

# Open Compute Network Operating System Version 1.2.4

OcNOS™ Validated Solution Guide  
Data Center Solution – EVPN with  
VXLAN



# Contents

Chapter 1 .....	3
Data Center Solution Overview .....	3
Data Center Virtualization .....	3
Virtualization Technologies .....	3
Data Center Virtualization with VXLAN and EVPN .....	4
Chapter 2 .....	4
VXLAN and EVPN Overview .....	5
OcNOS VXLAN EVPN Architecture .....	5
VXLAN using Unicast and Multicast Tunnels .....	5
EVPN Learns VTEP Topology .....	6
Basic Example Configuration .....	7
1. Non-EVPN: VXLAN Unicast Traffic .....	7
2. EVPN: VXLAN with EVPN Control Plane .....	10
3. Non-EVPN: VXLAN with Data Plane Learning .....	15
4. EVPN: VXLAN Tenant Identification using Port and VLAN .....	19
Conclusion .....	23



## Glossary

VXLAN	Virtual extensible LAN
EVPN	Ethernet Virtual Private Network
VM	Virtual Machine
PBB	Provider Backbone bridging
OTV	Overlay Transport Virtualization
NVGRE	Network virtualization using Generic Route Encapsulation
MPLS	Multiprotocol Label Switching
VPLS	Virtual Private LAN Service
STT	Stateless Transport Tunelling
ISIS	Intermediate system – Intermediate system
BGP	Border Gateway Protocol

# Chapter 1

## DATA CENTER SOLUTION OVERVIEW

- Data Center Virtualization
- Virtualization Technologies
- Data Center Virtualization with VXLAN and EVPN

### Data Center Virtualization

The increasing size and functionalities of hosted and captive data centers have also put an increasing demand on application services. The modern day data center is expected to host several categories of application services. This further horizontally increases the volume and size of the data center, and thus further increasing the running and operational costs.

Virtualization of application services has allowed limited scale data centers to be refurbished to serve new services at very fast turnarounds. Thus, it also helps in saving both capital and operational costs in the form of servers, cooling, electricity and maintenance

However, for hosted data centers, providing extended tenant services to enterprises still requires infrastructure changes on networking equipment and servers to provide application oriented architecture or tenant service isolation. Thus; providing hosted or multi-application oriented services in the data center still leads to increase in the overall costs. Using virtualization for networking apart from compute nodes, the infrastructure costs can be controlled. This virtualization is achieved using overlay protocol technologies.

An overlay protocol can be used to connect the customer virtual machines (VMs) on servers located at different locations in the network to communicate without affecting the L3 infrastructure. The following sections discuss the technologies that can be used for this purpose.

### Virtualization Technologies

An overlay is basically a tunneling protocol where the customer traffic can be tunneled across the network, without reconfiguring the network. Various tunneling technologies are in use in the enterprise and data center network.

802.1Q-in-Q tunneling or provider bridging provides a solution to scale beyond the 4K VLAN limitation, but it does not hide the customer MAC addresses from the core network.

PBB or Mac-in-Mac tunneling provided a solution to hide customer MAC addresses along with scaling, but it has a disadvantage on relying on xSTP protocols.

TRILL and SPB solved the issue of reliance on STP by using ISIS control plane learning. These technologies are deployable at the edge networks.



OTV and LISP are other tunneling technologies which address L2/L3 over L3 networks.

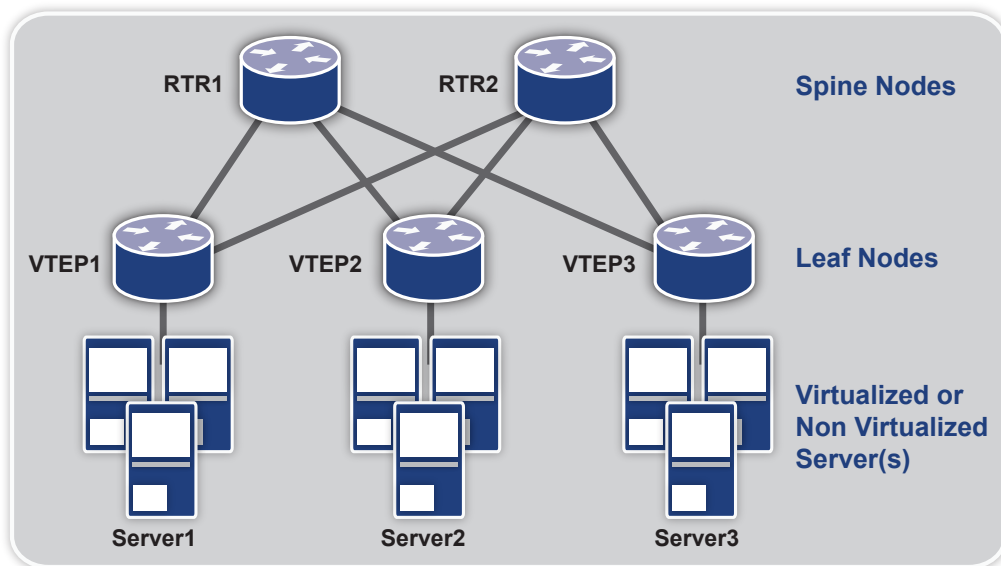
MPLS based VPLS and VPWS services provide VPN services within the data center and data center interconnect.

New host based virtualization technologies focus more on VM/Service mobility and multitenancy.

VXLAN, NVGRE and STT are some of the technologies developed in this area. VXLAN is the most popular among these as it is a simple IP/UDP-based protocol & gives scale. In this paper, VXLAN and EVPN will be discussed in details.

## Data Center Virtualization with VXLAN and EVPN

VXLAN, NVGRE and STT are some of the technologies developed in this area. In this paper, VXLAN and EVPN will be discussed in details.



The VTEPs (Virtual Tunnel Endpoints) are termination points in VxLAN deployments. they form UDP tunnels among themselves. VTEPs identify a specific tenant's traffic and encapsulate it within the UDP tunnel. If the traffic is broadcast, multicast or unknown, then the traffic is multicasted over UDP to other VTEPs. A VXLAN header is inserted by the VTEP to identify the tenant of the traffic.

OcNOS supports VTEP functionality for VXLAN tunnels.

VXLAN depends on multicast and data plane learning to discover the VTEPs.

EVPN is a control plane technology using MP-BGP for implementing VPN technologies in a network. EVPN was developed to provide the following improvements over the current VPN technologies.

- Control plane learning
- Multicast optimization
- Multihoming
- Simplicity in provisioning
- Achieving various services
- Better reconvergence

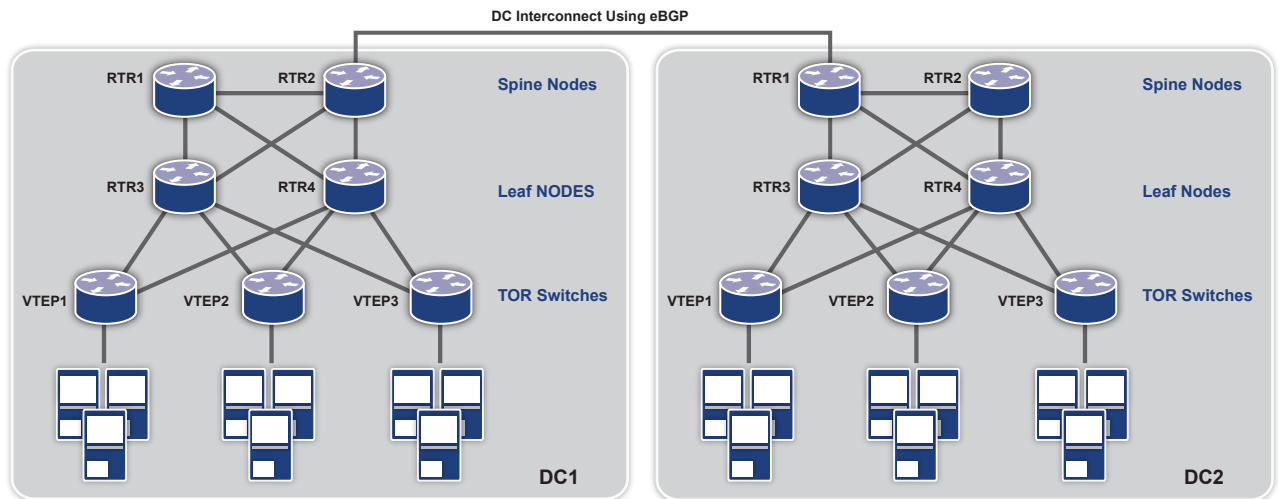
When VXLAN is deployed in DCI, multicast and data plane learning are not preferred. A VXLAN solution with EVPN control plane is preferred in that deployment.

