)	group pool	(Y/N):	
Use SUT (or RR) IP address as s					esses
	Local traffic	sources	-		
Edge port: 201/4					
Include edge ports as destinatio	ns (Y/N): (unchecked)				
Transmit from all CEs -or- Trans					
Selected CEs:					
Use CE link address -or- Use AL	L routes advertised by E-BGP	-or- Use host ad	dresses on E	-BGP netwo	rks incr
First group address: 233.0.0.1		Increment:		Groups pe	
Unique groups each CE (Y/N):		Increment:			
Create send/receive register (S,	G) group pools (Y/N): (check	(ed)			
Name prefix:	IP packet length:	Min:	Max:		Incr:
IP bandwidth:		% of maximum -or- I	Packets/sec	-or- Mb/sec);

Table 3. Remote traffic sources

Remote traffic sources				
Core port: 202/2				
Transmit from all PEs (Y/N): (cf	necked)	PE router:		
Transmit from all VRFs -or- Tran	smit from selected VRFs:			
Selected VRFs:				
First group address: 234.0.0.1		Increment:	Increment: Groups per VRF: 1	
Unique groups each VRF (Y/N):		Increment:		
Unique groups each PE (Y/N):		Increment:		
Use data MDT (Y/N):		Data MDT group addres	s:	
Name prefix	IP Packet Length:	Min:	Лах:	Incr:
IP bandwidth:		% of maximum -or- pac	kets/sec -or-	Mb/sec:
Join PIM group pools (local CE)				
Local CE -or- Remote CE: Local CE Edge Port: 20¼				
All VRFs -or- Selected VRF:		Selected VRFs:		
First group address: 234.0.0.1		Increment:	Groups per local CE: 1	
Unique groups for each local CE (Y/N):		Increment:		
Join group pool upon creation (Y/N):		Enable (S,G) joins (Y/N):		
Include sources from other edge	e ports (Y/N):	Define multiple group address ranges (Y/N):		
Number (of address ranges):		Increment:		
	Join PIM group pools	(remote CE)		
Local CE -or- Remote CE: Remote CE (selected) Core Port: 202/2				
All PE routers (Y/N): PE router:				
First group address: 233.0.0.1		Increment:	Groups p	er remote CE: 1
Unique groups for each remote	CE (Y/N):	Increment:		
Join group pool upon creation (Y/N): Enable (S,G) joins (Y/N):				

Detailed Procedures (Basic MVPN Topology)

These procedures describe the steps to configure the Basic Multicast VPN Topology described above.

The N2X test ports used in these detailed procedures are simulated and correspond to the actual test ports as follows:

Edge port 201/4 = 6501/1 and Core port 202/2 = 6501/2

N2X packets & protocols

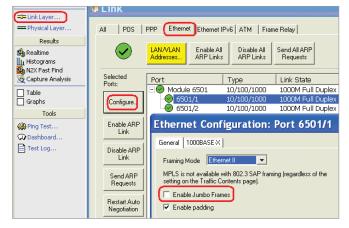
- 1. Launch an N2X test session and select two tri-rate Ethernet test ports.
- 2. In "Physical Layer" select interface type of SFP

Physical Layer	
Results	🗏 Physical 📃 📘
Realtime Histograms N2X Fast Find Capture Analysis Table Caseta	All SONET PCS VSR Turn All Lasers Off Lasers Off
☐ Graphs Tools Ping Test Ø Dashboard ☐ Test Log	Selected Ports: Port Type L Clock So Port Mode MediaType Configure Module 6501 10/100/1000 on Internal Full Duplex SFP Turn Lasers Off Module 6501/2 10/100/1000 on Internal Full Duplex SFP Turn Lasers Off Clock Source Internal Full Duplex SFP Clock Source Internal Restricted selection applies to clock source and port mode due to the ports selected. SFP Media Type SFP Mode Full Duplex Mode Media Type SFP Mode Mode

3. In "Link Layer" set N2X Tester and SUT IP address, and VLAN ID.

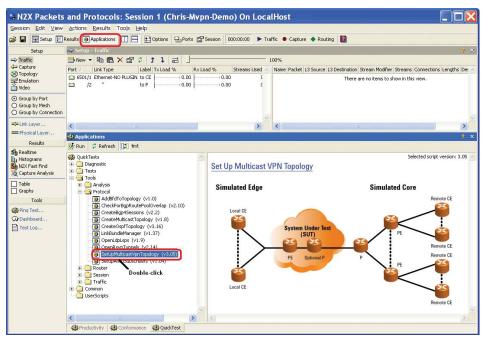
E Link Layer	📱 Link	
Results	AI POS PPP Cthomet Elveriel IPv6 ATM Frame Relay	
Realtime III Histograms N2X Fast Find Capture Analysis	LUNATIAN Engle Al APPLinka Send Al ARP Request APPLinka Send Al ARP Request	
Table	Selected Port Type Link State Auto-Negoti IPv4 SUT IPv4 Tester Framing A # VL # Ad Err.	
Graphs	Control Contro Control Control Control Control Control Control Control Control Co	
Tools	Configue	
Ping Test Dashboard Test Log	Ende APP	×
E rest Log	Disable APP Link Send AIARP Requests VLANID Image: Disable APP Propulsion Disable APP Image: Disable APP Image: Disable APP Image: Disable APP Image: Disable APP VLANID Image: Disable APP	0x8100
	Service Port ASP SUT Interface VLAN ID Ether Type Traffic First Address SUT IPAddees 10 - 128 - 65 - 553 7 3	No SUT
	Negatiation 10 10.128 6/9.253/20 10.00 10.128 6/9.254 First Address 10 138.69 264.7 10 R Negatiation Executive <	7 Default
	Lease Control Control Num Addetises 1 Farmer F-4 10.192.1.89/30 If 918 10.192.1.90 Modelier 1 / I	
	Last Address 1012888254 / 3	
	Requests First MAC Addr 0000 04-80-45 FE 🔽 Default	
	🗂 Generale Unique MAC Addresses	
	DK Canal	Help

