



# Ethernet VPN (EVPN) Virtual Extensible LAN (VxLAN) Over Generic Routing Encapsulation (GRE)

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## Overview

Ethernet VPN (EVPN) is a standards-based BGP distributed control plane for Network Virtualization Overlay (NVO), that provides Layer 2 (bridging) and Layer 3 (routing) connectivity over IP or IP/MPLS underlay networks.

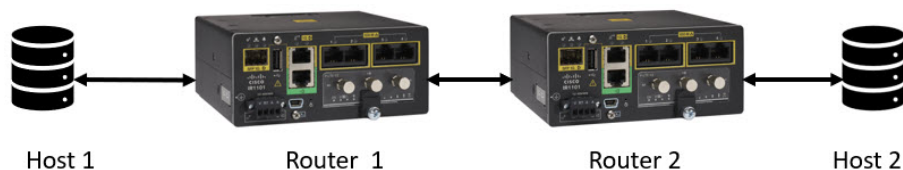
Virtual Extensible LAN (VxLAN) is a solution to support a flexible, large-scale multitenant environment over a shared common physical infrastructure. The transport protocol over the physical data center network is IP plus UDP.

Generic Routing Encapsulation (GRE) provides a virtual point-to-point private connection and encapsulates and forwards packets over an IP-based network.

This solution provides the customer the ability to extend an L2 broadcast domain over an L3 IP network. The GRE tunnel facilitates connection of disjoint L3 network subnets over which VxLAN packets can be transferred.

The following shows an example topology:

Figure 1: Topology



## Configuration Examples

The following configuration supports the topology illustrated in the [Overview, on page 1](#).

### Host 1

```
interface GigabitEthernet1/7
  switchport access vlan 21
  switchport mode access
!
interface Vlan21
  ip address 21.21.21.1 255.255.255.0
```

### Router 1

```
l2vpn evpn
  replication-type ingress
!
l2vpn evpn instance 21 vlan-based
  encapsulation vxlan
  replication-type ingress
  default-gateway advertise enable
!

bridge-domain 21
  member Vlan21 service-instance 21
  member evpn-instance 21 vni 30000
!
!
interface Loopback0
  ip address 100.100.100.1 255.255.255.255
!
interface Tunnel100
  ip address 102.102.102.1 255.255.255.252
  ip pim sparse-mode
  mpls ip
  tunnel source 192.168.5.100
  tunnel destination 192.168.5.200
!
interface GigabitEthernet0/0/0
  ip address 192.168.5.100 255.255.255.0
!
interface FastEthernet0/0/1
  switchport access vlan 21
  switchport mode access
!
interface FastEthernet0/0/2
!
```

```

!
interface Vlan21
  no ip address
  service instance 21 ethernet
    encapsulation dot1q 21
  !

!
interface nve1
  no ip address
  source-interface Loopback0
  host-reachability protocol bgp
  member vni 30000 ingress-replication
  !
router ospf 1
  router-id 100.100.100.1
  network 100.100.100.1 0.0.0.0 area 0
  network 102.102.102.0 0.0.0.3 area 0
  !
router bgp 1
  bgp router-id 100.100.100.1
  bgp log-neighbor-changes
  neighbor 102.102.102.2 remote-as 1
  !
  address-family ipv4
    redistribute connected
    neighbor 102.102.102.2 activate
    neighbor 102.102.102.2 send-community both
  exit-address-family
  !
  address-family vpnv4
    import l2vpn evpn
    neighbor 102.102.102.2 activate
    neighbor 102.102.102.2 send-community extended
  exit-address-family
  !
  address-family l2vpn evpn
    neighbor 102.102.102.2 activate
    neighbor 102.102.102.2 send-community both
  exit-address-family
  !
ip pim rp-address 100.100.100.2

```

## Router 2

```

l2vpn evpn
  replication-type ingress
  !
l2vpn evpn instance 21 vlan-based
  encapsulation vxlan
  replication-type ingress
  default-gateway advertise enable
  !
  !

bridge-domain 21
  member Vlan21 service-instance 21
  member evpn-instance 21 vni 30000
  !
  !
interface Loopback0
  ip address 100.100.100.2 255.255.255.255
  !
interface Tunnel100

