

CCIE Service Provider v3.0

Sample Lab

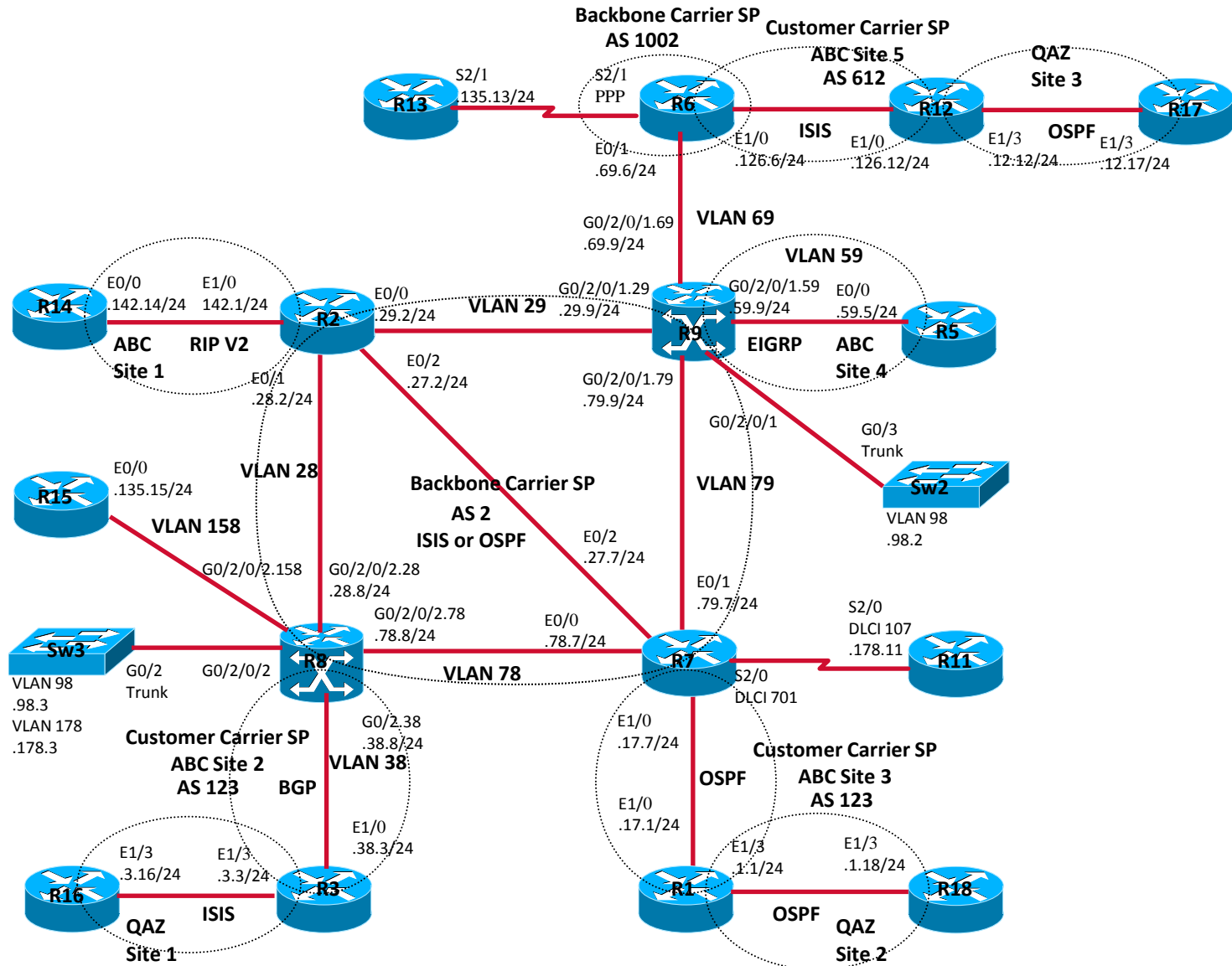
Part 6/7

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Cisco Systems

SP Sample Lab – Main Topology



SP Sample Lab – Addressing Scheme

- Backbone Carrier SP network Prefix: 2.2.0.0/24, 2002:2:2::/64
- Backbone Carrier SP router Loopback0: 2.2.0.Z/32, 2002:2:2::Z/128
- Customer Carrier SP/VPN network Prefix: 172.2.0.0/24, 2002:172:2::/64
- Customer Carrier SP/VPN router Loopback0: 172.2.0.Z/32, 2002:172:2::Z/128
- End Customer VPN network Prefix: 192.2.0.0/24
- End Customer VPN router Loopback0: 192.2.0.Z/32
- L2 VPN Customer network Prefix: 172.2.0.0/24
- L2 VPN Customer router Loopback0: 172.2.0.Z/32

“Z” is router number, for example “Z” value for R12 is “12”