4. (Optional) Enable Jumbo frames for MTU=9000.



Multicast VPN QuickTool launch and common parameters

 Launch the Setup Multicast VPN Topology QuickTool by clicking on "Applications" then navigating the QuickTests menu to Tools → Protocol, then double-click "SetUpMulticastVpnTopology"...



2. Click on the "Configure Tool" tab the begin the "Common Paramters" tab...

🚳 Set Up Multicast VPN Topology	
Eile <u>H</u> elp	
Overview Description Configure Session Configure Tool Test	Log
	mulated PEs & Remote CEs 】Local Traffic Sources 】Remote Traffic Sources 】Join PIM Group Pools 】
Port selection Edge ports: 101/1 101/2	Version: draft-rosen-vpn-mcast-08.txt
	AS number: 100
Core ports: 102/1 102/2	SUT PE loopback address (or route reflector): 192.18.1.1
	Advertise VRFs via iBGP
	☑ Use Type 2 2-Byte ASN
IP version selection	Advertise MDT capability in BGP open message
₩ IPv4 F IPv6	AFI: 1 SAFI: 66
	Back < Next > Exit
Test stopped	Version 3.05 Tol/Tk 8.3.4

3. Under "Port Selection" define the Edge ports that will emulate CEs and Core ports that will emulate PEs...

- Port selectio	on
Edge ports:	6501/1
Core ports:	6501/2

4. Select the draft Version 6 (draft-08 advertises MDT AFI/SAFI which are not needed in this example). Note that the "Advertise VRFs via iBGP" and "Use Type 2 2-Byte ASN" checkboxes are enabled by default...

Multicast VPN implementation options	
Version: draft-rosen-vpn-mcast-06.	
AS number: 100	
SUT PE loopback address (or route reflector): 192.18.1.1	
Advertise VRFs via iBGP	
☑ Use Type 2 2-Byte ASN	
🗖 Advertise MDT capability in BGP open message	
AFI: 1	
SAFI: 66	

5. Specify the <u>AS number</u> for the BGP core and <u>SUT PE loopback</u> address, which may also be a BGP route reflector, that peers with the emulated PEs...

AS number:	13979	
SUT PE loopback address (or route reflector):	192.168.0.69	

6. Click Next to complete "Common Parameters" tab...

🖏 Set Up Multicast VPN Topology	
Eile Help	
	t Log
Port selection	Multicast VPN implementation options Version: draft-rosen-vpn-mcast-06.bt
Edge ports: 6501/1 Core ports: 6501/2	AS number: 13379 SUT PE loopback address (or route reflector): 192.168.0.65
IP version selection	Use Type 2 2:Byte ASN Advertise MDT capability in BGP open message
№ IPv4 № IPv6	AFI: 1 SAFI: 66
	Back < Next > Exit
Test stopped	Version 3.05 Tcl/Tk 8.3.4

7. The next pop-up allows cleanup from previous configurations...

🗖 Plea	ase confirm
2	Do you want the session cleaned up (all traffic, BGP and PIM sessions, VPN definitions, multicast group pools and source pools removed) before continuing?
	Yes No Cancel

Multicast VPN QuickTool local CEs parameters

1. Begin setup of the "Local CEs" tab by clicking on the "Add CE Routers" button. In this example only one CE will be added. However larger topologies may add CEs on several ports and on sub-interfaces (VLANs, PVCs, etc.) within ports that have been setup prior to running the QuickTool...

🐁 Set Up Multicast VPN Topology (server: LocalHost)
Eile Help
Overview Description Configure Session Configure Tool Test Log
Common Parameters Local CEs Provider Core Topology Simulated PEs & Remote CEs Local Traffic Sources Remote Traffic Sources Join PIM Group Pools
- Local CE routers
Edge Port Number Of CEs Sub-interface Range First RT / Increment First IP Address Last IP Address First RP Address RP VPN Incr Last RT E-BGF
Add Edit Remove CE Routers CE Routers CE Routers
Back < Next> Exit
Test stopped Version 3.05 Tcl/Tk 8.3.4

2. Start by selecting the Edge port...

Add CEs (PIM-C Instances)			×
Local CE			
IP version:		• IPv4 • IPv6	
Edge port:		6501/1 💌	
First route target:		100:1	
Increment:		0:1	
Define VPN RP address			
First RP address:			
Г	Unique RP per VPN	Increment /:	
🗌 🔲 Define unicast addresses ad	vertised by E-BGP		
First unicast VPN route:			
Number of routes per VPN: 100			
Г	Unique routes per VPN	Increment 7:	
First tester AS number: 2000	D 📕 🗖 Unique teste	r AS per VPN (incr by 1)	
Sub-interface			
vlan:1			
			Select
			Select
			None
		-	
	OK Cancel		

3. Specify the <u>First route target</u> and RT Increment. Note that this value will be re-used in other parts of the setup...

