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INTERNET-DRAFT

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EVPN VXLAN Bypass VTEP
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Abstract

A principal feature of EVPN is the ability to support multihoming from a customer equipment (CE) to multiple provider edge equipment (PE) with all-active links. This draft specifies a mechanism to simplify PEs used with VXLAN tunnels and enhance VXLAN Active-Active reliability.

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1. Introduction

A principal feature of EVPN is the ability to support multihoming from a customer equipment (CE) to multiple provider edge equipment (PE) with links used in the all-active redundancy mode. That mode is where a device is multihomed to a group of two or more PEs and where all PEs in such a redundancy group can forward traffic to/from the multihomed device or network for a given VLAN [RFC7209]. This draft specifies a VXLAN gateway mechanism to simplify PE processing in the multi-homed case and enhance VXLAN Active-Active reliability.

1.1 Terminology and Acronyms

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "NOT RECOMMENDED", "MAY", and "OPTIONAL" in this document are to be interpreted as described in BCP 14 [RFC2119] [RFC8174] when, and only when, they appear in all capitals, as shown here.

This document uses the following acronyms and terms:

All-Active Redundancy Mode - When a device is multihomed to a group of two or more PEs and when all PEs in such redundancy group can forward traffic to/from the multihomed device or network for a given VLAN.

BUM - Broadcast, Unknown unicast, and Multicast.

CE - Customer Edge equipment.

DCI - Data Center Interconnect.

ESI - Ethernet Segment Identifier - A unique non-zero identifier that identifies an Ethernet segment.

NVE - Network Virtualization Edge.

PE - Provider Edge equipment.

Single-Active Redundancy Mode - When a device or a network is multihomed to a group of two or more PEs and when only a single PE in such a redundancy group can forward traffic to/from the multihomed device or network for a given VLAN.

VXLAN - Virtual eXtensible Local Area Network [RFC7348].

VXTEP - VXLAN Tunnel End Point.

2. VXLAN Gateway High Reliability

One example of the current situation would be a DCI (data center interconnect) using VXLAN tunnels that is multihomed for reliability as show in Figure 1. Each PE as a VXLAN Tunnel End Point (VTEP) uses a different IP adress. Thus each PE must process EVPN updates based on the ESIs [RFC7432].

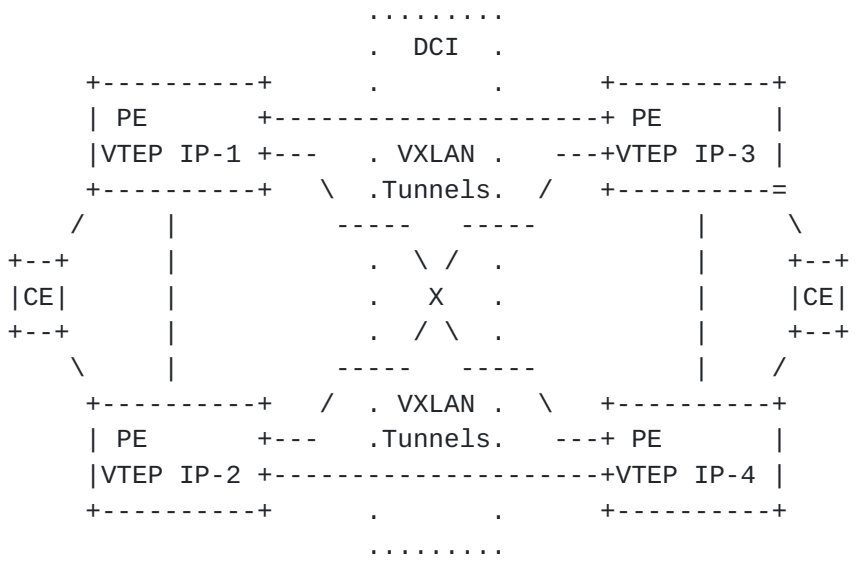

Figure 1. Current Situtation

The situation is greatly simplified if the set of VTEPs connected to a particular Ethernet segment all use the same anycast IP address. PEs no longer need to conern themselves with whether a remote CE is single or multi-homed. The situation is as shown in Figure 2. The IP address within each VTEP group is synchronized by messages within that group.

