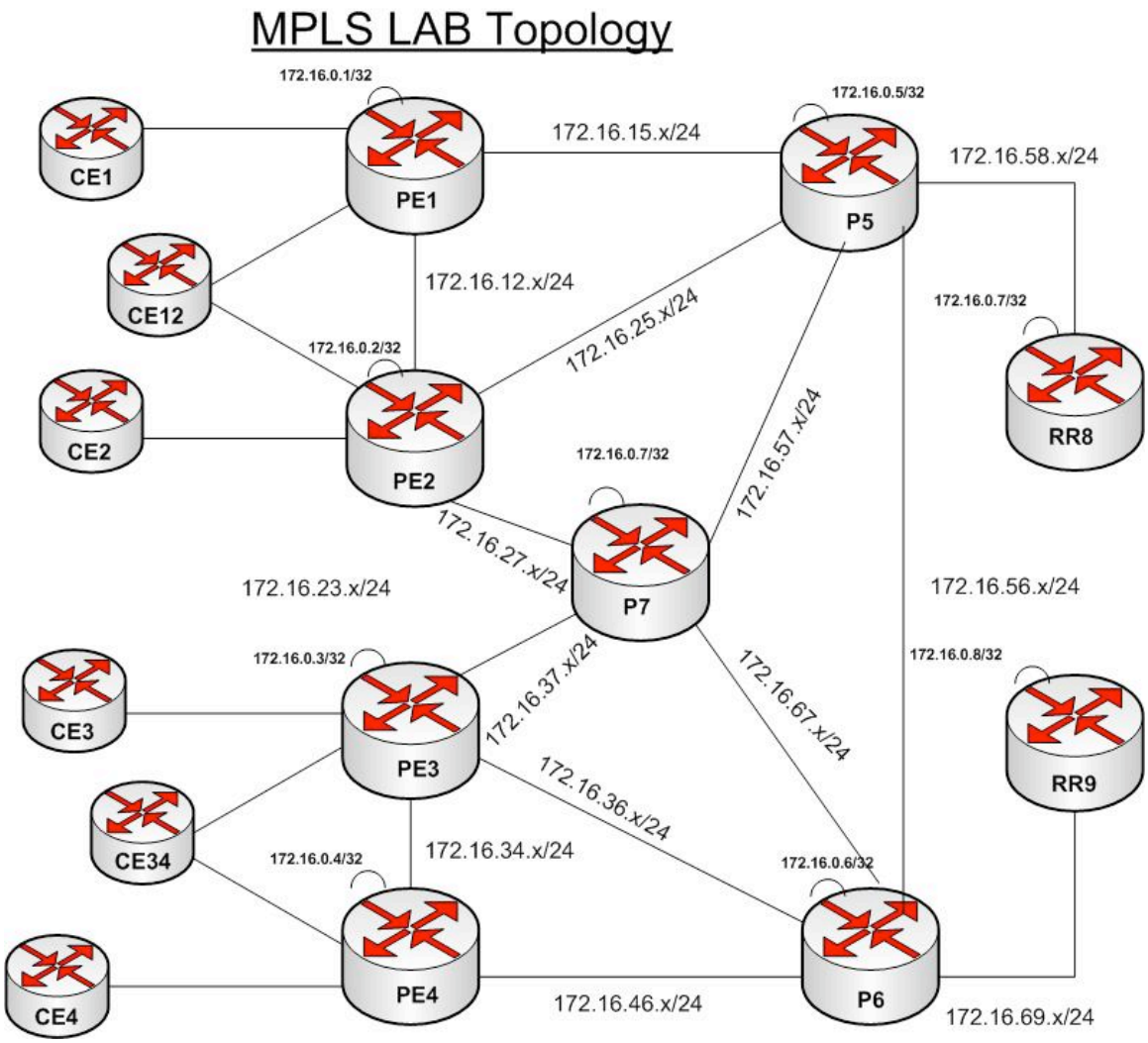
Lab: Basic MPLS VPN

Configuring MP-BGP
Configuring L3VPN with static routing
Configuring L3VPN with BGP routing

Lab Topology:

