Scalability Considerations for Enhanced VPN (VPN+)

draft-dong-teas-enhanced-vpn-vtn-scalability-03

Jie Dong, Zhenbin Li @Huawei
Liyan Gong, Fengwei Qin @China Mobile
Guangming Yang @China Telecom
James Guichard @Futurewei
Gyan Mishra @Verizon

TEAS WG       IETF 111 Online Meeting       July 2021
Recap of VPN+ / VTN

- VPN+ framework is described in `draft-ietf-teas-enhanced-vpn`
  - A layered architecture and candidate technologies to provide VPN+ services
  - One of the typical use cases is network slicing
- VTN is a virtual underlay network with a customized topology and a set of dedicated or shared network resources
  - VPN+ service is delivered by integrating the VPN overlays with VTNs
- Scalability becomes an important factor for the widely deployment of VPN+/VTN e.g. in network slicing scenarios
- This document provides scalability considerations of VTN
  - Scalability analysis of the control plane and data plane
  - Proposes scalability optimization mechanisms
Control Plane Scalability Optimization

- Reduce the number of control protocol instance/session for VTN information distribution
  - Use a shared control protocol instance/session for multiple VTNs
  - Need an identifier in the control messages to distinguish the information of different VTNs
- Decouple the advertisement and processing of different types of VTN attributes, e.g. the topology attribute and the resource attribute
  - The benefit of sharing the topology and SPF computation among multiple VTNs
  - Reduce the overhead in duplicated attribute advertisement
- Divide up the computation load between the centralized controller and the distributed control plane
  - A hybrid control mode is recommended

- 1 IGP instance, 1 IGP adjacency for multiple VTNs
- Shared topology and SPF computation between multiple VTNs

VTN-1
VTN-2
VTN-3

Shared topology
Shared SPF Tree
Data Plane Scalability Optimization

• Introduce a dedicated data plane ID to identify the set of resources allocated for per-VTN processing
  • Decouple the VTN resource ID from the topology-specific ID in packet forwarding

• IPv6 data plane
  • Destination IP address is used to determine the topology/path
  • A dedicated VTN resource ID is used to identify the set of resources used for per-VTN packet processing

• MPLS data plane
  • The MPLS forwarding labels are used to determine the topology/path
  • A dedicated label or extension header is used to identify the set of resources used for per-VTN packet processing
Further Considerations

• What types of VTN information need to be advertised in distributed control plane?
  • limitations in advertising large amount of per-VTN information
  • Some information can be centrally provisioned by the controller

• Flex-Algo or Multi-topology?
  • Flex-Algo supports up to 128 different logical topologies, IS-IS MT supports 4K
  • draft-dong-lsr-sr-enhanced-vpn defines the mechanisms to associate VTNs with either MT or Flex-Algo

• IGP or BGP?
  • BGP-LS and BGP-SPF may have better scalability than IGPs
  • Please refer to draft-dong-lsvr-bgp-spf-vtn for a possible approach
Document Update History

- Version -00 submitted in Feb. 2020
  - Analyzes the control plane and data plane scalability, and provide optimization suggestions

- Version -01 submitted in Nov. 2020
  - Add new coauthor
  - Mainly editorial changes

- Version -02 submitted in Feb. 2021
  - Add new coauthor
  - Add further analysis about the data plane options
  - Align the terminology with draft-ietf-teas-ietf-network-slice-definition

- Version -03 submitted in Jul. 2021
  - Add new coauthors
  - Editorial changes to align with draft-ietf-teas-ietf-network-slices
About the Terminology Alignment

• Different terms refer to the similar network construct for network slice realization
  • VTN
  • Slice Aggregate
  • …

• Recent discussion with the authors of draft-bestbar-ns-packet
  • It is agreed that a common “new term” in draft-ietf-teas-ietf-network-slices is needed for the underlay network construct of the network slice services
  • Both VTN and Slice Aggregate could map to the “new term”
Next Steps

• Work with the authors of draft-ietf-teas-ietf-network-slices to produce a common “new term”

• Update this document with the “new term”, the content has been stable and ready for adoption

• Based on the aligned terminology, collaboration on the following topics will happen between the draft authors
  • Scalability considerations and optimization
  • Procedures of network slice realization
  • Common network/device YANG models
  • Common protocol extensions
Thank You