SP Sample Lab – Setup

- Hardware

 - Two XR-12404 with two GigabitEthernet interfaces or equivalent

 - Thirteen Cisco 7200 series routers with Ethernet interfaces or equivalent

 - Three Cisco 3560G series or equivalent

- Software Operating System

 - XR12000-iosxr-k9-3.9.1.tar

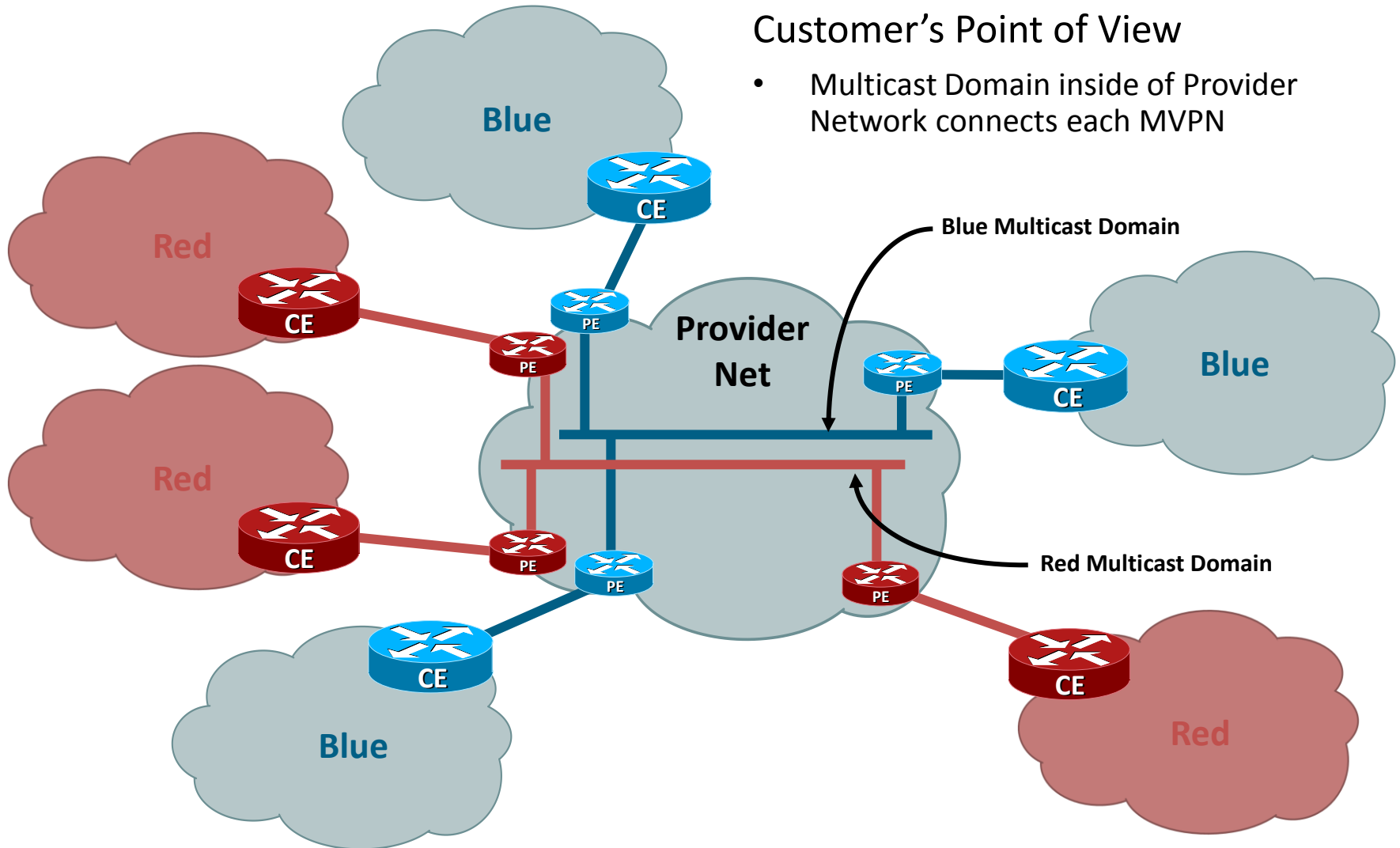
 - c7200-spservices-mz.122-33.SRE2.bin

 - c3560-advipservicesk9-mz.122-46.SE.bin

SP Sample Lab Questions

	Question, Configuration and Verification
1	IS-IS IPv4/IPv6
2	OSPF IPv4/IPv6
3	BGP unicast IPv4/IPv6
4	MPLS LDP
5	MPLS TE
6	MPLS TE FRR
7	MP-BGP intra-AS VPNv4
8	MP-BGP inter-AS VPNv4
9	CSC
10	MP-BGP VPNv6 - 6VPE
11	Multicast VPN
12	AToM
13	VPLS
14	L2TPv3

Multicast VPN: Overview

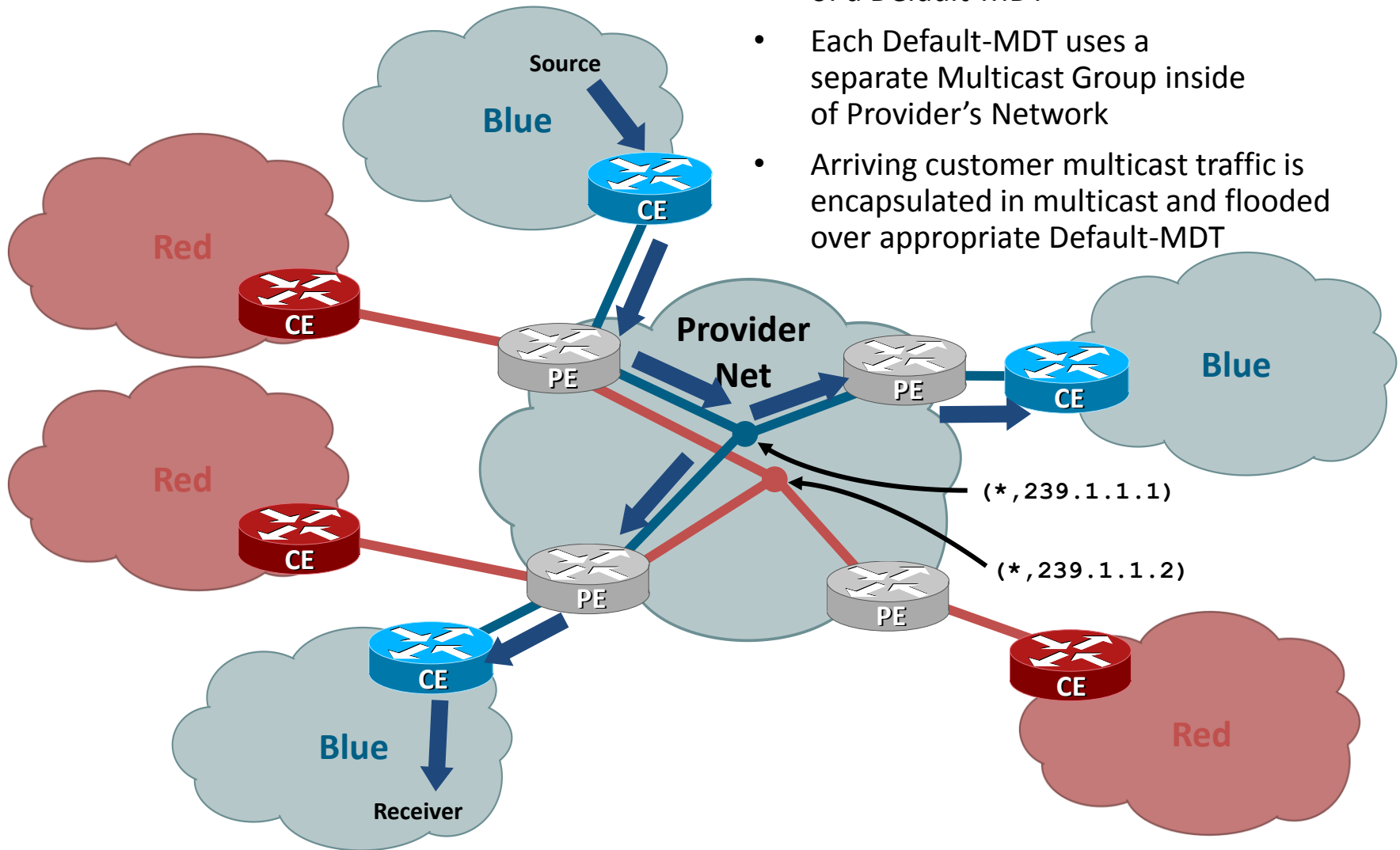


Customer's Point of View

- Multicast Domain inside of Provider Network connects each MVPN

Multicast VPN: Overview (Cont.)

