

Configure VXLAN

Contents

[Introduction](#)

[Prerequisites](#)

[Requirements](#)

[Components Used](#)

[Background Information](#)

[Terminology](#)

[What is VXLAN](#)

[Why VXLAN](#)

[Configure](#)

[Network Diagram](#)

[Configurations](#)

[3172-A](#)

[9396-A](#)

[9396-B](#)

[Verify](#)

[Example Outputs](#)

[3172-A](#)

[9396-A](#)

[9396-B](#)

[VXLAN Packet Capture](#)

[VXLAN PCAP](#)

[Troubleshoot](#)

[Related Information](#)

Introduction

This document describes a high level overview of Virtual Extensible LAN (VXLAN) and configuration examples with verification commands and output.

Prerequisites

Requirements

Cisco recommends that you have knowledge of these topics:

- Multicast routing concepts such as Rendezvous Point (RP) and Platform Independent Multicast (PIM).
- Virtual Port Channel (vPC) concepts.

This document assumes that the IP routing and multicast routing has been established prior to VXLAN configuration.

Components Used

The information in this document is based on these software and hardware versions:

- Nexus 9396s as vPC Virtual Tunnel Endpoints (VTEPs) that run Version 7.0(3)I1(1b)
- Nexus 3172 that runs Version 6.0(2)U5(1)
- LAN_ENTERPRISE_SERVICES_PKG license installed

The information in this document was created from the devices in a specific lab environment. All of the devices used in this document started with a cleared (default) configuration. If your network is live, ensure that you understand the potential impact of any command.

Background Information

Terminology

VXLAN (Virtual Extensible LAN) - The technology that provides the same Ethernet Layer 2 network services as VLAN does today, but with greater extensibility and flexibility.

VNID (Vxlan Network Identifier) - 24 bit segment ID that defines the broadcast domain. Interchangeable with "VXLAN Segment ID".

VTEP (Virtual Tunnel Endpoint) - This is the device that does the encapsulation and de-encapsulation.

NVE (Network Virtual Interface) - Logical interface where the encapsulation and de-encapsulation occur.

What is VXLAN

- VXLAN is a technology that allows overlaying a Layer 2 (L2) network over a Layer 3 (L3) underlay with use of any IP routing protocol.
- It uses MAC-in-UDP Encapsulation.

VXLAN solves three main problems:

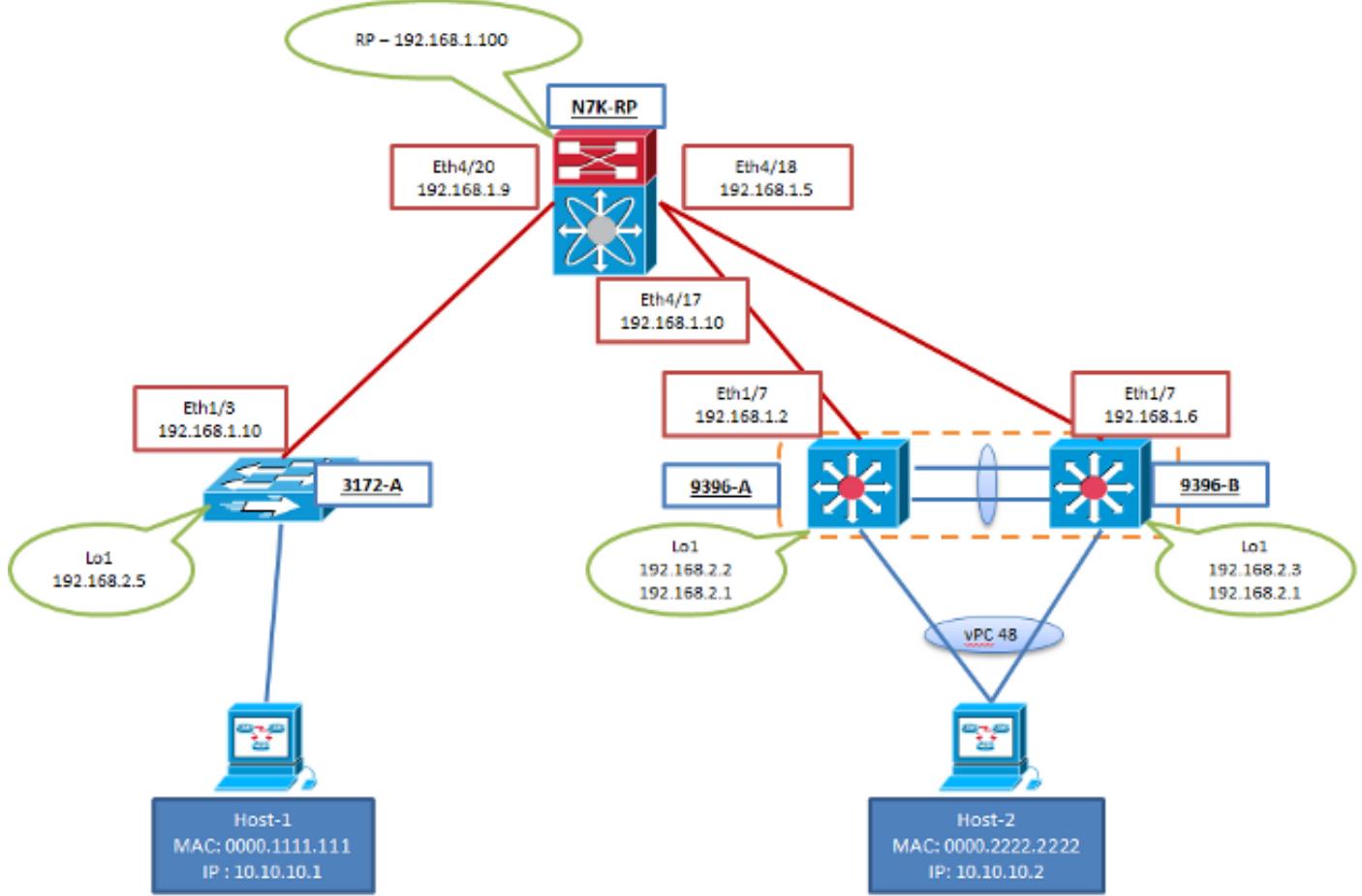
1. 16M VNIs (broadcast domains) versus the 4K offered by traditional VLANs.
2. Allows L2 to be extended anywhere in an IP network.
3. Optimized flooding.

Why VXLAN

- **VLAN Scalability** - VXLAN extends the L2 Segment ID field to 24-bits, which potentially allows up to 16 million unique L2 segments over the same network.
- **L2 Segment Elasticity over L3 Boundary** - VXLAN encapsulates an L2 frame in an IP-UDP header, which allows L2 adjacency across router boundaries.
- **Leverages multicast in the transport network in order to simulate flooding behavior for broadcast, unknown unicast, and multicast in the L2 segment.**
- **Leverage Equal Cost Multi-pathing (ECMP)** in order to achieve optimal path usage over the transport network.

Configure

Network Diagram



Configurations

These configurations are specific to the VxLAN portion of configuration. Notice that 9396-A and B are in a VPC domain while 3172-A is not. These configurations assume full reachability to all L3 interfaces in the topology with the routing protocol of your choice. Open Shortest Path First (OSPF) was used in this example. It also assumes the multicast routing has been established over these same L3 interfaces.

3172-A

```

feature ospf
feature pim
feature vn-segment-vlan-based
feature nv overlay

vlan 10
  vn-segment 160010
vlan 20
  vn-segment 160020

interface nve1
  source-interface loopback1
  member vni 160010 mcast-group 203.0.113.1
  member vni 160020 mcast-group 203.0.113.1
  no shutdown

interface Ethernet1/3
  no switchport
  ip address 192.168.1.10/30

```

```
ip router ospf 2 area 0.0.0.0
ip pim sparse-mode

interface Loopback1
 ip address 192.168.2.5/32
 ip router ospf 2 area 0.0.0.0
 ip pim sparse-mode
```

