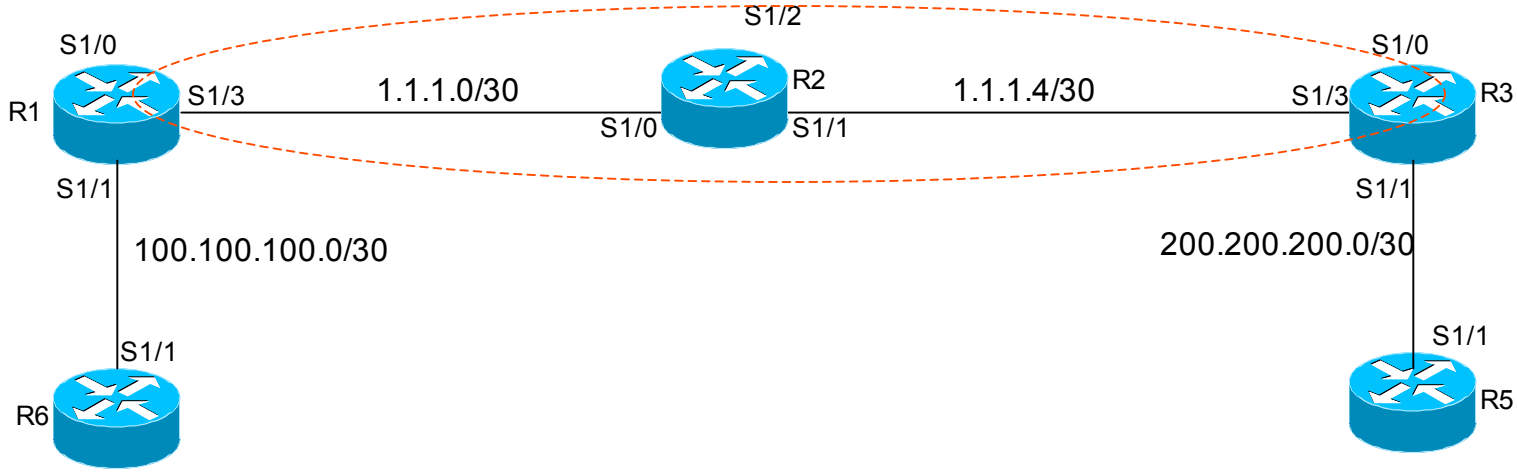
MPLS VPN

Lab Practice

Lab Topology



Loop back ip Address

- Configure loopback ip address on all the routers.

R1 = Loopback 0 = 10.1.1.1/32

R1 = Loopback 1 = 10.1.1.2/32

R2 = Loopback 0 = 10.1.1.3/32

R2 = Loopback 1 = 10.1.1.4/32

R3 = Loopback 0 = 10.1.1.5/32

R3 = Loopback 1 = 10.1.1.6/32

R5 = Loopback 0 = 10.1.1.9/32

R5 = Loopback 1 = 10.1.1.10/32

R6 = Loopback 0 = 10.1.1.11/32

R6 = Loopback 1 = 10.1.1.12/32

Configuring Service Provider IGP

- Configure the SP Network using IGP as the routing protocol.
- Use OSPF as the routing protocol in the service provider network.

```
R1#sh ip os n

Neighbor ID     Pri   State           Dead Time   Address         Interface
10.1.1.4          0   FULL/  -        00:00:36    1.1.1.2         Serial1/3
10.1.1.8          0   FULL/  -        00:00:31    1.1.1.10        Serial1/0
```

Configuring Ospf

router ospf 786

log-adjacency-changes

network x.x.x.x x.x.x.x area 0 **(Configure Service Provider Interface in Area 0)**

Note: Don't configure PE-CE link in ospf

R1#p 10.1.1.7 (Ping all the service provider interface)

Type escape sequence to abort.

Sending 5, 100-byte ICMP Echos to 10.1.1.7, timeout is 2 seconds:

!!!!!

