NVGRE and VXLAN
Encapsulation for L3VPN Extension

draft-yong-l3vpn-nvgre-vxlan-encap-00

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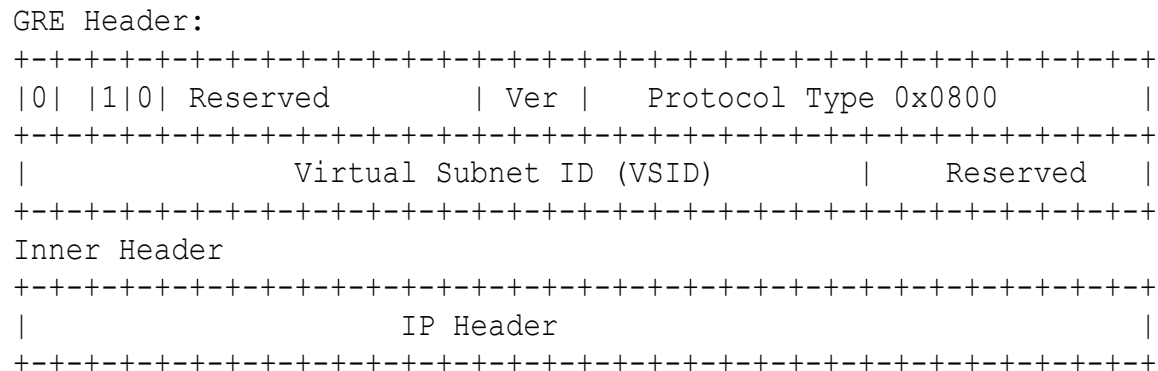
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Problem Statement

• Both NVGRE (draft-sridharan-virtualization-nvgre-01) and VXLAN (draft-mahalingam-dutt-dcops-vxlan-02) are originally specified for layer 2 vitalization overlay data encapsulation

• Several drafts propose to extend L3VPN into Data Center as layer 3 virtualization overlay
  – draft-fang-l3vpn-end-system-requirements-01
  – draft-fang-l3vpn-virtual-pe-framework-01
  – draft-drao-bgp-l3vpn-virtual-network-overlays-00
  – draft-fang-l3vpn-virtual-pe-01
  – draft-rfernando-l3vpn-service-chaining-01

• The above drafts also suggest using existing NVGRE or VXLAN data formats for layer 3 virtualization overlay beside MPLS based solution
  – carry an unnecessary inner Ethernet header per packet
  – an L3 overlay edge may interwork with an L2 overlay edge directly, where it prunes an error easily

About this draft

- Propose NVGRE enhancement for L3 virtualization overlay data encapsulation

- Propose VXLAN enhancement for L3 virtualization overlay data encapsulation
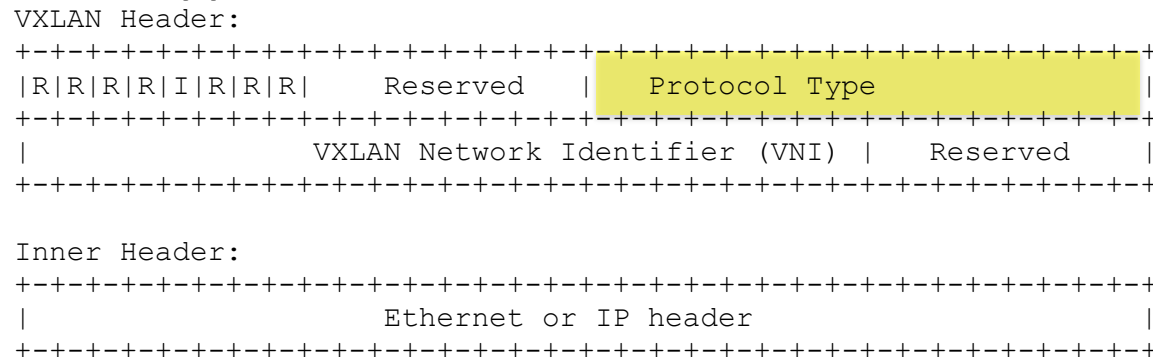
NVGRE Enhancement

- Proposed 0x0800 as the protocol type for IP payload

  – 0x6558 is the protocol type for Ethernet payload [NVGRE]

  – the version field in inner IP header can further differentiate IPv4 or IPv6 payload

- No change to other fields in NVGRE header

  – The usage of other field remains the same too

- No change to outer header

- Only IP header in the inner header if the protocol type value is 0x0800

```
GRE Header:
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|0| |1|0| Reserved        | Ver |   Protocol Type 0x0800        |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|              Virtual Subnet ID (VSID)        |    Reserved    |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
Inner Header
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                       IP Header                              |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

VXLAN Enhancement

- 16 reserved bits in VXLAN header as protocol type field
  - Specify 0x0800 for IP payload and 0x6558 as Ethernet payload
  - To support backward compatibility, value 0x0000 is also for Ethernet payload

- No change to other fields in VXLAN header
  - The usage of other fields remains the same too

- No change to outer header

- Inner header may be Ethernet or IP depending on the value in protocol type

```
VXLAN Header:
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|R|R|R|R|I|R|R|R|      Reserved      |        Protocol Type        |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                VXLAN Network Identifier (VNI) |    Reserved     |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+

Inner Header:
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                    Ethernet or IP header                       |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

Benefit of the Enhancements

- Maintain L3VPN implementation natively and decouple it completely from L2 overlay implementation
- Interwork with existing L3VPN customers
- Seamless support L2 and L3 overlay interworking
- BGP control plane works consistently with the data plane in term of multi-protocols support
  - the inner header on a data packet matches the address family being advertised by BGP
- Save 14 bytes in each packet for a native L3 overlay
  - lower the probability of the packet fragmentation
  - eliminate the unnecessary packet process

Next Step

- Welcome comment and feedback on this
- Update the draft