The next chapter describes the VXLAN and EVPN solution using OcNOS.

# Chapter 2

## VXLAN AND EVPN OVERVIEW

- OcNOS VXLAN EVPN architecture
- VXLAN using unicast and multicast tunnels
- EVPN to learn VTEP topology
- Basic example configurations



### OcNOS VXLAN EVPN Architecture

The above topology diagram demonstrates the network architecture which will be used to describe this solution. The access or top-of-rack (TOR) switches implement the VTEP functionality. The Leaf node routers act as Route Reflectors and communicate within the data center. The Spine node routers act as second-level hierarchical Route Reflectors to communicate between different data centers using eBGP on the data center interconnect (DCI). MP-BGP is used at the routers and VTEPs to implement EVPN.

### VXLAN using Unicast and Multicast Tunnels

VXLAN technology is defined in RFC 7348. The OcNOS implementation of VXLAN complies with the specification. In addition to providing the option of IP multicast for broadcast, unknown and multicast (BUM) traffic, the OcNOS implementation also provides an option for head-end replication of this kind of traffic.

This configuration shows a unicast-only VXLAN VNID (Tenant), mostly used for ELINE services. Also shown in this configuration is mapping a port to a tenant and a static entry for a remote virtual machine MAC address.

```
OcNOS(config)#nvo vxlan id 2
OcNOS(config-nvo)#vxlan map-network tunnel Tunnel4
OcNOS(config-nvo)#vxlan map-access port xe1
OcNOS(config-nvo)#vxlan static-entry host-mac 0000.0000.bbbb remote-vtep-ip 2.2.2.4
```

This configuration shows a VXLAN VNID with IP multicast tunnels. All broadcast, unknown and multicast traffic will be sent on the tunnel destined to the multicast IP address specified in the configuration.



```
OcNOS(config)#nvo vxlan id 54321 multicast 239.10.10.9
OcNOS(config-nvo)#vxlan map-network tunnel Tunnel4
OcNOS(config-nvo)#vxlan map-access port-vlan xe1 2
```

This configuration shows a VXLAN VNID with head-end replication. All broadcast, unknown and multicast traffic will be sent on all the unicast tunnels mapped to this tenant, in this case on both Tunnel4 and Tunnel5.

The tenant traffic can be identified through a port or through a port+VLAN identifier mapped to the tenant.

When a port is mapped to the tenant, all traffic arriving at the port is treated as the tenant traffic and tunneled to remote VTEP(s) using the tenant id (VNID) in the VXLAN header.

When a port+VLAN is mapped to the tenant, all traffic tagged with the specified VLAN arriving at the specified port is treated as the tenant traffic. When tunneled, the packet is encapsulated as shown in the below packet capture.

```
Frame 77: 110 bytes on wire (880 bits), 110 bytes captured (880 bits)
Ethernet II, Src: Dell_d9:22:c5 (34:17:eb:d9:22:c5), Dst: Dell_d5:2e:c5 (34:17:eb:d5:2e:c5)
Internet Protocol Version 4, Src: 2.2.2.2 (2.2.2.2), Dst: 1.1.1.1 (1.1.1.1)
User Datagram Protocol, Src Port: 49152 (49152), Dst Port: 4789 (4789)
Virtual extensible Local Area Network
  Flags: 0x08
  Reserved: 0x000000
  VXLAN Network Identifier (VNI): 100
  Reserved: 0
Ethernet II, Src: 00:00:00_00:bb:bb (00:00:00:00:bb:bb), Dst: 00:00:00_00:aa:aa (00:00:00:00:aa:aa)
802.1Q Virtual LAN, PRI: 0, CFI: 0, ID: 2
  000. .... .. = Priority: Best Effort (default) (0)
  ...0 .... .. = CFI: Canonical (0)
  ... 0000 0000 0010 = ID: 2
  Type: IP (0x0800)
  Trailer: 00000000000000000000000000000000
```

## EVPN Learns VTEP Topology

EVPN was introduced in RFC 7432 for VPLS. EVPN was then extended for overlay technologies like VXLAN in draft-ietf-bess-evpn-overlay-02. The OcNOS EVPN solution complies with these standards. It is implemented only for the VXLAN data plane and is extensible to other data planes.

EVPN defines the use of MP-BGP protocol for learning the MAC/IP of the hosts connected to the VTEPs. The host MAC/IP is learned at the local VTEP through data plane learning. This is then transmitted to the other VTEPs through MP BGP. The remote VTEPs learn these routes at the tunnels connected to these VTEPs. The tunnels are learned automatically through MP-BGP.

In the configuration below, BGP neighbors are configured for the EVPN address family

```
OcNOS(config)#router bgp 1
OcNOS(config-router)#bgp router-id 1.1.1.1
OcNOS(config-router)#neighbor 10.1.1.2 remote-as 1
OcNOS(config-router)#address-family l2vpn evpn
```

When configuring VXLAN VNIDs, it needs to be specified that EVPN will be used as a control plane. This is shown in the configuration below.

```
OcNOS(config)# nvo vxlan id 100 ingress-replication
OcNOS(config-nvo)# vxlan host-reachability-protocol evpn-bgp vrfblue
OcNOS(config-nvo)# vxlan map-access port xe1
```



As can be seen in the above configuration, for VNIDs that will be using EVPN, there is no need to configure a tunnel, it will be automatically configured through BGP EVPN.

When a VNID is configured with EVPN, a BGP update message is sent to the EVPN neighbors with this information. This is the “Inclusive Multicast Ethernet Tag Route”. OcNOS supports only head end replication with EVPN. Once the tunnels are established on receiving this route, the MAC IP advertisements for host MAC and IP are distributed to the remote VTEPs using BGP-MP. This is illustrated in the packet capture below. On receiving this route, the MAC/IP for the remote host is learned at this tunnel, and the packets will no longer be multicasted.

```

87 104.953557 10.1.1.2      10.1.1.1      BGP      85 KEEPALIVE Message
104 134.953769 10.1.1.2      10.1.1.1      BGP      85 KEEPALIVE Message
106 134.953969 10.1.1.1      10.1.1.2      BGP      89 KEEPALIVE Message
129 164.953262 10.1.1.2      10.1.1.1      BGP      85 KEEPALIVE Message
130 164.953427 10.1.1.1      10.1.1.2      BGP      89 KEEPALIVE Message

Flags: 0x90: Optional, Non-transitive, Complete, Extended Length
  1... .. = Optional: optional
  .0.. .. = Transitive: Non-transitive
  ..0. ... = Partial: Complete
  ...1 ... = Length: Extended length
Type Code: MP_REACH_NLRI (14)
Length: 48
Address family: Layer-2 VPN (25)
Subsequent address family identifier: EVPN (70)
Next hop network address (4 bytes)
Subnetwork points of attachment: 0
Network layer reachability information (39 bytes)
  EVPN NLRI: MAC Advertisement Route
    AFI: MAC Advertisement Route (2)
    Length: 37
    Route Distinguisher: 0001020202020001 (2.2.2.2:1)
    ESI: 00000000000000000000
    Ethernet Tag ID: 0
    MAC Address Length: 48
    MAC Address: 00:00:00_00:bb:bb (00:00:00:00:bb:bb)
    IP Address Length: 32
    IPv4 address: 11.11.11.20 (11.11.11.20)
    MPLS Label Stack: 6, (BOGUS: Bottom of Stack NOT set!)

0080 01 02 01 01 01 01 00 01 03 0c 00 00 00 00 09  .....F.....%
0090 90 0e 00 30 00 19 46 04 02 02 02 02 00 02 25 00  .....0.....%
00a0 01 02 02 02 02 00 01 00 00 00 00 00 00 00 00 00  .....0.....%
00b0 00 00 00 00 00 30 00 00 00 00 bb bb 20 0b 0b 0b  .....d
00c0 14 00 00 64
  
```

At the route reflectors, the neighbors are configured as RR clients for the EVPN address family. The hierarchical RRs help load balance the intra and inter data center traffic.

