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
**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
      - Each Flex-Algo is associated with a virtual or physical member link
        - Admin-group/extended admin group (color) is used for association
      - V flag: indicates the member links are virtual
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
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.

A more flexible & scalable solution can be provided by introducing VTN-ID and related TLVs into IGP.
Next Steps

- Solicit feedbacks and comments
- Refine the documents accordingly
Thank You