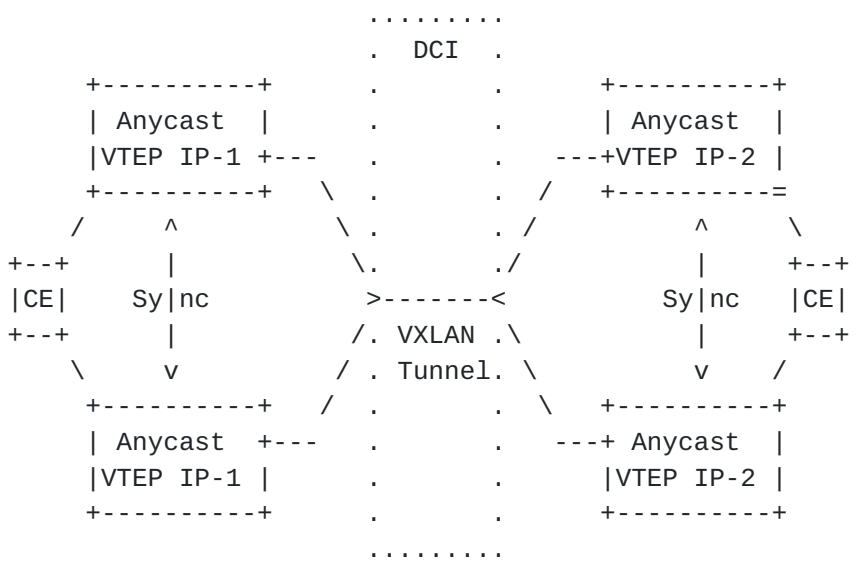

Figure 2. Situtation Using Anycast

3. Detailed Problem and Solution Requirement

In the scenario illustrated in Figure 3, where an enterprise site and a data center are interconnected, the VPN gateways (PE1 and PE2) and the enterprise site (CPE) are connected through a VXLAN tunnel to provide L2/L3 services between the enterprise site (CPE) and data center. The data center gateway (CE1) is dual-homed to PE1 and PE2 to access the VXLAN network, which enhances network access reliability. When one PE fails, services can be rapidly switched to the other PE, minimizing the impact on services.

As shown in Figure 3, PE1 and PE2 use a virtual address as a Network Virtualization Edge (NVE) interface address at the network side, namely, the Anycast VTEP address. In this way, the CPE is aware of only one remote NVE interface and establishes a VXLAN tunnel with the virtual address. The packets from the CPE can reach CE1 through either PE1 or PE2. However, single-homed CEs may exist, such as CE2 and CE3. As a result, after reaching a PE, the packets from the CPE may need to be forwarded by the other PE to a single-homed CE. Therefore, a bypass VXLAN tunnel needs to be established between PE1 and PE2. An EVPN peer relationship is established between PE1 and PE2. Different addresses, namely, bypass VTEP addresses, are configured for PE1 and PE2 so that they can establish a bypass VXLAN tunnel.

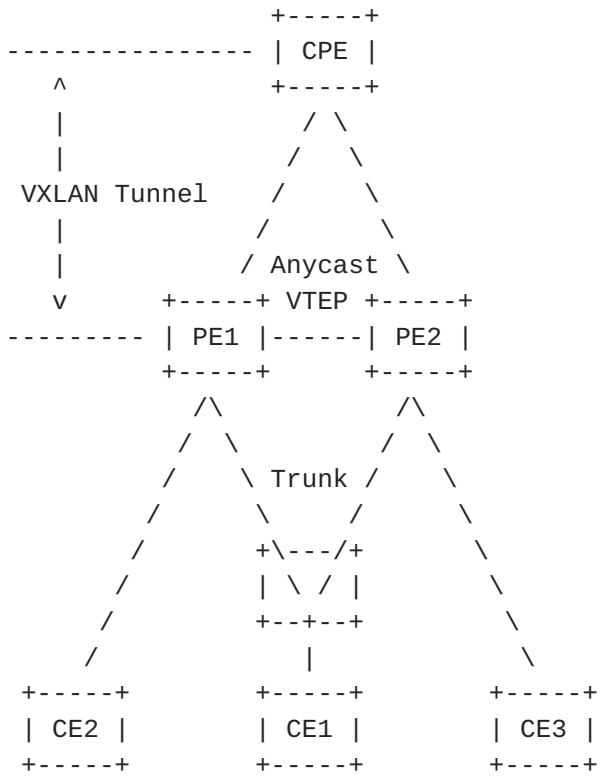

Figure 3. Basic networking of the VXLAN active-active scenario

4. The Bypass VXLAN Extended Community Attribute

This sections describes the extensions specified to meeting the requirements given in Section 3 and enhance VXLAN active-active reliability.