First route target:	13979:33800
Increment:	0:1

4. Enable the Define VPN RP address and enter the <u>First RP address</u>. For this example, leave the Unique RP per VPN box unchecked, but this will allow incrementing the RP with multiple VPNs. The VPN RP address represents the customer RP in a real CE device, where each can be a sub-interface on a single CE device...

Define VPN RP address		
First RP address:	192.168.2.69	
	Unique RP per VPN	Increment /:

5. Optionally the definition of unicast addresses can be enabled (not used in this example) in order to advertise via E-BGP from Local CE to SUT PE. If enabled, the unicast routes are specified that will act as traffic source addresses and allow scaling the number of routes per VPN, either uniquely or not, and with unique AS numbers and selected sub-interfaces...

[Define unicast addresses advertised by E-BGP				
	First unicast VPN route:				
	Number of routes per VPN: 100				

- 6. Click OK to complete "Add CEs (PIM-C Instances)" ...
- 7. Click Next to complete "Local CEs" tab...

🐁 Set Up Multicast VPN Topology (server: LocalHost)
Eile Help
Overview Description Configure Session Configure Tool Test Log
Common Parameters Local CEs Provider Core Topology Simulated PEs & Remote CEs Local Traffic Sources Remote Traffic Sources Join PIM Group Pools
Edge Port Number Of CEs Sub-interface Range First RT / Increment First IP Address Last IP Address First RP Address RP VPN Incr Last RT A
Add Edit Remove
CE Routers CE Routers
Back < Next > Exit
Version 3.05 Tcl/Tk 8.3.4

Multicast VPN QuickTool provider core topology parameters

1. Begin setup of the "Provider Core Topology" tab by clicking on the "Setup Topology" button...

🖏 Set Up Multicast VPN Topology (server: LocalHost)				
Eile Help				
Overview Description Configure Session Configure Tool Test Log				
Common Parameters Local CEs Provider Core Topology Simulated PEs & Remote CEs Local Traffic Sources Remote Traffic Sources Join PIM Group Pools				
Provider core topology				
Core Port Interface Address Router ID Neighbor Address RP Address IGP Area ID SUT Router ID Tester Router ID Tester System ID MPLS Prote				
Setup Edit Remove Topology Topology Topology				
Back (Next> Exit				
Version 3.05 Tc//Tk 8.3.4				

2. CONTINUE HERE-----Start by selecting the Core port...

Setup Topology	×			
- Provider core topology-				
Core port:	6501/2			
Interface address:	10.192.1.90			
Neighbor address:	10.192.1.89			
PIM-P instance				
Ro	uter ID: 10.192.1.90			
RP	Paddress: 10.192.1.89			
Use IGP				
🖸 OSPF	C ISIS			
Area ID:	0.0.0.0			
SUT router ID:	192.168.0.69			
Tester router ID:	10.192.1.90			
Network type:	Broadcast 🔽 🔽 Default			
C Use MPLS				
OK Cancel				

3. Define the N2X Interface (IP) address and <u>SUT Neighbor address</u> for PIM and the IGP...

Interface address:	10.192.1.90
Neighbor address:	10.192.1.89

4. Specify the N2X PIM Instance Router ID and PIM RP address in the connected router(s)...

PIM-P instance-		
	Router ID:	10.192.1.90
	RP address:	192.168.0.2

5. Select OSPF, set the <u>Area ID</u>, set the N2X Router ID and OSPF Network type. If "Use IGP" is not checked, then static routes to the simulated PE routers and the P router will need to be defined on the directly connected SUT interface.

🔽 Use IGP		
OSPF	C ISIS	
Area ID:	0.0.0.0	
SUT router ID:	192.168.0.9	
Tester router ID:	10.192.1.90	
Network type:	Point-to-point	💌 🗖 Default

6. Enable MPLS signaling and select LDP (or RSVP). Note, MPLS is only required if unicast VPN traffic is also required. To create a Multicast VPN topology, MPLS is not required.

Use MPLS			
	IDP	C RSVP	

- 7. Click OK to complete "Setup Topology"...
- 8. Click Next to complete "Provider Core Topology" tab...

🗞 Set Up Multicast VPN Topology (server: LocalHost)
Ele Help
Dverview Description Configure Session Configure Tool Test Log
Common Parameters Local CEs Provider Core Topology Simulated PEs & Remote CEs Local Traffic Sources Remote Traffic Sources Join PIM Group Pools
Provider core topology
Core Port Interface Address Router ID Neighbor Address RP Address IGP Area ID SUT Router ID Tester Router ID Tester System ID MPLS I
Setup Edit Remove Topology Topology Topology
Back K Next Exit
Version 3.05 Tcl/Tk 8.3.4