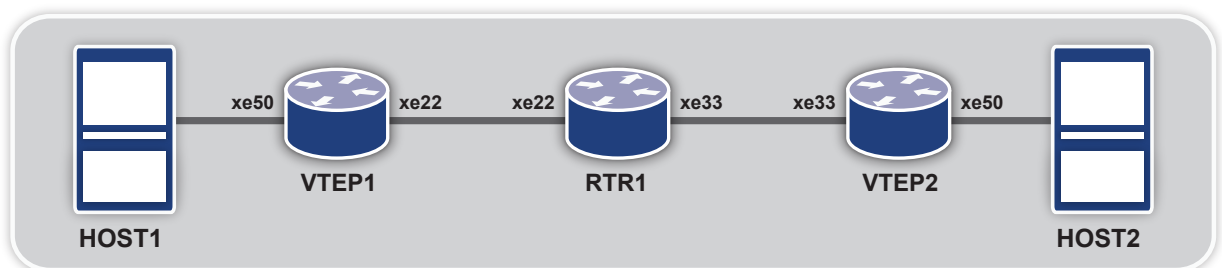
## Basic Example Configuration

### 1. Non-EVPN: VXLAN Unicast Traffic

This configuration has the following features:

- Data plane learning
- ISIS configured as interior gateway protocol
- The loopback interface is used as the VTEP IP

## Topology





## VTEP1

	Command	Purpose
Step 1	VTEP1#configure terminal	Entering configuration mode
Step 2	VTEP1(config)#bridge 1 protocol mstp	Creating bridge
Step 3	VTEP1(config)#interface xe50	Configure xe50 interface.
Step 4	VTEP1(config-if)#switchport	Configure the port as L2 port.
Step 5	VTEP1(config-if)#bridge-group 1	Add the port to the bridge
Step 6	VTEP1(config-if)#switchport mode access	Set the port as access port
Step 7	VTEP1(config-if)#no shutdown	Set interface state as up
Step 8	VTEP1(config-if)#exit	Exit interface mode
Step 9	VTEP1(config)#interface xe22	Configure xe22 interface
Step 10	VTEP1(config-if)#no switchport	Configure the port as L3 port.
Step 11	VTEP1(config-if)#ip address 11.11.11.1/24	Configure IP address on the interface
Step 12	VTEP1(config-if)#no shutdown	Set interface state as up
Step 13	VTEP1(config-if)#exit	Exit interface mode
Step 14	VTEP1(config)#interface lo	Configure loopback interface
Step 15	VTEP1(config-if)#ip address 2.2.2.1/24	Configure IP address on the interface
Step 16	VTEP1(config-if)#exit	Exit interface mode
Step 17	VTEP1(config)#router isis ipi	Configure ISIS as IGP.
Step 18	VTEP1(config-router)#is-type level-1	Set the ISIS as Level 1.
Step 19	VTEP1(config-router)#net 49.0001.1111.1111.1111.00	Establish a Network Entity Title for this instance, specifying the area address and the system ID.
Step 20	VTEP1(config-if)#exit	Exit router mode
Step 21	VTEP1(config)#interface lo	Configure loopback interface
Step 22	VTEP1(config-if)#ip router isis ipi	Enable IS-IS routing on an interface for area ipi
Step 23	VTEP1(config-if)#isis circuit-type level-1	Set the circuit type for the interface lo
Step 24	VTEP1(config-if)#exit	Exit interface mode
Step 25	VTEP1(config)#interface xe22	Configure xe22 interface
Step 26	VTEP1(config-if)#ip router isis ipi	Enable IS-IS routing on an interface for area ipi
Step 27	VTEP1(config-if)#isis circuit-type level-1	Set the circuit type for the interface xe22
Step 28	VTEP1(config-if)#exit	Exit interface mode
Step 29	VTEP1(config)#nvo vxlan enable	Enable VXLAN. Configure the node as VTEP.
Step 30	VTEP1(config)#interface tunnel 98	Configure Tunnel interface
Step 31	VTEP1(config-if)#tunnel mode vxlan	Set the tunnel interface for vxlan
Step 32	VTEP1(config-if)#tunnel source 2.2.2.1	Set the tunnel source ip
Step 33	VTEP1(config-if)#tunnel destination 3.3.3.1	Set the tunnel destination ip
Step 34	VTEP1(config-if)#exit	Exit interface mode
Step 35	VTEP1(config)#nvo vxlan id 54321 ingress- replication	Configure a VXLAN VPN with head end replication
Step 36	VTEP1(config-nvo)#vxlan map-access port xe50	Set xe50 as access port to VPN 54321
Step 37	VTEP1(config-nvo)#vxlan map-network tunnel Tunnel98	Set Tunnel98 as network tunnel for VPN 54321
Step 38	VTEP1(config-nvo)#vxlan static-entry host-mac 0000.0000.bbbb remote-vtep-ip 3.3.3.1	Add a static entry for remote host





## VTEP2

	Command	Purpose
Step 1	VTEP2#configure terminal	Entering configuration mode
Step 2	VTEP2(config)#bridge 1 protocol mstp	Creating bridge
Step 3	VTEP2(config)#interface xe50	Configure xe50 interface.
Step 4	VTEP2(config-if)#switchport	Configure the port as L2 port.
Step 5	VTEP2(config-if)#bridge-group 1	Add the port to the bridge
Step 6	VTEP2(config-if)#switchport mode access	Set the port as access port
Step 7	VTEP2(config-if)#no shutdown	Set interface state as up
Step 8	VTEP2(config-if)#exit	Exit interface mode
Step 9	VTEP2(config)#interface xe33	Configure xe33 interface
Step 10	VTEP2(config-if)#no switchport	Configure the port as L3 port.
Step 11	VTEP2(config-if)#ip address 12.12.12.1/24	Configure IP address on the interface
Step 12	VTEP2(config-if)#no shutdown	Set interface state as up
Step 13	VTEP2(config-if)#exit	Exit interface mode
Step 14	VTEP2(config)#interface lo	Configure loopback interface
Step 15	VTEP2(config-if)#ip address 3.3.3.1/24	Configure IP address on the interface
Step 16	VTEP2(config-if)#exit	Exit interface mode
Step 17	VTEP2(config)#router isis ipi	Configure ISIS as IGP.
Step 18	VTEP2(config-router)#is-type level-1	Set the ISIS as Level 1.
Step 19	VTEP2(config-router)#net 49.0001.3333.3333.00	Establish a Network Entity Title for this instance, specifying the area address and the system ID.
Step 20	VTEP2(config-if)#exit	Exit router mode
Step 21	VTEP2(config)#interface lo	Configure loopback interface
Step 22	VTEP2(config-if)#ip router isis ipi	Enable IS-IS routing on an interface for area ipi
Step 23	VTEP2(config-if)#isis circuit-type level-1	Set the circuit type for the interface lo
Step 24	VTEP2(config-if)#exit	Exit interface mode
Step 25	VTEP2(config)#interface xe33	Configure xe33 interface
Step 26	VTEP2(config-if)#ip router isis ipi	Enable IS-IS routing on an interface for area ipi
Step 27	VTEP2(config-if)#isis circuit-type level-1	Set the circuit type for the interface xe33
Step 28	VTEP2(config-if)#exit	Exit interface mode
Step 29	VTEP2(config)#nvo vxlan enable	Enable VXLAN. Configure the node as VTEP.
Step 30	VTEP2(config)#interface tunnel 98	Configure Tunnel interface
Step 31	VTEP2(config-if)#tunnel mode vxlan	Set the tunnel interface for vxlan
Step 32	VTEP2(config-if)#tunnel source 3.3.3.1	Set the tunnel source ip
Step 33	VTEP2(config-if)#tunnel destination 2.2.2.1	Set the tunnel destination ip
Step 34	VTEP2(config-if)#exit	Exit interface mode
Step 35	VTEP2(config)#nvo vxlan id 54321 ingress- replication	Configure a VXLAN VPN with head end replication
Step 36	VTEP2(config-nvo)#vxlan map-access port xe50	Set xe50 as access port to VPN 54321
Step 37	VTEP2(config-nvo)#vxlan map-network tunnel Tunnel98	Set Tunnel98 as network tunnel for VPN 54321
Step 38	VTEP2(config-nvo)#vxlan static-entry host-mac 0000.0000.aaaa remote-vtep-ip 2.2.2.1	Add a static entry for remote host



