

Framework of Network Virtualization Based on MPLS Global Label

draft-li-mpls-network-virtualization-framework-00

Zhenbin Li, Ming Li(Huawei)

IETF 88, Vancouver, BC, Canada

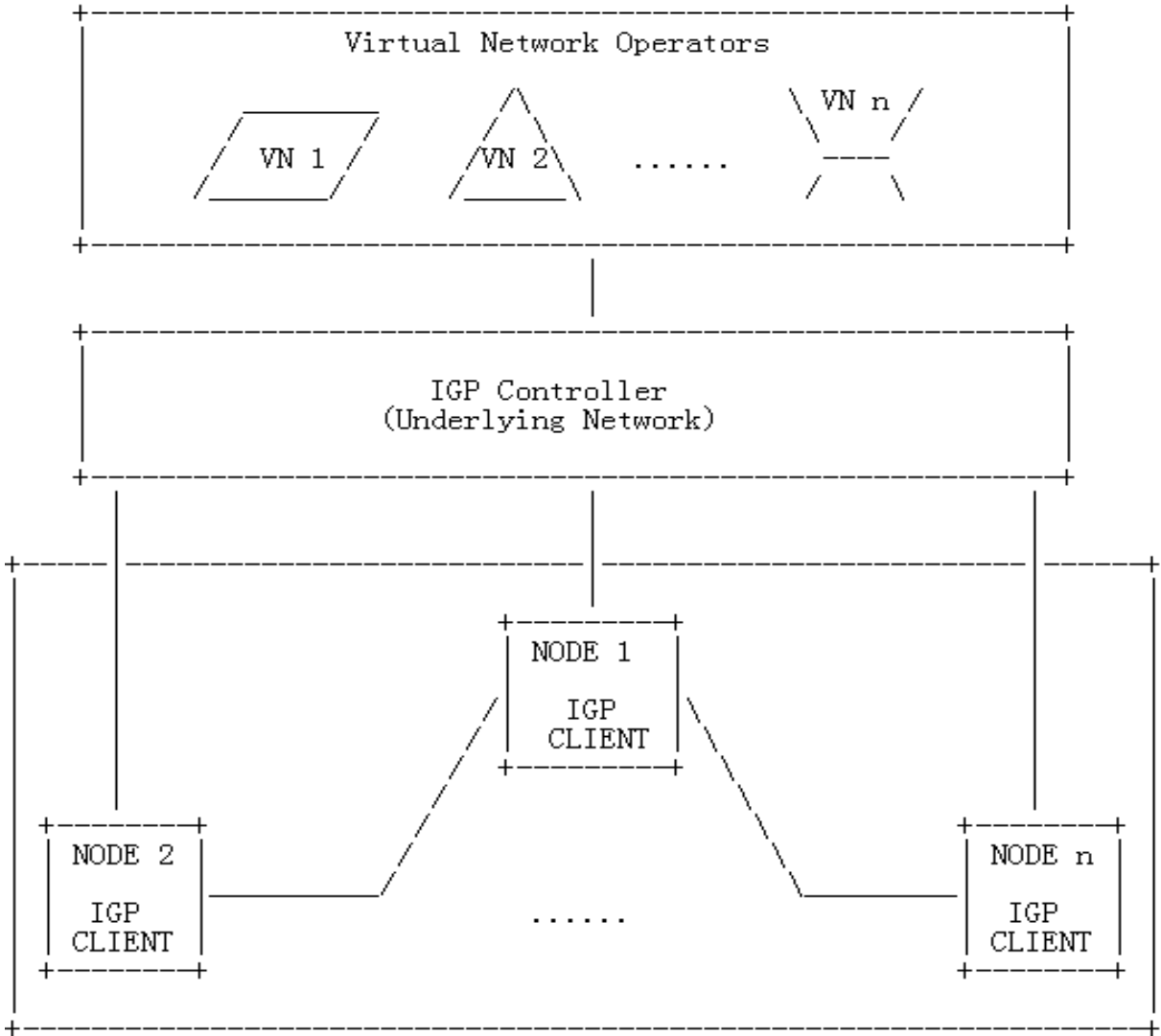
Introduction

- As the virtual network operators develop, it is desirable to provide better network virtualization solutions to facilitate the service.
- This document introduces a new framework to implement network virtualization based on MPLS global label. It can provide the virtualized network topology, nodes and links using MPLS global label which can make up the virtual network.

