Packet Network Slicing using Segment Routing

draft-peng-teas-network-slicing-04

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All Overview

• **All** (Administrative Instance Identifier): Explicit virtual network identification, it could be used as a *TN-slice identifier*, it indicates the topology, computing, storage resources of the dedicated virtual network.
  - All is the identifier of the dedicated Virtual Networks for the slice.
  - Support the **End-to-End Slicing**.
  - **Identifier the Unified NSI** across multi-domain of TN.
  - All is one of constraint criteria of the color template (draft-ietf-spring-segment-routing-policy), and color template with All provides a more flexible control.
  - Uniform Color template (Centralized and distributed, intra and inter domain) for overlay service mapping to underlay resource.
  - All meet the link requirements from 3GPP. It is **independent** of the existing domain partition of the network, i.e., any intra- or inter-domain link, and it is also **independent** of the existing underlay frame or routing technologies (IGP, BGP, Segment Routing, Flex-E, etc.), i.e., any L2 or L3 link is the candidate resource.

• There is no modification to the forwarding table(dataplane), except QoS policy per Slice.
**All as a TN-slice Identifier**

Create the TN-slice
- Assign/Select the All to the slice.
- Allocate resources(vNode,vLink...) to All
- All information is advertised via Control plane.

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I. SR-policy@All installed
II. Flow steer to SR policy or SR-BE@All

SR policy@All-1
- Color 1000(red)
- All IS 1
te metric

SR-BE@All-1
- with endogenous metric, may be:
  - min IGP metric
  - min delay
  - min TE metric
  ...

SR policy is not required.

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**Transport Network**

**Controller**

**Slice config**
- node/link join Alls
- SID allocation per All

**BGP-LS (with All attribute)**
**All as a Set of TN-slice Resource Identifiers**

- **L3 Interface Slice Isolation**

- **L2 Interface Slice Isolation**

• Only bundle interface join IGP instance.
• Bundle members could be any interface type.
• Control-plane packets will always be forwarded over the same path.
• Data-plane packets will be forwarded on the specific bundle member.

- **Resource Isolation**

• SIDs are allocated per All, and the resource (such as bandwidth) is allocated to All.
• All is one of constraint criteria of the Color Template (draft-ietf-spring-segment-routing-policy), and color template with All and other traditional criteria, such as bandwidth, delay, affinity, provide a more flexible control.
All for Multi-Domain Deployment

Option C: Colored BGP-LU without SDN

Option B Inter-domain

color 1000 is: All 1 SPF

color 1001 is: All 1 te metric

ASBR selects All-specific out-link according to uniform Color Template.

color 1000 is: All 1 SPF

color 1001 is: All 1 bandwidth 1G delay 10ms

ASBR selects All-specific out-link according to uniform Color Template.
All for Multi-Domain Deployment Cont.

- BGP-LS advertised link-state NLRI containing AII information.
- For the inter-domain link, BGP-LS can advertise DIRECT protocol type, or firstly put inter-domain interconnections to IGP instance, then always import data from IGP protocol source.
- Controller supports computation of E2E TE path based on TE-DB with AII attribute.
Combined with SR Flex-algorithm

Scenario 1:
For inter-domain case, SDN controller can create VN for All-AS based on All, and VN for FA-AS based on FA respectively. SDN controller computes E2E segment lists, each containing multiple ASes and based on different technologies. However, for distribute mode, at border node, an All with endogenous IGP-metric/delay/TE-metric can be mapped to the specific FA-id with the same metric.

Scenario 2:
For a single All-AS, we can continue to apply SR FA to optimize label stack depth. In this case, a new criteria All is added in FAD, same as adding All to Color Template.
Create a new top-level registry called "Network Slicing Parameters".
Request a new sub-registry "All (TN-slice Identifier) codepoint"

<table>
<thead>
<tr>
<th>Slice Type</th>
<th>Instance (Low 24bits)</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0(Normal)</td>
<td>0</td>
<td>Reservered for Default Slice: the original physical network.</td>
</tr>
<tr>
<td>endogenous:</td>
<td>nonzero</td>
<td>Normal Slice, for user defined.</td>
</tr>
<tr>
<td>IGP-metric</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1(uRLLC)</td>
<td>0</td>
<td>Reservered.</td>
</tr>
<tr>
<td>endogenous:</td>
<td>nonzero</td>
<td>Slice suitable for the handling of ultra-reliable low latency communications, for user defined.</td>
</tr>
<tr>
<td>delay</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2(TE)</td>
<td>0</td>
<td>Reservered.</td>
</tr>
<tr>
<td>endogenous:</td>
<td>nonzero</td>
<td>General TE Slice, for user defined</td>
</tr>
<tr>
<td>TE-metric</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
## All (TN-slice Identifier) codepoint Cont.

<table>
<thead>
<tr>
<th>Slice Type</th>
<th>Instance (Low 24bits)</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>3(eMBB) endogenous: TBD</td>
<td>0</td>
<td>Reservered.</td>
</tr>
<tr>
<td></td>
<td>nonzero</td>
<td>Slice suitable for the handling of 5G enhanced Mobile Broadband, for user defined.</td>
</tr>
<tr>
<td>4(MIoT) endogenous: TBD</td>
<td>0</td>
<td>Reservered.</td>
</tr>
<tr>
<td></td>
<td>nonzero</td>
<td>Slice suitable for the handling of massive IoT, for user defined.</td>
</tr>
<tr>
<td>5(V2X) endogenous: TBD</td>
<td>0</td>
<td>Reservered.</td>
</tr>
<tr>
<td></td>
<td>nonzero</td>
<td>Slice suitable for the handling of V2X services, for user defined.</td>
</tr>
<tr>
<td>6-255</td>
<td>any</td>
<td>Unassigned.</td>
</tr>
</tbody>
</table>
Next Step

• Comments welcome.

Thanks!