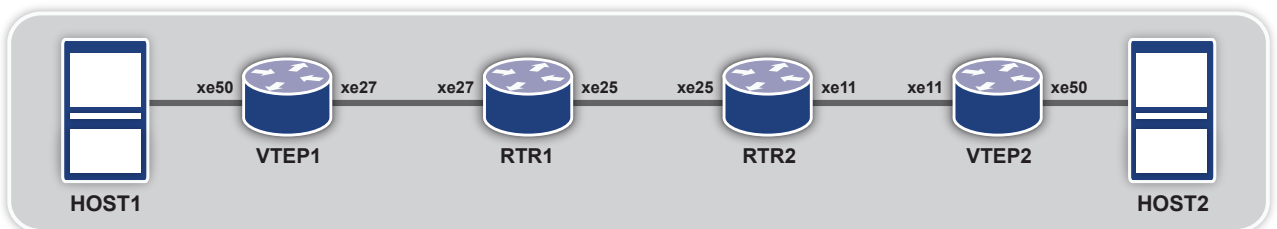
## RTR1

	CLI command	Purpose
Step 1	RTR1#configure terminal	Entering configuration mode
Step 2	RTR1(config)#interface xe22	Configure xe22 interface.
Step 3	RTR1(config-if)#no switchport	Configure the port as L3 port.
Step 4	RTR1(config-if)#ip address 11.11.11.2/24	Configure IP address on the interface
Step 5	RTR1(config-if)#no shutdown	Set interface state as up
Step 6	RTR1(config-if)#exit	Exit interface mode
Step 7	RTR1(config)#interface xe33	Configure xe33 interface
Step 8	RTR1(config-if)#no switchport	Configure the port as L3 port.
Step 9	RTR1(config-if)#ip address 12.12.12.2/24	Configure IP address on the interface
Step 10	RTR1(config-if)#no shutdown	Set interface state as up
Step 11	RTR1(config-if)#exit	Exit interface mode
Step 12	RTR1(config)#router isis ipi	Configure ISIS as IGP.
Step 13	RTR1(config-router)#is-type level-1	Set the ISIS as Level 1.
Step 14	RTR1(config-router)#net 49.0001.2222.2222.00	Establish a Network Entity Title for this instance, specifying the area address and the system ID.
Step 15	RTR1(config-if)#exit	Exit router mode
Step 16	RTR1(config)#interface xe22	Configure xe22 interface
Step 17	RTR1(config-if)#ip router isis ipi	Enable IS-IS routing on an interface for area ipi
Step 18	RTR1(config-if)#isis circuit-type level-1	Set the circuit type for the interface xe22
Step 19	RTR1(config-if)#exit	Exit interface mode
Step 20	RTR1(config)#interface xe33	Configure xe33 interface
Step 21	RTR1(config-if)#ip router isis ipi	Enable IS-IS routing on an interface for area ipi
Step 22	RTR1(config-if)#isis circuit-type level-1	Set the circuit type for the interface xe33
Step 23	RTR1(config-if)#exit	Exit interface mode

## 2. EVPN: VXLAN with EVPN Control Plane

In this configuration, the transit BGP routers are Route Reflectors that are EBGP peers.

### Topology





## VTEP1

	Command	Purpose
Step 1	VTEP1#configure terminal	Entering configuration mode
Step 2	VTEP1(config)#bridge 1 protocol mstp	Creating bridge
Step 3	VTEP1(config)#interface xe50	Configure xe50 interface.
Step 4	VTEP1(config-if)#switchport	Configure the port as L2 port.
Step 5	VTEP1(config-if)#bridge-group 1	Add the port to the bridge
Step 6	VTEP1(config-if)#switchport mode access	Set the port as access port
Step 7	VTEP1(config-if)#no shutdown	Set interface state as up
Step 8	VTEP1(config-if)#exit	Exit interface mode
Step 9	VTEP1(config)#interface xe27	Configure xe27 interface
Step 10	VTEP1(config-if)#no switchport	Configure the port as L3 port.
Step 11	VTEP1(config-if)#ip address 3.3.3.1/24	Configure IP address on the interface
Step 12	VTEP1(config-if)#no shutdown	Set interface state as up
Step 13	VTEP1(config-if)#exit	Exit interface mode
Step 14	VTEP1(config)#router isis ipi	Configure ISIS as IGP.
Step 15	VTEP1(config-router)#is-type level-2 only	Set the ISIS as Level 2
Step 16	VTEP1(config-router)#net 49.0001.1111.1111.1111.00	Establish a Network Entity Title for this instance, specifying the area address and the system ID.
Step 17	VTEP1(config-if)#exit	Exit router mode
Step 18	VTEP1(config)#interface xe27	Configure xe27 interface
Step 19	VTEP1(config-if)#ip router isis ipi	Enable IS-IS routing on an interface for area ipi
Step 20	VTEP1(config-if)#isis circuit-type level-2	Set the circuit type for the interface xe27
Step 21	VTEP1(config-if)#exit	Exit interface mode
Step 22	VTEP1(config)#nvo vxlan enable	Enable VXLAN. Configure the node as VTEP.
Step 23	VTEP1(config)#nvo vxlan vtep-ip-global 3.3.3.1	Configure the VTEP IP to be used in EVPN.
Step 24	VTEP1(config)#router bgp 1	Configure BGP Router
Step 25	VTEP1(config-router)#neighbor 3.3.3.2 remote-as 1	Configure BGP neighbor
Step 26	VTEP1(config-router)#address-family l2vpn evpn	Set the address family to evpn
Step 27	VTEP1(config-router-af)#neighbor 3.3.3.2 activate	Activate the neighbor for evpn address family.
Step 28	VTEP1(config-router-af)#exit	Exit address family mode
Step 29	VTEP1(config-router)#exit	Exit router mode
Step 30	VTEP1(config)#ip vrf vxlan100	Configure VRF for EVPN
Step 31	VTEP1(config-vrf)#rd 100:1	Configure Route Distinguisher
Step 32	VTEP1(config-vrf)#route-target both 100:100	Configure Route Target
Step 33	VTEP1(config-vrf)#exit	Exit VRF mode
Step 34	VTEP1(config)#nvo vxlan id 100 ingress-replication	Configure a VXLAN VPN with head end replication
Step 35	VTEP1(config-nvo)#vxlan host-reachability-protocol evpn-bgp vxlan100	Set EVPN based learning for VXLAN VPN 100
Step 36	VTEP1(config-nvo)#vxlan map-access port xe50	Set xe50 as access port to VPN 100
Step 37	VTEP1(config-nvo)#exit	Exit NVO mode



## RTR1

Step	Command	Purpose
Step 1	RTR1#configure terminal	Entering configuration mode
Step 2	RTR1(config)#interface xe27	Configure xe27 interface
Step 3	RTR1(config-if)#no switchport	Configure the port as L3 port.
Step 4	RTR1(config-if)#ip address 3.3.3.2/24	Configure IP address on the interface
Step 5	RTR1(config-if)#no shutdown	Set interface state as up
Step 6	RTR1(config-if)#exit	Exit interface mode
Step 7	RTR1(config)#interface xe25	Configure xe25 interface
Step 8	RTR1(config-if)#no switchport	Configure the port as L3 port.
Step 9	RTR1(config-if)#ip address 2.2.2.2/24	Configure IP address on the interface
Step 10	RTR1(config-if)#no shutdown	Set interface state as up
Step 11	RTR1(config-if)#exit	Exit interface mode
Step 12	RTR1(config)#router isis ipi	Configure ISIS as IGP.
Step 13	RTR1(config-router)#is-type level-2 only	Set the ISIS as Level 2
Step 14	RTR1(config-router)#net 49.0001.2222.2222.2222.00	Establish a Network Entity Title for this instance, specifying the area address and the system ID.
Step 15	RTR1(config-if)#exit	Exit router mode
Step 16	RTR1(config)#interface xe27	Configure xe27 interface
Step 17	RTR1(config-if)#ip router isis ipi	Enable IS-IS routing on an interface for area ipi
Step 18	RTR1(config-if)#isis circuit-type level-2	Set the circuit type for the interface xe27
Step 19	RTR1(config-if)#exit	Exit interface mode
Step 20	RTR1(config)#interface xe25	Configure xe25 interface
Step 21	RTR1(config-if)#ip router isis ipi	Enable IS-IS routing on an interface for area ipi
Step 22	RTR1(config-if)#isis circuit-type level-2	Set the circuit type for the interface xe25
Step 23	RTR1(config-if)#exit	Exit interface mode
Step 24	RTR1(config)#router bgp 1	Configure BGP Router
Step 25	RTR1(config-router)#neighbor 2.2.2.1 remote-as 2	Configure BGP neighbor
Step 26	RTR1(config-router)#neighbor 3.3.3.1 remote-as 1	Configure BGP neighbor
Step 27	RTR1(config-router)#address-family l2vpn evpn	Set the address family to evpn
Step 28	RTR 1(config-router-af)#neighbor 2.2.2.1 activate	Activate the neighbor for evpn address family.
Step 29	RTR1(config-router-af)#neighbor 3.3.3.1 activate	Activate the neighbor for evpn address family.
Step 30	RTR1(config-router-af)#neighbor 3.3.3.1 Configure RR client for this RR	Configure VRF for EVPN Configure Route Distinguisher
Step 31	RTR1(config-router-af)#exit	Exit address family mode
Step 32	RTR1(config-router)#exit	Exit router mode