9396-A

 **Note:** When vPCs are used as VTEPs, the secondary IP of the loopback interface is used and shared between the two peers. This is how both peers represent themselves as a single VTEP to the remote NVE peers.

```
feature ospf
feature pim
feature vn-segment-vlan-based
feature nv overlay

ip pim rp-address 192.168.1.100 group-list 224.0.0.0/4

vlan 1,10,20
vlan 10
  vn-segment 160010
vlan 20
  vn-segment 160020

vpc domain 1
  peer-switch
  peer-keepalive destination 10.122.140.99
  peer-gateway

interface port-channel1
  switchport mode trunk
  spanning-tree port type network
  vpc peer-link

interface port-channel48
  switchport mode trunk
  vpc 48

interface nve1
  mtu 9216
  no shutdown
  source-interface loopback1
  member vni 160010 mcast-group 203.0.113.1
  member vni 160020 mcast-group 203.0.113.1
interface Ethernet1/7
  no switchport
  ip address 192.168.1.2/30
  ip router ospf 1 area 0.0.0.0
  ip pim sparse-mode
  no shutdown

interface loopback1
  ip address 192.168.2.2/32
```

```
ip address 192.168.2.1/32 secondary
ip router ospf 1 area 0.0.0.0
ip pim sparse-mode
```

9396-B

 **Note:** When vPCs are used as VTEPs, the secondary IP of the loopback interface is used and shared between the two peers. This is how both peers represent themselves as a single VTEP to the remote NVE peers.

```
feature ospf
feature pim
feature vn-segment-vlan-based
feature nv overlay

ip pim rp-address 192.168.1.100 group-list 224.0.0.0/4

vlan 1,10,20
vlan 10
  vn-segment 160010
vlan 20
  vn-segment 160020

vpc domain 1
  peer-switch
  peer-keepalive destination 10.122.140.98
  peer-gateway

interface port-channel1
  switchport mode trunk
  spanning-tree port type network
  vpc peer-link

interface port-channel48
  switchport mode trunk
  vpc 48

interface nve1
  mtu 9216
  no shutdown
  source-interface loopback1
  member vni 160010 mcast-group 203.0.113.1
  member vni 160020 mcast-group 203.0.113.1

interface Ethernet1/7
  no switchport
  ip address 192.168.1.6/30
  ip router ospf 1 area 0.0.0.0
  ip pim sparse-mode
  no shutdown

interface loopback1
  ip address 192.168.2.3/32
  ip address 192.168.2.1/32 secondary
  ip router ospf 1 area 0.0.0.0
```

```
ip pim sparse-mode
```

Verify

Use this section to confirm that your configuration works properly.

The [Cisco CLI Analyzer](#) (registered customers only) supports certain **show** commands. Use the Cisco CLI Analyzer in order to view an analysis of **show** command output.

- **show nve peers** <--- you can not see any output for this until traffic is initiated from both sides of the overlay
- **show nve vni**
- **show run interface nve1**
- **show nve internal platform interface detail** (9K only)
- **show mac address-table**
- **show ip mroute detail**

Example Outputs

These outputs are in a steady state. The VTEP peers have discovered each other and traffic has passed between both in the encap and decap directions.

3172-A

```
3172-A# show nve peers
Interface          Peer-IP          Peer-State
-----            -----            -----
nve1              192.168.2.1      Up

3712-A# show nve vni
Interface          VNI           Multicast-group   VNI State
-----            -----            -----            -----
nve1              160010         203.0.113.1       Up
nve1              160020         203.0.113.1       Up

3172-A# show run interface nve1
!Command: show running-config interface nve1
!Time: Sat Apr 25 15:09:13 2015

version 6.0(2)U5(1)

interface nve1
  source-interface loopback1
  member vni 160010 mcast-group 203.0.113.1
  member vni 160020 mcast-group 203.0.113.1
  no shutdown

3172-A# show nve internal platform interface detail

3172-A# show mac address-table vlan 10
Legend:
  * - primary entry, G - Gateway MAC, (R) - Routed MAC, O - Overlay MAC
  age - seconds since first seen,+ - primary entry using vPC Peer-Link
```

VLAN	MAC Address	Type	age	Secure	NTFY	Ports/SWID.SSID.LID
* 10	0000.1111.1111	dynamic	5030	F	F	Eth1/48
* 10	0000.2222.2222	dynamic	5010	F	F	nve1(192.168.2.1)

