Generalized IPv6 Tunnel

draft-li-generalized-ipv6-tunnel-00

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Why Need GIP6

- Currently there are many types of IP tunnels, such as VXLAN and GRE. On IPv6 networks, it is hard to define extensions for all these tunnels to support new features. On the other hand it is not recommended to extend new features based on the IPv4 data plane for these tunnels

Many Types Of IP tunnels

- GRE Tunnels: defined in [RFC2784].
- IP in IP Tunnels: defined in [RFC1853].
- L2TPv3 Tunnels: defined in [RFC3931].
- ISATAP Tunnels: defined in [RFC4214].
- IPv4/IPv6 over IPv6 (4over6) Tunnels: defined in [RFC2473].
- VXLAN Tunnels: defined in [RFC7348].
- NVGRE Tunnels: defined in [RFC7637].
- MPLS over UDP: defined in [RFC7510].
- VXLAN-GPE (Generic Protocol Extension for VXLAN) Tunnels: defined in [I-D.ietf-nvo3-vxlan-gpe].

New Features

- [I-D.dong-6man-enhanced-vpn-vtn-id] defines the IPv6 encapsulation used to determine resource isolation.
- [I-D.li-apn-ipv6-encap] defines the IPv6 encapsulation of an APN.
- [I-D.ietf-6man-ipv6-alt-mark] defines IPv6 encapsulation for Alternate Marking.
- [I-D.ietf-ippm-ioam-ipv6-options] defines IPv6 encapsulation for IOAM.

Challenges

If the existing IP tunnels need to support new features such as Alternate Marking, IOAM, resource isolation, and APN, the following problems exist:

1. **A Lot Of Standardization work:** All of the IP tunnels mentioned above need to be extended accordingly, resulting in a lot of standardization work.

2. It is **hard to keep the consistency** between IPv4 and IPv6 for these IP tunnels (except IPv4 transition tunnels) since the possible extensions are recommended to be only done over the IPv6.

3. **Functions Redundant:** IPv6 can directly support some functions of these IP tunnels which cannot be done over the IPv4. This means such functions becomes redundant over the IPv6. For example, VXLAN takes use of the UDP to support ECMP. However for the IPv6 VXLAN, the Flow Label in the IPv6 header can also be used to support ECMP.

4. **Difficult to extend based on the existing format:** Some IP tunnels such as VXLAN and GRE have their own headers. If these tunnels need to support new features over the IPv6, there will face the challenge of the choice between reusing the exiting IPv6 encapsulations for these new features based on the IPv6 extension header and define new extensions based on their own tunnel headers.
    1) - If the tunnel header is extended, it will be redundant with the existing IPv6 encapsulation for the new features based on the IPv6 extension header.
    2) - For some existing IP tunnels (such as IP in IP) that do not have their own headers, they have to reuse the IPv6 encapsulations for these new features based the IPv6 header. extensions need to be redefined in the IPv6 extension header. As a result, their extensions may be different from that of the IP tunnels which have their own headers.

GIP6 Technical Description

- The Generalized IPv6 (GIP6) tunnel is defined to use the IPv6 header and IPv6 extension header to support both existing IP tunnels functions and new features.

A GIP6 encapsulated packet has the following format:

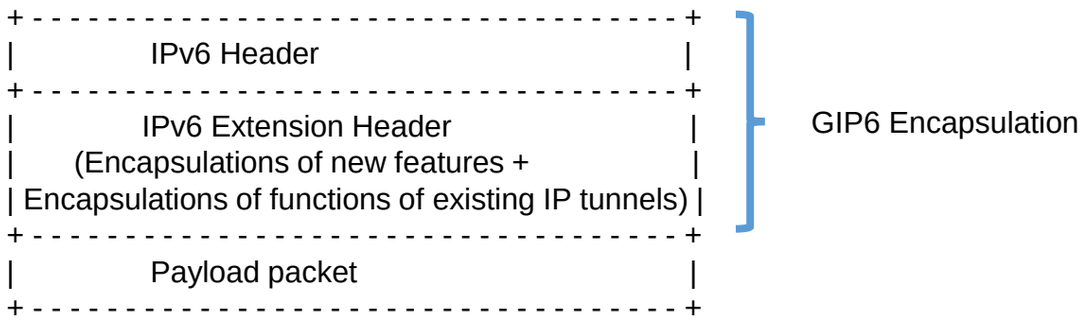


Figure 1. GIP6 Encapsulation

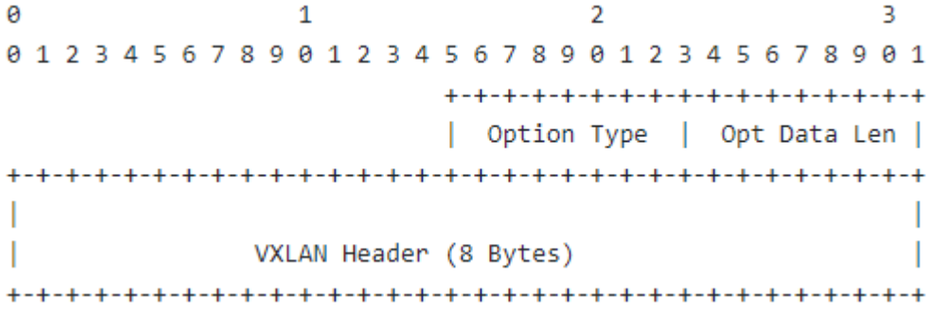
Use Case：GIP6 for VXLAN

- 1. The function of the UDP is replaced by the flow label of the IPv6 header in the GIP6 tunnel. To ensure compatibility, the value of the flow label calculated for the purpose of ECMP SHOULD be the same as that of the source port of the UDP.
- 2. Definition of the VN Option

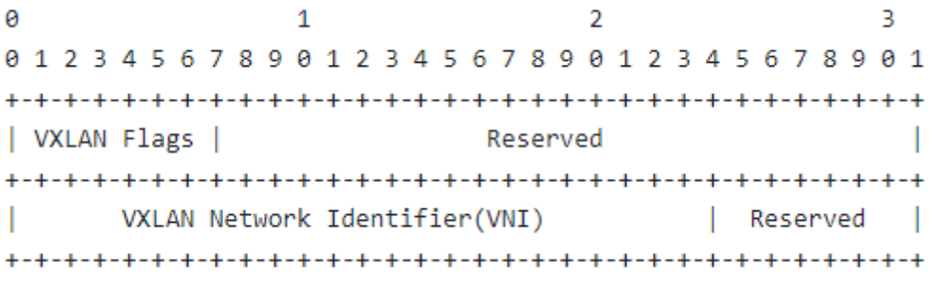
A new option called VN Option is defined to carry the VXLAN header information. The VN Option MUST only be encapsulated in the Destination Options Header (DOH).

The following figure shows the data fields format of the VN option:

VN Option



VXLAN headers



Next Steps

- Comments are welcome

Thank You