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EVPN control plane for Geneve
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Abstract

This document describes how Ethernet VPN (EVPN) control plane can be used with Network Virtualization Overlay over Layer 3 (NV03) Generic Network Virtualization Encapsulation (Geneve) encapsulation for NV03 solutions. EVPN control plane can also be used by a Network Virtualization Endpoints (NVEs) to express Geneve tunnel option TLV(s) supported in transmission and/or reception of Geneve encapsulated data packets.

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INTERNET DRAFT

EVPN control plane for Geneve

September 14, 2018

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Table of Contents

1	Introduction	3
1.1	Terminology	3
2	GENEVE extensions	4
2.1	Ethernet option TLV	4
3	BGP Extensions	6
3.1	Geneve Tunnel Option Types sub-TLV	6
4	Operation	7
5	Security Considerations	8
6	IANA Considerations	8
7	Acknowledgements	9
8	References	9
8.1	Normative References	9
8.2	Informative References	10
	Authors' Addresses	10

INTERNET DRAFT

EVPN control plane for Geneve

September 14, 2018

1 Introduction

The Network Virtualization over Layer 3 (NV03) solutions for network virtualization in data center (DC) environment are based on an IP-based underlay. An NV03 solution provides layer 2 and/or layer 3 overlay services for virtual networks enabling multi-tenancy and workload mobility. The NV03 working group have been working on different dataplane encapsulations. The Generic Network Virtualization Encapsulation [[GENEVE](#)] have been recently recommended to be the proposed standard for network virtualization overlay encapsulation.

This document describes how the EVPN control plane can signal Geneve encapsulation type in the BGP Tunnel Encapsulation Extended Community defined in [[TUNNEL-ENCAP](#)]. In addition, this document defines how to communicate the Geneve tunnel option types in a new BGP Tunnel Encapsulation Attribute sub-TLV. The Geneve tunnel options are encapsulated as TLVs after the Geneve base header in the Geneve packet as described in [[GENEVE](#)].

[DT-ENCAP] recommends that a control plane determines how Network Virtualization Edge devices (NVEs) use the GENEVE option TLVs when sending/receiving packets. In particular, the control plane negotiates the subset of option TLVs supported, their order and the total number of option TLVs allowed in the packets. This negotiation capability allows, for example, interoperability with hardware-based NVEs that can process fewer options than software-based NVEs.

This EVPN control plane extension will allow a Network Virtualization Edge (NVE) to express what Geneve option TLV types it is capable to receive or to send over the Geneve tunnel to its peers.

In the datapath, a transmitting NVE MUST NOT encapsulate a packet destined to another NVE with any option TLV(s) the receiving NVE is not capable of processing.

[1.1](#) Terminology

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.

Most of the terminology used in this documents comes from [[RFC7432](#)] and [[NVO3-FRWK](#)].

NVO3: Network Virtualization Overlay over Layer 3

Boutros

Expires March 18, 2019

[Page 3]

INTERNET DRAFT

EVPN control plane for Geneve

September 14, 2018

GENEVE: Generic Network Virtualization Encapsulation.

NVE: Network Virtualization Edge.

VNI: Virtual Network Identifier.

MAC: Media Access Control.

OAM: Operations, Administration and Maintenance.

PE: Provide Edge Node.

CE: Customer Edge device e.g., host or router or switch.

EVPN: Ethernet VPN.

EVI: An EVPN instance spanning the Provider Edge (PE) devices participating in that EVPN.

MAC-VRF: A Virtual Routing and Forwarding table for Media Access Control (MAC) addresses on a PE.

[2.](#) GENEVE extensions

This document adds some extensions to the [[GENEVE](#)] encapsulation that are relevant to the operation of EVPN.

[2.1](#) Ethernet option TLV

[EVPN-OVERLAY] describes when an ingress NVE uses ingress replication

Where:

- Option Class is set to Ethernet (new Option Class requested to IANA)
- Type is set to EVPN-OPTION (new type requested to IANA) and C bit must be set.
- B bit is set to 1 for BUM traffic.
- L bit is set to 1 for Leaf-Indication.
- Source-ID is a 24-bit value that encodes the ESI-label value signaled on the EVPN Autodiscovery per-ES routes, as described in [RFC7432] for multi-homing and [RFC8317] for leaf-to-leaf BUM filtering. The ESI-label value is encoded in the high-order 20 bits of the Source-ESI field.