Multicast VPN QuickTool simulated PEs and remote CEs parameters

1. Begin setup of the "Simulated PEs and Remote CEs" tab by clicking on the "Add PE Routers" button...

🚳 Set Up Multicast VPN Topology (server: LocalHost)
Eile Help
Overview Description Configure Session Configure Tool Test Log
Common Parameters Local CEs Provider Core Topology Simulated PEs & Remote CEs Local Traffic Sources Remote Traffic Sources Join PIM Group Pools
PE routes (BGP peers) PE routes (BGP peers)
Core Port PE IP Address Number Of VPNv4 VRFs First VPNv4 RT / Increment First Unicast VPNv4 Route Increment Per VPN First VPNv4 RP Address
Add Edit Remove
PE Routers PE Routers
Back < Next > Exit
Version 3.05 Tc//Tk 8.3.4

2. Start by selecting the Core port...

Add PE Routers
PE routers
Core port: 6501/2 💌
Number of peers: 2
First IP address: 192.18.1.2 Increment /: 24
First IGP link address (OSPF): 12.1.1.0 Increment /: 24
AS number: 13979
SUT (or route reflector) IP address: 192.168.0.69
VBF version: VBF version:
Remote CEs
VPNv4 VRFs VPNv4 Default MDTs VPNv4 Data MDTs VPNv6 VRFs VPNv4
VRFs
Number of VRFs: 2
Local preference path attribute: 100
First route target: 100:1 Increment /: 0:1
Last route target: 100:2
Unicast VPN route
First unicast VPN route: 10.1.0.1
Increment /: 24
✓ Unique VPN routes Increment per VPN /: 24
Define VPN BP address
First RP address:
Unique RP for each VPN Increment per VPN /:
OK

3. Set the number of peers (PEs) to one and the first PE IP address and define the first IGP link address to be added into the IGP grid in the N2X...

Number of peers:	1		
First IP address:	192.168.0.80	Increment /:	24
First IGP link address (OSPF):	12.1.1.0	Increment /:	24

4. Click on the "VPNv4 VRFs" tab...

[Remote CEs			
	VPNv4 VRFs	VPNv4 Default MDTs	│ VPNv4 Data MDTs] 🗸

5. Specify the number of VRFs, the Local preference, First route target and Increment...

Number of VRFs:	1	
Local preference path attribute:	100	
First route target:	13979:33800	Increment /: 0:1
Last route target:	13979:33800	

6. Specify unicast routes to be advertised by the CE, set the Increment, if the routes are unique and the increment per VPN (increments only apply if Number of VRFs is more than one)...

Unicast VPN route			
First unicast VPN route:	10.1.0.1		
Increment /:	24		
Unique VPN routes		Increment per VPN /:	24

7. Enable VPN RP address, then define the <u>first RP address</u> (enable unique RP for each VPN if more than one)...

Define VPN RP address			
First RP address:	192.1	68.2.69	1
🔲 Unique RP for each	VPN	Increment p	er VPN 7:

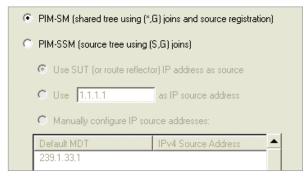
8. Click on the "VPNv4 Default MDTs" tab...

F	Remote CEs-							
	VPN∨4 VRFs	VPNv4 Defau	ult MDTs) V	PN∨4 Da	ata MDTs	VPN	/6 VRFs	VPNvt
	— Default MD)Ts						
	First	default MDT:	239.1.33.1		Increme	ent 7:	32	
	Last	default MDT:	239.1.33.1					
		Join default MD	T group pool					
	۲	PIM-SM (shared	l tree using (*,	G) joins	and source	registra	ation)	
	С	PIM-SSM (sour	ce tree using (S,G) joir	ns)			
		🖸 Use SUT (o	r route reflect	or) IP ad	ldress as so	urce		
		C Use 1.1.1	.1	as IP s	source addr	ess		
		C Manually co	onfigure IP sou	irce add	resses:			
		Default MDT 239.1.33.1		IPv4 S	iource Addr	ess		

9. Define the First default MDT (increment does not apply)...

First default MDT:	239.1.33.1	Increment /:	32
Last default MDT:	239.1.33.1		

10. Select PIM-SM (or PIM-SSM and select source address method)...



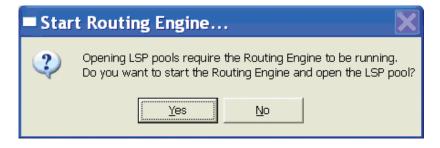
11. Select PIM-SM (or PIM-SSM and select source addresses) then click on "VPNv4 Data MDTs"...

Remote CEs	
VPNv4 VRFs VPNv4 Default MDTs VPN	Iv4 Data MDTs] VPNv6 VRFs= VPNv()
Default MDTs	
First default MDT: 239.1.33.1	Increment /: 32
Last default MDT: 239.1.33.1	
Join default MDT group pool	
 PIM-SM (shared tree using (*,G) 	joins and source registration)
O PIM-SSM (source tree using (S,	G) joins)
 Use SUT (or route reflector) 	IP address as source
O Use 1.1.1.1	as IP source address
C Manually configure IP source	e addresses:
Default MDT I	Pv4 Source Address
239.1.33.1	

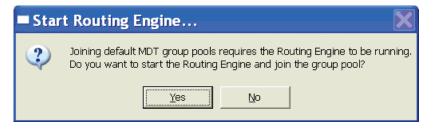
12. The "VPNv4 Data MDTs" parameters are not used in this example, so click OK to complete "Add PE Routers"...

