

BGP-LS Extensions for Scalable SR based Enhanced VPN (VPN+)

draft-dong-idr-bgpls-sr-enhanced-vpn-04

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Background

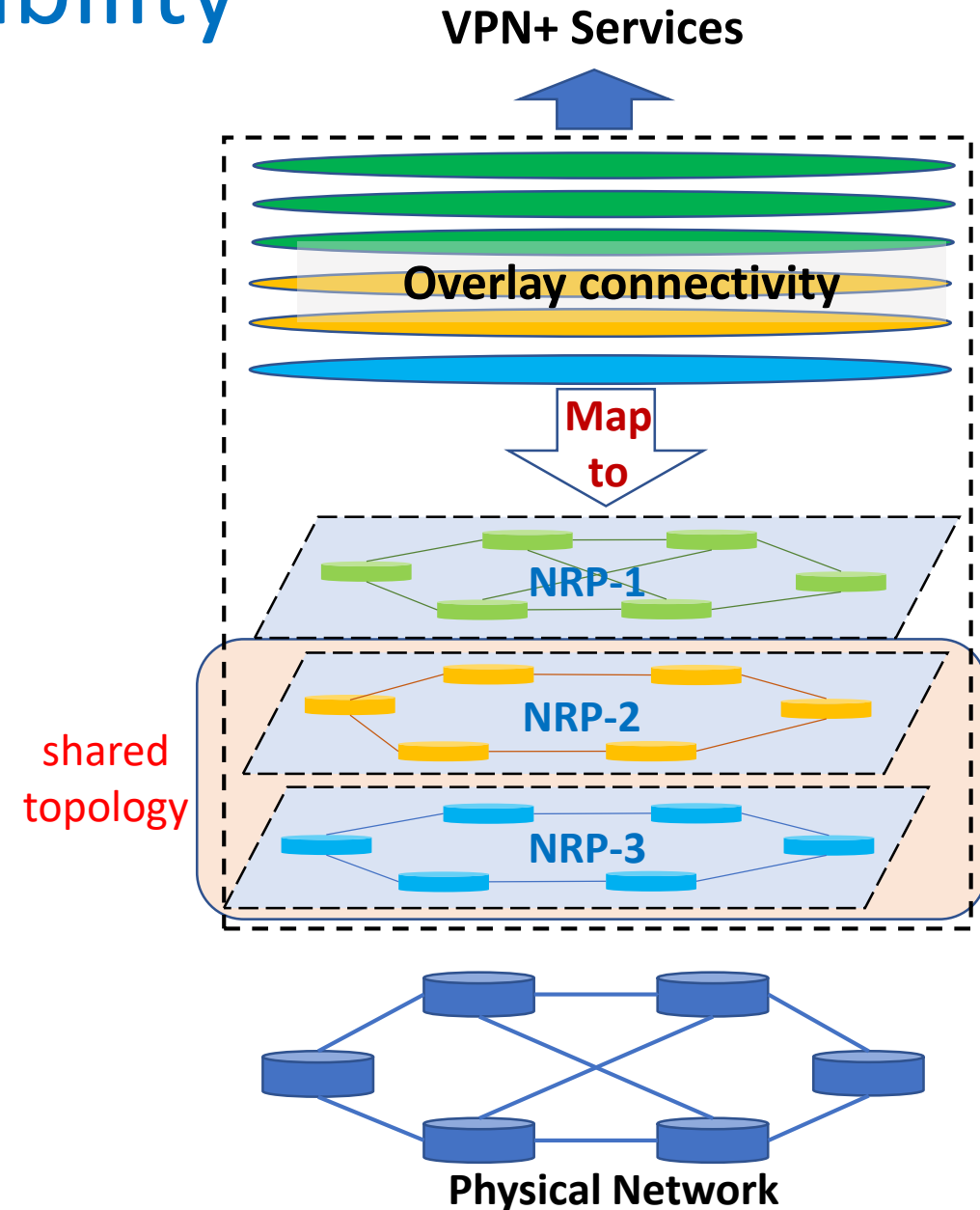
- VPN+ framework is described in draft-ietf-teas-enhanced-vpn
 - One typical use case is to deliver IETF network slice service
- IETF network slice framework is described in draft-ietf-teas-ietf-network-slices
 - It introduces the concept Network Resource Partition (NRP) for network slice realization
 - An NRP is an instantiation of VTN defined in VPN+ framework
- The scalability of NRP is analyzed in draft-dong-teas-nrp-scalability
 - It also provides guidelines for control plane and data plane optimization
- The IGP extensions for Scalable SR VPN+ are defined in draft-dong-lsr-sr-enhanced-vpn
 - Follows the mechanisms described in draft-dong-teas-nrp-scalability
- This document defines the BGP-LS extensions for scalable SR VPN+
 - To distribute the intra and inter-domain NRP topology and resource attributes to network controller

