Segment Routing based Solution for Hierarchical IETF Network Slices
draft-gong-teas-hierarchical-slice-solution-00

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Background

- **Network slicing**
  partition a physical network into multiple isolated logical networks of varying sizes

- **IETF Network Slice**
  defined by [I-D.ietf-teas-ietf-network-slices] with general principles of network slicing

- **Network Resource Partition (NRP):**
  collection of resources in the underlay network. A NRP support one or a group of IETF network slice services

- **hierarchical IETF network slices**
  a network slice can be further sliced into other network slices. [I-D.dong-teas-hierarchical-ietf-network-slice] describes the possible scenarios:
  - level-1 can be industry slices; level-2 can be customer slices

This draft proposes a **two-level hierarchical IETF network slices solution** based on **Segment routing**.

**Level-1 network slice**: realized by associating Flex-Algo with dedicated sub-interfaces

**Level-2 network slice**: realized by using SR Policy with additional NRP-ID on data plane
2 Level hierarchical Slice based on Segment routing

**Level-1 network slice**

**Topology for Level-1 network slice:** associated with a Flex-Algo

(All the nodes belong to the level-1 NRP participate in the associated Flex-Algo)

**Traffic Forwarding:** Traffics of the level-1 network slices are steered into the Flex-Algo paths by using Prefix-SIDs or SRv6 locators.

**Level-2 network slice**

**Topology for Level-2 network slice:** Specify the path on the level-1 NRP through SR policy.

**Traffic Forwarding:** Traffics of the level-2 network slice are steered into the SR Policies.
network resources for the two-level network slices

Bandwidth resource of a physical interface is partitioned in a hierarchical manner

✓ **Bandwidth for Level-1 network Slice**

  is guaranteed by layer-3 sub-interfaces with dedicated bandwidth.

  **layer-3 sub-interface** is
  
  – included by the Flex-Algo which is associated with the level-1 NRP
  – excluded by irrelevant Flex-Algos

  **Data plane Identifier:** Prefix-SIDs or SRv6 locators associated with Flex-Algo

✓ **Bandwidth for Level-2 network Slice**

  is guaranteed by HQoS queues with dedicated bandwidth under the layer-3 sub-interface of level-1 NRP

  **Data plane Identifier:** NRP-ID associated with HQos Queue
NRP vs Network Slice

Each NRP can be used to support one or a group of network slice

- **Level-1 NRP**
  - 1:N. multiple level-1 network slices share one level-1 NRP means these level-1 network slices associate one Flex-Algo
  - 1:1. One Level-1 NRP supports one Level-1 network slice

- **Level-2 NRP**
  - 1:1. One Level-2 NRP supports one Level-2 network slice
Example --- Slice service planning and requirements

Slice Service Planning

✓ 2 Level-1 slice
  – Slice1 for education -- FlexAlgo 128
  – Slice2 for healthcare. -- FlexAlgo 129

network slice and NRP are 1:1

Requirements

✓ Slice1
  2 customer require Level-2 slice
  – University 1. interconnection between PE1 and PE2 and interconnection between PE1 and PE3
  – University 2. interconnection between PE1 and PE2

✓ Slice2
  1 customer requires Level-2 slice
Example --- NRP of link bandwidth

Taking PE1 as an example

✓ **Interface1** connect to P1
  - **Sub-interface 1-1** for NRP-1
    - Queue 1-1-1, for NRP-1-1
    - Queue 1-1-2, for NRP-1-2
  - **Sub-interface 1-2** for NRP-2
    - Queue 1-2-1, for NRP-2-1

✓ **Interface2** connect to P3
  - **Sub-interface 2-1** for NRP-1
    - Queue 2-1-1, for NRP-1-1
Taking PE1 as an example

**Forwarding on Level-1 Slice**

From University 1 (PE1) to University 2 (PE2) on Slice1

- **Encapsulation:**
  Destination is END SID of PE2 associated with FlexAlgo128

- **Path:**
  PE1->P1->PE2. through layer-3 sub-interface

**Forwarding on Level-2 Slice**

Form campus of university 1 at PE1 to campus at PE2 on Slice1-1

- **Encapsulation**
  IPv6 Header
  SHR: all segments are associated with Flex-Algo 128
  HBH: carries the level-2 NRP-ID of Slice1-1

- **Path**
  PE1->P1->PE2. through the HQoS queue
Next Steps

• Any questions or comments are Welcome
• Seeking for feedback
Thank You