Remote CEs VPNv4 VRFs │ VPNv4 Default	t MDTs (VPNv4 Data MDTs) VPNv6 VRFs VPNv4
Data MDTs	
🔲 Define data MDT:	s
First data MDT range:	239.1.1.0 Increment /: 24
Data MDTs per VRF:	1
Last data MDT range:	239.1.1.0 ~ 239.1.1.0
📕 Enable data MDT	(S,G) group pool
📕 Join data MDT (S	,G) group pool
💿 Use SUT (or n	route reflector) IP address as source
🔿 Use 1.1.1.1	as IP source address
Manually conf	figure IP source addresses:
Data MDT	IPv4 Source Address
239.1.1.0	•
	Concel

13. The next pop-up allows the Routing Engine to be started. Click "Yes" to start all protocols and open LSPs or click "No" to start manually in the N2X GUI...



14. A similar pop-up appears for the default MDT...



15. Click Next to complete "Simulated PEs and Remote CEs" tab...

🚳 Set Up Multicast	VPN Topology (server: LocalHo	ost)		
<u>Eile H</u> elp					
Overview Description Config	ure Session Configure Tool	Test Log			
Common Parameters Local	CEs Provider Core Topolo	Gui Simulated PEs & Remo	e CEs] Local Traffic Source	Bemote Traffic S	ources] Join PIM Group Pools]
PE routers (iBGP peers)		907	T Eocal Hallie Source	a prionote ridine o	ources coint int croup r cois
	Number Of VPNv4 VRFs	First VPNv4 RT / Increment	First Unicast VPNv4 Route	In second Day (DN	First VPNv4 RP Address
6501/2 192.168.0.80		13979:338002 / 0:1	10.1.0.1 / 24	24	192.168.2.69
					-
			Add	Edit	Remove
			PE Routers.		
				Back <	Next> Exit
					Version 3.05 Tcl/Tk 8.3.4
					Persion 3.00 [TCPTK 0.3.4

Multicast VPN QuickTool local traffic sources parameters

1. Begin setup of the "Local Traffic Sources" tab by clicking on the "Add Sources" button...

🛎 Set Up Multicast VPN Topology (server: LocalHost)
Eile Help
Overview Description Configure Session Configure Tool Test Log
Common Parameters Local CEs Provider Core Topology Simulated PEs & Remote CEs Local Traffic Sources Remote Traffic Sources Join PIM Group Pools
Local traffic
Edge Port Number Of Sources Sub-interface Range CEs Number Of CEs First Group Address Groups Per CE Unique Groups Per CE Stream Group H
Add Remove Sources
Sources
Back < Next > Exit
Version 3.05 Tcl/Tk 8.3.4
Version 5.03 TOP IK 6.5.4

2. Start by selecting the edge port...

Add Local Traffic Sources	
Local traffic source	
IP version	Source addresses
	Use CE link address
	C Use ALL routes advertised by E-BGP
	C Use 1 host addresses on E-BGP advertised networks; Increment on a / 32 prefix
Select source CEs	Group addresses
Select edge port: 6501/1	First group address: 239.18.1.2
Include edge ports as destinations	Increment /: 32
Transmit from all CEs	Groups per CE: 10
C Transmit from selected CEs	Unique groups for each CE Increment /: 24
Route Target Sub-interface	Create Send/Receive Register (S.G) group pools
	Stream groups
	Name prefix: IPv4LocalTraffic
	Name prefix: IPv4LocalTraffic IP packet length: Fixed Min: 128 Max Incr. (bytes)
	IP bandwidth: 10 % of maximum V
	, , , , , , , , , , , , , , , , , , , ,
L	OK Cancel

3. Disable "Include edge ports as destinations" and select "Transmit from all CEs". Note, if there is only a one edge port as in this example, the option "Include edge ports as destinations" is irrelevant. Enable this option only if you have more than one edge port in your test topology and you intend to receive traffic on the other edge ports.

Select source CEs
Select edge port: 6501/1
Include edge ports as destinations
Transmit from all CEs
Transmit from selected CEs

4. Source addresses use CE links since E-BGP was previously not enabled at the CE in this example...



5. Define the first group address, set the Groups per CE to one, then enable "Create Send/ Receive Register..."

Group addresses		
First group address:	233.0.0.1	
Increment /:	32	
Groups per CE:	1	
🔲 Unique groups for a	each CE	Increment /: 24
✓ Create Send/Rece	ive Register (S,G) group pools	

- 6. After reviewing Stream group parameters (unchanged in this example), click OK to complete "Add Local Traffic sources"...
- 7. Click Next to complete "Local Traffic Sources" tab...

