End-to-End and Hierarchical

IETF Network Slices

draft-li-teas-e2e-ietf-network-slicing-02

draft-dong-teas-hierarchical-network-slice-01

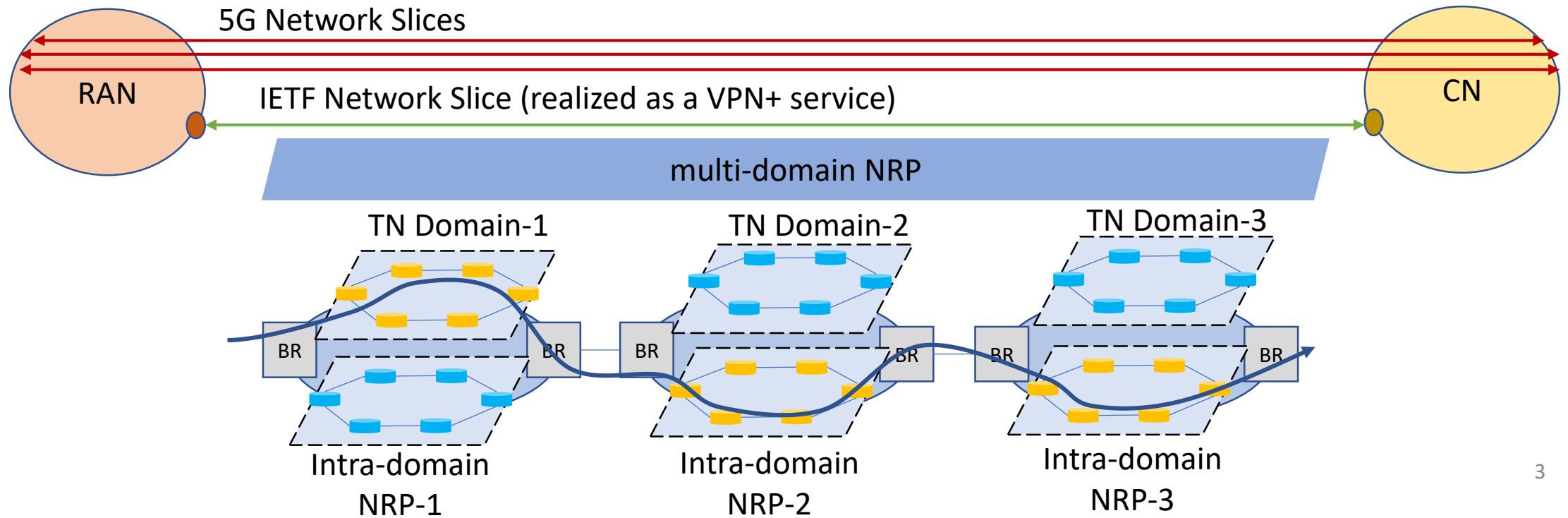Zhenbin Li, Jie Dong @Huawei

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Background

- Network slicing can be used to meet the connectivity and SLO/SLE requirements of different services or customers in a shared network

- The concept network slice was firstly defined in 3GPP
  - Network Slice in 3GPP only covers the RAN and mobile core (CN) network slice subnets
  - IETF network slice provides the transport part of the 5G E2E network slice

- draft-ietf-teas-ietf-network-slices describes the concept and general framework of IETF network slice
  - IETF network slices can be realized by mapping one or a group of connectivity constructs to an NRP

- An IETF network slice may span multiple domains, and may be further sliced to provide fine-granular connections and resources to hierarchical customers and services
  - These scenarios are briefly mentioned in draft-ietf-teas-ietf-network-slices
  - It seems useful to elaborate on these scenarios and the realization considerations

