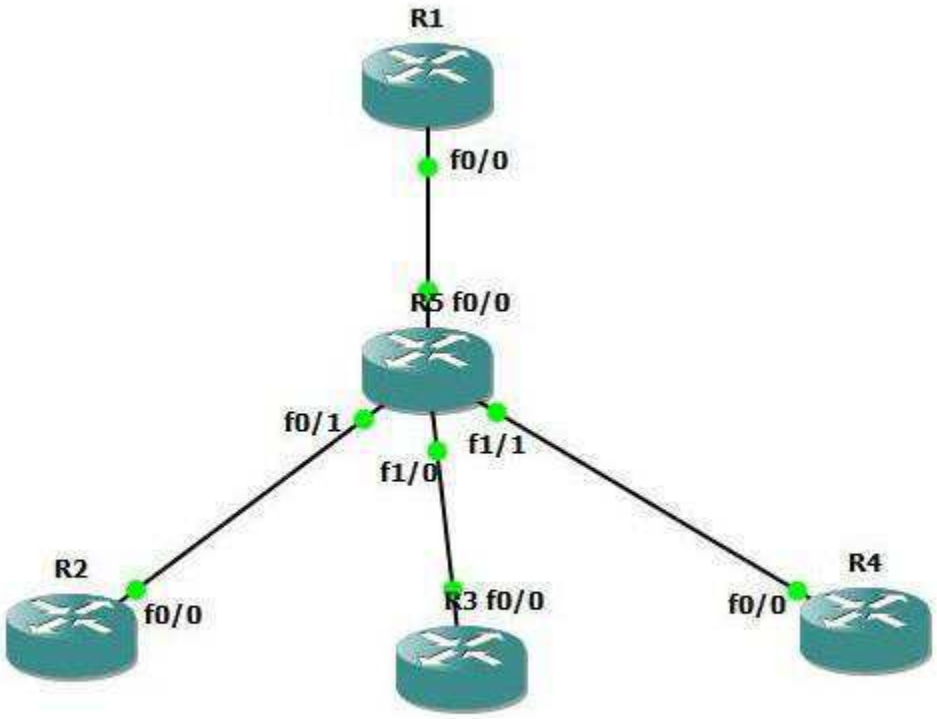

Routing
Switching
Tigers
Forum
DMVPN
www.rstforum.net

DMVPN Topology



LAB 4: Configure BGP over DMVPN:

Task 1: Configure BGP over DMVPN Process

Step 1 In the configuration mode of router configure BGP over DMVPN by following command:

R1:

```
router ospf 1
network 0.0.0.0 0.0.0.0 area 0
exit

int tunnel 0
ip ospf network broadcast
ip ospf priority 255
exit

router bgp 65000
neighbor 192.168.0.2 remote-as 65000
neighbor 192.168.0.2 soft-reconfiguration inbound
neighbor 192.168.0.3 remote-as 65000
neighbor 192.168.0.3 soft-reconfiguration inbound
neighbor 192.168.0.4 remote-as 65000
neighbor 192.168.0.4 soft-reconfiguration inbound
address-family ipv4
network 11.0.0.0 mask 255.0.0.0
exit
```

R2:

```
router ospf 1
network 0.0.0.0 0.0.0.0 area 0
exit

interface tunnel 0
ip ospf network broadcast
ip ospf priority 0
exit

router bgp 65000
neighbor 192.168.0.1 remote-as 65000
neighbor 192.168.0.1 soft-reconfiguration inbound
address-family ipv4
network 22.0.0.0 mask 255.0.0.0
exit
```

R3:

```
router ospf 1
network 0.0.0.0 0.0.0.0 area 0
exit

interface tunnel 0
ip ospf network broadcast
ip ospf priority 0
exit

router bgp 65000
neighbor 192.168.0.1 remote-as 65000
neighbor 192.168.0.1 soft-reconfiguration inbound
address-family ipv4
network 33.0.0.0 mask 255.0.0.0
exit
```