Success rate is 100 percent (5/5), round-trip min/avg/max = 24/39/56 ms

Securing SP IGP

! OSPF Route Authentication

int Serial AA/BB
ip ospf network non-broadcast
ip ospf message-digest-key 1 md5 <*password*>

router ospf 1
log-adjacency-changes
passive-interface default
no passive interface SerialAA/BB
neighbor *X.X.X.X*
network *X.X.X.X Y.Y.Y.Y* area *0*
area 0 authentication message-digest

Enabling CEF

You will enable Cisco express forwarding on all routers
CEF is needed to built the Fib table which is required for MPLS

R2(config)#ip cef (This is the Fib table)

R2#sh ip cef 10.1.1.1

10.1.1.1/32, version 10, epoch 0, cached adjacency 1.1.1.1
0 packets, 0 bytes
via 1.1.1.1, SstEthernet0/0, 0 dependencies
next hop 1.1.1.1, SstEthernet0/0
valid cached adjacency

Enable MPLS

Enable MPLS LDP on Core facing interface. Do not enable on Customer interface.

```
R1(config)# mpls ip

interfac S0/0
ip address x.x.x.x 255.255.255.252
duplex auto
speed auto
Mpls ip

Trouble shooting commands

Show mpls ldp neigh
sh ip cef x.x.x.x
Debug mpls ldp transport
```

Securing LDP Neighbor

Sample configuration on R1 LDP neighbour to R2

mpls ldp neighbor 1.1.1.2 password cisco

Monitoring LSP

You need to perform LSP test

Ping the Sr end loop back address.
Trace the Sr end loop back address. (MPLS Labels)

```
R4#ping 10.1.1.1
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 10.1.1.1, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 76/118/156 ms

R4#traceroute 10.1.1.1
Type escape sequence to abort.
Tracing the route to 10.1.1.1
  1 1.1.1.5 [MPLS: Label 17 Exp 0] 100 msec 60 msec 76 msec
  2 1.1.1.1 188 msec 80 msec *
```

Preparing for MPLS VPN

- Configure MPBGP
- Configuring VRF
- Configuring RD
- Configuring Route Target

Basic troubleshooting commands

Ping vrf

Traceroute vrf

Configuring MPBGP

- Activate the BGP process on router R1 and R3. (Use the AS number 20)
- Disable auto summary and no synchronization
- Enable VPNV4 between R1 and R3
- Use loopback 0 for configuration of BGP.

Verifying the neighbor relationship

Show ip bgp summary

Show bgp neighbor

Solution of configuring MP-BGP

```
router bgp 20
 bgp log-neighbor-changes
 neighbor 10.1.1.5 remote-as 20
 neighbor 10.1.1.5 update-source Loopback0
 !
address-family vpnv4
neighbor 10.1.1.5 activate
neighbor 10.1.1.5 send-community both
neighbor 10.1.1.5 next-hop-self
exit-address-family
```

Verify

```
R1#sh ip bgp neighbors 10.1.1.5

For address family: VPNv4 Unicast
 BGP table version 1, neighbor version 1/0
Output queue size : 0
 Index 1, Offset 0, Mask 0x2
 Member of update-group 1
 NEXT_HOP is always this router
 Community attribute sent to this neighbor
                         Sent       Rcvd
 Prefix activity:            ----       ----
   Prefixes Current:              0          0
```

The Big show commands

- Show ip bgp vpnv4 vrf abc (This command will help you to identify the routing table of MPBGP which runs inside the core)
- Show ip bgp vpnv4 all
- Show ip bgp neighbours

Configuring VRF

- Configure a vrf on the routers R1 and R3. Select the name as R1 and R3
- RD value for R1= 1:1 and R3= 3:3
- RT value for R1=1:1 and R3=3:3
- Apply the VRF to the PE-CE link. (Apply the vrf to interface to S0/1)
- Re apply the ip address to the interface