The egress NVEs that make use of ESIs in the data path (because they have a local multi-homed ES or support [RFC8317]) SHOULD advertise their Ethernet A-D per-ES routes along with the Geneve tunnel sub-TLV and in addition to the ESI-label Extended Community. The ingress NVE can then use the Ethernet option-TLV when sending GENEVE packets based on the [RFC7432] and [RFC8317] procedures. The egress NVE will use the Source-ID field in the received packets to make filtering decisions.

Note that [EVPN-OVERLAY] modifies the [RFC7432] split-horizon procedures for NV03 tunnels using the "local-bias" procedure. "Local-

bias" relies on tunnel IP source address checks (instead of ESI-labels) to determine whether a packet can be forwarded to a local ES.

While "local-bias" MUST be supported along with GENEVE encapsulation, the use of the Ethernet option-TLV is RECOMMENDED to follow the same procedures used by EVPN MPLS.

An ingress NVE using ingress replication to flood BUM traffic MUST send B=1 in all the GENEVE packets that encapsulate BUM frames. An egress NVE SHOULD determine whether a received packet encapsulates a BUM frame based on the B bit. The use of the B bit is only relevant to GENEVE packets with Protocol Type 0x6558 (Bridged Ethernet).

3. BGP Extensions

As per [EVPN-OVERLAY] the BGP Encapsulation extended community defined in [TUNNEL-ENCAP] is included with all EVPN routes advertised by an egress NVE.

This document specifies a new BGP Tunnel Encapsulation Type for Geneve and a new Geneve tunnel option types sub-TLV as described below.

3.1 Geneve Tunnel Option Types sub-TLV

The Geneve tunnel option types is a new BGP Tunnel Encapsulation Attribute Sub-TLV.

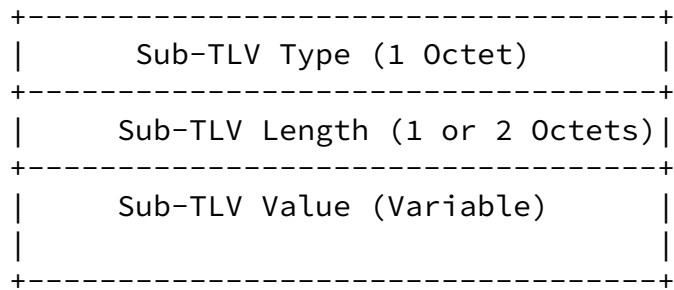
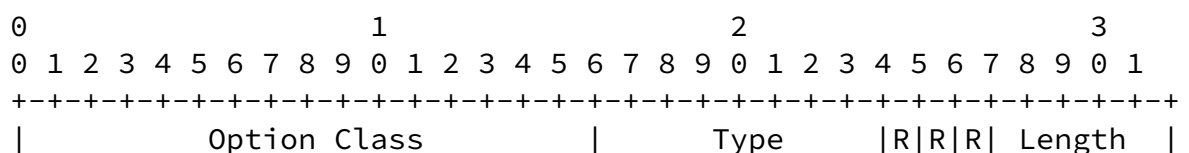


Figure 1: Geneve tunnel option types sub-TLV

The Sub-TLV Type field contains a value in the range from 192-252. To be allocated by IANA.

Sub-TLV value MUST match exactly the first 4-octets of the option TLV format. For instance, if we need to signal support for two option TLVs:



+-----+	Option Class	Type	R R R	Length	+

Where, an NVE receiving the above sub-TLV, will send GENEVE packets to the originator NVE with only the option TLVs the receiver NVE is capable of receiving, and following the same order. Also the high order bit in the type, is the critical bit, MUST be set accordingly.

The above sub-TLV(s) MAY be included with only Ethernet A-D per-ES routes.