3172-A# show ip mroute detail
IP Multicast Routing Table for VRF "default"

Total number of routes: 3
Total number of (*,G) routes: 1
Total number of (S,G) routes: 1
Total number of (*,G-prefix) routes: 1

(*, 231.1.1.1/32), uptime: 3w3d, static(1) pim(0) ip(0)
Stats: 15/1539 [Packets/Bytes], 0.000 bps
Incoming interface: Ethernet1/3, RPF nbr: 192.168.1.9, uptime: 1w0d
Outgoing interface list: (count: 1)
Loopback1, uptime: 3w3d, static

(192.168.2.5/32, 231.1.1.1/32), uptime: 3w3d, ip(0) mrib(1) pim(1)
Stats: 142751/9136064 [Packets/Bytes], 34.133 bps
Incoming interface: loopback1, RPF nbr: 192.168.2.5, uptime: 3w3d
Outgoing interface list: (count: 2)
Ethernet1/3, uptime: 1w0d, pim
Loopback1, uptime: 3w3d, mrib, (RPF)

(*, 232.0.0.0/8), uptime: 3w3d, pim(0) ip(0)
Stats: 0/0 [Packets/Bytes], 0.000 bps
Incoming interface: Null, RPF nbr: 0.0.0.0, uptime: 3w3d
Outgoing interface list: (count: 0)

9396-A

9396-A# show nve peers

Interface	Peer-IP	State	LearnType	Uptime	Router-Mac
nve1	192.168.2.5	Up	DP	2d20h	n/a

9396-A# show nve vni

Codes: CP - Control Plane DP - Data Plane
UC - Unconfigured SA - Suppress ARP

Interface	VNI	Multicast-group	State	Mode	Type	[BD/VRF]	Flags
nve1	160010	203.0.113.1	Up	DP	L2	[10]	
nve1	160020	203.0.113.1	Up	DP	L2	[20]	

9396-A# show run interface nve1

```
!Command: show running-config interface nve1
!Time: Sat Apr 25 15:20:45 2015

version 7.0(3)I1(1a)

interface nve1
  mtu 9216
  no shutdown
  source-interface loopback1
```

```
member vni 160010 mcast-group 203.0.113.1
member vni 160020 mcast-group 203.0.113.1
```

```
9396-A# show nve internal platform interface detail
```

```
Printing details of all NVE Interfaces
```

IIntf	State	PriIP	SecIP	Vnis	Peers
nve1	UP	192.168.2.2	192.168.2.1	2	1

```
SW_BD/VNIs of interface nve1:
```

=====	=====	=====	=====	=====	=====
Sw BD	Vni	State	Intf	Type	Vrf-ID
10	160010 UP		nve1	DP	0
20	160020 UP		nve1	DP	0

```
Peers of interface nve1:
```

```
=====
```

```
peer_ip: 192.168.2.5, peer_id: 1, state: UP MAC-learning: Enabled
```

```
active_swbds:
```

```
add_pending_swbds:
```

```
rem_pending_swbds:
```

```
9396-A# show mac address-table vlan 10
```

```
Legend:
```

```
* - primary entry, G - Gateway MAC, (R) - Routed MAC, O - Overlay MAC
age - seconds since last seen,+ - primary entry using vPC Peer-Link,
(T) - True, (F) - False
```