## RTR2

Step	Command	Purpose
Step 1	RTR2#configure terminal	Entering configuration mode
Step 2	RTR2(config)#interface xe25	Configure xe25 interface
Step 3	RTR2(config-if)#no switchport	Configure the port as L3 port.
Step 4	RTR2(config-if)#ip address 2.2.2.1/24	Configure IP address on the interface
Step 5	RTR2(config-if)#no shutdown	Set interface state as up
Step 6	RTR2(config-if)#exit	Exit interface mode
Step 7	RTR2(config)#interface xe11	Configure xe11 interface
Step 8	RTR2(config-if)#no switchport	Configure the port as L3 port.
Step 9	RTR2(config-if)#ip address 4.4.4.1/24	Configure IP address on the interface
Step 10	RTR2(config-if)#no shutdown	Set interface state as up
Step 11	RTR2(config-if)#exit	Exit interface mode
Step 12	RTR2(config)#router isis ipi	Configure ISIS as IGP.
Step 13	RTR2(config-router)#is-type level-2 only	Set the ISIS as Level 2
Step 14	RTR2(config-router)#net 49.0001.3333.3333.00	Establish a Network Entity Title for this instance, specifying the area address and the system ID.
Step 15	RTR2(config-if)#exit	Exit router mode
Step 16	RTR2(config)#interface xe25	Configure xe25 interface
Step 17	RTR2(config-if)#ip router isis ipi	Enable IS-IS routing on an interface for area ipi
Step 18	RTR2(config-if)#isis circuit-type level-2	Set the circuit type for the interface xe25
Step 19	RTR2(config-if)#exit	Exit interface mode
Step 20	RTR2(config)#interface xe11	Configure xe11 interface
Step 21	RTR2(config-if)#ip router isis ipi	Enable IS-IS routing on an interface for area ipi
Step 22	RTR2(config-if)#isis circuit-type level-2	Set the circuit type for the interface xe11
Step 23	RTR2(config-if)#exit	Exit interface mode
Step 24	RTR2(config)#router bgp 2	Configure BGP Router
Step 25	RTR2(config-router)#neighbor 2.2.2.2 remote-as 1	Configure BGP neighbor
Step 26	RTR2(config-router)#neighbor 4.4.4.2 remote-as 2	Configure BGP neighbor
Step 27	RTR2(config-router)#address-family l2vpn evpn	Set the address family to evpn
Step 28	RTR2(config-router-af)#neighbor 2.2.2.2 activate	Activate the neighbor for evpn address family.
Step 29	RTR2(config-router-af)#neighbor 4.4.4.2 activate	Activate the neighbor for evpn address family.
Step 30	RTR2(config-router-af)#neighbor 4.4.4.2 route-reflector-client	Configure RR client for this RR
Step 31	RTR2(config-router-af)#exit	Exit address family mode
Step 32	RTR2(config-router)#exit	Exit router mode



## VTEP2

	Command	Purpose
Step 1	VTEP2#configure terminal	Entering configuration mode
Step 2	VTEP2(config)#bridge 1 protocol mstp	Creating bridge
Step 3	VTEP2(config)#interface xe50	Configure xe50 interface.
Step 4	VTEP2(config-if)#switchport	Configure the port as L2 port.
Step 5	VTEP2(config-if)#bridge-group 1	Add the port to the bridge
Step 6	VTEP2(config-if)#switchport mode access	Set the port as access port
Step 7	VTEP2(config-if)#no shutdown	Set interface state as up
Step 8	VTEP2(config-if)#exit	Exit interface mode
Step 9	VTEP2(config)#interface xe11	Configure xe11 interface
Step 10	VTEP2(config-if)#no switchport	Configure the port as L3 port.
Step 11	VTEP2(config-if)#ip address 4.4.4.2/24	Configure IP address on the interface
Step 12	VTEP2(config-if)#no shutdown	Set interface state as up
Step 13	VTEP2(config-if)#exit	Exit interface mode
Step 14	VTEP2(config)#router isis ipi	Configure ISIS as IGP.
Step 15	VTEP2(config-router)#is-type level-2 only	Set the ISIS as Level 2
Step 16	VTEP2(config-router)#net 49.0001.4444.4444.4444.00	Establish a Network Entity Title for this instance, specifying the area address and the system ID.
Step 17	VTEP2(config-if)#exit	Exit router mode
Step 18	VTEP2(config)#interface xe11	Configure xe11 interface
Step 19	VTEP2(config-if)#ip router isis ipi	Enable IS-IS routing on an interface for area ipi
Step 20	VTEP2(config-if)#isis circuit-type level-2	Set the circuit type for the interface xe27
Step 21	VTEP2(config-if)#exit	Exit interface mode
Step 22	VTEP2(config)#nvo vxlan enable	Enable VXLAN. Configure the node as VTEP.
Step 23	VTEP2(config)#nvo vxlan vtep-ip-global 4.4.4.2	Configure the VTEP IP to be used in EVPN.
Step 24	VTEP2(config)#router bgp 2	Configure BGP Router
Step 25	VTEP2(config-router)#neighbor 4.4.4.1 remote-as 2	Configure BGP neighbor
Step 26	VTEP2(config-router)#address-family l2vpn evpn	Set the address family to evpn
Step 27	VTEP2(config-router-af)#neighbor 4.4.4.1 activate	Activate the neighbor for evpn address family.
Step 28	VTEP2(config-router-af)#exit	Exit address family mode
Step 29	VTEP2(config-router)#exit	Exit router mode
Step 30	VTEP2(config)#ip vrf vxlan100	Configure VRF for EVPN
Step 31	VTEP2(config-vrf)#rd 101:1	Configure Route Distinguisher
Step 32	VTEP2(config-vrf)#route-target both 100:100	Configure Route Target
Step 33	VTEP2(config-vrf)#exit	Exit VRF mode
Step 34	VTEP2(config)#nvo vxlan id 100 ingress-replication	Configure a VXLAN VPN with head end replication
Step 35	VTEP2(config-nvo)#vxlan host-reachability-protocol evpn-bgp vxlan100	Set EVPN based learning for VXLAN VPN 100
Step 36	VTEP2(config-nvo)#vxlan map-access port xe50	Set xe50 as access port to VPN 100
Step 37	VTEP2(config-nvo)#exit	Exit NVO mode

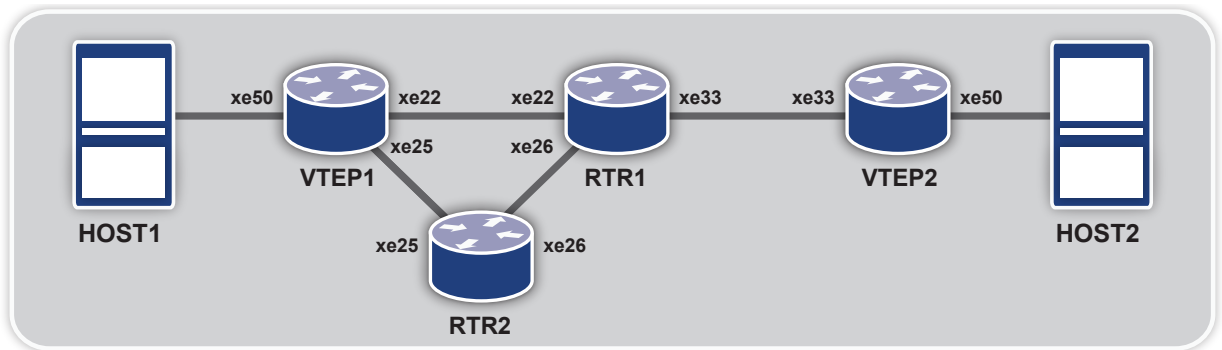


### 3. Non-EVPN: VXLAN with Data Plane Learning

This configuration has the following features:

- The VTEP is connected to more than one router
- Link failover happens when one router interface shuts down and then the packets are forwarded using the other router

### Topology



### VTEP1

Step	Command	Purpose
Step 1	VTEP1#configure terminal	Entering configuration mode
Step 2	VTEP1(config)#bridge 1 protocol mstp	Creating bridge
Step 3	VTEP1(config)#interface xe50	Configure xe50 interface.
Step 4	VTEP1(config-if)#switchport	Configure the port as L2 port.
Step 5	VTEP1(config-if)#bridge-group 1	Add the port to the bridge
Step 6	VTEP1(config-if)#switchport mode access	Set the port as access port
Step 7	VTEP1(config-if)#no shutdown	Set interface state as up
Step 8	VTEP1(config-if)#exit	Exit interface mode
Step 9	VTEP1(config)#interface xe22	Configure xe22 interface
Step 10	VTEP1(config-if)#no switchport	Configure the port as L3 port.
Step 11	VTEP1(config-if)#ip address 11.11.11.1/24	Configure IP address on the interface
Step 12	VTEP1(config-if)#no shutdown	Set interface state as up
Step 13	VTEP1(config-if)#exit	Exit interface mode
Step 14	VTEP1(config)#interface xe25	Configure xe25 interface
Step 15	VTEP1(config-if)#no switchport	Configure the port as L3 port.
Step 16	VTEP1(config-if)#ip address 21.21.21.1/24	Configure IP address on the interface
Step 17	VTEP1(config-if)#no shutdown	Set interface state as up
Step 18	VTEP1(config-if)#exit	Exit interface mode
Step 19	VTEP1(config)#interface lo	Configure loopback interface
Step 20	VTEP1(config-if)#ip address 2.2.2.1/24	Configure IP address on the interface
Step 21	VTEP1(config-if)#exit	Exit interface mode
Step 22	VTEP1(config)#router isis ipi	Configure ISIS as IGP.
Step 23	VTEP1(config-router)#is-type level-1	Set the ISIS as Level 1.
Step 24	VTEP1(config-router)#net 49.0001.1111.1111.1111.00	Establish a Network Entity Title for this instance, specifying the area address and the system ID.