```

```

ip address 102.102.102.2 255.255.255.252
ip pim sparse-mode
mpls ip
tunnel source 192.168.5.200
tunnel destination 192.168.5.100
!
interface GigabitEthernet0/0/0
ip address 192.168.5.200 255.255.255.0
negotiation auto
!
interface GigabitEthernet0/1/0
switchport access vlan 21
switchport mode access
!
!
interface Vlan21
no ip address
service instance 21 ethernet
 encapsulation dot1q 21
!
!
interface nve1
no ip address
source-interface Loopback0
host-reachability protocol bgp
member vni 30000 ingress-replication
!
router ospf 1
router-id 100.100.100.2
network 100.100.100.2 0.0.0.0 area 0
network 102.102.102.0 0.0.0.3 area 0
!
router bgp 1
bgp router-id 100.100.100.2
bgp log-neighbor-changes
neighbor 102.102.102.1 remote-as 1
!
address-family ipv4
 redistribute connected
 neighbor 102.102.102.1 activate
 neighbor 102.102.102.1 send-community both
exit-address-family
!
address-family vpv4
 import l2vpn evpn
 neighbor 102.102.102.1 activate
 neighbor 102.102.102.1 send-community extended
exit-address-family
!
address-family l2vpn evpn
 neighbor 102.102.102.1 activate
 neighbor 102.102.102.1 send-community both
exit-address-family
!
ip forward-protocol nd
ip pim rp-address 100.100.100.2

```

## Host 2

```

interface GigabitEthernet1/7
switchport access vlan 21
switchport mode access
!

```

```
interface Vlan21
 ip address 21.21.21.2 255.255.255.0
```

## Configuration Steps

The following steps configure Router 1:

1. Create the EVPN and EVPN instance:

```
l2vpn evpn
 replication-type ingress
 !
 l2vpn evpn instance 21 vlan-based
 encapsulation vxlan
 replication-type ingress
 default-gateway advertise enable
```

2. Add a port to VLAN 21:

```
interface FastEthernet0/0/1
 switchport access vlan 21
 switchport mode access
```

3. Configure BDI 21 on Vlan 21:

```
interface Vlan21
 no ip address
 service instance 21 ethernet
 encapsulation dot1q 21
```

4. Assign IP to Loopback interface:

```
interface Loopback0
 ip address 100.100.100.1 255.255.255.255
```

5. Configure IP on WAN interface:

```
interface GigabitEthernet0/0/0
 ip address 192.168.5.100 255.255.255.0
```

6. Configure a GRE Tunnel with WAN interface IP:

```
interface Tunnell00
 ip address 102.102.102.1 255.255.255.252
 ip pim sparse-mode
 mpls ip
 tunnel source 192.168.5.100
 tunnel destination 192.168.5.200
```

7. Configure VXLAN:

```
interface nve1
 no ip address
 source-interface Loopback0
 host-reachability protocol bgp
 member vni 30000 ingress-replication
```

8. Apply the EVPN and VxLAN instance on BDI (Bridge domain interface):

```
bridge-domain 21
 member Vlan21 service-instance 21
 member evpn-instance 21 vni 30000
```

9. Configure OSPF and BGP as overlay protocol:

```

router ospf 1
router-id 100.100.100.1
network 100.100.100.1 0.0.0.0 area 0
network 102.102.102.0 0.0.0.3 area 0
!
router bgp 1
bgp router-id 100.100.100.1
bgp log-neighbor-changes
neighbor 102.102.102.2 remote-as 1
!
address-family ipv4
  redistribute connected
  neighbor 102.102.102.2 activate
  neighbor 102.102.102.2 send-community both
exit-address-family
!
address-family vpnv4
  import l2vpn evpn
  neighbor 102.102.102.2 activate
  neighbor 102.102.102.2 send-community extended
exit-address-family
!
address-family l2vpn evpn
  neighbor 102.102.102.2 activate
  neighbor 102.102.102.2 send-community both
exit-address-family

```

Perform similar steps to configure Router 2 with the appropriate IP addresses. Then configure IP addresses on both of the hosts for reachability.

## Troubleshooting

The following show commands can be used to help troubleshoot your setup.