E2E IETF Network Slice

- 5G network slice is one typical use case of E2E IETF network slices
- In the TN segment, one or multiple 5G network slices can be mapped to an IETF network slice
    - The realization could be a VPN+ service
- In the underlay network, the IETF network slice can be supported by a multi-domain NRP, which is the concatenation of multiple intra-domain NRPs
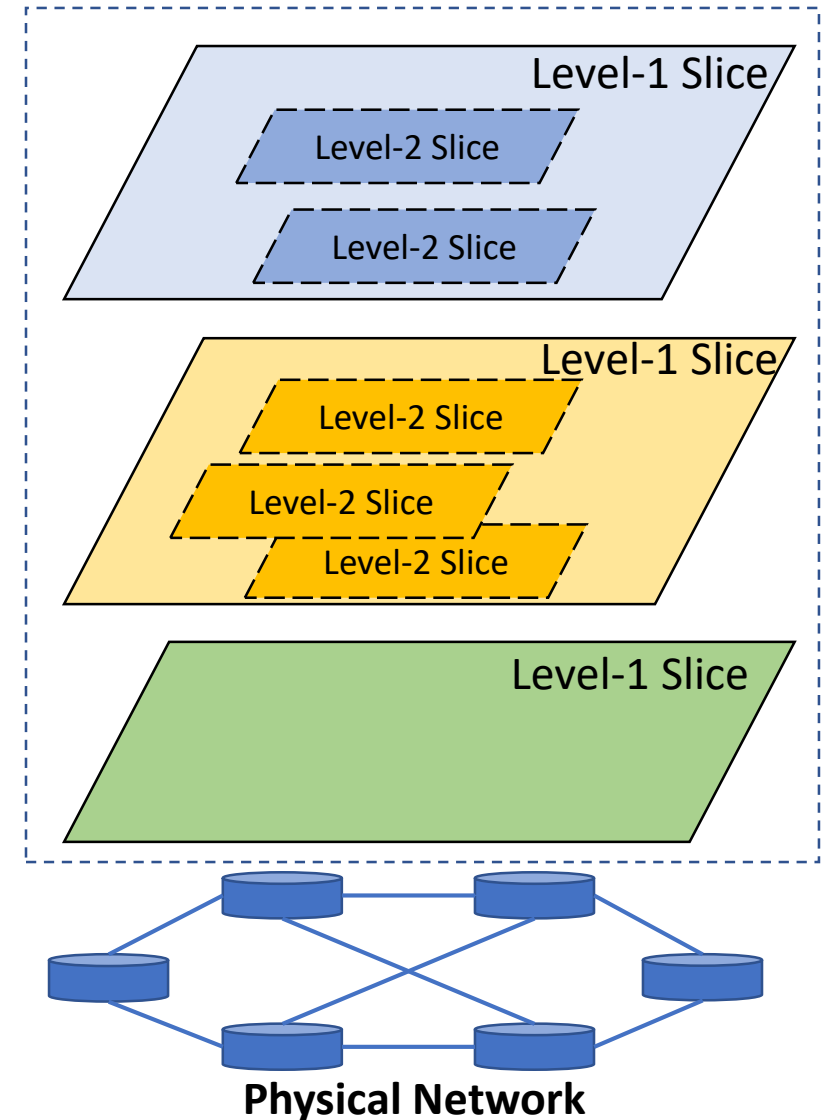   - Similar to the inter-domain VPNs

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Concatenation of NRPs

- A network controller is needed for the creation and concatenation of multiple NRPs for an end-to-end network slice

- The NRP ingress node steers IETF network slice traffic into the multi-domain NRP

- Information of the multi-domain NRP needs to be carried in data packet for the mapping of network slice service to the intra-domain NRP at the domain border nodes
  - It could be either an E2E NRP identifier, or
  - A list of the identifiers of the intra-domain NRPs to be traversed

- The encapsulation of multi-domain NRP information with different data plane technologies are specified in the following documents
  - draft-li-spring-sr-e2e-ietf-network-slicing
  - draft-li-6man-e2e-ietf-network-slicing
  - draft-li-mpls-e2e-ietf-network-slicing

Hierarchical IETF Network Slices

- Multiple customer network slices in an industrial network slice
  - Level-1: education network slice
  - Level-2: university A network slice

- Multiple application network slices in a customer network slice
  - Level-1: hospital network slice
  - Level-2: medical service network slice

- Network slices in a wholesale network slice
  - Level-1: wholesale network slice
  - Level-2: customer network slice

Level-1 Slice
Level-2 Slice
Level-2 Slice

Level-1 Slice
Level-2 Slice
Level-2 Slice
Level-2 Slice

Level-1 Slice

Physical Network

Realization of Hierarchical Network Slices

- Hierarchical resource partitioning in forwarding plane

  - For hierarchical network slicing, forwarding plane network resources need to be partitioned in a hierarchical manner

  - Different options of hierarchical resource representation at link level

- Identification of hierarchical NRPs in data plane

  - The identifier needs to be able to identify NRPs at different levels

  - The options of data plane NRP identifiers

    - Use a unified data plane identifier for different levels of NRPs

    - Use hierarchical identifiers

Realization of Hierarchical Network Slices (cont.)

- Control plane may need to distribute the attributes of different levels of hierarchical NRPs among network nodes and to the network controller
  - As the number of hierarchical network slices increases, control plane optimization would be needed

- Management plane needs to provide life-cycle management to different levels of network slices and NRPs
  - It should allow to manage different levels of network slices separately, while the relationship and constraints between different levels need to be maintained

Next Steps

- End-to-end and hierarchical network slices can be considered as advanced applications of IETF network slice. The maturity is not the same as the base IETF network slice framework

- There was concern about whether they can be stand-alone drafts

- Question to the WG:

  - Should we merge the E2E and hierarchical network slice drafts into one document, or keep them separate as is?

- Further comments and feedbacks are welcome

  - Will update the drafts accordingly

Thank You