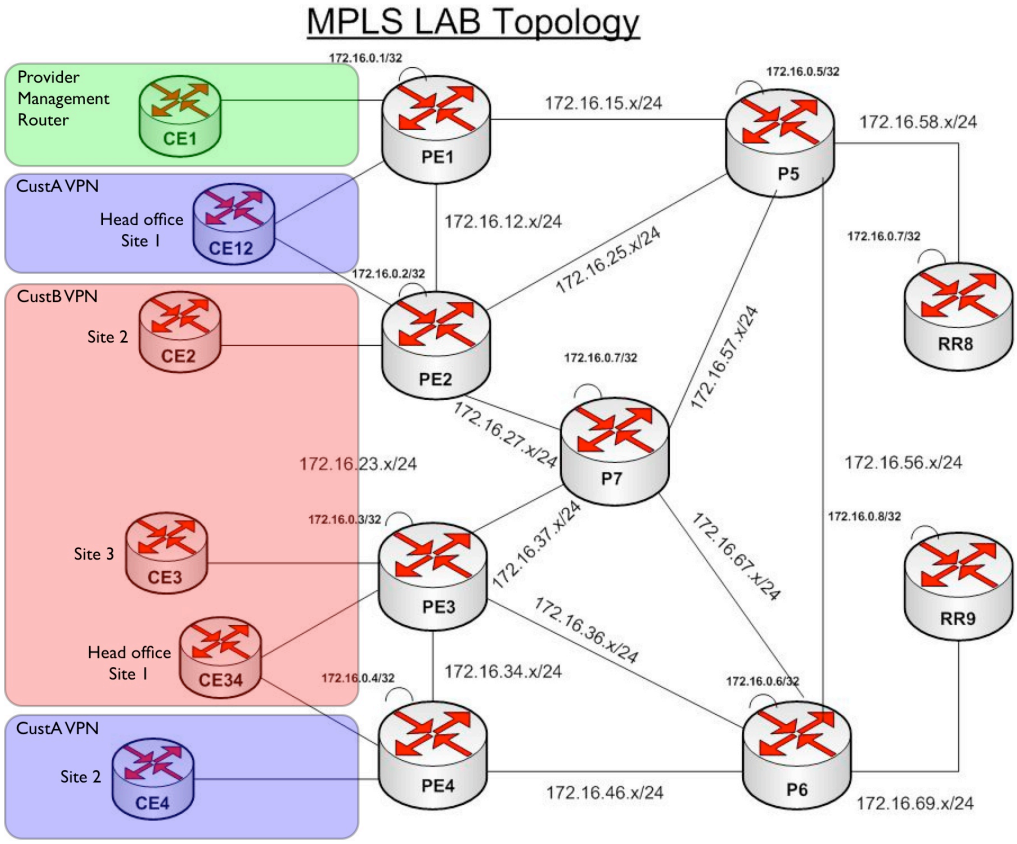


Objective: MP-BGP

1. Capture the complete output of ‘show ip bgp neighbor’ , ‘show ip bgp vpnv4 all neighbor’ show ip bgp and show ip route bgp in a notepad . Make sure you peer with the RR’s Loopback address and the update-source is Loopback 0
2. Issue ping from your PE loopback 100 ip address to remote PE’s Loopback 100 ip address (If it is not successful then don’t move forward unless the issue is resolved)
3. Clear the log on the PE router by issuing clear log
4. enable ‘debug ip bgp 172.16.0.x’ , where x is either 8 or 9
5. issue clear ip bgp 172.16.0.x , where x is the same value as in step 4
6. Wait for the BGP neighbor to come up
7. Issue ‘show log’ and capture the output in notepad file , clear the log after capture
8. Check for the capabilities sent and received with the RR
9. Configure the RRs (both) and your PE such that they activate the BGP session with the RR in vpnv4 address family , ensure that they don’t form a bgp session with the RR on ipv4 address family
10. Does the Address family configuration change cause the BGP neighbor to reset
11. Wait for the BGP session to come up
12. Capture the complete output of ‘show ip bgp neighbor’ , ‘show ip bgp vpnv4 all neighbor’ show ip bgp and show ip route bgp in a notepad .
13. Issue ‘show log’ and capture the output in notepad file , clear the log after capture
14. Check for the capabilities sent and received with the RR
15. Compare the outputs captured in Step 1 and Step 12
16. Compare the capabilities exchanged in Step 7 to that in Step 13
17. Issue ping from your PE loopback 100 ip address to remote PE’s Loopback 100 ip address (Is it now successful???)
18. What is the reason behind the loss of connectivity (please verify if you are seeing an expected behavior)
19. Configure the RRs (both) and your PE such that they activate the BGP session with the RR in vpnv4 address family and ipv4 address family
20. Wait for the BGP neighbor to come up
21. Capture the complete output of ‘show ip bgp neighbor’ , ‘show ip bgp vpnv4 all neighbor’ show ip bgp and show ip route bgp in a notepad .
22. Issue ‘show log’ and capture the output in notepad file , clear the log after capture
23. Issue ping from your PE loopback 100 ip address to remote PE’s Loopback 100 ip address (Is it now successful???)
24. Capture the outputs collected in Step 1 , Step 12 and Step 21
25. Capture the outputs collected in Step 7 , Step 13 and Step 22