VLAN	MAC Address	Type	age	Secure	NTFY	Ports
+	0000.1111.1111	dynamic	0	F	F	nve1(192.168.2.5)
*	0000.2222.2222	dynamic	0	F	F	Po48
G	- 7c0e.ceca.f177	static	-	F	F	sup-eth1(R)

```
9396-A# show ip mroute detail
```

```
IP Multicast Routing Table for VRF "default"
```

```
Total number of routes: 4
```

```
Total number of (*,G) routes: 1
```

```
Total number of (S,G) routes: 2
```

```
Total number of (*,G-prefix) routes: 1
```

```
(*, 231.1.1.1/32), uptime: 2d21h, nve(1) ip(0) pim(0)
```

```
  Data Created: No
```

```
  Stats: 1/64 [Packets/Bytes], 0.000 bps
```

```
  Stats: Inactive Flow
```

```
  Incoming interface: Ethernet1/7, RPF nbr: 192.168.1.1
```

```
  Outgoing interface list: (count: 1)
```

```
    nve1, uptime: 2d21h, nve
```

```
(192.168.2.1/32, 203.0.113.1/32), uptime: 2d21h, nve(0) ip(0) mrrib(0) pim(0)
```

```
  Data Created: Yes
```

```
  VXLAN Flags
```

```
    VXLAN Encap
```

```
  Stats: 1/51 [Packets/Bytes], 0.000 bps
```

```
  Stats: Inactive Flow
```

```
  Incoming interface: loopback1, RPF nbr: 192.168.2.1
```

```
  Outgoing interface list: (count: 0)
```

```
(192.168.2.5/32, 203.0.113.1/32), uptime: 2d21h, ip(0) mrib(0) nve(1) pim(0)
  Data Created: Yes
  Stats: 16474/1370086 [Packets/Bytes], 13.600 bps
  Stats: Active Flow
  Incoming interface: Ethernet1/7, RPF nbr: 192.168.1.1
  Outgoing interface list: (count: 1)
    nve1, uptime: 2d21h, nve

(*, 232.0.0.0/8), uptime: 2d21h, pim(0) ip(0)
  Data Created: No
  Stats: 0/0 [Packets/Bytes], 0.000 bps
  Stats: Inactive Flow
  Incoming interface: Null, RPF nbr: 0.0.0.0
  Outgoing interface list: (count: 0)
```

9396-A# show vpc

Legend:

(*) - local vPC is down, forwarding via vPC peer-link

vPC domain id	:	1
Peer status	:	peer adjacency formed ok
vPC keep-alive status	:	peer is alive
Configuration consistency status	:	success
Per-vlan consistency status	:	success
Type-2 consistency status	:	success
vPC role	:	secondary
Number of vPCs configured	:	1
Peer Gateway	:	Enabled
Dual-active excluded VLANs	:	-
Graceful Consistency Check	:	Enabled
Auto-recovery status	:	Disabled

vPC Peer-link status

id	Port	Status	Active vlans
1	Po1	up	1,10,20

vPC status

id	Port	Status	Consistency	Reason	Active vlans
48	Po48	up	success	success	1,10

9396-B

9396-B# show nve peers

Interface	Peer-IP	State	LearnType	Uptime	Router-Mac
nve1	192.168.2.5	Up	DP	1w0d	n/a

9396-B# show nve vni

Codes: CP - Control Plane	DP - Data Plane
UC - Unconfigured	SA - Suppress ARP

Interface	VNI	Multicast-group	State	Mode	Type [BD/VRF]	Flags
-----------	-----	-----------------	-------	------	---------------	-------

```
nve1      160010  203.0.113.1        Up    DP    L2 [10]
nve1      160020  203.0.113.1        Up    DP    L2 [20]
```

9396-B# show run interface nve1

```
!Command: show running-config interface nve1
!Time: Sat Apr 25 15:23:25 2015
```

version 7.0(3)I1(1b)

```
interface nve1
  mtu 9216
  no shutdown
  source-interface loopback1
  member vni 160010 mcast-group 203.0.113.1
  member vni 160020 mcast-group 203.0.113.1
```

9396-B# show nve internal platform interface detail

Printing details of all NVE Interfaces

Intf	State	PriIP	SecIP	Vnis	Peers
nve1	UP	192.168.2.3	192.168.2.1	2	1

SW_BD/VNIs of interface nve1:

Sw BD	Vni	State	Intf	Type	Vrf-ID
10	160010 UP		nve1	DP	0
20	160020 UP		nve1	DP	0

Peers of interface nve1:

```
peer_ip: 192.168.2.5, peer_id: 1, state: UP MAC-learning: Enabled
active_swbds:
add_pending_swbds:
rem_pending_swbds:
```

9396-B# show mac address-table vlan 10

Legend:

```
* - primary entry, G - Gateway MAC, (R) - Routed MAC, O - Overlay MAC
age - seconds since last seen,+ - primary entry using vPC Peer-Link,
(T) - True, (F) - False
```