- Each Multicast Domain consists of a Default-MDT
- Each Default-MDT uses a separate Multicast Group inside of Provider's Network
- Arriving customer multicast traffic is encapsulated in multicast and flooded over appropriate Default-MDT



Mapping to Lab Exam Blueprint

- This question of the sample lab maps to following sections/sub-sections in the Lab Exam Blueprint document below;

<https://learningnetwork.cisco.com/docs/DOC-9991>

1.0 – Implement, Optimize and Troubleshoot Core IP Technologies

1.7 – Implement, Optimize and Troubleshoot Multicast

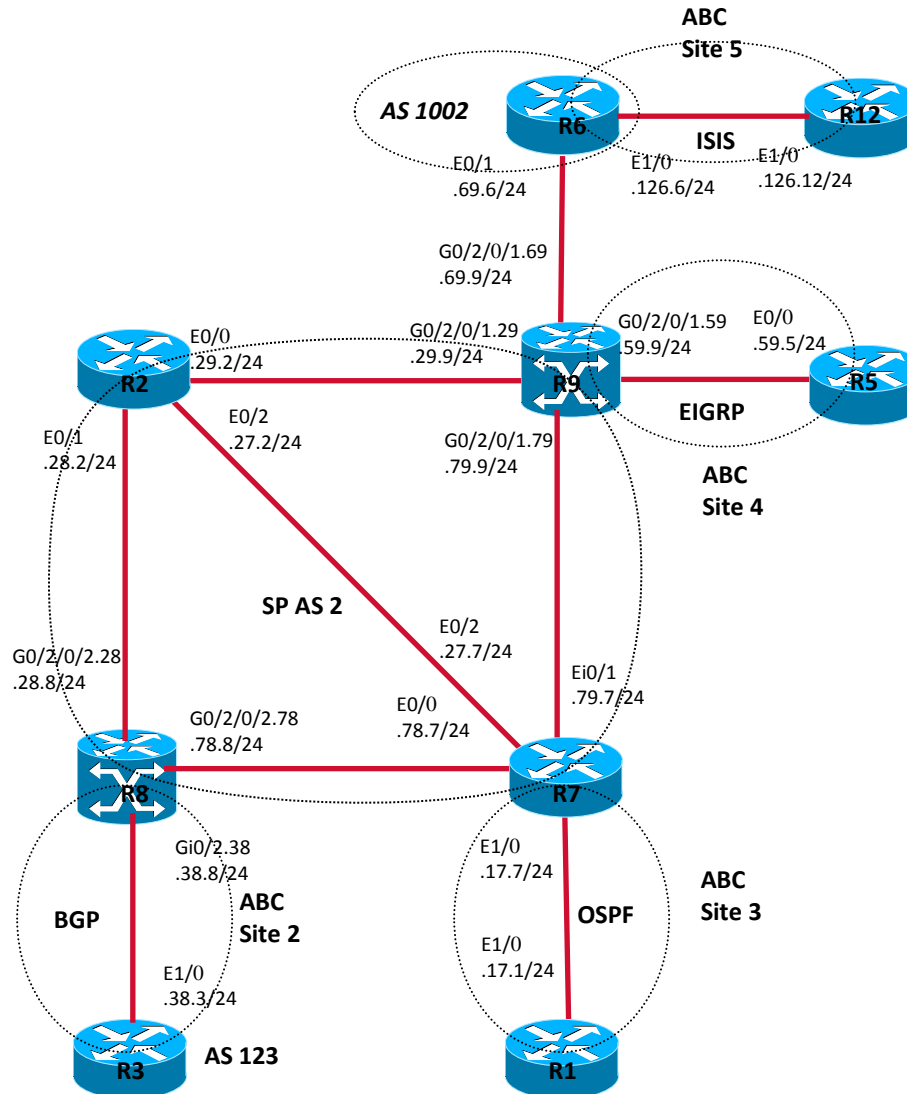
3.0 – Implement, Optimize and Troubleshoot L3VPN Technologies

3.6 – Implement, Optimize and Troubleshoot Multicast VPN

- For more details, please review the Lab Exam Checklist document below;

<https://learningnetwork.cisco.com/docs/DOC-10145>

Multicast VPN – Sub Topology



Multicast VPN - Question

- Configure default MDT address 239.255.13.27
- Configure R2 loopback 0 as RP for AS 2 , use BSR method to distribute RP.
Configure R6 loopback0 is RP for AS 1002
- Configure MSDP between R2 and R6, use loopback 0 IP address as source IP
- Configure R1 loopback0 as RP for ABC site 2, 3, 4 and 5. Use static method to define RP
- Configure R1, R3, R5 and R12 loopback0 to join multicast group of 239.255.X.X (X is router number). Ensure R1, R3, R5 and R12 can ping these multicast group

- Configure MP-BGP IPv4 MDT between R2, R7, R8 and R9, R9 is route-reflector
- Configure MP-BGP IPv4 MDT between R6 and R9
- Ensure multicast VPN source and group information be distributed among R2, R7, R8, R9 and R6

Multicast VPN Configuration

R2 (IOS) configuration

```
vrf definition ABC
rd 2:2
!
address-family ipv4
route-target export 2:2
route-target import 2:2
route-target import 1002:2
mdt default 239.255.13.27
!
ip multicast-routing
ip multicast-routing vrf ABC
!
interface Loopback0
ip address 2.2.0.2 255.255.255.255
ip pim sparse-mode
!
interface Ethernet0/0
ip address 2.2.29.2 255.255.255.0
ip pim sparse-mode
!
```

```
interface Ethernet0/1
ip address 2.2.28.2 255.255.255.0
ip pim sparse-mode
!
interface Ethernet0/2
ip address 2.2.27.2 255.255.255.0
ip pim sparse-mode
!
interface Ethernet1/0
vrf forwarding ABC
ip address 172.2.142.2 255.255.255.0
ip pim sparse-mode
!
router bgp 2
neighbor 2.2.0.9 remote-as 2
neighbor 2.2.0.9 update-source Loopback0
!
address-family ipv4 mdt
no bgp nexthop trigger enable
neighbor 2.2.0.9 activate
neighbor 2.2.0.9 send-community extended
!
ip pim bsr-candidate Loopback0 0 255
ip pim rp-candidate Loopback0 priority 255
ip pim vrf ABC rp-address 172.2.0.1
ip msdp peer 2.2.0.6 connect-source Loopback0
```

Multicast VPN Configuration (Cont.)