4. Operation

The following figure shows an example of an NV03 deployment with EVPN.

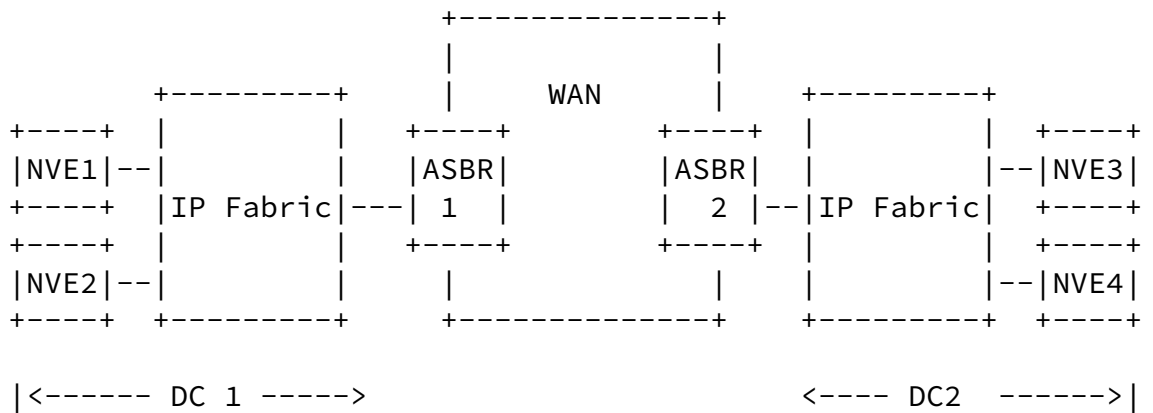


Figure 2: Data Center Interconnect with ASBR

iBGP sessions are established between NVE1, NVE2, ASBR1, possibly via a BGP route-reflector. Similarly, iBGP sessions are established between NVE3, NVE4, ASBR2.

eBGP sessions are established among ASBR1 and ASBR2.

routes. For inter-AS option B, the ASBRs re-advertise these routes with NEXT_HOP attribute set to their IP addresses as per [RFC4271].

NVE1 sets the BGP Encapsulation extended community defined in all EVPN routes advertised. NVE1 sets the BGP Tunnel Encapsulation Attribute Tunnel Type to Geneve tunnel encapsulation, and sets the Tunnel Encapsulation Attribute Tunnel sub-TLV for the Geneve tunnel option types with all the Geneve option types it can transmit and receive.

All other NVE(s) learn what Geneve option types are supported by NVE1 through the EVPN control plane. In the datapath, NVE2, NVE3 and NVE4 only encapsulate overlay packets with the Geneve option TLV(s) that NVE1 is capable of receiving.

A PE advertises the BGP Encapsulation extended community defined in [RFC5512] if it supports any of the encapsulations defined in [EVPN-OVERLAY]. A PE advertises the BGP Tunnel Encapsulation Attribute defined in [TUNNEL-ENCAP] if it supports Geneve encapsulation.

5. Security Considerations

The mechanisms in this document use EVPN control plane as defined in [RFC7432]. Security considerations described in [RFC7432] are equally applicable.

This document uses IP-based tunnel technologies to support data plane transport. Security considerations described in [RFC7432] and in [EVPN-OVERLAY] are equally applicable.

6. IANA Considerations

IANA is requested to allocate the following:

BGP Tunnel Encapsulation Attribute
Tunnel Type:

XX Geneve Encapsulation

BGP Tunnel Encapsulation Attribute Sub-TLVs a Code point from the range of 192-252 for Geneve tunnel option types sub-TLV.

IANA is requested to assign a new option class from the "Geneve Option Class" registry for the Ethernet option TLV.

Option Class	Description
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XXXX-----
Ethernet option

7. Acknowledgements

The authors wish to thank T. Sridhar, for his input, feedback, and helpful suggestions.

8. References

8.1 Normative References

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Boutros

Expires March 18, 2019

[Page 9]

INTERNET DRAFT

EVPN control plane for Geneve

September 14, 2018

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Boutros

Expires March 18, 2019

[Page 10]