Background – Virtual Operator

- Virtual network operators can deploy possible services based on the virtual network which is provided by the underlying network.
- Owing to the technology limitation, the virtual network operators face following challenges:
 - It is hard to get the traffic and data information of internal nodes. So it is hard to develop value-added services.
 - Traditional VPN technology is just to provide a transparent pipe for virtual network operators which cannot control and manage the internal nodes.
 - Traditional technologies can not implement virtualization of network nodes and links. It is hard to provide flexible virtual networks.
 - It is unable to implement central control, which is hard to provide customized virtual networks based on policies and open APIs.
- On the other hand, the underlying network operators do not hope to expose much internal network details to the virtual network operators. Furthermore, it also exerts much burden on the virtual network operation and management if there is much internal network details for the virtual network operators.

Architecture of MPLS Virtual Network



Architecture of MPLS Virtual Network (Cont.)

- There is a central controller to control network nodes. The controller can construct different virtual networks according to the requirements proposed by the virtual network operators.
- IGP runs among the controller and the network nodes. MPLS global labels can be allocated by the IGP controller for the virtual network topologies, the virtual nodes and the virtual links.
- The label binding between the MPLS global label and the virtual network topology/node/link are flooded among the controller and the network nodes.
- When the network nodes receive the label mapping messages, they will install corresponding MPLS forwarding entries accordingly.

Example of MPLS Virtual Network

Virtual Network 1: VT-GL 1

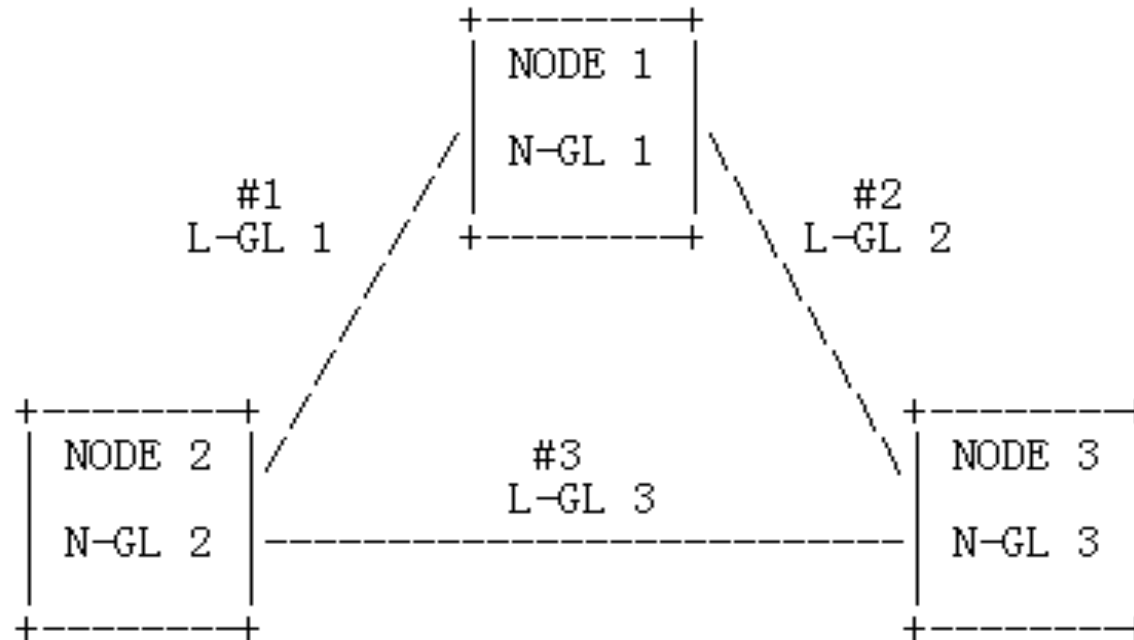
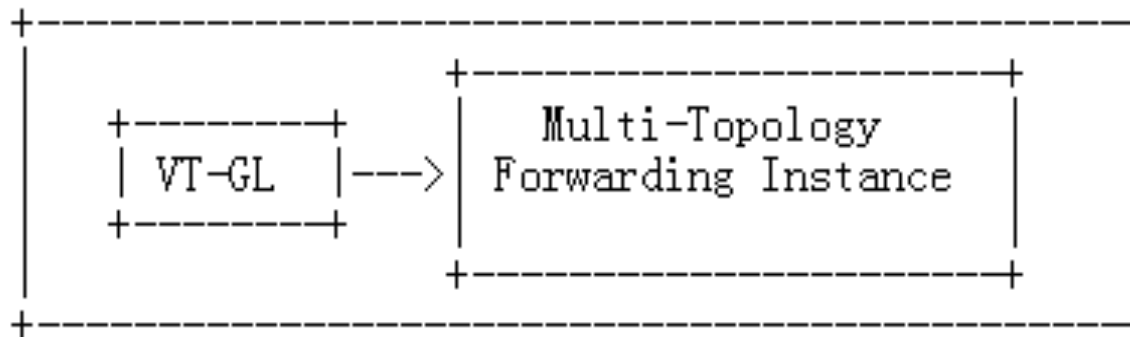