R7 (IOS) configuration

```
vrf definition ABC
```

```
rd 2:2
```

```
!
```

```
address-family ipv4
```

```
route-target export 2:2
```

```
route-target import 2:2
```

```
route-target import 1002:2
```

```
mdt default 239.255.13.27
```

```
!
```

```
ip multicast-routing
```

```
ip multicast-routing vrf ABC
```

```
!
```

```
interface Loopback0
```

```
ip address 2.2.0.7 255.255.255.255
```

```
ip pim sparse-mode
```

```
!
```

```
interface Ethernet0/0
```

```
ip address 2.2.78.7 255.255.255.0
```

```
ip pim sparse-mode
```

```
!
```

```
interface Ethernet0/1
```

```
ip address 2.2.79.7 255.255.255.0
```

```
ip pim sparse-mode
```

```
!
```

```
interface Ethernet0/2
```

```
ip address 2.2.27.7 255.255.255.0
```

```
ip pim sparse-mode
```

```
!
```

```
interface Ethernet1/0
```

```
vrf forwarding ABC
```

```
ip address 172.2.17.7 255.255.255.0
```

```
ip pim sparse-mode
```

```
!
```

```
router bgp 2
```

```
neighbor 2.2.0.9 remote-as 2
```

```
neighbor 2.2.0.9 update-source Loopback0
```

```
!
```

```
address-family ipv4 mdt
```

```
no bgp nexthop trigger enable
```

```
neighbor 2.2.0.9 activate
```

```
neighbor 2.2.0.9 send-community extended
```

```
exit-address-family
```

```
!
```

```
ip pim vrf ABC rp-address 172.2.0.1
```

```
!
```

Multicast VPN Configuration (Cont.)

R8 (IOS-XR) configuration

```
router bgp 2
address-family ipv4 mdt
!
neighbor 2.2.0.9
remote-as 2
update-source Loopback0
address-family ipv4 mdt
!
!
multicast-routing
vrf ABC address-family ipv4
interface GigabitEthernet0/2/0/2.38
enable
!
mdt default ipv4 239.255.13.27
rate-per-route
!
address-family ipv4
interface Loopback0
enable
!
```

```
interface GigabitEthernet0/2/0/2.28
enable
!
interface GigabitEthernet0/2/0/2.78
enable
!
mdt source Loopback0
rate-per-route
!
router pim vrf ABC address-family ipv4
rp-address 172.2.0.1
interface GigabitEthernet0/2/0/2.38
enable
!
router pim vrf default address-family ipv4
interface Loopback0
enable
!
interface GigabitEthernet0/2/0/2.28
enable
!
interface GigabitEthernet0/2/0/2.78
enable
!
```

Multicast VPN Configuration (Cont.)

R9 (IOS-XR) configuration

```
router bgp 2
address-family ipv4 mdt
!
neighbor 2.2.0.2
remote-as 2
update-source Loopback0
address-family ipv4 mdt
route-reflector-client
next-hop-self
!
!
neighbor 2.2.0.7
remote-as 2
update-source Loopback0
address-family ipv4 mdt
route-reflector-client
next-hop-self
!
!
neighbor 2.2.0.8
remote-as 2
update-source Loopback0
address-family ipv4 mdt
route-reflector-client
next-hop-self
!
!

neighbor 2.2.69.6
remote-as 1002
address-family ipv4 mdt
route-policy default_policy_pass_all in
route-policy default_policy_pass_all out
!
multicast-routing
vrf ABC address-family ipv4
interface GigabitEthernet0/2/0/1.59
enable
!
mdt default ipv4 239.255.13.27
!
address-family ipv4
interface Loopback0
enable
!
interface GigabitEthernet0/2/0/1.29
enable
!
interface GigabitEthernet0/2/0/1.69
enable
!
interface GigabitEthernet0/2/0/1.79
enable
!
mdt source Loopback0

router pim vrf ABC address-family ipv4
rp-address 172.2.0.1
interface GigabitEthernet0/2/0/1.59
enable
!
!
router pim vrf default address-family ipv4
interface Loopback0
enable
!
interface GigabitEthernet0/2/0/1.29
enable
!
interface GigabitEthernet0/2/0/1.69
bsr-border
enable
!
interface GigabitEthernet0/2/0/1.79
enable
!
!
```

Multicast VPN Configuration (Cont.)

R6 (IOS) configuration

```
vrf definition ABC
rd 1002:2
!
address-family ipv4
route-target export 1002:2
route-target import 1002:2
route-target import 2:2
mdt default 239.255.13.27
!
ip multicast-routing
ip multicast-routing vrf ABC
!
interface Ethernet0/0
ip address 2.2.46.6 255.255.255.0
ip pim sparse-mode
!
interface Ethernet0/1
ip address 2.2.69.6 255.255.255.0
ip pim bsr-border
ip pim sparse-mode
!
```

```
interface Ethernet1/0
vrf forwarding ABC
ip address 172.2.126.6 255.255.255.0
ip pim sparse-mode
!
router bgp 1002
neighbor 2.2.69.9 remote-as 2
!
address-family ipv4 mdt
neighbor 2.2.69.9 activate
neighbor 2.2.69.9 send-community extended
exit-address-family
!
ip pim bsr-candidate Loopback0 0
ip pim rp-candidate Loopback0
ip pim vrf ABC rp-address 172.2.0.1
ip msdp peer 2.2.0.2 connect-source Loopback0
```

Multicast VPN Configuration (Cont.)

R3 configuration

```
ip multicast-routing
!  
interface Loopback0  
ip address 172.2.0.3 255.255.255.255  
ip pim sparse-mode  
ip igmp join-group 239.255.3.3  
!  
interface Ethernet1/0  
ip address 172.2.38.3 255.255.255.0  
ip pim sparse-mode  
!  
ip pim rp-address 172.2.0.1
```

R1 configuration

```
ip multicast-routing
!  
interface Loopback0  
ip address 172.2.0.1 255.255.255.255  
ip pim sparse-mode  
ip igmp join-group 239.255.1.1  
!  
interface Ethernet1/0  
ip address 172.2.17.1 255.255.255.0  
ip pim sparse-mode  
!  
ip pim rp-address 172.2.0.1
```


Multicast VPN Configuration (Cont.)

