YANG Data Model for DetNet Mapping with Network Slice

draft-sw-detnet-network-slice-mapping-yang

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Agenda

- Problem Statement
- Applicability of DetNet to Network Slice
- Mapping Process and Requirements
- YANG Modeling Approach
- Next Steps

Problem Statement

- Advantages and Limitations for DetNet [Ref RFC8655]
  - *Provides a capability for the delivery of data flows with extremely low packet loss rates and bounded end-to-end delivery latency.*
  - *Provides a reliable and available service by dedicating network resources such as link bandwidth and buffer space to DetNet flows and/or classes of DetNet flows.*
  - *Any application can apply DetNet, as long as the necessary resources be reserved. Resource reservation can leverage protocols such as RSVP.*
  - *The premise for DetNet with deterministic service delivery is that necessary network resources (such as bandwidth, buffer space, latency related) are reserved.*
  - *The existing protocols such as RSVP is limited and can's satisfy resource guarantee for necessary time/bandwidth/buffer resources reservation, optimization.*
- Network Slicing can resolve the resource reservation and optimization problem through NRP (Network Resource Partition) delivery.

Problem Statement

- IETF Network Slice
  - *Refer to [I-D.ietf-teas-ietf-network-slices]*
  - *"An IETF Network Slice enables connectivity between a set of Service Demarcation Points (SDPs) with specific Service Level Objectives (SLOs) and Service Level Expectations (SLEs) (see Section 4) over a common underlay network."*
  - *SLOs: Guaranteed Minimum Bandwidth, Guaranteed Maximum Latency, Maximum Permissible Delay Variation, Maximum Permissible Packet Loss Rate, Availability.*
  - *SLEs: Security, Geographic Restrictions, Maximal Occupancy Level, Isolation, Diversity.*
  - *NRP (Network Resource Partition) consists of a subset of the buffer/queuing/scheduling resources in the underlay network, applied to slice-flow aggregate to meet specific network resource guarantees.*

- The applicability of DetNet to Network Slice enables necessary resource service guarantee (such as big bandwidth, time slots, etc.) to DetNet flows.

Applicability of DetNet to Network Slice

Example for Low-latency (e.g., <50ms) deterministic service over NRP

- Step1: the TSN user applies for necessary network resources for low-latency deterministic service. (message flow from TSN endpoint to IETF NSC)

- Step 2: The IETF NSC sends NRP profile/policy to the underlying network nodes to meet low-latency SLO request

- Step 3: The PE and P nodes make corresponding network resource reservation and right path computation according to NRP profile/policy

- Step 4: The deterministic service flow is mapped to the underlying NRP resources and transported to its destination with resource guarantee
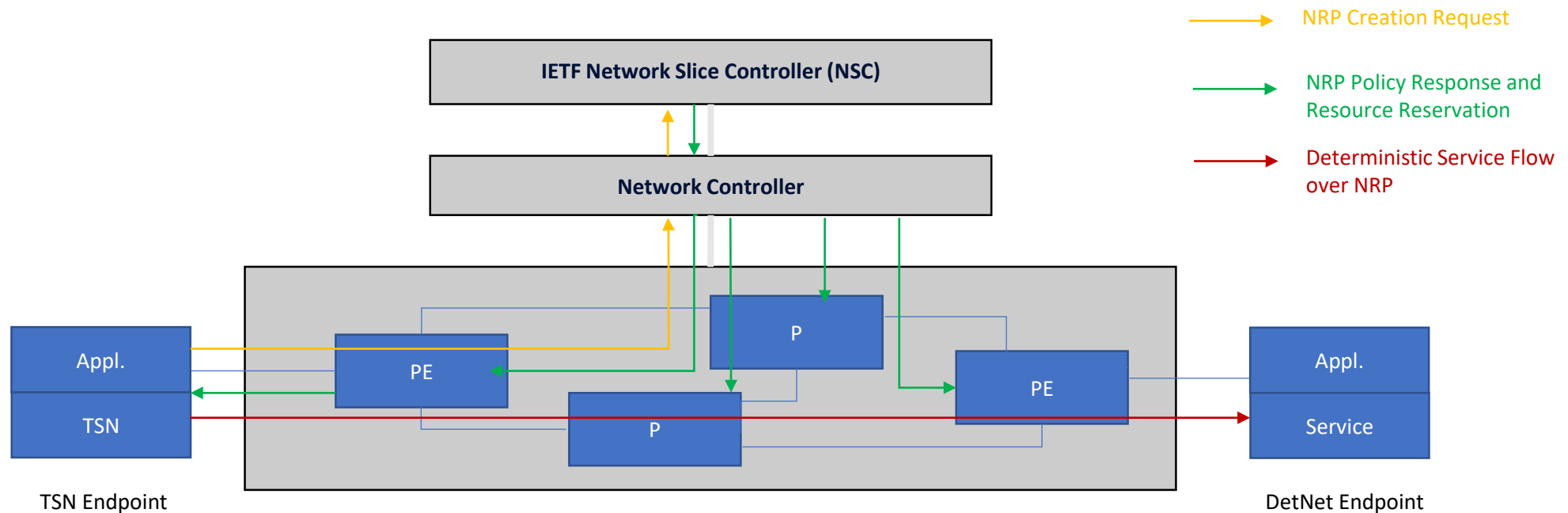