🚳 Set Up Multicast VPN Topology (server: LocalHost)
Eile Help
Overview Description Configure Session Configure Tool Test Log
Common Parameters Local CEs Provider Core Topology Simulated PEs & Remote CEs Local Traffic Sources Remote Traffic Sources Join PIM Group Pools
Edge Port Number Of Sources Sub-interface Range CEs Number Of CEs First Group Address Groups Per CE Unique Groups Per CE Stream
6501/1 1 vlarc 1 13979:338002 1 (IPv4) 233.0.0.1 / 32 1 No - Overlapping 1
Add Remove
Sources Sources
Back < Next> Exit
Version 3.05 Tcl/Tk 8.3.4

Multicast VPN QuickTool remote traffic sources parameters

1. Begin setup of the "Remote Traffic Sources" tab by clicking on the "Add Sources" button...

🚳 Set Up Multicast VPN Topology (server: LocalHost)
Eile Help
Overview Description Configure Session Configure Tool Test Log
Common Parameters Local CEs Provider Core Topology Simulated PEs & Remote CEs Local Traffic Sources Remote Traffic Sources Join PIM Group Pools
Common admeters Ecolar cos monder que reputigo principales reservembre cos Ecolarmanio sources monder name ecolación principal de la Remote traffic
Core Port PE IP Address Number Of Sources VRFs Number Of VRFs First Group Address Groups Per VRF Unique Groups Per VRF MDT Address S
Add Remove
Sources Sources
Back < Next> Exit
Version 3.05 Tcl/Tk 8.3.4

2. Start by selecting the Core port...

Add Remote Traffic Sources	
Remote traffic source	
IP version IPv4 C IPv6	Group addresses
Select source VRFs	First group address: 239.18.1.2
Core port: 6501/2	Increment /: 32
Transmit from all PEs	Groups per VRF: 10
PE router: 192.168.0.80	Unique groups for each VRF Increment /: 24
 Transmit from all VRFs 	Unique groups for each PE Increment /: 16
C Transmit from selected VRFs	🔲 Use data MDT
Route Target	Data MDT group address: 1st
	Stream groups Name prefix: IPv4RemoteTraffic IP packet length: Fixed Min: 128 Max. Incr. (bytes)
	IP bandwidth: 10 % of maximum
	OK Cancel

3. Enable "Transmit from all PEs" and select "Transmit from all VRFs"...

— Select sou	rce VRFs
Core port:	6501/2
🔽 Trans	mit from all PEs
PE router:	192.168.0.80
Trans	mit from all VRFs
C Trans	mit from selected VRFs

4. Define the first group address then set the Groups per VRF to one...

First group address: 234.0.0.1		
Increment /: 32 Groups per VRF: 1		
Unique groups for each VRF	Increment /:	24
Unique groups for each PE	Increment /:	16
Use data MDT		
Data MDT group address: 1st	<u> </u>	

5. Click Next to complete "Remote Traffic Sources" tab...

🚳 Set Up Multicast VPN Topology (server: LocalHost)
Eile Help
Overview Description Configure Session Configure Tool Test Log
Common Parameters Local CEs Provider Core Topology Simulated PEs & Remote CEs Local Traffic Sources Remote Traffic Sources Join PIM Group Pools
Core Port PE IP Address Number Of Sources VRFs Number Of VRFs First Group Address Groups Per VRF Unique Groups Per VRF MDT Ad
6501/2 192.168.0.80 1 13979.338002 1 (IPv4) 234.0.0.1 / 32 1 No · Overlapping Default
Add Remove Sources Sources
Back < Next > Exit
Version 3.05 Tcl/Tk 8.3.4

Multicast VPN QuickTool join PIM group pools parameters

1. Begin setup of the "Join PIM Group Pools" tab by clicking on the "Add Group Pools" button...

Elle Help Overview Description Configure Session Configure Tool Test Log Common Parameters Local CEs Provider Core Topology Simulated PEs & Remote CEs Local Traffic Sources Remote Traffic Sources Join PIM Group Pools Group membership profiles Port Group State Join Sent From PE IP Address VRFs Number Of VRFs First Group Address Groups Unique Groups Increment Per VRF Join Type
Common Parameters Local CEs Provider Core Topology Simulated PEs & Remote CEs Local Traffic Sources Remote Traffic Sources Join PIM Group Pools Group membership profiles
Group membership profiles
Group membership profiles
Group membership profiles
Add Remove Join Prune Group Pools Group Pools Group Pools Group Pools
Back < Next> Exit
Version 3.05 Tcl/Tk 8.3.4

2. Start by selecting the "Local CE" and then the Edge port...

Add Group Pools	X
PIM Group Pool	
IP version	Group addresses to join
IPv4 C IPv6	First group address: 239.18.1.2
Send joins from	Increment /: 32
Local CE C Remote CE	Groups per local CE: 10
Edge port: 6501/1	Unique groups for each local CE Increment /: 24
All PE routers	☑ Join group pool upon creation
PE router:	✓ Enable (S,G) joins
Select VRF	Include sources from other edge ports
 All C Select 	Define multiple group address ranges
Route Target Sub-interface	Number: 2 Increment /: 16
	Cancel

3. Define the "First group address" and set "Groups per local CE" then click OK to complete "Add Group Pools" for the Local CE...

— Group addresses to join —				
First group address:	234.0.0.1			
Increment /:	32			
Groups per local CE:	1			
🔲 Unique groups for ea	ch local CE	Increment /:	24	
🔽 Join group pool upon	creation			
🔽 Enable (S,G) joins				
Include sources from other edge ports				
🔲 Define multiple group	address ranges			
Number:	2	Increment /:	16	

4. The next pop-up will appear if the Routing Engine was not previously started. Click "Yes" to start all protocols and open LSPs or click "No" to start manually in the N2X GUI...