### Router 1

```
Router1#show l2vpn evpn peers vxlan
```

Interface	VNI	Peer-IP	Num routes	eVNI	UP time
nve1	30000	100.100.100.2	1	30000	00:00:18

```
Router1#show nve peers
```

'M' - MAC entry download flag 'A' - Adjacency download flag  
'4' - IPv4 flag '6' - IPv6 flag

Interface	VNI	Type	Peer-IP	RMAC/Num_RT	eVNI	state	flags	UP time
nve1	30000	L2CP	100.100.100.2	1	30000	UP	N/A	00:00:40

```
Router1#show l2vpn evpn mac
```

MAC Address	EVI	BD	ESI	Ether Tag	Next Hop(s)
0000.24aa.c926	21	21	0000.0000.0000.0000.0000	0	Vl21:21
0000.24aa.c927	21	21	0000.0000.0000.0000.0000	0	100.100.100.2

```
Router1#show bgp l2vpn evpn all
```

BGP table version is 7, local router ID is 100.100.100.1  
Status codes: s suppressed, d damped, h history, \* valid, > best, i - internal,

```

        r RIB-failure, S Stale, m multipath, b backup-path, f RT-Filter,
        x best-external, a additional-path, c RIB-compressed,
        t secondary path, L long-lived-stale,
Origin codes: i - IGP, e - EGP, ? - incomplete
RPKI validation codes: V valid, I invalid, N Not found

```

```

      Network          Next Hop          Metric LocPrf Weight Path
Route Distinguisher: 100.100.100.1:21
*> [2][100.100.100.1:21][0][48][000024AAC926][0][*]/20
    0.0.0.0                                32768 ?
*>i [2][100.100.100.1:21][0][48][000024AAC927][0][*]/20
    100.100.100.2                          0    100    0 ?
Route Distinguisher: 100.100.100.2:21
*>i [2][100.100.100.2:21][0][48][000024AAC927][0][*]/20
    100.100.100.2                          0    100    0 ?
Route Distinguisher: 100.100.100.1:21
*> [3][100.100.100.1:21][0][32][100.100.100.1]/17
    0.0.0.0                                32768 ?
*>i [3][100.100.100.1:21][0][32][100.100.100.2]/17
    100.100.100.2                          0    100    0 ?
      Network          Next Hop          Metric LocPrf Weight Path
Route Distinguisher: 100.100.100.2:21
*>i [3][100.100.100.2:21][0][32][100.100.100.2]/17
    100.100.100.2                          0    100    0 ?
Router1#

```

## Router 2

```
Router2#show l2vpn evpn peers vxlan
```

Interface	VNI	Peer-IP	Num routes	eVNI	UP time
nve1	30000	100.100.100.1	1	30000	00:00:17

```
Router2#show nve peers
```

```

'M' - MAC entry download flag 'A' - Adjacency download flag
'4' - IPv4 flag '6' - IPv6 flag

```

Interface	VNI	Type	Peer-IP	RMAC/Num_RTs	eVNI	state	flags	UP time
nve1	30000	L2CP	100.100.100.1	1	30000	UP	N/A	00:00:22

```
Router2#show l2vpn evpn mac
```

MAC Address	EVI	BD	ESI	Ether Tag	Next Hop(s)
0000.24aa.c926	21	21	0000.0000.0000.0000.0000	0	100.100.100.1
0000.24aa.c927	21	21	0000.0000.0000.0000.0000	0	Vl21:21

```
Router2#show bgp l2vpn evpn all
```

```

BGP table version is 23, local router ID is 100.100.100.2
Status codes: s suppressed, d damped, h history, * valid, > best, i - internal,
               r RIB-failure, S Stale, m multipath, b backup-path, f RT-Filter,
               x best-external, a additional-path, c RIB-compressed,
               t secondary path, L long-lived-stale,
Origin codes: i - IGP, e - EGP, ? - incomplete
RPKI validation codes: V valid, I invalid, N Not found

```

```

      Network          Next Hop          Metric LocPrf Weight Path
Route Distinguisher: 100.100.100.1:21
*>i [2][100.100.100.1:21][0][48][000024AAC926][0][*]/20
    100.100.100.1                          0    100    0 ?
Route Distinguisher: 100.100.100.2:21
*>i [2][100.100.100.2:21][0][48][000024AAC926][0][*]/20
    100.100.100.1                          0    100    0 ?

```

```
*> [2][100.100.100.2:21][0][48][000024AAC927][0][*]/20
      0.0.0.0                                     32768 ?
Route Distinguisher: 100.100.100.1:21
*>i [3][100.100.100.1:21][0][32][100.100.100.1]/17
      100.100.100.1                               0      100      0 ?
Route Distinguisher: 100.100.100.2:21
*>i [3][100.100.100.2:21][0][32][100.100.100.1]/17
      100.100.100.1                               0      100      0 ?
*> [3][100.100.100.2:21][0][32][100.100.100.2]/17
      0.0.0.0                                     32768 ?
Router2#
```

## Additional Resources

The following are additional sources of information:

- [Configure VXLAN](#)
- [Configure GRE Tunnels](#)