R4:

```
router ospf 1
network 0.0.0.0 0.0.0.0 area 0
exit

interface tunnel 0
ip ospf network broadcast
ip ospf priority 0
exit

router bgp 65000
neighbor 192.168.0.1 remote-as 65000
neighbor 192.168.0.1 soft-reconfiguration inbound
address-family ipv4
network 44.0.0.0 mask 255.0.0.0
exit
```

Task 2: BGP over DMVPN Verification

Step 1 Verify BGP Table

```
R1#show ip bgp
BGP table version is 8, local router ID is 11.11.11.11
Status codes: s suppressed, d damped, h history, * valid, > best, i - internal,
              r RIB-failure, S Stale
Origin codes: i - IGP, e - EGP, ? - incomplete
   Network          Next Hop            Metric LocPrf Weight Path
*> 11.11.11.0/24    0.0.0.0                  0         32768 i
 >i22.22.22.0/24    192.168.0.2              0    100      0 i
 >i33.33.33.0/24    192.168.0.3              0    100      0 i
 >i44.44.44.0/24    192.168.0.4              0    100      0 i

R2#show ip bgp
BGP table version is 4, local router ID is 22.22.22.22
Status codes: s suppressed, d damped, h history, * valid, > best, i - internal,
Origin codes: i - IGP, e - EGP, ? - incomplete
   Network          Next Hop            Metric LocPrf Weight Path
 >i11.11.11.0/24    192.168.0.1              0    100      0 i
*> 22.22.22.0/24    0.0.0.0                  0         32768 i

R3#show ip bgp
BGP table version is 4, local router ID is 33.33.33.33
Status codes: s suppressed, d damped, h history, * valid, > best, i - internal,
Origin codes: i - IGP, e - EGP, ? - incomplete
   Network          Next Hop            Metric LocPrf Weight Path
 >i11.11.11.0/24    192.168.0.1              0    100      0 i
*> 33.33.33.0/24    0.0.0.0                  0         32768 i

R4#show ip bgp
BGP table version is 4, local router ID is 44.44.44.44
Status codes: s suppressed, d damped, h history, * valid, > best, i - internal,
Origin codes: i - IGP, e - EGP, ? - incomplete
   Network          Next Hop            Metric LocPrf Weight Path
 >i11.11.11.0/24    192.168.0.1              0    100      0 i
*> 44.44.44.0/24    0.0.0.0                  0         32768 i
```

Split Horizon doesn't allows spoke to forward BGP Routes to other spokes, because rule is Routes received from one IBGP neighbor is not forwarded to other IBGP neighbor.

Step 2 Configure BGP Route Reflector

R1:

```
router bgp 65000
neighbor 192.168.0.2 remote-as 1
neighbor 192.168.0.2 route-reflector-client
neighbor 192.168.0.4 remote-as 1
neighbor 192.168.0.4 route-reflector-client
exit
```

R1#show ip bgp

```
BGP table version is 8, local router ID is 11.11.11.11
Status codes: s suppressed, d damped, h history, * valid, > best, i - internal,
              r RIB-failure, S Stale
Origin codes: i - IGP, e - EGP, ? - incomplete

   Network          Next Hop            Metric LocPrf Weight Path
*> 11.11.11.0/24    0.0.0.0                  0         32768 i
 >i22.22.22.0/24    192.168.0.2              0    100      0 i
 >i33.33.33.0/24    192.168.0.3              0    100      0 i
 >i44.44.44.0/24    192.168.0.4              0    100      0 i
```

R2#show ip bgp

```
BGP table version is 14, local router ID is 22.22.22.22
Status codes: s suppressed, d damped, h history, * valid, > best, i - internal,
              r RIB-failure, S Stale
Origin codes: i - IGP, e - EGP, ? - incomplete

   Network          Next Hop            Metric LocPrf Weight Path
 >i11.11.11.0/24    192.168.0.1              0    100      0 i
*> 22.22.22.0/24    0.0.0.0                  0         32768 i
 >i33.33.33.0/24    192.168.0.3              0    100      0 i
 >i44.44.44.0/24    192.168.0.4              0    100      0 i
```