5. Continue setup of the "Join PIM Group Pools" tab by clicking on the "Add Group Pools" button again...

🗞 Set Up Multicast VPN Topology (server: LocalHost)
Eile Help
Overview Description Configure Session Configure Tool Test Log
Common Parameters Local CEs Provider Core Topology Simulated PEs & Remote CEs Local Traffic Sources Remote Traffic Sources Join PIM Group Pools
Group membership profiles
Port Group State Join Sent From PE IP Address VRFs Number Of VRFs First Group Address Groups Unique Groups Increment Pe
Four choop state source form the the Address of Vens National Vens instantiop address attracts for the attraction of the
Add Remove Join Prune Group Pools Group Pools Group Pools Group Pools
Back < Next > Exit
Version 3.05 Tcl/Tk 8.3.4

6. Select the "Remote CE" this time. The Core port and other settings can remain at defaults...

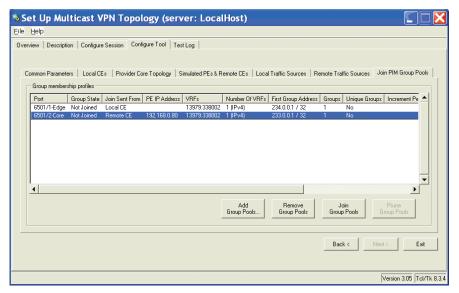
Send joins from	
C Local CE	Remote CE
Core port:	6501/2
All PE routers	
PE router:	192.168.0.80

7. Define the "First group address" and set "Groups per local CE" then click OK to complete "Add Group Pools" for the Remote CE...

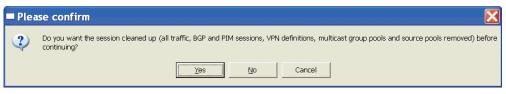
 Group addresses to join - 			
First group address:	233.0.0.1		
Increment /: Groups per remote CE:	32 1		
Unique groups for ea	ach remote CE	Increment /:	24
🔽 Join group pool upor	n creation		
🔽 Enable (S,G) joins			
📕 Define multiple group	o address ranges		
Number:	2	Increment 7:	16

 This complete the steps to setup the Multicast VPN Topology. The QuickTool can now either be minimized or closed. If you intend to continue to modify your mVPN configuration, keep the QuickTool open and return to it and edit the configuration as required – the new Multicast VPN topology will be re-created in the main N2X GUI.

CAUTION: If you intend to close the QuickTool, read the next step prior to closing the QuickTool...



9. When closing the QuickTool click "No" in the pop-up so the topology will not be deleted in the main N2X GUI...



10. Once the Routing Engine and Traffic have been started, the GUI should show all protocols in functional states and no loss in the Results statistics.

Note: Some protocol operations may need to be performed, including opening BGP and joining PIM groups...

🔒 🔚 😰 Setup 🛛	Results 📵 Applications 🔲 📄 🐮 🔾	tions	Ports	Session 000	:04:09 🕨 Tr	affic 🔎 Cap	oture 🔶 Rou	ting [
Setup	🖶 Setup - Emulation														
⇒ Traffic	🗩 New - 🖻 🛍 🗙 🗗 🎭 Resul	s 🔍	Details	Log Action	s-PIM 🔻										
Capture			1	1	Tester Address		SUT Address								
Emulation	Name /	Coun	State	Action Control	Tester IPv4	Tester IPv6	SUT IPv4	SUT IP	v6						
 Summary 	Port 201/4 (Ethernet-GbE SFP SX)	1 dev	ice (1 Up)		1		1	100000000000000000000000000000000000000							
BGP-4 Peer	PIM Router 1	1	HelloAdjacent		10.128.69.254	-		-							
	Ouble-dick here to add R		Access protocol	emulations.>											
OSIPF PIM	E Dort 202/2 (Ethernet-GbE SFP SX)	5 dev	ices (5 Up)												
	BGP-4 IPv4 Internal Peer 10	1	Open		192.168.0.80	2	192.168.0.69	9 -							
== Link Layer	🗹 🖈 LDP Peer 5	1	Operational		10.192.1.90	-	10.192.1.89	-							
Physical Layer	SPFv2 Router 2	1	Full		10.192.1.90	-	10.192.1.89								
Results	V 📌 PIM Router 3	1	HelloAdjacent		10.192.1.90	-	27	-							
Se Realtime	PIM Router 11	1	HelloAdjacent		192.168.0.80	-	*								
Histograms	Couble-click here to add R		Access protocol	emulations.>											
N2X Fast Find															
Capture Analysis															
✓ Table															
Graphs	🖉 Results - Realtime														
Tools	👔 Setup 🔳 🙋 🖉 🕀	Q	ΔμΣ	Δ											
Ping Test												Tx Test	Rx Test		Average
Dashboard	Port /								Rx Test Packets	Tx Test	Rx Test Octets	Throughput (Mb/s)	Throughput (Mb/s)		Latency (us)
	All Ports									22590300					(us) 81.52
Test Log	201/4							75301		11295150			75.903		72.54
	201/4->202/2, IPv4LocalTraffic_VLAN:	00 1.	source address	= 10.128.69.2	254. destination	address = 2	33.0.0.1	75301		11295150			104.819		90.50
	202/2		Contraction of the local data					75301		11295150					90.50
	202/2->201/4, IPv4RemoteTraffic -> P		(0.0.00.0	11		11 11		70001	70004		9487926	90.361	75.903	0	72.54