## VTEP1 cont.

	Command	Purpose
Step 25	VTEP1(config-if)#exit	Exit router mode
Step 26	VTEP1(config)#interface lo	Configure loopback interface
Step 27	VTEP1(config-if)#ip router isis ipi	Enable IS-IS routing on an interface for area ipi
Step 28	VTEP1(config-if)#isis circuit-type level-1	Set the circuit type for the interface lo
Step 29	VTEP1(config-if)#exit	Exit interface mode
Step 30	VTEP1(config)#interface xe22	Configure xe22 interface
Step 32	VTEP1(config-if)#isis circuit-type level-1	Set the circuit type for the interface xe22
Step 33	VTEP1(config-if)#exit	Exit interface mode
Step 34	VTEP1(config)#interface xe22	Configure xe22 interface
Step 35	VTEP1(config-if)#ip router isis ipi	Enable IS-IS routing on an interface for area ipi
Step 36	VTEP1(config-if)#isis circuit-type level-1	Set the circuit type for the interface xe22
Step 37	VTEP1(config-if)#exit	Exit interface mode
Step 38	VTEP1(config)#nvo vxlan enable	Enable VXLAN. Configure the node as VTEP.
Step 39	VTEP1(config)#interface tunnel 98	Configure Tunnel interface
Step 40	VTEP1(config-if)#tunnel mode vxlan	Set the tunnel interface for vxlan
Step 41	VTEP1(config-if)#tunnel source 2.2.2.1	Set the tunnel source ip
Step 42	VTEP1(config-if)#tunnel destination 3.3.3.1	Set the tunnel destination ip
Step 43	VTEP1(config-if)#exit	Exit interface mode
Step 44	VTEP1(config)#nvo vxlan id 54321 ingress-replication	Configure a VXLAN VPN with head end replication
Step 45	VTEP1(config-nvo)#vxlan map-access port xe50	Set xe50 as access port to VPN 54321
Step 46	VTEP1(config-nvo)#vxlan map-network tunnel Tunnel98	Set Tunnel98 as network tunnel for VPN 54321
Step 47	VTEP1(config-nvo)#vxlan static-entry host-mac 0000.0000.bbbb remote-vtep-ip 3.3.3.1	Add a static entry for remote host





## VTEP2

	Command	Purpose
Step 1	VTEP2#configure terminal	Entering configuration mode
Step 2	VTEP2(config)#bridge 1 protocol mstp	Creating bridge
Step 3	VTEP2(config)#interface xe50	Configure xe50 interface.
Step 4	VTEP2(config-if)#switchport	Configure the port as L2 port.
Step 5	VTEP2(config-if)#bridge-group 1	Add the port to the bridge
Step 6	VTEP2(config-if)#switchport mode access	Set the port as access port
Step 7	VTEP2(config-if)#no shutdown	Set interface state as up
Step 8	VTEP2(config-if)#exit	Exit interface mode
Step 9	VTEP2(config)#interface xe33	Configure xe33 interface
Step 10	VTEP2(config-if)#no switchport	Configure the port as L3 port.
Step 11	VTEP2(config-if)#ip address 12.12.12.1/24	Configure IP address on the interface
Step 12	VTEP2(config-if)#no shutdown	Set interface state as up
Step 13	VTEP2(config-if)#exit	Exit interface mode
Step 14	VTEP2(config)#interface lo	Configure loopback interface
Step 15	VTEP2(config-if)#ip address 3.3.3.1/24	Configure IP address on the interface
Step 16	VTEP2(config-if)#exit	Exit interface mode
Step 17	VTEP2(config)#router isis ipi	Configure ISIS as IGP.
Step 18	VTEP2(config-router)#is-type level-1	Set the ISIS as Level 1.
Step 19	VTEP2(config-router)#net 49.0001.3333.3333.00	Establish a Network Entity Title for this instance, specifying the area address and the system ID.
Step 20	VTEP2(config-if)#exit	Exit router mode
Step 21	VTEP2(config)#interface lo	Configure loopback interface
Step 22	VTEP2(config-if)#ip router isis ipi	Enable IS-IS routing on an interface for area ipi
Step 23	VTEP2(config-if)#isis circuit-type level-1	Set the circuit type for the interface lo
Step 24	VTEP2(config-if)#exit	Exit interface mode
Step 25	VTEP2(config)#interface xe33	Configure xe33 interface
Step 26	VTEP2(config-if)#ip router isis ipi	Enable IS-IS routing on an interface for area ipi
Step 27	VTEP2(config-if)#isis circuit-type level-1	Set the circuit type for the interface xe33
Step 28	VTEP2(config-if)#exit	Exit interface mode
Step 29	VTEP2(config)#nvo vxlan enable	Enable VXLAN. Configure the node as VTEP.
Step 30	VTEP2(config)#interface tunnel 98	Configure Tunnel interface
Step 31	VTEP2(config-if)#tunnel mode vxlan	Set the tunnel interface for vxlan
Step 32	VTEP2(config-if)#tunnel source 3.3.3.1	Set the tunnel source ip
Step 33	VTEP2(config-if)#tunnel destination 2.2.2.1	Set the tunnel destination ip
Step 34	VTEP2(config-if)#exit	Exit interface mode
Step 35	VTEP2(config)#nvo vxlan id 54321 ingress-replication	Configure a VXLAN VPN with head end replication
Step 36	VTEP2(config-nvo)#vxlan map-access port xe50	Set xe50 as access port to VPN 54321
Step 37	VTEP2(config-nvo)#vxlan map-network tunnel Tunnel98	Set Tunnel98 as network tunnel for VPN 54321
Step 38	VTEP2(config-nvo)#vxlan static-entry host-mac 0000.0000.aaaa remote-vtep-ip 2.2.2.1	Add a static entry for remote host



## RTR1

Step	Command	Purpose
Step 1	RTR1#configure terminal	Entering configuration mode
Step 2	RTR1(config)#interface xe22	Configure xe22 interface.
Step 3	RTR1(config-if)#no switchport	Configure the port as L3 port.
Step 4	RTR1(config-if)#ip address 11.11.11.2/24	Configure IP address on the interface
Step 5	RTR1(config-if)#no shutdown	Set interface state as up
Step 6	RTR1(config-if)#exit	Exit interface mode
Step 7	RTR2(config)#interface xe26	Configure xe26 interface
Step 8	RTR2(config-if)#no switchport	Configure the port as L3 port.
Step 9	RTR2(config-if)#ip address 22.22.22.1/24	Configure IP address on the interface
Step 10	RTR2(config-if)#no shutdown	Set interface state as up
Step 11	RTR2(config-if)#exit	Exit interface mode
Step 12	RTR1(config)#interface xe33	Configure xe33 interface
Step 13	RTR1(config-if)#no switchport	Configure the port as L3 port.
Step 14	RTR1(config-if)#ip address 12.12.12.2/24	Configure IP address on the interface
Step 15	RTR1(config-if)#no shutdown	Set interface state as up
Step 16	RTR1(config-if)#exit	Exit interface mode
Step 17	RTR1(config)#router isis ipi	Configure ISIS as IGP.
Step 18	RTR1(config-router)#is-type level-1	Set the ISIS as Level 1.
Step 19	RTR1(config-router)#net 49.0001.2222.2222.2222.00	Establish a Network Entity Title for this instance, specifying the area address and the system ID.
Step 20	RTR1(config-if)#exit	Exit router mode
Step 21	RTR1(config)#interface xe22	Configure xe22 interface
Step 22	RTR1(config-if)#ip router isis ipi	Enable IS-IS routing on an interface for area ipi
Step 23	RTR1(config-if)#isis circuit-type level-1	Set the circuit type for the interface xe22
Step 24	RTR1(config-if)#exit	Exit interface mode
Step 25	RTR1(config)#interface xe33	Configure xe33 interface
Step 26	RTR1(config-if)#ip router isis ipi	Enable IS-IS routing on an interface for area ipi
Step 27	RTR1(config-if)#isis circuit-type level-1	Set the circuit type for the interface xe33
Step 28	RTR1(config-if)#exit	Exit interface mode
Step 29	RTR2(config)#interface xe26	Configure xe26 interface
Step 30	RTR2(config-if)#ip router isis ipi	Enable IS-IS routing on an interface for area ipi
Step 31	RTR2(config-if)#isis circuit-type level-1	Set the circuit type for the interface xe26
Step 32	RTR2(config-if)#exit	Exit interface mode