R3#show ip bgp
BGP table version is 8, local router ID is 33.33.33.33
Status codes: s suppressed, d damped, h history, * valid, > best, i - internal,
r RIB-failure, S Stale
Origin codes: i - IGP, e - EGP, ? - incomplete

	Network	Next Hop	Metric	LocPrf	Weight	Path
>i	11.11.11.0/24	192.168.0.1	0	100	0	i
>i	22.22.22.0/24	192.168.0.2	0	100	0	i
*>	33.33.33.0/24	0.0.0.0	0		32768	i
>i	44.44.44.0/24	192.168.0.4	0	100	0	i

R4#show ip bgp
BGP table version is 14, local router ID is 44.44.44.44
Status codes: s suppressed, d damped, h history, * valid, > best, i - internal,
r RIB-failure, S Stale
Origin codes: i - IGP, e - EGP, ? - incomplete

	Network	Next Hop	Metric	LocPrf	Weight	Path
>i	11.11.11.0/24	192.168.0.1	0	100	0	i
>i	22.22.22.0/24	192.168.0.2	0	100	0	i
>i	33.33.33.0/24	192.168.0.3	0	100	0	i
*>	44.44.44.0/24	0.0.0.0	0		32768	i

Step 1 Verify DMVPN Tunnel creation

```
R1#show dmvpn
Legend: Attrb --> S - Static, D - Dynamic, I - Incomplete
      N - NATed, L - Local, X - No Socket
      # Ent --> Number of NHRP entries with same NBMA peer
      NHS Status: E --> Expecting Replies, R --> Responding
      UpDn Time --> Up or Down Time for a Tunnel
==========================================================================

Interface: Tunnel0, IPv4 NHRP Details
Type:Hub, NHRP Peers:3,

 # Ent  Peer NBMA Addr Peer Tunnel Add State  UpDn Tm Attrb
 ----- --------------- --------------- ----- -------- -----
   1     172.16.2.2     192.168.0.2    UP 01:35:07     D
   1     172.16.3.2     192.168.0.3    UP 01:35:01     D
   1     172.16.4.2     192.168.0.4    UP 01:35:02     D

R2#show dmvpn
Legend: Attrb --> S - Static, D - Dynamic, I - Incomplete
      N - NATed, L - Local, X - No Socket
      # Ent --> Number of NHRP entries with same NBMA peer
      NHS Status: E --> Expecting Replies, R --> Responding
      UpDn Time --> Up or Down Time for a Tunnel
==========================================================================

Interface: Tunnel0, IPv4 NHRP Details
Type:Spoke, NHRP Peers:3,

 # Ent  Peer NBMA Addr Peer Tunnel Add State  UpDn Tm Attrb
 ----- --------------- --------------- ----- -------- -----
   1     172.16.1.2     192.168.0.1    UP 00:55:53     S


R2#ping 192.168.0.3

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.0.3, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 196/261/340 ms
```

```
R2#show dmvpn
Legend: Attrb --> S - Static, D - Dynamic, I - Incomplete
      N - NATed, L - Local, X - No Socket
      # Ent --> Number of NHRP entries with same NBMA peer
      NHS Status: E --> Expecting Replies, R --> Responding
      UpDn Time --> Up or Down Time for a Tunnel
==========================================================================

Interface: Tunnel0, IPv4 NHRP Details
Type:Spoke, NHRP Peers:3,

 # Ent  Peer NBMA Addr Peer Tunnel Add State  UpDn Tm Attrb
 ----- --------------- --------------- ----- -------- -----
   1     172.16.1.2     192.168.0.1    UP 00:57:01    S
   1     172.16.3.2     192.168.0.3    UP 00:51:50    D
```