Discuss the results with the Instructors

Objective: Configure L3VPN PE-CE static



1. First we need to create VRF-lite on our CEs use the VRF name **vpn-staticlab** for this lab. The following steps are not required on CE1

VRF Name	Loopback #	IP Addressing
vpn-staticlab rd 10:2000	Lo120	120.x.100.1/24 primary 120.x.101.1/24 secondary 120.x.102.1/24 secondary 120.x.103.1/24 secondary

Remember to add the loopbacks to the VRF for this lab.

2. Two L3VPNs will be configured (VRF names are case sensitive)

VRF name/RT	PE	RD	PE Subint	PE IP	CE	CE Subint	CE IP
CustA-static 10:2	PE1	10:102	Fa1/1.2	192.168.100.1/24	CE12	Fa0/0.2	192.168.100.2/24
	PE2	10:102	Fa1/1.2	192.168.101.1/24		Fa1/0.2	192.168.101.2/24
	PE4	10:102	Fa1/0.2	192.168.102.1/24	CE4	Fa0/0.2	192.168.102.2/24
CustB-static	PE3	10:203	Fa1/1.2	192.168.200.1/24	CE34	Fa0/0.2	192.168.200.2/24

20:2	PE4	10:204	Fa1/1.2	192.168.201.1/24		Fa1/0.2	192.168.201.2/24
	PE2	10:202	Fa1/0.2	192.168.202.1/24	CE2	Fa0/0.2	192.168.202.2/24
	PE3		Fa1/0.2	192.168.203.1/24	CE3	Fa0/0.2	192.168.203.2/24

Make the 802.1q tag the same as the sub interface number.

2. Configure the PE-CE sub interfaces and loopback IP addresses. Test connectivity by using pings (remember to use the VRF)
3. On each PE, create the Customer VRF and route distinguishers for each customer VPN
4. Test connectivity between customer VPN sites
5. Do you have connectivity from CustA sites to CustB sites? Why or why not?
6. Check the route table of your P routers. Do you see your Customer VPN routes? Why or why not?
7. Check what loopbacks are configured on each CE
8. On each PE, create a static route within your customer VPN for your CE Loopback ranges.
   e.g. for PE1:
   ip route vrf CustA 110.100.1.0 255.255.255.0 fa 1/1.2 192.168.100.2
9. Configure a default route within the vrf from each of the CE back to it's PE.
   i.e ip route vrf vpn-staticlab 0.0.0.0 0.0.0.0 fa 0/0.2 192.168.100.1
10. Check for connectivity from the loopback of each CE to the loopback of the other sites in that customer VPN. Does it work? If not, why not?
11. Do you have connectivity from the loopbacks in custA's VPN to the loopbacks in CustB's VPN? Why or why not
12.

Objective: Configure L3VPN PE-CE with RIP

26. First we need to create VRF-lite on our CEs use the VRF name **vpn-riplab** for this lab.

VRF Name	Loopback #	IP Addressing
vpn-riplab rd 10:3000	Lo130	130.x.100.1/24 primary 130.x.101.1/24 secondary 130.x.102.1/24 secondary 130.x.103.1/24 secondary

Remember to add the loopbacks to the VRF for this lab.