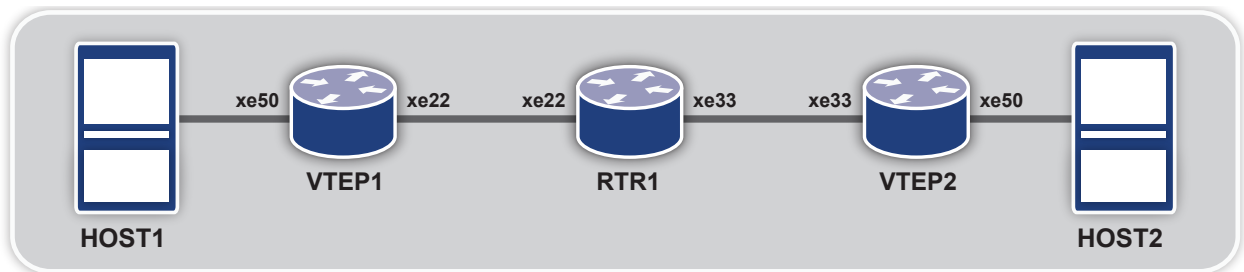
## RTR2

	Command	Purpose
Step 1	RTR2#configure terminal	Entering configuration mode
Step 2	RTR2(config)#interface xe25	Configure xe25 interface.
Step 3	RTR2(config-if)#no switchport	Configure the port as L3 port.
Step 4	RTR2(config-if)#ip address 21.21.21.2/24	Configure IP address on the interface
Step 5	RTR2(config-if)#no shutdown	Set interface state as up
Step 6	RTR2(config-if)#exit	Exit interface mode
Step 7	RTR2(config)#interface xe26	Configure xe26 interface
Step 8	RTR2(config-if)#no switchport	Configure the port as L3 port.
Step 9	RTR2(config-if)#ip address 22.22.22.2/24	Configure IP address on the interface
Step 10	RTR2(config-if)#no shutdown	Set interface state as up
Step 11	RTR2(config-if)#exit	Exit interface mode
Step 12	RTR2(config)#router isis ipi	Configure ISIS as IGP.
Step 13	RTR2(config-router)#is-type level-1	Set the ISIS as Level 1.
Step 14	RTR2(config-router)#net 49.0001.4444.4444.4444.00	Establish a Network Entity Title for this instance, specifying the area address and the system ID.
Step 15	RTR2(config-if)#exit	Exit router mode
Step 16	RTR2(config)#interface xe25	Configure xe25 interface
Step 17	RTR2(config-if)#ip router isis ipi	Enable IS-IS routing on an interface for area ipi
Step 18	RTR2(config-if)#isis circuit-type level-1	Set the circuit type for the interface xe25
Step 19	RTR2(config-if)#exit	Exit interface mode
Step 20	RTR2(config)#interface xe26	Configure xe26 interface
Step 21	RTR2(config-if)#ip router isis ipi	Enable IS-IS routing on an interface for area ipi
Step 22	RTR2(config-if)#isis circuit-type level-1	Set the circuit type for the interface xe26
Step 23	RTR2(config-if)#exit	Exit interface mode

### 4. EVPN: VXLAN Tenant Identification using Port and VLAN

All the other test cases mentioned until have used only the port for identification. In this configuration, the VLAN identifier (2 in this example) is also used along with port to identify the tenant. So, data traffic must be tagged with the configured VLAN (2 in this case).

### Topology





## VTEP1

	Command	Purpose
Step 1	VTEP1#configure terminal	Entering configuration mode
Step 2	VTEP1(config)#bridge 1 protocol mstp	Creating bridge
Step 3	VTEP1(config)#vlan 2-10 bridge 1 state enable	Create VLANs for the bridge
Step 4	VTEP1(config)#interface xe50	Configure xe50 interface.
Step 5	VTEP1(config-if)#switchport	Configure the port as L2 port.
Step 6	VTEP1(config-if)#bridge-group 1	Add the port to the bridge
Step 7	VTEP1(config-if)#switchport mode hybrid	Set the port as hybrid port
Step 8	VTEP1(config-if)#switchport hybrid allowed vlan add 2 egress-tagged enable	Make the port a member of VLAN 2
Step 9	VTEP1(config-if)#no shutdown	Set interface state as up
Step 10	VTEP1(config-if)#exit	Exit interface mode
Step 11	VTEP1(config)#interface xe22	Configure xe22 interface
Step 12	VTEP1(config-if)#no switchport	Configure the port as L3 port.
Step 13	VTEP1(config-if)#ip address 10.1.1.2/24	Configure IP address on the interface
Step 14	VTEP1(config-if)#no shutdown	Set interface state as up
Step 15	VTEP1(config-if)#exit	Exit interface mode
Step 16	VTEP1(config)#interface lo	Configure lo interface
Step 17	VTEP1(config-if)#ip address 3.3.3.3/32	Configure IP address on the interface
Step 18	VTEP1(config-if)#exit	Exit interface mode
Step 19	VTEP1(config)#router isis ipi	Configure ISIS as IGP.
Step 20	VTEP1(config-router)#is-type level-1	Set the ISIS as Level 1
Step 21	VTEP1(config-router)#net 49.0001.3333.3333.00	Establish a Network Entity Title for this instance, specifying the area address and the system ID.
Step 22	VTEP1(config-if)#exit	Exit router mode
Step 23	VTEP1(config)#interface xe22	Configure xe22 interface
Step 24	VTEP1(config-if)#ip router isis ipi	Enable IS-IS routing on an interface for area ipi
Step 25	VTEP1(config-if)#isis circuit-type level-1	Set the circuit type for the interface lo
Step 26	VTEP1(config-if)#exit	Exit interface mode
Step 27	VTEP1(config)#interface lo	Configure lo interface
Step 28	VTEP1(config-if)#ip router isis ipi	Enable IS-IS routing on an interface for area ipi
Step 29	VTEP1(config-if)#isis circuit-type level-1	Set the circuit type for the interface lo
Step 30	VTEP1(config-if)#exit	Exit interface mode
Step 31	VTEP1(config)#nvo vxlan enable	Enable VXLAN. Configure the node as VTEP.
Step 32	VTEP1(config)#nvo vxlan vtep-ip-global 3.3.3.3	Configure the VTEP IP to be used in EVPN.
Step 33	VTEP1(config)#router bgp 1	Configure BGP Router
Step 34	VTEP1(config-router)#bgp router-id 3.3.3.3	Configure BGP Router id
Step 35	VTEP1(config-router)#neighbor 10.1.1.1 remote-as 1	Configure BGP neighbor
Step 36	VTEP1(config-router)#address-family l2vpn evpn	Set the address family to evpn
Step 37	VTEP1(config-router-af)#neighbor 10.1.1.1 activate	Activate the neighbor for evpn address family.
Step 38	VTEP1(config-router-af)#exit	Exit address family mode
Step 39	VTEP1(config-router)#exit	Exit router mode



## VTEP1 cont.

	Command	Purpose
Step 40	VTEP1(config)#ip vrf vxlan100	Configure VRF for EVPN
Step 41	VTEP1(config-vrf)#rd 3.3.3.3:1	Configure Route Distinguisher
Step 42	VTEP1(config-vrf)#route-target both 3.3.3.3:1	Configure Route Target
Step 43	VTEP1(config-vrf)#exit	Exit VRF mode
Step 44	VTEP1(config)#nvo vxlan id 100 ingress-replication	Configure a VXLAN VPN with head end replication
Step 45	VTEP1(config-nvo)#vxlan host-reachability-protocol evpn-bgp vxlan100	Set EVPN based learning for VXLAN VPN 100
Step 46	VTEP1(config-nvo)#vxlan map-access port-vlan xe50 2	Set xe50 and vlan 2 as access port to VPN 100