R5 configuration

```
ip multicast-routing
!  
interface Loopback0  
ip address 172.2.0.5 255.255.255.255  
ip pim sparse-mode  
ip igmp join-group 239.255.5.5  
!  
interface Ethernet1/0  
ip address 172.2.59.5 255.255.255.0  
ip pim sparse-mode  
!  
ip pim rp-address 172.2.0.1
```

R12 configuration

```
ip multicast-routing
!  
interface Loopback0  
ip address 172.2.0.12 255.255.255.255  
ip pim sparse-mode  
ip igmp join-group 239.255.5.5  
!  
interface Ethernet1/0  
ip address 172.2.126.12 255.255.255.0  
ip pim sparse-mode  
!  
ip pim rp-address 172.2.0.1
```

RP group map

R2 RP group map

```
R2#show ip pim rp mapping
```

```
PIM Group-to-RP Mappings
```

```
This system is a candidate RP (v2)
```

```
This system is the Bootstrap Router (v2)
```

```
Group(s) 224.0.0.0/4
```

```
RP 2.2.0.2 (?), v2
```

```
Info source: 2.2.0.2 (?), via bootstrap, priority 255, holdtime 150
```

```
Uptime: 6d02h, expires: 00:01:35
```

R7 RP group map

```
R7#show ip pim rp mapping
```

```
PIM Group-to-RP Mappings
```

```
Group(s) 224.0.0.0/4
```

```
RP 2.2.0.2 (?), v2
```

```
Info source: 2.2.0.2 (?), via bootstrap, priority 255, holdtime 150
```

```
Uptime: 6d01h, expires: 00:01:59
```

RP group map (Cont.)

R8 RP group map

RP/0/0/CPU0:R8#show pim group-map

Group Range	Proto	Client	Groups	RP address	Info
224.0.1.39/32*	DM	perm	0	0.0.0.0	
224.0.1.40/32*	DM	perm	1	0.0.0.0	
224.0.0.0/24*	NO	perm	0	0.0.0.0	
232.0.0.0/8*	SSM	config	0	0.0.0.0	
224.0.0.0/4*	SM	bsr+	2	2.2.0.2	RPF: Gi0/2/0/2.28,2.2.28.2
224.0.0.0/4	SM	static	0	0.0.0.0	RPF: Null,0.0.0.0

R9 RP group map

RP/0/0/CPU0:R9#show pim group-map

Group Range	Proto	Client	Groups	RP address	Info
224.0.1.39/32*	DM	perm	0	0.0.0.0	
224.0.1.40/32*	DM	perm	1	0.0.0.0	
224.0.0.0/24*	NO	perm	0	0.0.0.0	
232.0.0.0/8*	SSM	config	0	0.0.0.0	
224.0.0.0/4*	SM	bsr+	2	2.2.0.2	RPF: Gi0/2/0/1.29,2.2.29.2
224.0.0.0/4	SM	static	0	0.0.0.0	RPF: Null,0.0.0.0

MSDP connection

R2#show ip msdp summary

MSDP Peer Status Summary

Peer Address	AS	State	Uptime/	Reset SA	Peer Name
			Downtime	Count	
			Count		
2.2.0.6	1002	Up	5d01h	3 1	?

R6#show ip msdp summary

MSDP Peer Status Summary

Peer Address	AS	State	Uptime/	Reset SA	Peer Name
			Downtime	Count	
			Count		
2.2.0.2	2	Up	5d01h	1 4	?

MSDP Active Source

R2#show ip msdp sa-cache

MSDP Source-Active Cache - 1 entries

(2.2.0.6, 239.255.13.27), RP 2.2.0.6, BGP/AS 1002, 1d02h/00:05:53, Peer 2.2.0.6

R6#show ip msdp sa-cache

MSDP Source-Active Cache - 4 entries

(2.2.0.2, 239.255.13.27), RP 2.2.0.2, BGP/AS 2, 1d02h/00:05:50, Peer 2.2.0.2

(2.2.0.7, 239.255.13.27), RP 2.2.0.2, BGP/AS 2, 1d02h/00:05:50, Peer 2.2.0.2

(2.2.0.8, 239.255.13.27), RP 2.2.0.2, BGP/AS 2, 1d02h/00:05:50, Peer 2.2.0.2

(2.2.0.9, 239.255.13.27), RP 2.2.0.2, BGP/AS 2, 1d02h/00:05:50, Peer 2.2.0.2

VRF Site RP group map

R8 VRF ABC RP group map

RP/0/0/CPU0:R8#show pim vrf ABC group-map

Group Range	Proto	Client	Groups	RP address	Info
224.0.1.39/32*	DM	perm	0	0.0.0.0	
224.0.1.40/32*	DM	perm	1	0.0.0.0	
224.0.0.0/24*	NO	perm	0	0.0.0.0	
232.0.0.0/8*	SSM	config	0	0.0.0.0	
224.0.0.0/4*	SM	config	2	172.2.0.1	RPF: md,2.2.0.7
224.0.0.0/4	SM	static	0	0.0.0.0	RPF: Null,0.0.0.0

R7 VRF RP ABC RP group map

R2#show ip pim vrf ABC rp mapping

PIM Group-to-RP Mappings

Group(s): 224.0.0.0/4, Static

RP: 172.2.0.1 (?)

VRF Site RP group map (Cont.)

R9 VRF ABC RP group map

RP/0/0/CPU0:R9#show pim vrf ABC group-map

Group Range	Proto	Client	Groups	RP address	Info
224.0.1.39/32*	DM	perm	0	0.0.0.0	
224.0.1.40/32*	DM	perm	1	0.0.0.0	
224.0.0.0/24*	NO	perm	0	0.0.0.0	
232.0.0.0/8*	SSM	config	0	0.0.0.0	
224.0.0.0/4*	SM	config	2	172.2.0.1	RPF: md,2.2.0.7
224.0.0.0/4	SM	static	0	0.0.0.0	RPF: Null,0.0.0.0

R6 VRF ABC RP group map

R6#show ip pim vrf ABC rp mapping

PIM Group-to-RP Mappings

Group(s): 224.0.0.0/4, Static

RP: 172.2.0.1 (?)