Figure 2 An Example of MPLS Virtual Network

- VT-GL: Global Label for Virtual Topology
- N-GL: Global Label for Virtual Node
- L-GL: Global Label for Virtual Link

MPLS Virtualization of Network Topology

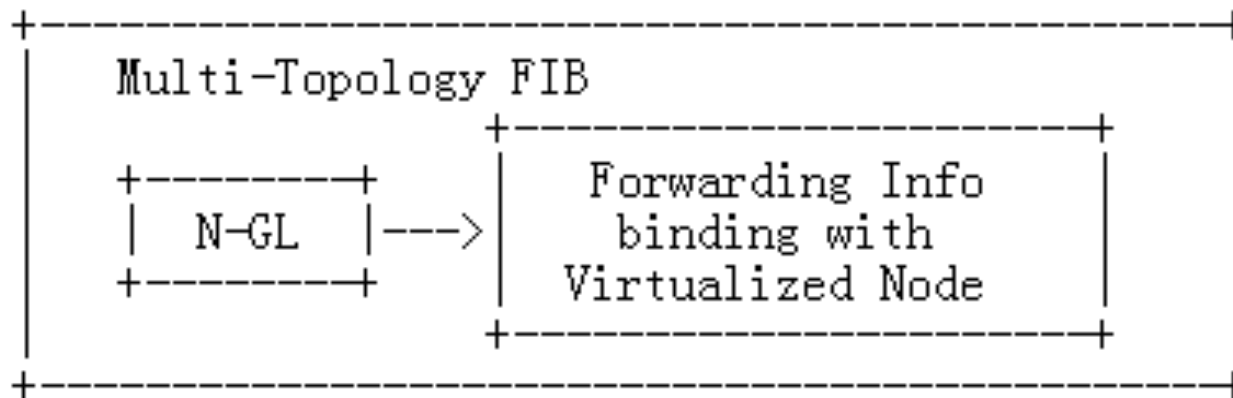
- MPLS global label is allocated by the IGP controller for the virtual network topology. The label binding between the Multi-Topology ID and the Global Label are flooded from the IGP controller to the network nodes.
- [I-D. li-isis-mpls-multi-topology] defines the corresponding IS-IS protocol extension and procedures to support MPLS Multi-Topology.
- Forwarding Entry installed for MPLS Multi-topology:



- MPLS Multi-topology based on global label can also be used for MRT FRR scenarios to reduce the number of labels allocated in multi-topology without introducing LDP in pure IP network.

