# IGP Extensions for Segment Routing based VPN+ / VTN

*draft-dong-lsr-sr-enhanced-vpn-03*

*draft-xie-lsr-sr-vtn-mt-00*

*draft-zhu-lsr-sr-vtn-flexalgo-00*

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# Background

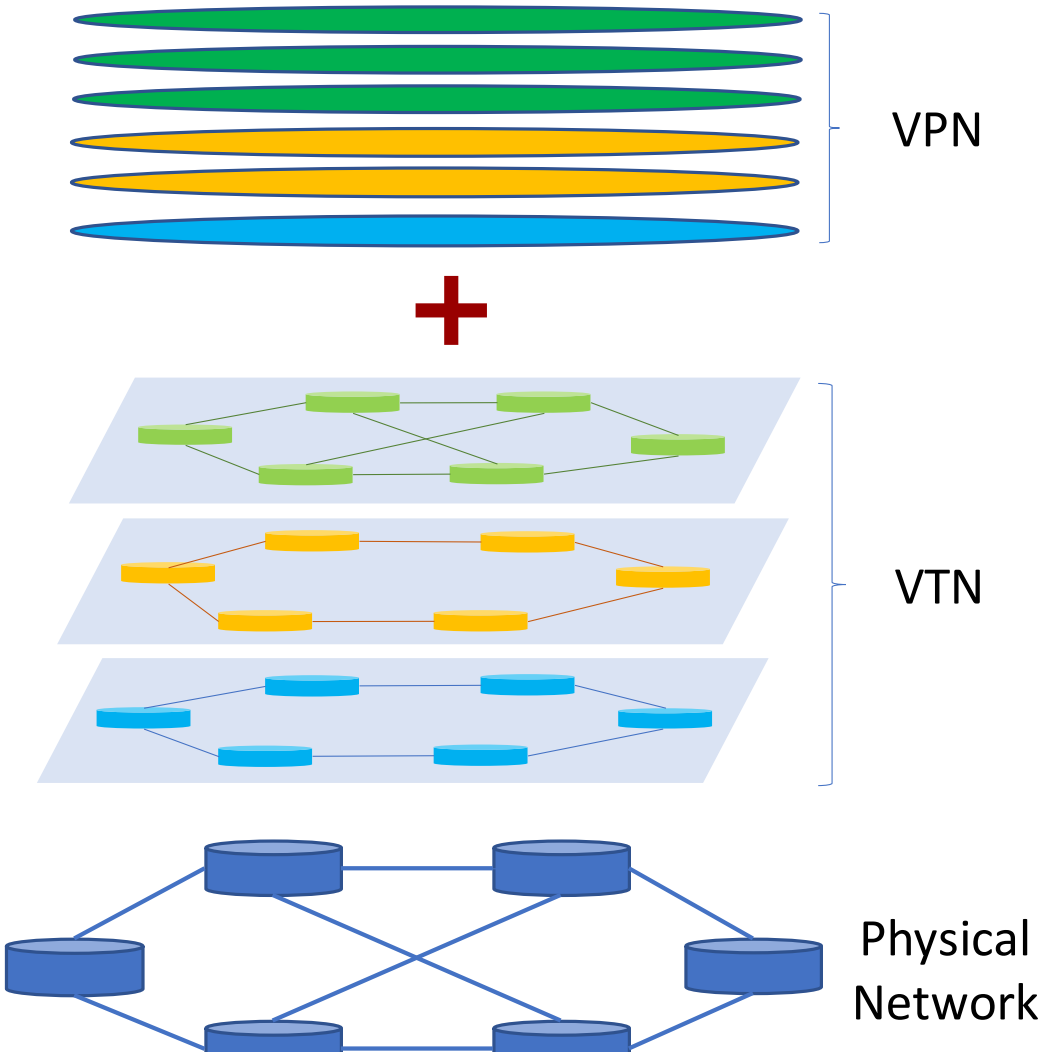
- VPN+ framework is described in *draft-ietf-teas-enhanced-vpn*
  - A layered architecture and candidate technologies to enable enhanced VPN services
  - VTN is introduced as the virtual underlay network in VPN+ architecture