Verify VRF

Show ip vrf detail

Show ip vrf xxx interface

Show ip protocol vrf xxx

Show ip route vrf xxx

Show ip bgp vpnv4 vrf xxx

Ping vrf xxx y.y.y.y

Solution for configuring VRF

```
ip vrf R1
rd 1:1
route-target export 1:1
route-target import 1:1

interface Serial1/1
ip vrf forwarding R1
ip address 100.1.1.1 255.255.255.252
no ip directed-broadcast
shutdown
```

The Big Show commands

- Show ip vrf
- Show ip vrf detail

  Interface that participate and the import and export route target community attached to the vrf.
- Show ip vrf interface state of the interface/protocol of the specific interface i.e. line protocol up or down

Configure CE

- Configure the CE – PE link both for R1 and R3
- Verify the configuration by ping test.
- Ensure Loopback is configured on the CE.

MPLS VPN CONNECTIVITY USING STATIC ROUTES

Exercise 1: Configure PE-CE link using static routes

Configure PE – CE link using static route

Configure Redistribution to MPBGP

Configure the CE loopback of R6 and R5 reachable using static routes

Verify the connectivity using ping and trace route

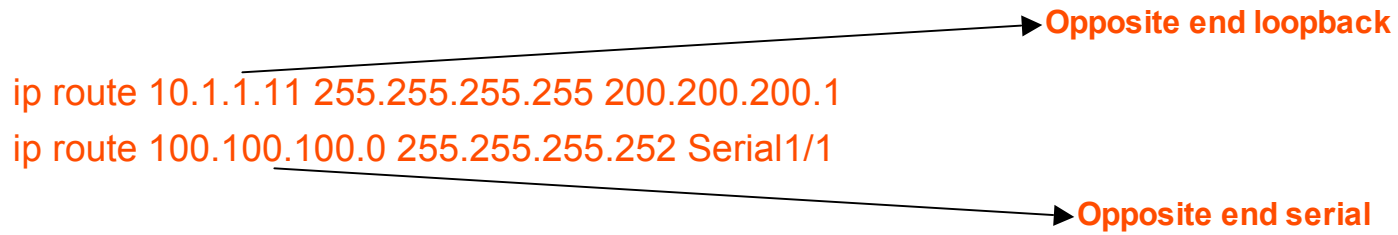
Solution for Exercise 1

Configure a vrf enabled static route on R1 and R3 router for Loopback 0

ip route vrf R1 10.1.1.11 255.255.255.255 100.100.100.2
ip route vrf R3 10.1.1.9 255.255.255.255 200.200.200.2

Verify the connectivity for R1 and R3
Ping to CE loopback of R5 and R6

Configure static routes on both the CE for the opposite loopback and serial. (R5 to configure route for R6 and vice-versa)



Contd..

- Redistribute the static route in BGP

```
address-family ipv4 vrf R1
redistribute static
redistribute connected
no synchronization
```

- Verify the MPBGP is receiving the route on the other PE R1 should receive the route of R3 and vice-versa. (sh ip bgp vpnv4 all)

  Verification for label allocation and routing table

  show tag-switching forwarding vrf R1 or R3 (Will show you the local label which is assigned and advertised through MPBGP)

  show ip bgp vpnv4 all tags (This command will show you the label advertised across the MPGP link)

- Ping vrf xx y.y.y.y

Contd..

sh ip vrf R1 x.x.x.x detail

Opposite end destination

200.200.200.0/30, version 12, epoch 0, cached adjacency to Serial1/3

0 packets, 0 bytes

tag information set, all rewrites owned

local tag: VPN route head

fast tag rewrite with Se1/3, point2point, tags imposed {18 22}

via 10.1.1.5, 0 dependencies, recursive

next hop 1.1.1.2, Serial1/3 via 10.1.1.5/32 (Default)

valid cached adjacency

Inner and outer label

tag rewrite with Se1/3, point2point, tags imposed {18 22}

Ping from one CE to other CE loopback address

Disable ttl propagation in the core and trace

Disabling TTL Propagation

Disable TTL propagation on all routers.