Multicast VPN Tunnel Adjacency

R8 Tunnel neighbor

RP/0/0/CPU0:R8#show pim vrf ABC neighbor

Neighbor Address	Interface	Uptime	Expires	DR	pri	Flags
2.2.0.2	mdtABC	6d02h	00:01:28	1		P
2.2.0.6	mdtABC	4d05h	00:01:16	1		P
2.2.0.7	mdtABC	6d01h	00:01:44	1		P
2.2.0.8*	mdtABC	10w2d	00:01:34	1		B
2.2.0.9	mdtABC	6d02h	00:01:17	1 (DR)		B
172.2.38.3	GigabitEthernet0/2/0/2.38	6d02h	00:01:17	1		P
172.2.38.8*	GigabitEthernet0/2/0/2.38	8w6d	00:01:36	1 (DR)		B P

R7 Tunnel neighbor

R7#show ip pim vrf ABC neighbor

Neighbor Address	Interface	Uptime/Expires	Ver	DR
172.2.17.1	Ethernet1/0	6d01h/00:01:17	v2	1 / S P
2.2.0.6	Tunnel1	4d05h/00:01:42	v2	1 / S P
2.2.0.9	Tunnel1	6d01h/00:01:44	v2	1 / DR
2.2.0.8	Tunnel1	6d01h/00:01:31	v2	1 /
2.2.0.2	Tunnel1	6d01h/00:01:24	v2	1 / S P

Multicast VPN Tunnel Adjacency (Cont.)

R9 Tunnel neighbor

RP/0/0/CPU0:R9#show pim vrf ABC neighbor

Neighbor Address	Interface	Uptime	Expires	DR	pri	Flags
2.2.0.2	mdtABC	6d23h	00:01:29	1		P
2.2.0.6	mdtABC	5d02h	00:01:25	1		P
2.2.0.7	mdtABC	6d22h	00:01:27	1		P
2.2.0.8	mdtABC	6d23h	00:01:36	1		B
2.2.0.9*	mdtABC	10w3d	00:01:39	1 (DR)		B A
172.2.59.5	GigabitEthernet0/2/0/1.59	6d23h	00:01:41	1		P
172.2.59.9*	GigabitEthernet0/2/0/1.59	10w3d	00:01:21	1 (DR)		B P A

R6 Tunnel neighbor

R6#show ip pim vrf ABC neighbor

Neighbor Address	Interface	Uptime/Expires	Ver	DR
172.2.126.12	Ethernet1/0	2d05h/00:01:18	v2	1 / S P
2.2.0.9	Tunnel0	5d02h/00:01:21	v2	1 / DR
2.2.0.8	Tunnel0	5d02h/00:01:18	v2	1 /
2.2.0.2	Tunnel0	5d02h/00:01:41	v2	1 / S P
2.2.0.7	Tunnel0	5d02h/00:01:39	v2	1 / S P

Multicast VPN Multicast routes

R7 MVPN mroute

R7#show ip mroute 239.255.13.27

(* , 239.255.13.27), 01:11:12/stopped, RP 2.2.0.2, flags: SJCFZ

Incoming interface: Ethernet0/2, RPF nbr 2.2.27.2

Outgoing interface list:

MVRF ABC, Forward/Sparse, 01:11:12/00:00:46

(2.2.0.2, 239.255.13.27), 01:10:44/00:02:39, flags: JTZ

Incoming interface: Ethernet0/2, RPF nbr 2.2.27.2

Outgoing interface list:

MVRF ABC, Forward/Sparse, 01:10:44/00:01:15

(2.2.0.8, 239.255.13.27), 01:11:08/00:03:19, flags: TZ

Incoming interface: Ethernet0/0, RPF nbr 2.2.78.8

Outgoing interface list:

Ethernet0/1, Forward/Sparse, 01:10:25/00:03:05

MVRF ABC, Forward/Sparse, 01:11:08/00:00:51

(2.2.0.6, 239.255.13.27), 01:11:09/00:03:19, flags: TZ

Incoming interface: Ethernet0/1, RPF nbr 2.2.79.9

Outgoing interface list:

Ethernet0/0, Forward/Sparse, 01:10:54/00:02:34

MVRF ABC, Forward/Sparse, 01:11:12/00:00:47

(2.2.0.7, 239.255.13.27), 01:11:13/00:03:26, flags: FT

Incoming interface: Loopback0, RPF nbr 0.0.0.0

Outgoing interface list:

Ethernet0/1, Forward/Sparse, 01:10:38/00:02:52

Ethernet0/0, Forward/Sparse, 01:10:54/00:02:34

Ethernet0/2, Forward/Sparse, 01:11:13/00:03:13

(2.2.0.9, 239.255.13.27), 01:11:14/00:03:26, flags: TZ

Incoming interface: Ethernet0/1, RPF nbr 2.2.79.9

Outgoing interface list:

Ethernet0/0, Forward/Sparse, 01:10:54/00:02:34

MVRF ABC, Forward/Sparse, 01:11:14/00:00:45

Multicast VPN Multicast routes(Cont.)

R8 MVPN mroute

RP/0/0/CPU0:R8#show mrib ipv4 route 239.255.13.27

(* ,239.255.13.27) RPF nbr: 2.2.28.2 Flags: C MD MH CD

Incoming Interface List

GigabitEthernet0/2/0/2.28 Flags: A NS, Up: 6d22h

Outgoing Interface List

Loopback0 Flags: F NS, Up: 10w3d

(2.2.0.2,239.255.13.27) RPF nbr: 2.2.28.2 Flags: MD MH CD

MVPN TID: 0xe0000001

Incoming Interface List

GigabitEthernet0/2/0/2.28 Flags: A, Up: 6d22h

Outgoing Interface List

Loopback0 Flags: F NS, Up: 6d23h

(2.2.0.6,239.255.13.27) RPF nbr: 2.2.78.7 Flags: MD MH CD

Incoming Interface List

GigabitEthernet0/2/0/2.78 Flags: A, Up: 2d17h

Outgoing Interface List

Loopback0 Flags: F NS, Up: 6d23h

(2.2.0.7,239.255.13.27) RPF nbr: 2.2.78.7 Flags: MD MH CD

Incoming Interface List

GigabitEthernet0/2/0/2.78 Flags: A, Up: 2d17h

Outgoing Interface List

Loopback0 Flags: F NS, Up: 4w5d

(2.2.0.8,239.255.13.27) RPF nbr: 2.2.0.8 Flags: ME MH

Incoming Interface List

Loopback0 Flags: F A, Up: 10w3d

Outgoing Interface List

GigabitEthernet0/2/0/2.28 Flags: F NS, Up: 5d03h

GigabitEthernet0/2/0/2.78 Flags: F NS, Up: 5d03h

Loopback0 Flags: F A, Up: 10w3d

(2.2.0.9,239.255.13.27) RPF nbr: 2.2.78.7 Flags: MD MH CD

Incoming Interface List

GigabitEthernet0/2/0/2.78 Flags: A, Up: 2d17h

Outgoing Interface List

Loopback0 Flags: F NS, Up: 4w5d

Multicast VPN Multicast routes(Cont.)