Required Parameters (Blank Form)

Table 4. Required parameters (blank form)

	N	2X port parameters					
Edge port(s):	Tester IP:	SUT IP:	VLAN:				
Core port(s):	Tester IP:	SUT IP:	VLAN:				
(Optional): Jumbo frames (Y/							
	MVP	N QuickTool parameters					
		Common					
Edge ports:		· · ·	Core ports:				
IP version (IPv4/IPv6):			Draft version:				
AS number:		SUT PE loopback (or	SUT PE loopback (or RR):				
Advertise VRF via iBGP (Y/N		Use Type 2 2-Byte A					
If draft-08 → Advertise MDT	in BGP open (Y/N):	AFI:	SAFI:				
Educ nonti		Local CEs	J				
Edge port:	N.	First route target:	Increment:				
Define VPN RP address (Y/N	l):	Unique RP (Y/N):					
First RP address:	vortional by E BCD (from CE	Increment:					
Define unicast addresses adv First unicast VPN route:	TEILISEU DY E-DOP (TROM CE	Increment:					
Number of routes per VPN:		Unique Routes per V					
First Tester AS number		Unique tester AS per					
		Provider Core Topology	·····				
Core port :							
Interface address (N2X):		Neighbor address (S	Neighbor address (SUT):				
PIM-P router ID (N2X):			PIM-P RP address (SUT):				
Use IGP (Y/N):	OSPF -or- ISIS:	Area ID:					
Tester router ID (N2X):		SUT router ID (SUT):					
OPSF network type:		, , , , , , , , , , , , , , , , ,					
Use MPLS (Y/N):		LDP -or- RSVP:					
	Simu	llated PEs and remote CEs					
Core port:		Number of peers (PE	s) :				
First IP address (PE):		Increment:					
First IGP link address (OSPF)	:	Increment:					
	Simulated PE	Es and remote CEs \rightarrow VPNv4 VRF	s				
Number of VRFs:		Local pref PA:					
First Route target:		Increment:	Increment:				
First unicast VPN route:		Increment:	Increment:				
Unique VPN routes (Y/N):		Increment per VPN:	Increment per VPN:				
Define VPN RP address (Y/N	l):	First RP address:					
Unique RP each VPN (Y/N):		Increment per VPN:					
	Simulated PEs ar	nd remote CEs \rightarrow VPNv4 default	MDTs				
First default MDT:		Increment:					
Join default MDT group (Y/N		PIM-SM -or- PIM-SS					
PIM-SSM: Use SUT IP addres		Iress as source or- Manually con	· ·				
Define dat- MDT- (V//N)		and remote CEs \rightarrow VPNv4 data N					
Define data MDTs (Y/N):	First data MDT range:		Increment:				
Data MDTs per VRF: Enable data MDT (S,G) group	nool (V/NI):	Join data MDT (S,G)	group pool (V/N):				
LUADE DATA WILL IN DUDIT			yroup poor (17 N).				

Table 5. Local traffic sources (blank form)

	Local traff	ic sources						
Edge port:								
Include edge ports as destinations (Y/N):								
Transmit from all CEs -or- Transmit from selected CEs:								
Selected CEs:								
Use CE link address -or- Use ALL	routes advertised by E-BGP –or-	Use host addresse	s on E-BGP	networks i	ncr			
First group address:		Increment:	Groups pe	er CE:				
Unique groups each CE (Y/N):	Increment:							
Create send/receive register (S,G	i) group pools (Y/N):							
Name prefix:	IP packet length:	Min:	Incr:					
IP bandwidth:		% of maximum -or- p	ackets/sec	-or- Mb/se	c:			
	Remote tra	ffic sources						
Core port:								
Transmit from all PEs (Y/N):		PE router:						
Transmit from all VRFs -or- Trans	mit from selected VRFs:							
Selected VRFs:								
First group address:	Increment: Groups per VRF:							
Unique groups each VRF (Y/N):	Increment:							
Unique groups each PE (Y/N):	Increment:							
Use data MDT (Y/N):	Data MDT group add	ress:						
Name prefix	Min:	Max:		Incr:				
IP bandwidth:	% of maximum -or- p	ackets/sec	-or- Mb/se	c:				
	Join PIM group	pools (local CE)						
Local CE -or- remote CE: Local CE		Edge port:						
All VRFs -or- Selected VRF:		Selected VRFs:						
First group address:		Increment:	er local CE:					
Unique groups for each local CE (Increment:							
Join group pool upon creation (Y	Enable (S,G) joins (Y/N):							
Include sources from other edge	Define multiple group address ranges (Y/N):							
Number (of address ranges):	Increment:							
	Join PIM group p	oools (remote CE)						
Local CE -or- remote CE: Remote CE		Core port:						
All PE routers (Y/N):		PE router:						
First group address:		Increment:		Groups pe	er remote CE:			
Unique groups for each remote C	E (Y/N):	Increment:						
Join group pool upon creation (Y	Join group pool upon creation (Y/N):			Enable (S,G) joins (Y/N):				

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