This document specifies two new BGP extended communities, called the Bypass VXLAN Extended Community. The extended communities have a Type indicating they are transitive and are IPv4-address-specific or IPv6-address-specific, depending on whether the VTEP address to be accommodated is IPv4 or IPv6. In the new extended communities, the 4-byte or 16-byte global administrator field encodes the IPv4 or IPv6 address that is the VTEP address and the 2-byte local administrator field is formatted as shown in Figures 4 and 5.

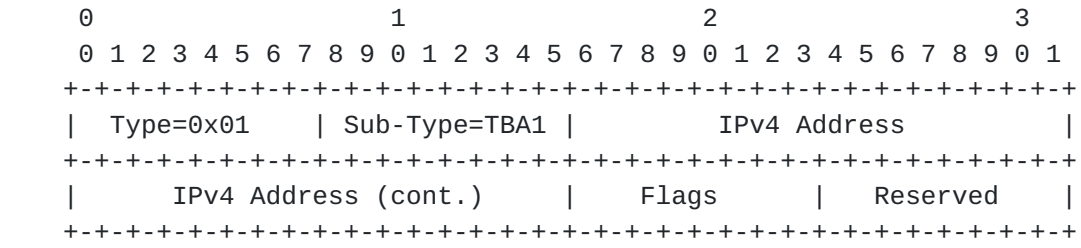

Figure 4. IPv4-address-specific Bypass VXLAN Extended Community

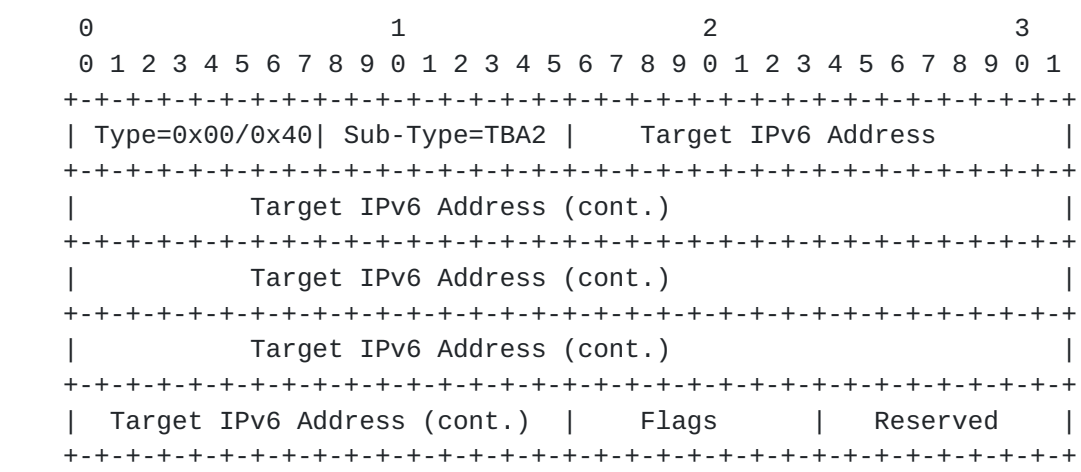

Figure 5. IPv6-address-specific Bypass VXLAN Extended Community

Where

Type:
- 0x01 = type for IPv4 specific use.
- 0x00 = type for transitive IPv6 specific use.
- 0x40 = type for non-transitive IPv6 specific use.

Sub-Type:

TBA1 = subtype for IPv4 specific use.

TBA2 = subtype for IPv6 specific use.

IPv4/IPv6: An address of that type.

Flags: MUST be sent as zero and ignored on receipt.

Reserved: MUST be sent as zero and ignored on receipt.

5. Control Plane Processing

Using the topology in Figure 3:

1) PE2 sends a multicast route to PE1. The source address of the route is the Anycast VTEP address shared by PE1 and PE2. The route carries the bypass VXLAN extended community attribute, including the bypass VTEP address of PE1.