VLAN	MAC Address	Type	age	Secure	NTFY	Ports
*	0000.1111.1111	dynamic	0	F	F	nve1(192.168.2.5)
+	0000.2222.2222	dynamic	0	F	F	Po48
G	58f3.9ca3.64dd	static	-	F	F	sup-eth1(R)

9396-B# show ip mroute detail

IP Multicast Routing Table for VRF "default"

Total number of routes: 4

Total number of (*,G) routes: 1

Total number of (S,G) routes: 2

Total number of (*,G-prefix) routes: 1

(*, 231.1.1.1/32), uptime: 2w1d, nve(1) ip(0) pim(0)

Data Created: No

```

VXLAN Flags
  VXLAN Decap
VPC Flags
  RPF-Source Forwarder
Stats: 1/64 [Packets/Bytes], 0.000 bps
Stats: Inactive Flow
Incoming interface: Ethernet1/7, RPF nbr: 192.168.1.5
Outgoing interface list: (count: 1)
  nve1, uptime: 2w1d, nve

(192.168.2.1/32, 203.0.113.1/32), uptime: 2w1d, nve(0) ip(0) mrib(0) pim(1)
Data Created: Yes
VXLAN Flags
  VXLAN Encap
VPC Flags
  RPF-Source Forwarder
Stats: 5/511 [Packets/Bytes], 0.000 bps
Stats: Inactive Flow
Incoming interface: loopback1, RPF nbr: 192.168.2.1
Outgoing interface list: (count: 1)
  Ethernet1/7, uptime: 1w0d, pim

(192.168.2.5/32, 203.0.113.1/32), uptime: 2w1d, ip(0) mrib(0) pim(0) nve(1)
Data Created: Yes
VXLAN Flags
  VXLAN Decap
VPC Flags
  RPF-Source Forwarder
Stats: 86621/7241564 [Packets/Bytes], 13.600 bps
Stats: Active Flow
Incoming interface: Ethernet1/7, RPF nbr: 192.168.1.5
Outgoing interface list: (count: 1)
  nve1, uptime: 2w1d, nve

(*, 232.0.0.0/8), uptime: 2w1d, pim(0) ip(0)
Data Created: No
Stats: 0/0 [Packets/Bytes], 0.000 bps
Stats: Inactive Flow
Incoming interface: Null, RPF nbr: 0.0.0.0
Outgoing interface list: (count: 0)

```

9396-B# show vpc
Legend:
(*) - local vPC is down, forwarding via vPC peer-link

vPC domain id	:	1
Peer status	:	peer adjacency formed ok
vPC keep-alive status	:	peer is alive
Configuration consistency status	:	success
Per-vlan consistency status	:	success
Type-2 consistency status	:	success
vPC role	:	primary
Number of vPCs configured	:	1
Peer Gateway	:	Enabled
Dual-active excluded VLANs	:	-
Graceful Consistency Check	:	Enabled
Auto-recovery status	:	Disabled