- SR based VPN+ is defined in *draft-dong-spring-sr-for-enhanced-vpn*
  - Associate SR SIDs with different set of network resource for packet processing
  - Resource-aware SIDs can be used to build resource guaranteed virtual networks
  - Describe the mechanisms for SR based virtual network creation and forwarding

- These documents define the IGP mechanisms and extensions for SR VPN+
  - Distribution of the required information to network nodes and controller
  - Reuse existing protocol extensions to build a basic/simplified solution
  - Provide a flexible and scalable solution with additional extensions

# Terminology

- VPN+
  - An enhanced VPN service (VPN+) is a VPN service with additional commitments such as enhanced isolation and performance guarantee.
- VTN
  - A VTN is a virtual underlay network that connects customer edge points with the capability of providing the isolation and performance characteristics required by the customer. **A VTN has a customized topology and a set of dedicated or shared network resources.**
- A VTN provides the required underlay network characteristics for one or a group of VPN+ services



# Mechanism in draft-lsr-sr-vtn-mt

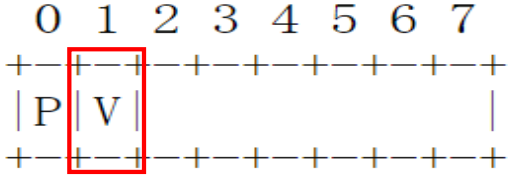
- Describes how to use Multi-Topology and existing IS-IS TLVs/sub-TLVs to advertise VTN attributes
  - MT-ID is reused as the control plane identifier of VTN
  - Use MT IS-IS for VTN topology advertisement
  - Use IS-IS SR to advertise per-topology SR-MPLS SIDs or SRv6 Locators/SIDs
  - **Advertise per-topology TE attributes for each VTN**
    - E.g. Maximum Link Bandwidth sub-TLV can be reused to advertise the sub-set of bandwidth allocated to each VTN
    - Note one link can participate in multiple topologies (VTNs)
      - Thus physical link bandwidth should not be advertised per-topology
    - Advertise the association of MT-ID with L2 bundle member link
      - L2 bundle could be generalized for physical/virtual member links

# Comments & Discussion on LSR List

- Should this document be standard track or informational?
- Can existing TE attributes be carried at per-topology level?
  - IANA registry shows “yes”, while RFC 5120 is vague about this:
    - **“If** traffic engineering or some other applications are being applied per topology level **later**…”
  - If these are allowed, another question comes:
    - Is there need to further specify how to advertise the topology-specific TE attributes, especially when one link participates in multiple topologies?
- Can MT-ID be associated with L2 bundle member links?
  - Current feedback is “No, MT-ID is a L3 construct”
    - While the L3 parent link can participate in multiple MTs
  - One approach is to generalize IGP L2 bundle for per-topology/VTN TE attributes advertisement and association (see next slide)

# Mechanism in draft-lsr-sr-vtn-flexalgo

- Describes how to use Flex-Algo and L2 bundle extensions to advertise VTN attributes
  - Flex-Algo ID is reused as the control plane identifier of VTN
  - Use Flex-Algo to describe the topology constraints of VTN
  - Use IS-IS SR to advertise algorithm-specific prefix SIDs/SRv6 Locators
  - Extend IS-IS L2 bundle to advertise the TE attributes associated with each Flex-Algo/VTN
    - L2 bundle is extended for both virtual and physical member links




V flag: indicates the member links are virtual

    - Each Flex-Algo is associated with a virtual or physical member link
      - Admin-group/extended admin group (color) is used for association