Overview of the Related Drafts

Framework	IETF Network Slice Concept and general framework draft-ietf-teas-ietf-network-slices	VPN+ framework can be used for slice realization draft-ietf-teas-enhanced-vpn	NRP Scalability considerations draft-dong-teas-nrp-scalability
	Resource-aware SID based data plane draft-ietf-spring-sr-for-enhanced-vpn	IPv6 HBH EH based data plane draft-ietf-6man-enhanced-vpn-vtn-id	MPLS EH/AD based data plane draft-li-mpls-enhanced-vpn-vtn-id
Data Plane	VTN/NRP information distribution		
	MT based VTN info distribution draft-ietf-lsr-isis-sr-vtn-mt draft-ietf-idr-bgpls-isis-sr-vtn-mt	Flex-Algo based VTN info distribution draft-zhu-lsr-isis-sr-vtn-flexalgo draft-zhu-idr-bgpls-sr-vtn-flexalgo	Scalable VTN/NRP info distribution draft-dong-lsr-sr-enhanced-vpn draft-dong-idr-bgpls-sr-enhanced-vpn
Control Plane	VTN/NRP specific path computation & instantiation		
	draft-dong-idr-sr-policy-nrp	draft-dong-pce-pcep-vtn	
Mgmt. Plane	IETF Network Slice Service YANG draft-ietf-teas-ietf-network-slice-nbi-yang	NRP YANG draft-wd-teas-nrp-yang	WG document Individual draft