VRF name RT	PE	RD	PE Subint	PE IP	CE	CE Subint	CE IP
CustA-rip 10:3	PE1	10:103	Fa1/1.3	193.168.100.1/24	CE12	Fa0/0.3	193.168.100.2/24
	PE2	10:103	Fa1/1.3	193.168.101.1/24		Fa0/1.3	193.168.101.2/24

	PE4	10:103	Fa1/0.3	193.168.102.1/24	CE4	Fa0/0.3	193.168.102.2/24
Cust B-rip 20:3	PE3	10:303	Fa1/1.3	193.168.200.1/24	CE34	Fa0/0.3	193.168.200.2/24
	PE4	10:304	Fa1/1.3	193.168.201.1/24		Fa0/1.3	193.168.201.2/24
	PE2	10:302	Fa1/0.3	193.168.202.1/24	CE2	Fa0/0.3	193.168.202.2/24
	PE3		Fa1/0.3	193.168.203.1/24	CE3	Fa0/0.3	193.168.203.2/24

Make the 802.1q tag the same as the subinterface number.

3. Configure the PE-CE subinterfaces and loopback IP addresses. Test connectivity by using pings (remember to use the VRF)
4. On each PE, create the Customer VRF and route distinguishers for each customer VPN
5. Test connectivity between customer VPN sites (i.e. from the PE-CE link addresses)
6. Configure RIP routing in the customer VRF for this lab on the PEs, for example for custA-rip on PE1:
   Rack1-PE1(config)# router rip
   Rack1-PE1(config)# version 2

Why is no network statement required?

Rack1-PE1(config)# address-family ipv4 vrf custA-rip
Rack1-PE1(config)# redistribute rip
Rack1-PE1(config)# no auto-summary
Rack1-PE1(config)# no synchronization
Rack1-PE1(config)# exit-address-family

Why is the above required?

7. Configure RIP routing in the vpn-riplab VRF on the CE. For example, on CE12:

   Rack1-CE12(config)# router rip
   Rack1-CE12(config)# redistribute connected
   Rack1-CE12(config)# network XXX
   Rack1-CE12(config)# no auto summary

   Remember to include all networks you want to redistribute into RIP.

8. Check the RIP routes received on the PEs

Objective: Configure L3VPN PE-CE with BGP

13. We will create another VRF on the CE and PEs for this exercise and create the same architecture as in the RIP example, but using BGP. First we need to create VRF-lite on our CEs use the VRF name **vpn-bgplab** for this lab.

VRF Name	Loopback #	IP Addressing
vpn-bgplab rd 10:4000	Lo140	140.x.100.1/24 primary 140.x.101.1/24 secondary 140.x.102.1/24 secondary 140.x.103.1/24 secondary

Remember to add the loopbacks to the VRF for this lab.

VRF name+ AS number + RT	PE	RD	PE Subint	PE IP	CE	CE Subint	CE IP
CustA-bgp AS 1000 10:4	PE1	10:104	Fa1/1.4	194.168.100.1/24	CE12	Fa0/0.4	194.168.100.2/24
	PE2	10:104	Fa1/1.4	194.168.101.1/24		Fa0/1.4	194.168.101.2/24
	PE4	10:104	Fa1/0.4	194.168.102.1/24	CE4	Fa0/0.4	194.168.102.2/24
CustB-bgp AS 2000 20:4	PE3	10:403	Fa1/1.4	194.168.200.1/24	CE34	Fa0/0.4	194.168.200.2/24
	PE4	10:404	Fa1/1.4	194.168.201.1/24		Fa0/1.4	194.168.201.2/24
	PE2	10:402	Fa1/0.4	194.168.202.1/24	CE2	Fa0/0.4	194.168.202.2/24
	PE3		Fa1/0.4	194.168.203.1/24	CE3	Fa0/0.4	194.168.203.2/24

Make the 802.1q tag the same as the subinterface number.