2) After receiving the multicast route from PE2, PE1 considers that an Anycast relationship be established with PE2. This is because the source address (Anycast VTEP address) of the route is the same as the local virtual address of PE1 and the route carries the bypass VTEP extended community attribute. Based on the bypass VXLAN extended attribute of the route, PE1 establishes a bypass VXLAN tunnel to PE2.

3) PE1 learns the MAC address of the CEs through upstream packets from the CEs and advertises them as routes to PE2 through BGP EVPN. The routes carry the ESI of the links accessed by the CEs, and information about the VLANs that the CE access, and the bypass VXLAN extended community attribute.

4) PE1 learns the MAC address of the CPE through downstream packets at the network side, specifies that the next-hop address of the MAC route can be iterated to a static VXLAN tunnel, and advertises the route to PE2. The next-hop address of the MAC route cannot be changed.

6. Data Packet Processing

This section describes how Layer 2 unicast and BUM (Broadcast, Unknown unicast, and Multicast) packets are forwarded. A description of how Layer 3 packets transmitted on the same subnet and Layer 3 packets transmitted across subnets cases are forwarded will be provided in a furture version of this document.

6.1 Layer 2 Unicast Packet Forwarding

The following two subsections discuss Layer 2 unicast forwarding in the topology shown in Figure 3.

6.1.1 Uplink

After receiving Layer 2 unicast packets destined for the CPE from CE1, CE2, and CE3, PE1 and PE2 search for their local MAC address table to obtain outbound interfaces, perform VXLAN encapsulation on the packets, and forward them to the CPE.

6.1.2 Downlink

After receiving a Layer 2 unicast packet sent by the CPE to CE1, PE1 performs VXLAN decapsulation on the packet, searches the local MAC address table for the destination MAC address, obtains the outbound interface, and forwards the packet to CE1.

After receiving a Layer 2 unicast packet sent by the CPE to CE2, PE1 performs VXLAN decapsulation on the packet, searches the local MAC address table for the destination MAC address, obtains the outbound interface, and forwards the packet to CE2.

After receiving a Layer 2 unicast packet sent by the CPE to CE3, PE1 performs VXLAN decapsulation on the packet, searches the local MAC address table for the destination MAC address, and forwards it to PE2 over the bypass VXLAN tunnel. After the packet reaches PE2, PE2 searches the destination MAC address, obtains the outbound interface, and forwards the packet to CE3.

The process for PE2 to forward packets from the CPE is the same as that for PE1 to forward packets from the CPE.

6.2 BUM Packet Forwarding

Using the topology in Figure 3, if the destination address of a BUM packet from the CPE is the Anycast VTEP address of PE1 and PE2, the BUM packet may be forwarded to either PE1 or PE2. If the BUM packet reaches PE2 first, PE2 sends a copy of the packet to CE3 and CE1. In addition, PE2 sends a copy of the packet to PE1 through the bypass VXLAN tunnel between PE1 and PE2. After the copy of the packet reaches PE1, PE1 sends it to CE2, not to the CPE or CE1. In this way, CE1 receives only one copy of the packet.

Using the topology in Figure 3, after a BUM packet from CE2 reaches PE1, PE1 sends a copy of the packet to CE1 and the CPE. In addition, PE1 sends a copy of the packet to PE2 through the bypass VXLAN tunnel between PE1 and PE2. After the copy of the packet reaches PE2, PE2 sends it to CE3, not to the CPE or CE1.

Using the topology in Figure 3, after a BUM packet from CE1 reaches PE1, PE1 sends a copy of the packet to CE2 and the CPE. In addition, PE1 sends a copy of the packet to PE2 through the bypass VXLAN tunnel between PE1 and PE2. After the copy of the packet reaches PE2, PE2 sends it to CE3, not to the CPE or CE1.

7. IANA Considerations

IANA is requested to assign two new Extended Community attribute SubTypes as follows:

7.1 IPv4 Specific

Sub-Type Value	Name	Reference
TBA1	Bypass VXLAN Extended Community	[this doc]

7.2 IPv6 Specific

Sub-Type Value	Name	Reference
TBA2	Bypass VXLAN Extended Community	[this doc]

8. Security Considerations

TBD

For general EVPN Security Considerations, see [RFC7432].

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TBD

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