Figure1 Low-latency deterministic service over NRP example

Mapping Process

- Instantiation for APP-flow to DetNet service awareness flow

- Generate mapping policy of DetNet-flow/flow aggregations (may per flow-id, src-des-addr，mpls label, etc.) with IETF Network Slice instances (i.e., NRP-id) in management plane

- Send mapping policy of DetNet flow associated with underlying NRP to the DetNet/IETF Network Slice Nodes

- Complete the corresponding of identification of deterministic service flows (such as IP 6-tuple, MPLS labels, etc.) with NRP-id, realize the underlying resource slice awareness of DetNet flow/flow aggregation in data plane.

- Through the network resource occupation of hop-by-hop nodes along the path, network resources required by the deterministic networking service flow is guaranteed.

Mapping Requirements

- The mapping of DetNet services with underlying network slice resources (i.e., NRP) SHOULD support:
  - Service endpoint mapping between DetNet Edge Nodes and IETF Network Slice SDPs
  - Access service mapping between DetNet UNI and IETF Network Slice AC
  - Instance mapping between DetNet flows and NRP
- One specific DetNet flow MAY be bounded with an existing NRP instance
- A new NRP instance MAY need to be created if there is no NRP available to meet the resource requirements for DetNet services
- One or more DetNet flows MAY share the same NRP instance
- The NRP instance SHOULD provide necessary buffer/queuing/scheduling network resources for DetNet services on demand
- One existing NRP instance MAY need to be modified to adapt to resource requirements of DetNet flows

YANG Modeling Approach

```
module: ietf-ns-detnet-mapping-types
  +--rw ns-mapping-templates
     +--rw ns-mapping-template* [id]
        +--rw id                    string
        +--rw description?          string
        +--rw map-type?             identityref
               +--rw ns-slo-ref?
                    ->/ns:slice-template/ns-slo-sle-templates/id
```

```
                +--------------+         +--------------------+
                |   DetNet     |o-------|                    |
                +--------------+ augment|                    |
                                        |                    |
                +--------------+        |Augmented DetNet Model|
                | DetNet & NS  |------->|                    |
                | Mapping Types| import |                    |
                +--------------+        |                    |
                                        +--------------------+
```

```
module: ietf-ns-detnet-service-mapping
   augment /dnet:detnet:detnet/service:sub-layer
         /service:sub-layer:
      +--rw ns-detnet-mapping
         +--rw ns-mapping
            +--rw map-type?                          identityref
            +--rw ns-id                              string
            +--rw ns-mapping-template-ref?
                  -> /nsdmt:ns-mapping-templates/ns-mapping-template/id
                 {template}?
```
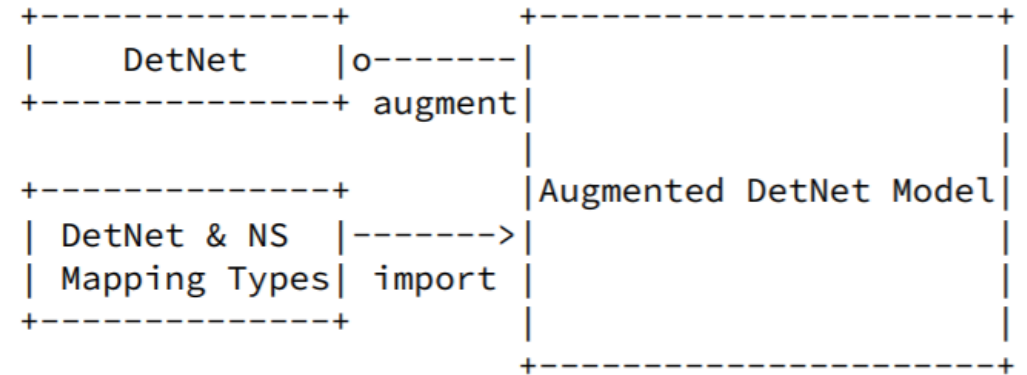
Next Steps

- Update applicability section

- Update YANG section if needed

- Welcome comments and questions

Thank You