1. Configure the PE-CE subinterfaces and loopback IP addresses. Test connectivity by using pings (remember to use the VRF)
2. On each PE, create the Customer VRF and route distinguishers for each customer VPN
3. Test connectivity between customer VPN sites (i.e. from the PE-CE link addresses)
4. Configure a BGP neighbour on the PE associated with each CE. E.g. for the PE1 to CE12 session:
   Rack1-PE1(config)# router bgp 100
   Rack1-PE1(config)# address-family ipv4 vrf vpn1
   Rack1-PE1(config)# neighbor 192.168.100.2 remote-as 200

Rack1-PE1(config)# neighbor 192.168.100.2 activate
Rack1-PE1(config)# neighbor 192.168.100.2 as-override
Rack1-PE1(config)# no auto-summary
Rack1-PE1(config)# no synchronization
Rack1-PE1(config)# exit-address-family

6. Configure BGP neighbour(s) on each CE.
7. Confirm routes sent and received on each device. What do you need to add to each BGP peering session to see received routes? What implications does this have for memory consumption?
8. Confirm you have complete connectivity within your customer VPN
9. Check the route table for your customer VPN on each PE
10. Do you see the routes on the P routers?

Objective: Configure L3VPN PE-CE mixed routing protocols (Optional , only if time permits)

1. We will create another VRF on the CE and PEs for this exercise and create the same architecture as in the RIP example, but using BGP. First we need to create VRF-lite on our CEs use the VRF name **vpn-mixlab** for this lab.

VRF Name	Loopback #	IP Addressing
vpn-mixlab rd 10:5000	Lo150	150.x.100.1/24 primary 150.x.101.1/24 secondary 150.x.102.1/24 secondary 150.x.103.1/24 secondary

Remember to add the loopbacks to the VRF for this lab.

VRF name+ AS number + RT	**PE**	**RD**	**PE Subint**	**PE IP**	**CE**	**CE Subint**	**CE IP**
CustA-mix AS 1000 10:5	PE1	10:105	Fa1/1.5	195.168.100.1/24	CE12	Fa0/0.5	195.168.100.2/24
	PE2	10:105	Fa1/1.5	195.168.101.1/24		Fa0/1.5	195.168.101.2/24
	PE4	10:105	Fa1/0.5	195.168.102.1/24	CE4	Fa0/0.5	195.168.103.2/24
cust B-mix AS 2000 20:5	PE3	10:503	Fa1/1.5	195.168.200.1/24	CE34	Fa0/0.5	195.168.200.2/24
	PE4	10:504	Fa1/1.5	195.168.201.1/24		Fa0/1.5	195.168.201.2/24
	PE2	10:502	Fa1/0.5	195.168.202.1/24	CE2	Fa0/0.5	195.168.202.2/24
	PE3		Fa1/0.5	195.168.203.1/24	CE3	Fa0/0.5	195.168.203.2/24

Make the 802.1q tag the same as the subinterface number.

2. Using what you have learned in the last two examples, configure up the customer VPNs such that CE12 and CE34 use BGP peering towards the L3VPN core, and the remaining remote sites use static routing.

3. Our MPLS L3VPN provider wishes to manage the customer CE devices from it's management network. To do this, routes need to be selectively imported to the providers management VPN from each customer VPN. Customer CE will be managed via the 140.100.x.1 loopback address.

We will be adding the following VPN to our network:

VRF name	**Site Name**	**PE**	**RD**	**PE Subint**	**PE IP**	**CE**	**CE Subint**	**CE IP**

mgmt	Mgmt	PE1	100:99	Fa0/0.99	192.168.99.1/24	CE1	Fa0/0.3	192.168.99.2/24

We will keep the configuration of CE1 (the service provider management router in this lab) the same as previously, and create VRFs on it.

VRF Name	Loopback #	IP Addressing
vpn-mgmt	Lo140	10.99.99.1/24

4. Configure up the above on PE1 and CE1
5. Create import and export statements that will allow CE1 to learn the 140.100.x.0/24 routes from each of the customer CEs.
6. Create import and export statements that will allow each customer CE to learn the 10.99.99.0/24 route from the vpn-mgmt VPN.
7. Check the routing table for the 10.99.99.0/24 prefix on the CE, the PE, and P routers.

Objective: Configuring import and export Rts

1.

Objective: Extranet / Management VRF

5. Our MPLS L3VPN provider wishes to manage the customer CE devices from it's management network. To do this, routes need to be selectively imported to the management VPN
6.