Notice that the tunnel to R4 has been flagged as dynamic, in contrast to the static tunnel to the hub/NHS.

```
R2# ping 192.168.0.4

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.0.4, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 156/189/220 ms

R2#traceroute 192.168.0.4 source loopback 1
Type escape sequence to abort.
Tracing the route to 192.168.0.4

1 192.168.0.4 396 msec 508 msec
```

Once the dynamically tunnel is formed between spoke to spoke router, DMVPN allows to Spoke to Spoke directly communication at next hop thus bypassing the Hub router completely

```
R2#show dmvpn
Legend: Attrb --> S - Static, D - Dynamic, I - Incomplete
      N - NATed, L - Local, X - No Socket
      # Ent --> Number of NHRP entries with same NBMA peer
      NHS Status: E --> Expecting Replies, R --> Responding
      UpDn Time --> Up or Down Time for a Tunnel
==========================================================================

Interface: Tunnel0, IPv4 NHRP Details
Type:Spoke, NHRP Peers:3,

 # Ent  Peer NBMA Addr Peer Tunnel Add State  UpDn Tm Attrb
 ----- --------------- --------------- ----- -------- -----
   1     172.16.1.2     192.168.0.1    UP 00:58:55     S
   1     172.16.3.2     192.168.0.3    UP 00:53:43     D
   1     172.16.4.2     192.168.0.4    UP 00:56:37     D

R3#show dmvpn
Legend: Attrb --> S - Static, D - Dynamic, I - Incomplete
      N - NATed, L - Local, X - No Socket
      # Ent --> Number of NHRP entries with same NBMA peer
      NHS Status: E --> Expecting Replies, R --> Responding
      UpDn Time --> Up or Down Time for a Tunnel
==========================================================================

Interface: Tunnel0, IPv4 NHRP Details
Type:Spoke, NHRP Peers:3,

 # Ent  Peer NBMA Addr Peer Tunnel Add State  UpDn Tm Attrb
 ----- --------------- --------------- ----- -------- -----
   1     172.16.1.2     192.168.0.1    UP 01:00:16     S
   1     172.16.2.2     192.168.0.2    UP 00:55:20     D
   1     172.16.4.2     192.168.0.4    UP 00:00:03     D
```

```
R4#sh dmvpn
Legend: Attrb --> S - Static, D - Dynamic, I - Incomplete
      N - NATed, L - Local, X - No Socket
      # Ent --> Number of NHRP entries with same NBMA peer
      NHS Status: E --> Expecting Replies, R --> Responding
      UpDn Time --> Up or Down Time for a Tunnel
==========================================================================

Interface: Tunnel0, IPv4 NHRP Details
Type:Spoke, NHRP Peers:3,

 # Ent  Peer NBMA Addr Peer Tunnel Add State  UpDn Tm Attrb
 ----- --------------- --------------- ----- -------- -----
     1    172.16.1.2     192.168.0.1    UP 01:00:41    S
     1    172.16.2.2     192.168.0.2    UP 00:58:41    D
     1    172.16.3.2     192.168.0.3    UP 00:00:31    D
```

DMVPN Tunnel from one to spoke to every other spoke is dynamically formed thus direct communication from spoke to spoke is possible

Brilliance of DMVPN lies in its ability to dynamically establish spoke-to-spoke tunnels.
In a legacy hub and spoke design, a packet destined from R2 to R4 would need to be routed through R1, to exit the R2 tunnel and the get re-encapsulated to enter the R4 tunnel.
Clearly a better path lies directly via R5, and DMVPN allows us to take advantage of this.
Packet capture of traffic from R2 to R4. Traffic initially follows the path through R1 as described above, while a dynamic tunnel is built from R2 to R4 using NHRP.
After the new tunnel has been established, traffic flows across it, bypassing R1 completely.