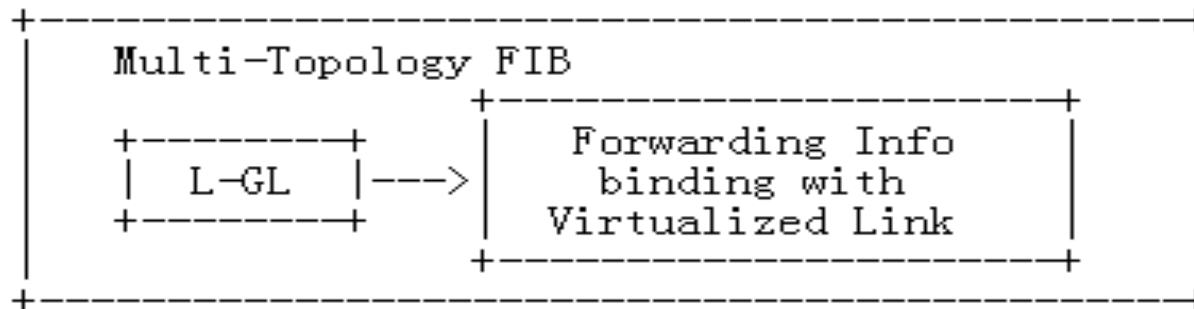
MPLS Virtualization of Network Nodes

- MPLS global label is allocated by the IGP controller for the tuple { Multi-Topology ID, Underlying Node Identification, Attributes of the Virtualized Node }.
- [I-D. li-isis-mpls-vnode-vlink] defines the corresponding IS-IS protocol extension and procedures to implement virtual nodes node and virtual link based on MPLS global label.
- Forwarding Entry installed for MPLS Virtual Node:

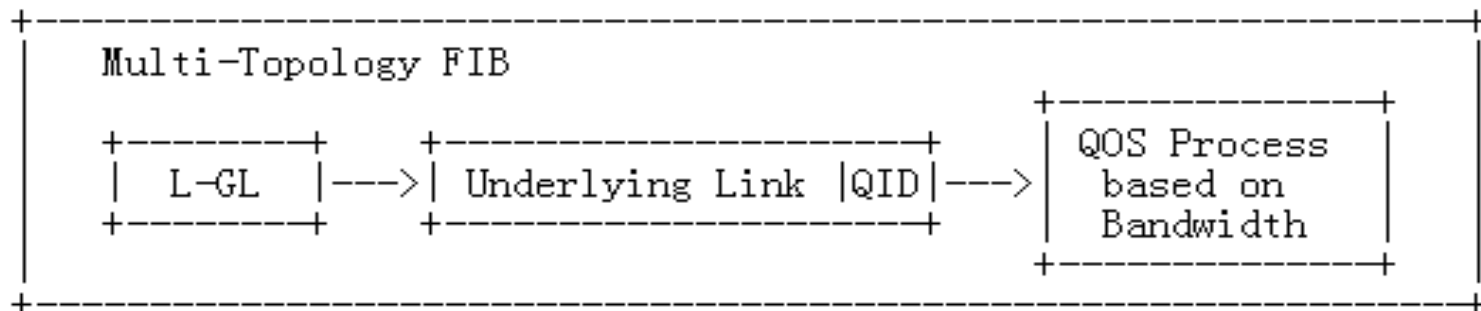


MPLS Virtualization of Network Links

- MPLS global label is allocated by the IGP controller for the tuple { Multi-Topology ID, Underlying Link Identification, Attributes of the Virtualized Link }.
- Forwarding Entry installed for MPLS Virtual Node:

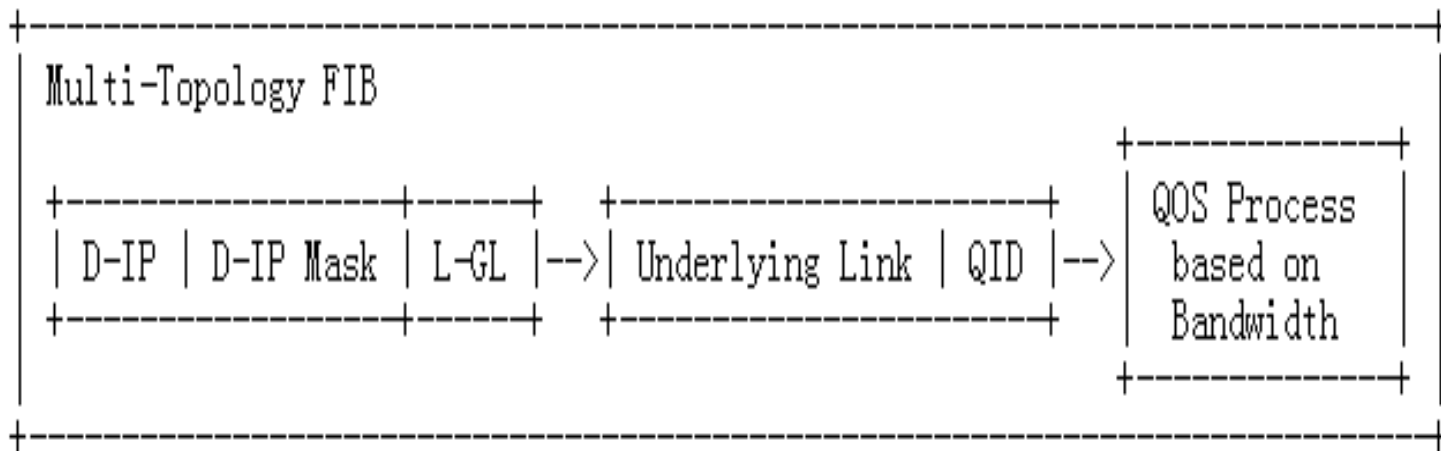


- When bandwidth as attribute of the virtual link, MPLS forwarding entry can be as follows:



Forwarding in Virtual Network

- Traditional SPF or CSPF Path Calculation
 - Virtualized nodes and links can be added to the LSDB or be added to the TEDB after applying specific MPLS TE attributes.
 - IP forwarding entry or MPLS TE forwarding entry may be created which can use the virtual link as the outgoing link.

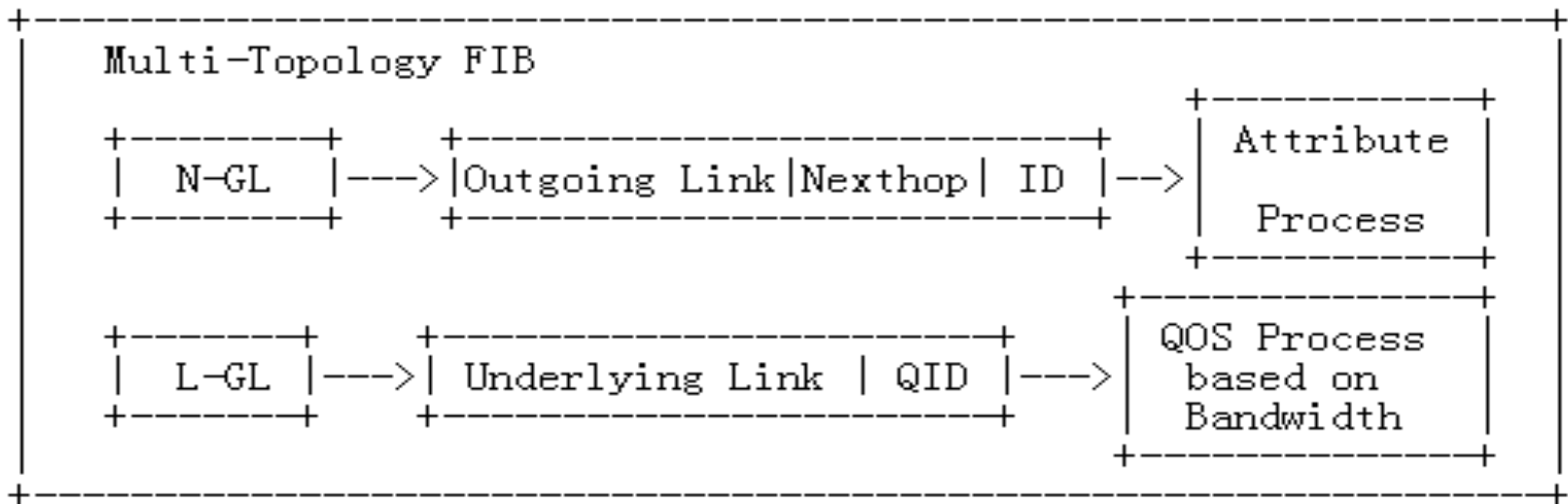


- In this case, the forwarding entry related with L-GL is not an independent entry. The L-GL is just like an internal index to link different parts of the forwarding information.

Forwarding in Virtual Network (cont.)

- Segment Routing

- MPLS virtual nodes and links can also be used for Segment Routing.
- The MPLS virtual node is just like the Node Segment in the Segment Routing. The MPLS virtual link is just like the Adjacency Segment in the Segment Routing.



- In this case, the forwarding entry related with N-GL or L-GL is the independent MPLS forwarding entry. QoS-based Segment Routing can be applied.

Next Steps

- Solicit more comments and feedbacks.
- Revise the draft.