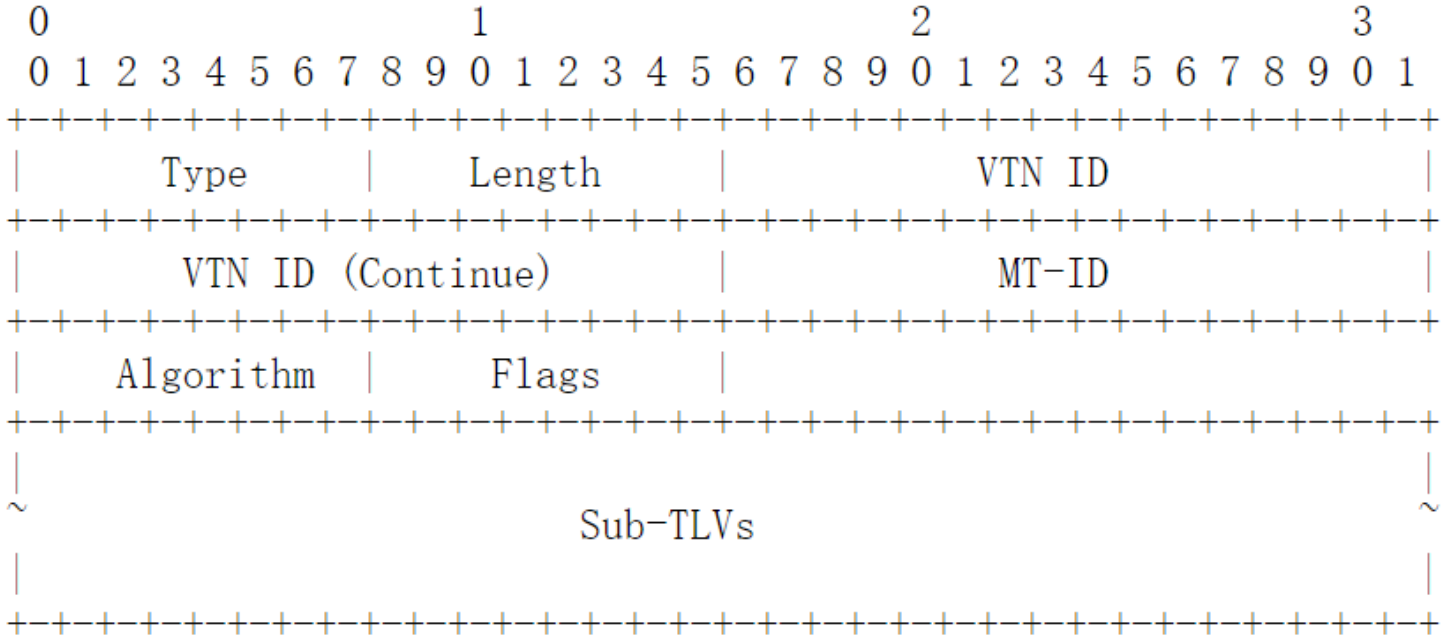
# Mechanism in draft-lsr-sr-enhanced-vpn

- Provides a more flexible and scalable solution to build SR based VTNs
  - It is important to meet the customized service requirements
  - Scalability needs to be considered to meet future service scenarios

- Multi-dimension VTN definition
  - A VTN is defined as a combination of several attributes
    - Topology: one topology can be shared by multiple VTNs
    - Resource: a set of network resource can be shared by multiple VTNs
    - …
  - Decouple the advertisement and processing of different attributes
    - Reuse existing protocol components when possible
    - Reduce overhead in advertisement and computation

# Advertisement of VTN Definition

- Virtual Transport Network Definition (VTND)
  - A new sub-TLV of IS-IS Router-Capability TLV 242