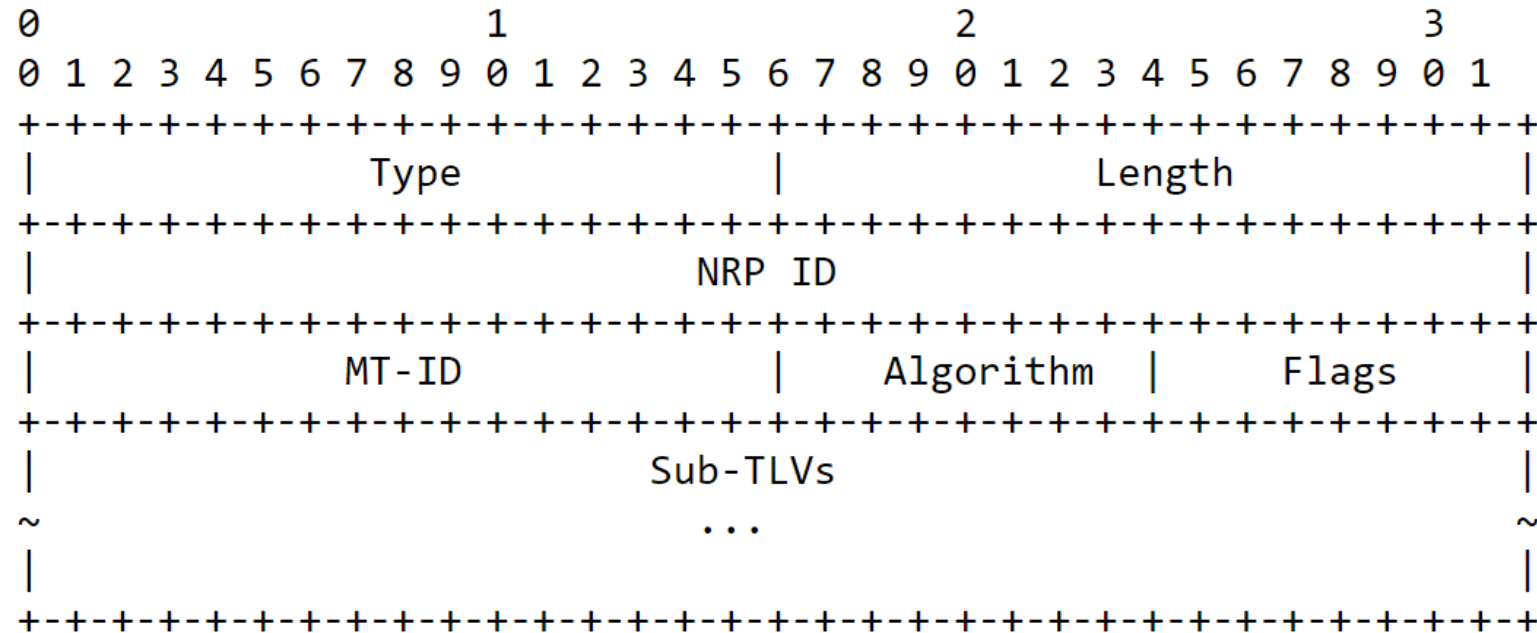
Optimizations for Better Scalability

- Multiple overlay connectivity services can map to the same VTN/NRP
 - NRP provides the underlay network topology and resources required by a group of overlay connectivity services
- Decouples the topology and resource attributes of NRP
 - Multiple NRPs can share the same topology, and the topology-specific route computation
 - Multiple NRPs may share the same set of resources on some network segments
- Introduces network-wide VTN/NRP ID in data plane
 - Avoids the allocation and distribution of per-NRP SR SIDs/SRv6 Locators



BGP-LS Extensions: NRP Definition sub-TLV

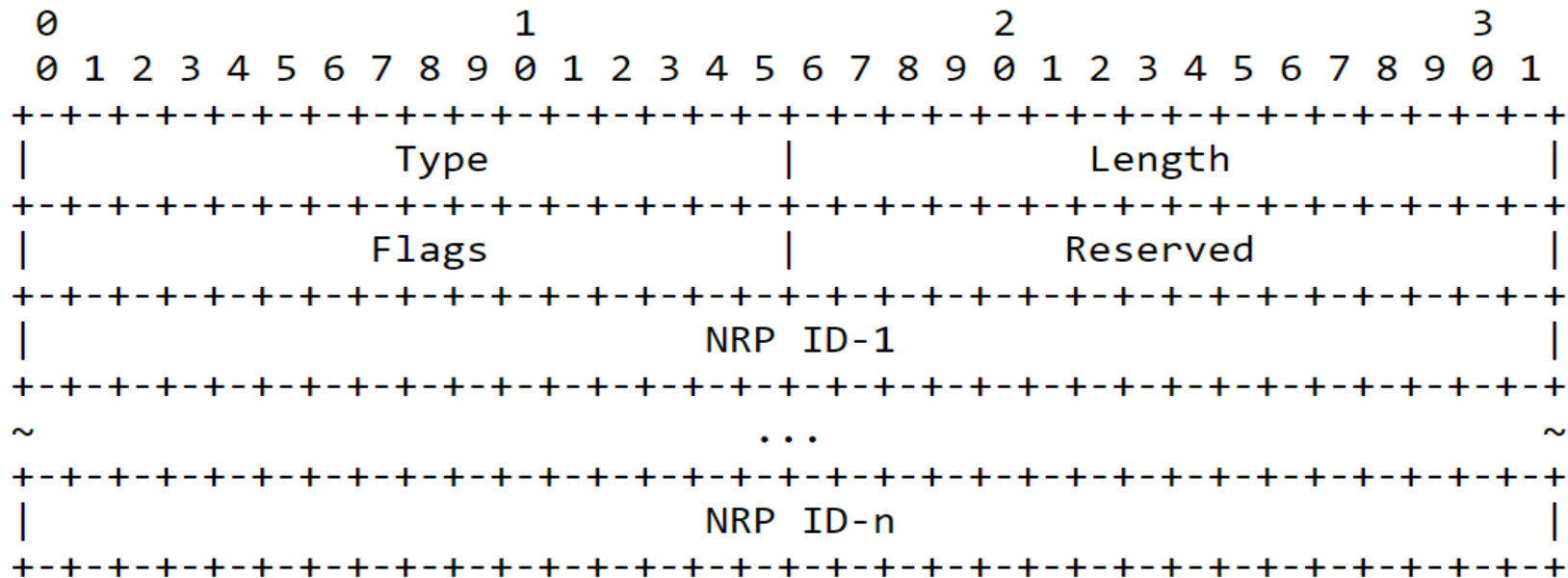
- A new TLV of BGP-LS Attribute associated with a Node NLRI
 - Is used to advertise the associated topology and other attributes of an NRP



- NRP-ID: 32-bit network-wide identifier of NRP
- MT-ID: : 16-bit identifier which contains the MT-ID of the IGP topology
- Algorithm: 8-bit algorithm ID, can be normal algorithm or Flex-Algo
- Sub-sub-TLVs: optional for additional attributes of NRP