Examine the trace from CE to CE loopbacks

no tag-switching ip propagate-ttl

MPLS VPN CONNECTIVITY USING EBGP

Exercise 6: Configuring EBGP between PE - CE

- Remove the existing static route configuration from PE and CE
- Remove the existing Redistribution form PE
- Verify the configuration
- Configure EBGP as the PE – CE configuration
- Verify the configuration

Configuring BGP

Configure BGP on the CE with autonomous system **2** on R6 and **3** on R5

```
router bgp 3
 no synchronization
 bgp log-neighbor-changes
 network 10.1.1.9 mask 255.255.255.255
 neighbor 200.200.200.1 remote-as 20
 no auto-summary
```

Configure BGP on the PE routers

```
address-family ipv4
neighbor 10.1.1.1 activate
no auto-summary
no synchronization
exit-address-family
```

Verify

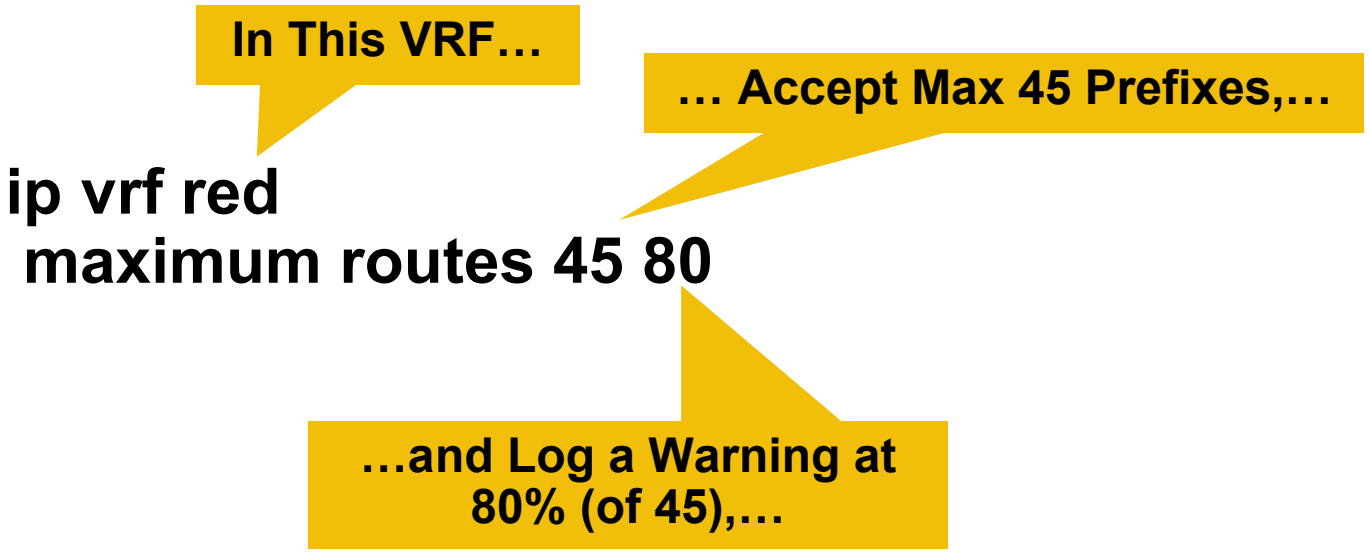
Sh ip route vrf R1

Sh ip bgp neigh

Perform a ping test from one CE to other CE

Configure VRF Maximum Prefix Number

- For a VRF: Specify the maximum number of
  routes allowed



Enable Authentication PE-CE

```
router bgp 1
no synchronization
bgp log-neighbor-changes
no auto-summary
!

 address-family ipv4 vrf abc
 no synchronization
 neighbor x.x.x.x remote-as 20
 neighbor x.x.x.x password cisco
 neighbor x.x.x.x activate
```

Apply Prefix List

- Add loopbacks from 100 to 105 on the CE router
- Advertise loopback in BGP
- Int loopback
  215.1.1.1
  216.1.1.1
  217.1.1.1
  218.1.1.1
  219.1.1.1
- Prefix filter this routes on the PE Router

THANKS