vPC Peer-link status

id	Port	Status	Active vlans
--	---	-----	-----

1 Po1 up 1,10,20

vPC status

id	Port	Status	Consistency	Reason	Active vlans
48	Po48	up	success	success	1,10

VXLAN Packet Capture

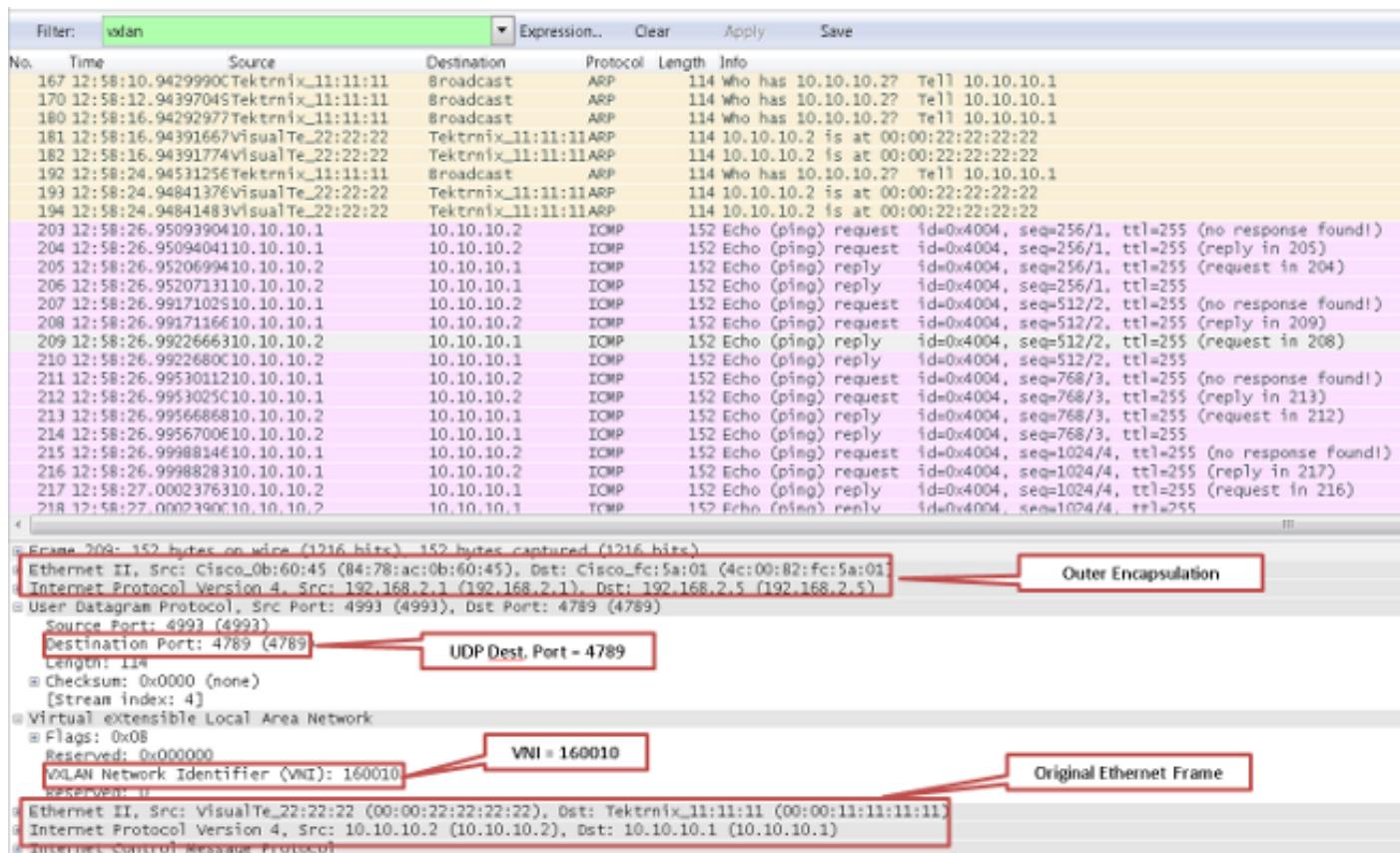
The packet capture (PCAP) is from the previous topology and contains the OSPF hellos, the PIM Joins/Registers, and the VXLAN encapsulated traffic for the topology shown in the network diagram. You can notice some Internet Control Message Protocol (ICMP) flags such as 'no response'. This is due to the nature of the monitor session completed on the RP.

The monitor session included interfaces Eth4/17-18 and Eth4/20, so it throws off Wireshark some. The important information is the format and flags.

 **Note:** All encapsulated packets (BUM, or known unicast) are sourced from the VTEP loopback IP destined to the remote VTEP loopback IP. This is the secondary loopback IP on any vPC VTEPs.

BUM (Broadcast, Unknown unicast, Multicast) traffic can be destined to the mcast-group.

Unicast traffic is then destined to the remote VTEP loopback IP.



Troubleshoot

There is currently no specific information available to troubleshoot this configuration.

Related Information

- [**VXLAN Overview: Cisco Nexus 9000 Series Switches**](#)
- [**Technical Support & Documentation - Cisco Systems**](#)