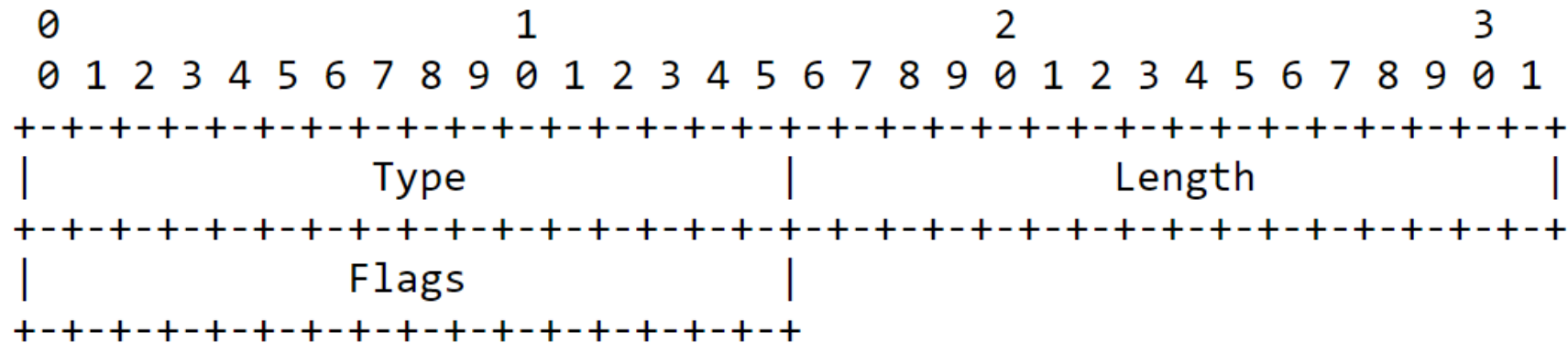
BGP-LS Extensions: NRP IDs Sub-TLV

- Is used to describe the list of NRPs that a link belongs to
 - Can be carried in the BGP-LS attribute associated with a Link NLRI
 - For both intra-domain links and the inter-domain links
 - Can also be carried as a sub-TLV in the L2 Bundle Member Attributes TLV



BGP-LS Extensions: Link Attribute Flags TLV

- Is used to specify the attributes of a link
 - Can be carried in the BGP-LS attribute associated with a Link NLRI
 - Can also be carried as a sub-TLV in the L2 Bundle Member Attributes TLV



- Flags: 16-bit flags. This field is consistent with the Flag field in IS-IS Link Attribute sub-TLV in [RFC 5029].
- A new Flag "E" is defined:
 - Link excluded from load balancing. When the flag is set, it indicates this link is only used for traffic of the associated NRPs.

Intra-domain Topology Advertisement

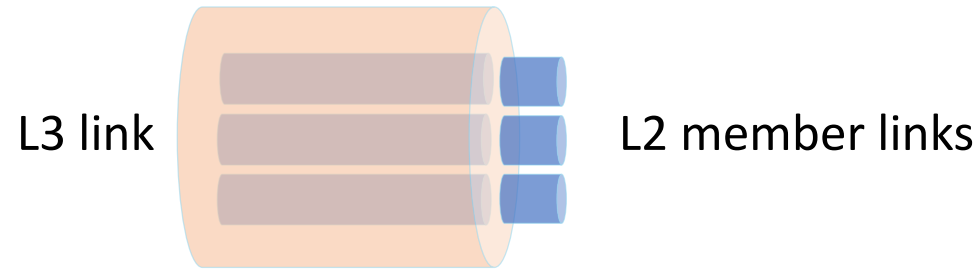
- The intra-domain topology associated with an NRP can be distributed by reusing MT and/or Flex-Algo mechanisms
 - MT can be used to define logical topology and per-topology node/link attributes
 - Flex-Algo can be used to specify the metric type and topological constraints applied to a topology
 - The <topology, algorithm> tuple can be referred to by multiple NRPs
- BGP-LS extensions for SR provide the distribution of per <topology, algorithm> SR SIDs and SRv6 Locators

Inter-domain Topology Advertisement

- Uses BGP-LS EPE to distribute the inter-domain links and the BGP peering segments
 - BGP peer-adj-SID, peer-node-SID or peer-set-SIDs
- NRP IDs TLV can be carried in the BGP-LS attribute of the inter-domain link NLRI
 - To describe the list of NRPs the inter-domain link is associated with

