IETF Network Slice Topology YANG Data Model

draft-liu-teas-transport-network-slice-yang-07

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Motivation

• A network slice customer may request an additional level of control to customize the service paths in a network slice (Sec. 2 of draft-ietf-teas-ietf-network-slices)

• In some use cases, a customer may ask for shared instead of dedicated resources to save cost
  • Resources are reserved ahead but not activated
  • Connections can be activated on demand
  • Resource sharing may be between connections/connectivity constructs belongs to different network slices for the same customer (not between slices belonging to different customers)

• Current NS NBI model only addresses connectivity-based network slicing
  • Dedicated connections with resources allocated for each connection
  • To request resource sharing, on-demand reconfiguration of connections is needed but there is no guarantee that resources are always available at the time of request

• Customized topology can help -
  • Customer can express some level of customized control: explicit path, diversity, protection/restoration, etc.
  • A customized topology can encode resource reservation request to secure the resources
  • Allows customer to use resources to create and reconfigure network slice connections in a flexible way

• And it’s complementary!
  • Optional extension to support resource reservation in addition to connectivity-based slicing
Terminologies

- **Customized Topology**: A topology defined by the customer and served as an input to the network slice service provider, i.e. to the Network Slice Controller (NSC). *(In scope)*

- **Abstract Topology**: A topology exposed to the customer by the network slice service provider prior to the creation of network slices. *(Out of scope)*

- **NRP Topology**: A topology internal to the NSC to facilitate the mapping of network slices to underlying network resources. *(Out of scope)*
Some History with This Draft

• (-00 to -05) of the draft was positioned as an alternative model for network slicing NBI
  • Provider may expose an abstract topology using this model
  • Customer may define a network slice as a customized topology using the same model

• (-06 and -07) of the draft re-positioned the draft
  • As a complementary data model for resource-based network slices (reserve and activate)
  • Only used by the customer to define customized topologies
An Example Scenario

Network Slice Request: multiple stadiums share one 100G HD broadcast channel to the TV station

- Alternating use of bandwidth between the stadiums (no parallel TV broadcast events on the same day)
- Bandwidth must be available at the time of request
- No pre-defined schedule (or ad-hoc events) with the broadcast

Option 1
- Created NS with dedicated connections (s1-t, s2-t, s3-t)
- Pay for 3x needed bandwidth

Option 2
- Created NS with one connection (s1-t)
- Dynamically reconfigure the NS connection to connect one stadium with the TV station
- Bandwidth may not be available at the time of reconfiguration
An Example Scenario (Cont.)

Network Slice Request: multiple stadiums share one 100G HD broadcast channel to the TV station

- Alternating use of bandwidth between the stadiums (no parallel TV broadcast events on the same day)
- Bandwidth must be available at the time of request
- No pre-defined schedule (or ad-hoc events) with the broadcast

Option 3

- Create a customized topology with two nodes and one 100G link
  - vPE1 represents an abstracted view of the 3 stadiums
  - vPE2 represents the TV station
- Pay only 1x 100G bandwidth
- Resources can be reserved in advance (but not committed)
- Customer can dynamically create/remove connections
- Of course, the NSC will need to work with underlying network controller(s) to support the resource reservation (part of SLO/SLE for the topology) and activation
- More fine-grained control can be expressed
  - Use P node to describe route preferences (e.g., geo-location)
  - Multi-path protection & restoration
How does a Customer Understand a Customized Topology?

- Customized topology is defined in the customer context, may not be understood by the provider. Provider needs to translate a customized topology an internal realization (e.g. mapped to an NRP if supported)

- There are a few options...
  - Associate a SAP/SDP with a TP in the customized topology
  - Use the same id between the customer and provider
  - What about P-nodes in a customized topology?
    - The customized topology can be as simple as PE nodes + links, so a P-node is completely optional
    - A P-node may be used to represent a policy node, e.g. a geo location over which a service path must (or must not) traverse

- Another option is to expose an abstract topology
  - Does not apply to all providers due to security / data privacy consideration
  - However, if exposed, such an abstract topology could help the provider to advertise its capabilities to the customer
    - Mechanism to expose an abstract topology is outside the scope of this draft
    - E.g. with an augment of RFC9408, or RFC8795 (TE topology)
Updates to draft -07

- Text updates to clarify the use of customized topology and address comments received from the WG
- Moved augments for adding service paths over NS connections from draft-ietf-ccamp-otn-slicing to this draft
Open issue

• Currently, draft-ietf-teas-ietf-network-slice-nbi-yang has a reference to a customized topology without specifying how to use it

• Shall we move the above reference to this draft?
  • Clear separation of modeling: ns-nbi focuses only on connection-based network slicing, while this draft provides resource-based slicing with definitions to a customized topology and usage of such a topology
Next Steps

• Request for WG adoption
• Resolve open issues

* GitHub Repo
  
  https://github.com/aguoiietf/ietf-network-slice-topology
Thank You!