R9 MVPN mroute

RP/0/0/CPU0:R9#show mrib ipv4 route 239.255.13.27

(* ,239.255.13.27) RPF nbr: 2.2.29.2 Flags: C MD MH CD
Incoming Interface List
GigabitEthernet0/2/0/1.29 Flags: A NS, Up: 3d20h
Outgoing Interface List
Loopback0 Flags: F NS, Up: 10w3d

(2.2.0.2,239.255.13.27) RPF nbr: 2.2.29.2 Flags: MD MH
Incoming Interface List
GigabitEthernet0/2/0/1.29 Flags: A, Up: 3d20h
Outgoing Interface List
GigabitEthernet0/2/0/1.69 Flags: F NS, Up: 5d03h
Loopback0 Flags: F NS, Up: 6d23h

(2.2.0.6,239.255.13.27) RPF nbr: 2.2.69.6 Flags: MD MH
Incoming Interface List
GigabitEthernet0/2/0/1.69 Flags: A, Up: 5d03h
Outgoing Interface List
GigabitEthernet0/2/0/1.29 Flags: F NS, Up: 3d20h
GigabitEthernet0/2/0/1.79 Flags: F NS, Up: 4d22h
Loopback0 Flags: F NS, Up: 6d23h

(2.2.0.7,239.255.13.27) RPF nbr: 2.2.79.7 Flags: MD MH
Incoming Interface List
GigabitEthernet0/2/0/1.79 Flags: A, Up: 6d22h
Outgoing Interface List
GigabitEthernet0/2/0/1.69 Flags: F NS, Up: 5d03h
Loopback0 Flags: F NS, Up: 6d23h

(2.2.0.8,239.255.13.27) RPF nbr: 2.2.79.7 Flags: MD MH
Incoming Interface List
GigabitEthernet0/2/0/1.79 Flags: A, Up: 2d18h
Outgoing Interface List
GigabitEthernet0/2/0/1.69 Flags: F NS, Up: 5d03h
Loopback0 Flags: F NS, Up: 6d23h

(2.2.0.9,239.255.13.27) RPF nbr: 2.2.0.9 Flags: ME MH
Incoming Interface List
Loopback0 Flags: F A, Up: 10w3d
Outgoing Interface List
GigabitEthernet0/2/0/1.29 Flags: F NS, Up: 3d20h
GigabitEthernet0/2/0/1.69 Flags: F NS, Up: 5d03h
GigabitEthernet0/2/0/1.79 Flags: F NS, Up: 5d04h
Loopback0 Flags: F A, Up: 10w3d

Multicast VPN Multicast routes(Cont.)

R6 MVPN mroute

R6#show ip mroute 239.255.13.27

(* , 239.255.13.27), 01:37:35/stopped, RP 2.2.0.6, flags: SJCZ
Incoming interface: Null, RPF nbr 0.0.0.0
Outgoing interface list:
MVRF ABC, Forward/Sparse, 01:37:35/00:01:24

(2.2.0.2, 239.255.13.27), 01:37:28/00:02:31, flags: JTZ
Incoming interface: Ethernet0/1, RPF nbr 2.2.69.9
Outgoing interface list:
MVRF ABC, Forward/Sparse, 01:37:28/00:01:31

(2.2.0.6, 239.255.13.27), 01:37:32/00:03:21, flags: T
Incoming interface: Loopback0, RPF nbr 0.0.0.0
Outgoing interface list:
Ethernet0/1, Forward/Sparse, 01:37:29/00:03:02

(2.2.0.7, 239.255.13.27), 01:37:35/00:02:51, flags: JTZ
Incoming interface: Ethernet0/1, RPF nbr 2.2.69.9
Outgoing interface list:
MVRF ABC, Forward/Sparse, 01:37:35/00:01:24

(2.2.0.8, 239.255.13.27), 01:37:36/00:02:59, flags: JTZ
Incoming interface: Ethernet0/1, RPF nbr 2.2.69.9
Outgoing interface list:
MVRF ABC, Forward/Sparse, 01:37:36/00:01:22

(2.2.0.9, 239.255.13.27), 01:37:36/00:02:59, flags: JTZ
Incoming interface: Ethernet0/1, RPF nbr 2.2.69.9
Outgoing interface list:
MVRF ABC, Forward/Sparse, 01:37:36/00:01:22

Multicast ping Verification

R3

```
R3#ping 239.255.5.5 source loopback 0 repeat 2
```

```
Type escape sequence to abort.
```

```
Sending 2, 100-byte ICMP Echos to 239.255.5.5, timeout is 2 seconds:
```

```
Packet sent with a source address of 172.2.0.3
```

```
Reply to request 0 from 172.2.59.5, 56 ms
```

```
Reply to request 1 from 172.2.59.5, 60 ms
```

```
R3#ping 239.255.1.1 source loopback 0 repeat 2
```

```
Type escape sequence to abort.
```

```
Sending 2, 100-byte ICMP Echos to 239.255.1.1, timeout is 2 seconds:
```

```
Packet sent with a source address of 172.2.0.3
```

```
Reply to request 0 from 172.2.17.1, 20 ms
```

```
Reply to request 1 from 172.2.17.1, 32 ms
```

```
R3#ping 239.255.12.12 source loopback 0 repeat 2
```

```
Type escape sequence to abort.
```

```
Sending 2, 100-byte ICMP Echos to 239.255.12.12, timeout is 2 seconds:
```

```
Packet sent with a source address of 172.2.0.3
```

```
Reply to request 0 from 172.2.126.12, 52 ms
```

```
Reply to request 1 from 172.2.126.12, 48 ms
```

Multicast ping Verification (Cont.)