Advertisement of NRP Resource Attributes

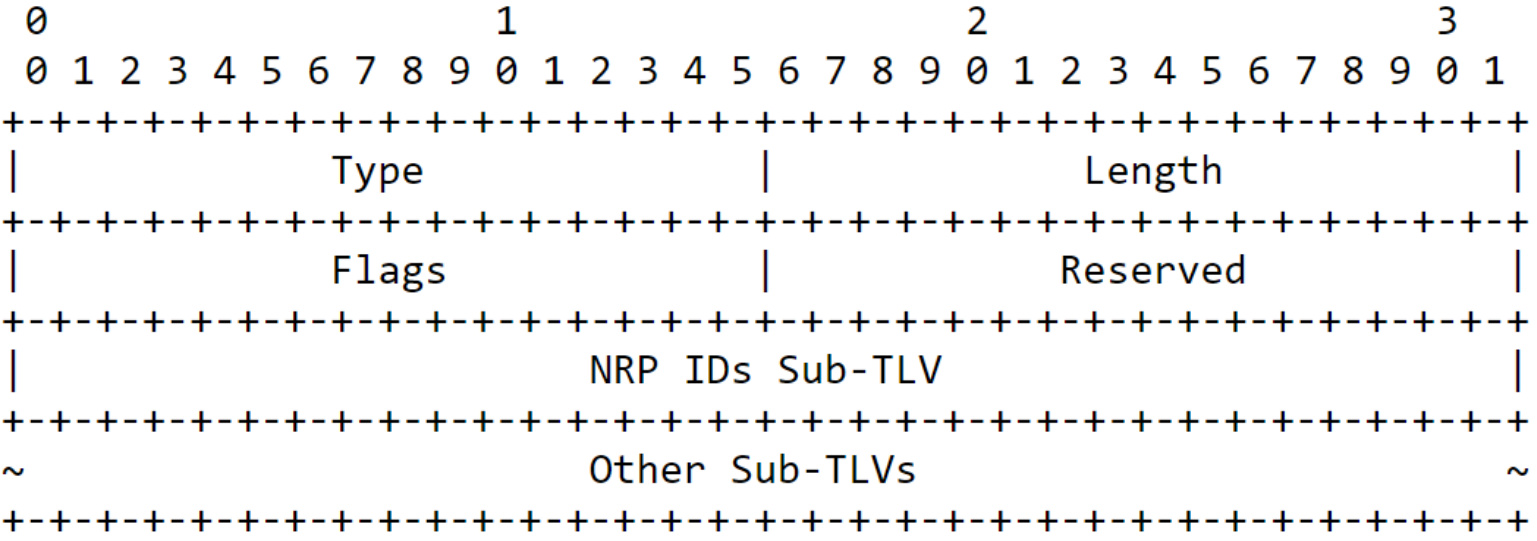
- Option 1: L2 bundle based approach
 - A partition of the link resource can be realized using a physical or virtual L2 member link of the L3 link, thus can be advertised using BGP-LS for L2 bundle member link



- An NRP IDs sub-TLV is carried under the BGP-LS L2 Bundle Member Attributes TLV
 - To specify the list of NRPs associated with the L2 member link
- A Link Attribute Flags TLV is carried under the L2 Bundle Member Attributes TLV
 - Use E flag to indicate whether this member link can be used for load balancing
- The bandwidth and other TE attributes of the L2 bundle member links can be advertised using the existing TE attribute TLVs of BGP-LS

Advertisement of NRP Resource Attributes (cont.)

- Option 2: Per-NRP link TE attributes
 - A new NRP-specific TE attribute TLV is defined to advertise the link attributes associated with different NRPs.



- NRP IDs Sub-TLV: A list of NRP IDs which are associated the same set of TE attributes
- Other Sub-TLVs: The TE attributes TLVs, e.g. bandwidth sub-TLV

Advertisement of NRP-specific Data Plane IDs

- Option 1: Per-NRP SR SIDs and SRv6 Locators
 - New TLVs for NRP-specific SR-MPLS Prefix-SID and Adj-SID
 - New sub-TLV for NRP-specific SRv6 Locators and SRv6 End SIDs
 - New sub-TLVs for NRP-specific SRv6 End.X SIDs
- Option 2: Dedicated NRP-ID in data plane
 - The data plane NRP-ID can be the same as the NRP-ID in control plane
 - No need to advertise additional NRP-specific data plane information
 - The encapsulation of NRP ID information is defined for IPv6 and MPLS data plane

Next Steps

- Solicit comments and feedbacks
- Refine the draft accordingly
- Work on the terminology alignment with the TEAS documents and the IGP extensions draft

Thank You