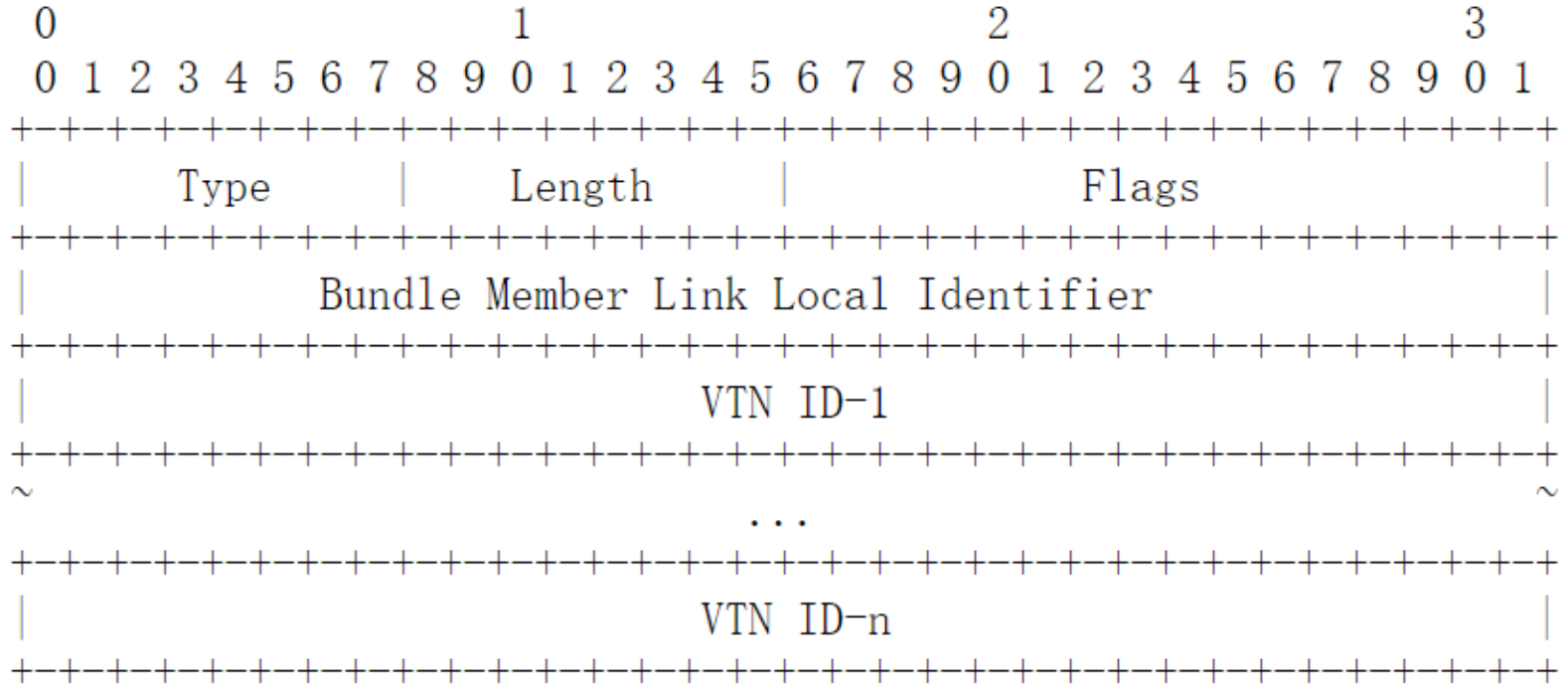

  - VTN-ID: 32-bit global significant identifier of VTN
  - MT-ID: 16-bit topology identifier
  - Algorithm: 8-bit algorithm ID. Can be normal algorithm or Flex-Algo
  - Sub-TLVs: Optional sub-TLVs for additional attributes

# Advertisement of VTN Topology Attributes

- Multi-topology based topology advertisement
  - MTR can be used with SR to define network topologies
    - Applicable to both SR-MPLS and SRv6
    - Topology-specific SIDs and SRv6 Locators
    - Topology-specific attributes
- Flex-Algo based topology advertisement
  - Flex-Algo can be used to define the topological constraints
    - Applicable to both SR-MPLS and SRv6
    - Algorithm-specific SIDs and SRv6 Locators
- Both are considered as options for topology advertisement
  - Combination of MT and algorithm is also possible
- Note one MT or Flex-Algo could be referenced by multiple VTNs

# Advertisement of VTN Resource Attributes

- Extend IGP L2bundle mechanism (ISIS TLV 25)
  - A subset of resource of an L3 link can be described as physical or virtual member link
  - A new Flag “Virtual (V)” is used to indicate whether the member links are virtual
  - A new VTN-ID sub-TLV in the L2 Bundle Member Attributes
    - Describe the mapping relationship between the VTNs and the member link



# Advertisement of VTN-specific Data Plane IDs

- SR-MPLS
  - VTN-specific prefix-SIDs
  - VTN-specific adj-SIDs
- SRv6
  - VTN-specific SRv6 Locators
- Dedicated VTN-ID in data plane
  - The data plane VTN-ID can be the same as the VTN-ID in control plane
  - One possible encapsulation is defined in draft-dong-6man-enhanced-vpn-vtn-id

# Summary

- VTN provides the required virtual underlay network to support VPN+ services
- MT/Flex-Algo based VTN mechanisms are based on combination of existing TLVs as much as possible
  - Some additional specification or small extensions may be needed
- A more flexible & scalable solution can be provided by introducing VTN-ID and related TLVs into IGP
  - May further to the data plane

# Next Steps

- Solicit feedbacks and comments
- Refine the documents accordingly

# Thank You