R5

```
R1#ping 239.255.5.5 source loopback 0 repeat 2
```

```
Type escape sequence to abort.
```

```
Sending 2, 100-byte ICMP Echos to 239.255.5.5, timeout is 2 seconds:
```

```
Packet sent with a source address of 172.2.0.1
```

```
Reply to request 0 from 172.2.59.5, 24 ms
```

```
Reply to request 0 from 172.2.59.5, 24 ms
```

```
Reply to request 1 from 172.2.59.5, 20 ms
```

```
Reply to request 1 from 172.2.59.5, 28 ms
```

```
R1#ping 239.255.12.12 source loopback 0 repeat 2
```

```
Type escape sequence to abort.
```

```
Sending 2, 100-byte ICMP Echos to 239.255.12.12, timeout is 2 seconds:
```

```
Packet sent with a source address of 172.2.0.1
```

```
Reply to request 0 from 172.2.126.12, 24 ms
```

```
Reply to request 0 from 172.2.126.12, 24 ms
```

```
Reply to request 1 from 172.2.126.12, 20 ms
```

```
Reply to request 1 from 172.2.126.12, 32 ms
```

Multicast ping Verification (Cont.)

R12

```
R12#ping 239.255.1.1 source loopback 0 repeat 2
```

```
Type escape sequence to abort.
```

```
Sending 2, 100-byte ICMP Echos to 239.255.1.1, timeout is 2 seconds:
```

```
Packet sent with a source address of 172.2.0.12
```

```
Reply to request 0 from 172.2.17.1, 20 ms
```

```
Reply to request 0 from 172.2.17.1, 28 ms
```

```
Reply to request 1 from 172.2.17.1, 20 ms
```

```
Reply to request 1 from 172.2.17.1, 28 ms
```

```
R12#ping 239.255.3.3 source loopback 0 repeat 2
```

```
Type escape sequence to abort.
```

```
Sending 2, 100-byte ICMP Echos to 239.255.3.3, timeout is 2 seconds:
```

```
Packet sent with a source address of 172.2.0.12
```

```
Reply to request 0 from 172.2.38.3, 48 ms
```

```
Reply to request 0 from 172.2.38.3, 48 ms
```

```
Reply to request 1 from 172.2.38.3, 44 ms
```

```
Reply to request 1 from 172.2.38.3, 52 ms
```


Multicast VPN MDT table

R2 MVPN mdt table

R2#show ip bgp ipv4 mdt all

BGP table version is 31, local router ID is 2.2.0.2

Network	Next Hop	Metric	LocPrf	Weight	Path
---------	----------	--------	--------	--------	------

Route Distinguisher: 2:2 (default for vrf ABC)

*> 2.2.0.2/32	0.0.0.0			0	?
---------------	---------	--	--	---	---

*>i2.2.0.7/32	2.2.0.7	0	100	0	?
---------------	---------	---	-----	---	---

*>i2.2.0.8/32	2.2.0.8	100	0	i	
---------------	---------	-----	---	---	--

*>i2.2.0.9/32	2.2.0.9	100	0	i	
---------------	---------	-----	---	---	--

Route Distinguisher: 1002:2

*>i2.2.0.6/32	2.2.0.9	0	100	0	1002 ?
---------------	---------	---	-----	---	--------

R8 MVPN mdt table

RP/0/0/CPU0:R8#show bgp ipv4 mdt

BGP router identifier 2.2.0.8, local AS number 2

Network	Next Hop	Metric	LocPrf	Weight	Path
---------	----------	--------	--------	--------	------

Route Distinguisher: 2:2

*>i2.2.0.2/96	2.2.0.2	0	100	0	?
---------------	---------	---	-----	---	---

*>i2.2.0.7/96	2.2.0.7	0	100	0	?
---------------	---------	---	-----	---	---

*> 2.2.0.8/96	0.0.0.0			0	i
---------------	---------	--	--	---	---

*>i2.2.0.9/96	2.2.0.9	100	0	i	
---------------	---------	-----	---	---	--

Route Distinguisher: 1002:2

*>i2.2.0.6/96	2.2.0.9	0	100	0	1002 ?
---------------	---------	---	-----	---	--------

Multicast VPN MDT table (Cont.)

R7 MVPN mdt table

R7#show ip bgp ipv4 mdt all

BGP table version is 21, local router ID is 2.2.0.77

Network	Next Hop	Metric	LocPrf	Weight	Path
---------	----------	--------	--------	--------	------

Route Distinguisher: 2:2 (default for vrf ABC)

*>i2.2.0.2/32	2.2.0.2	0	100	0	?
---------------	---------	---	-----	---	---

*> 2.2.0.7/32	0.0.0.0			0	?
---------------	---------	--	--	---	---

*>i2.2.0.8/32	2.2.0.8	100		0	i
---------------	---------	-----	--	---	---

*>i2.2.0.9/32	2.2.0.9	100		0	i
---------------	---------	-----	--	---	---

Route Distinguisher: 1002:2

*>i2.2.0.6/32	2.2.0.9	0	100	0	100
---------------	---------	---	-----	---	-----

R9 MVPN mdt table

RP/0/0/CPU0:R9#show bgp ipv4 mdt

BGP router identifier 2.2.0.9, local AS number 2

Network	Next Hop	Metric	LocPrf	Weight	Path
---------	----------	--------	--------	--------	------

Route Distinguisher: 2:2

*>i2.2.0.2/96	2.2.0.2	0	100	0	?
---------------	---------	---	-----	---	---

*>i2.2.0.7/96	2.2.0.7	0	100	0	?
---------------	---------	---	-----	---	---

*>i2.2.0.8/96	2.2.0.8	100		0	i
---------------	---------	-----	--	---	---

*> 2.2.0.9/96	0.0.0.0			0	i
---------------	---------	--	--	---	---

Route Distinguisher: 1002:2

*> 2.2.0.6/96	2.2.69.6	0		0	1002 ?
---------------	----------	---	--	---	--------

Multicast VPN MDT table (Cont.)

R6 MVPN mdt table

R6#show ip bgp ipv4 mdt all

BGP table version is 7, local router ID is 2.2.0.6

Network	Next Hop	Metric	LocPrf	Weight	Path
Route Distinguisher: 2:2					
*> 2.2.0.2/32	2.2.69.9		0	2	?
*> 2.2.0.7/32	2.2.69.9		0	2	?
*> 2.2.0.8/32	2.2.69.9		0	2	i
*> 2.2.0.9/32	2.2.69.9		0	2	i
Route Distinguisher: 1002:2 (default for vrf ABC)					
*> 2.2.0.6/32	0.0.0.0		0		?



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