## RTR1

	Command	Purpose
Step 1	RTR1#configure terminal	Entering configuration mode
Step 2	RTR1(config)#interface xe22	Configure xe22 interface
Step 3	RTR1(config-if)#no switchport	Configure the port as L3 port.
Step 4	RTR1(config-if)#ip address 10.1.1.1/24	Configure IP address on the interface
Step 5	RTR1(config-if)#no shutdown	Set interface state as up
Step 6	RTR1(config-if)#exit	Exit interface mode
Step 7	RTR1(config)#interface xe33	Configure xe33 interface
Step 8	RTR1(config-if)#no switchport	Configure the port as L3 port.
Step 9	RTR1(config-if)#ip address 10.2.1.1/24	Configure IP address on the interface
Step 10	RTR1(config-if)#no shutdown	Set interface state as up
Step 11	RTR1(config-if)#exit	Exit interface mode
Step 12	RTR1(config)#router isis ipi	Configure ISIS as IGP.
Step 13	RTR1(config-router)#is-type level 1	Set the ISIS as Level 1
Step 14	RTR1(config-router)#net 49.0001.2222.2222.2222.00	Establish a Network Entity Title for this instance, specifying the area address and the system ID.
Step 15	RTR1(config-if)#exit	Exit router mode
Step 16	RTR1(config)#interface xe22	Configure xe22 interface
Step 17	RTR1(config-if)#ip router isis ipi	Enable IS-IS routing on an interface for area ipi
Step 18	RTR1(config-if)#isis circuit-type level-1	Set the circuit type for the interface xe22
Step 19	RTR1(config-if)#exit	Exit interface mode
Step 20	RTR1(config)#interface xe33	Configure xe33 interface
Step 21	RTR1(config-if)#ip router isis ipi	Enable IS-IS routing on an interface for area ipi
Step 22	RTR1(config-if)#isis circuit-type level-1	Set the circuit type for the interface xe33
Step 23	RTR1(config-if)#exit	Exit interface mode
Step 24	RTR1(config)#router bgp 1	Configure BGP Router
Step 25	RTR1(config-router)#neighbor 10.1.1.2 remote-as 1	Configure BGP neighbor
Step 26	RTR1(config-router)#neighbor 10.2.1.2 remote-as 1	Configure BGP neighbor
Step 27	RTR1(config-router)#address-family l2vpn evpn	Set the address family to evpn
Step 28	RTR 1(config-router-af)#neighbor 10.1.1.2 activate	Activate the neighbor for evpn address family.



## RTR1 cont.

	Command	Purpose
Step 29	RTR1(config-router-af)#neighbor 10.2.1.2 activate	Activate the neighbor for evpn address family.
Step 30	RTR1(config-router-af)#neighbor 10.1.1.2 route-reflector-client	Configure RR client for this RR
Step 31	RTR1(config-router-af)#neighbor 10.2.1.2 route-reflector-client	Configure RR client for this RR
Step 32	RTR1(config-router-af)#exit	Exit address family mode
Step 33	RTR1(config-router)#exit	Exit router mode

## VTEP2

	Command	Purpose
Step 1	VTEP2#configure terminal	Entering configuration mode
Step 2	VTEP2(config)#bridge 1 protocol mstp	Creating bridge
Step 3	VTEP2(config)#vlan 2-10 bridge 1 state enable	Create VLANs for the bridge
Step 4	VTEP2(config)#interface xe50	Configure xe50 interface.
Step 5	VTEP2(config-if)#switchport	Configure the port as L2 port.
Step 6	VTEP2(config-if)#bridge-group 1	Add the port to the bridge
Step 7	VTEP2(config-if)#switchport mode hybrid	Set the port as hybrid port
Step 8	VTEP2(config-if)#switchport hybrid allowed vlan add 2 egress-tagged enable	Make the port a member of VLAN 2
Step 9	VTEP2(config-if)#no shutdown	Set interface state as up
Step 10	VTEP2(config-if)#exit	Exit interface mode
Step 11	VTEP2(config)#interface xe33	Configure xe33 interface
Step 12	VTEP2(config-if)#no switchport	Configure the port as L3 port.
Step 13	VTEP2(config-if)#ip address 10.2.1.2/24	Configure IP address on the interface
Step 14	VTEP2(config-if)#no shutdown	Set interface state as up
Step 15	VTEP2(config-if)#exit	Exit interface mode
Step 16	VTEP2(config)#interface lo	Configure lo interface
Step 17	VTEP2(config-if)#ip address 4.4.4.4/32	Configure IP address on the interface
Step 18	VTEP2(config-if)#exit	Exit interface mode
Step 19	VTEP2(config)#router isis ipi	Configure ISIS as IGP.
Step 20	VTEP2(config-router)#is-type level-1	Set the ISIS as Level 1
Step 21	VTEP2(config-router)#net 49.0001.4444.4444.4444.00	Establish a Network Entity Title for this instance, specifying the area address and the system ID.
Step 22	VTEP2(config-if)#exit	Exit router mode
Step 23	VTEP2(config)#interface xe33	Configure xe33 interface
Step 24	VTEP2(config-if)#ip router isis ipi	Enable IS-IS routing on an interface for area ipi
Step 25	VTEP2(config-if)#isis circuit-type level-1	Set the circuit type for the interface xe33
Step 26	VTEP2(config-if)#exit	Exit interface mode
Step 27	VTEP2(config)#interface lo	Configure lo interface
Step 28	VTEP2(config-if)#ip router isis ipi	Enable IS-IS routing on an interface for area ipi
Step 29	VTEP2(config-if)#isis circuit-type level-1	Set the circuit type for the interface lo
Step 30	VTEP2(config-if)#exit	Exit interface mode



## VTEP2 cont.

	Command	Purpose
Step 31	VTEP2(config)#nvo vxlan enable	Enable VXLAN. Configure the node as VTEP.
Step 32	VTEP2(config)#nvo vxlan vtep-ip-global 4.4.4.4	Configure the VTEP IP to be used in EVPN.
Step 33	VTEP2(config)#router bgp 1	Configure BGP Router
Step 34	VTEP2(config-router)#bgp router-id 4.4.4.4	Configure BGP Router id
Step 35	VTEP2(config-router)#neighbor 10.2.1.1 remote-as 1	Configure BGP neighbor
Step 36	VTEP2(config-router)#address-family l2vpn evpn	Set the address family to evpn
Step 37	VTEP2(config-router-af)#neighbor 10.2.1.1 activate	Activate the neighbor for evpn address family.
Step 38	VTEP2(config-router-af)#exit	Exit address family mode
Step 39	VTEP2(config-router)#exit	Exit router mode
Step 40	VTEP2(config)#ip vrf vxlan100	Configure VRF for EVPN
Step 41	VTEP2(config-vrf)#rd 4.4.4.4:1	Configure Route Distinguisher
Step 42	VTEP2(config-vrf)#route-target both 3.3.3.3:1	Configure Route Target
Step 43	VTEP2(config-vrf)#exit	Exit VRF mode
Step 44	VTEP2(config)#nvo vxlan id 100 ingress-replication	Configure a VXLAN VPN with head end replication
Step 45	VTEP2(config-nvo)#vxlan host-reachability-protocol evpn-bgp vxlan100	Set EVPN based learning for VXLAN VPN 100
Step 46	VTEP2(config-nvo)#vxlan map-access	Set xe50 and vlan 2 as access port to VPN 100
Step 47	VTEP2(config-nvo)#exit	Exit NVO mode

## Conclusion

OcNOS is a feature rich solution for data center deployments. VXLAN with EVPN is a perfect solution to provide various services especially in a multi-tenant and hybrid cloud environments. OcNOS is fully standards compliant in both these features.



### About IP Infusion

IP Infusion, the leader in disaggregated networking solutions, delivers the best network OS for white box and network virtualization. IP Infusion offers network operating systems for both physical and virtual networks to carriers, service providers and enterprises to achieve the disaggregated networking model. With the OcNOS™ and VirNOS™ network operating systems, IP Infusion offers a single, unified physical and virtual software solution to deploy new services quickly at reduced cost and with greater flexibility. Over 300 customers worldwide, including major networking equipment manufacturers, use IP Infusion's respected ZebOS platform to build networks to address the evolving needs of cloud, carrier and mobile networking. IP Infusion is headquartered in Santa Clara, Calif., and is a wholly owned and independently operated subsidiary of ACCESS CO., LTD. Additional information can be found at <http://www.ipinfusion.com>.

Phone: +1 877-MYZEBOS  
 Email: [sales@ipinfusion.com](mailto:sales@ipinfusion.com)  
 Web: [www.ipinfusion.com](http://www.ipinfusion.com)

U.S. (Santa Clara), +1 408-400-1912  
 Japan (Tokyo), +81 03-5259-3771  
 Korea (Seoul) +82 (2) 3153-5224

India (Bangalore), +91 (80) 6728 7000  
 China (Shanghai), +86 186 1658-6466  
 EMEA (Stockholm), +46 8 566 300 00

IP Infusion  
 An ACCESS Company  
 (408) 400-3000  
[www.ipinfusion.com](http://www.ipinfusion.com)  
 3965 Freedom Circle, Suite 200  
 Santa Clara, CA 95054