Applicability of ACTN to Support 5G Transport

draft-lee-teas-actn-5g-transport-00

IETF 105 TEAS Session

Young Lee
John Kaippallimalil

Problem to be Solved

How to provisioning and grant transport network path/resources for 5G user plane.
 i.e., transport path between two 3GPP UP network functions (gNB, UPF)

A network slice is defined by 3GPP as an end-to-end logical network comprising a set of managed resources and network functions [3GPP TS 28.531].
- 3GPP 5QI fields are not sent inband in user plane (i.e., they are only sent on N2, N4 interfaces)
- QFI (in GTP-U downstream) is only used to differentiate flows to bearer on the radio side
- DSCP used in 4G – but is not immutable across domains – and does not consider slicing aspects
         (isolation, replication, load balancing, etc.)

Transport network slice instantiation and its life cycle operation [VN-Model],[Transport-Slicing].

How to map 5G slice instance to transport slice instance

Provisioning of User Plane, VN resources on Path

Mapping between 5G, Transport slices

How to map slice, QoS of user in 5G domain to transport domain?

5G QoS (5QI) and slice information (NSSAI) based on service offered to UE (client).

Transport Network QoS and slice related to service it offers to clients (5G domain, CDN, etc.)

Mapping NSSAI, 5QI of PDU session to "transport slice" needed.

Separate Transport Network edge and 5G User Plane Network Function

5G User Plane Network Functions may not host transport Provider Edge (PE)

This was identified in draft-ietf-dmm-5g-uplane-analysis

Transport between 2 5G functions may cross multiple L2 networks

5G UP functions may be hosted in data centers, with backhaul network in between.

Carrying slice mapping info in IP layer (header extensions ?) avoids L2 issues.

Transport Context Identifier

MTNC (Mobile Transport Network Context)

o Identifier that maps a class of service (QCI, slice) and other QoS requirements such as reliability, isolation, security, etc. in 3GPP domain to VN slice instance in transport domain.

o Generated by TNF, unique id per path and service offered in transport network

o Transport network needs to creates VNs/Tunnels that correspond to MTNC and program data plane for routing per MTNC ID.

o Not a 1:1 association between PDU session and MTNC identifiers

o MTNC generated prior to PDU session establishment – thus no additional delay

o Identifier scales well.
"T" traffic classes across "N" sites require only a maximum of $(N* (N-1)/2) * T$ (E.g., T = 3, N = 25; MTNC ids required is 900)
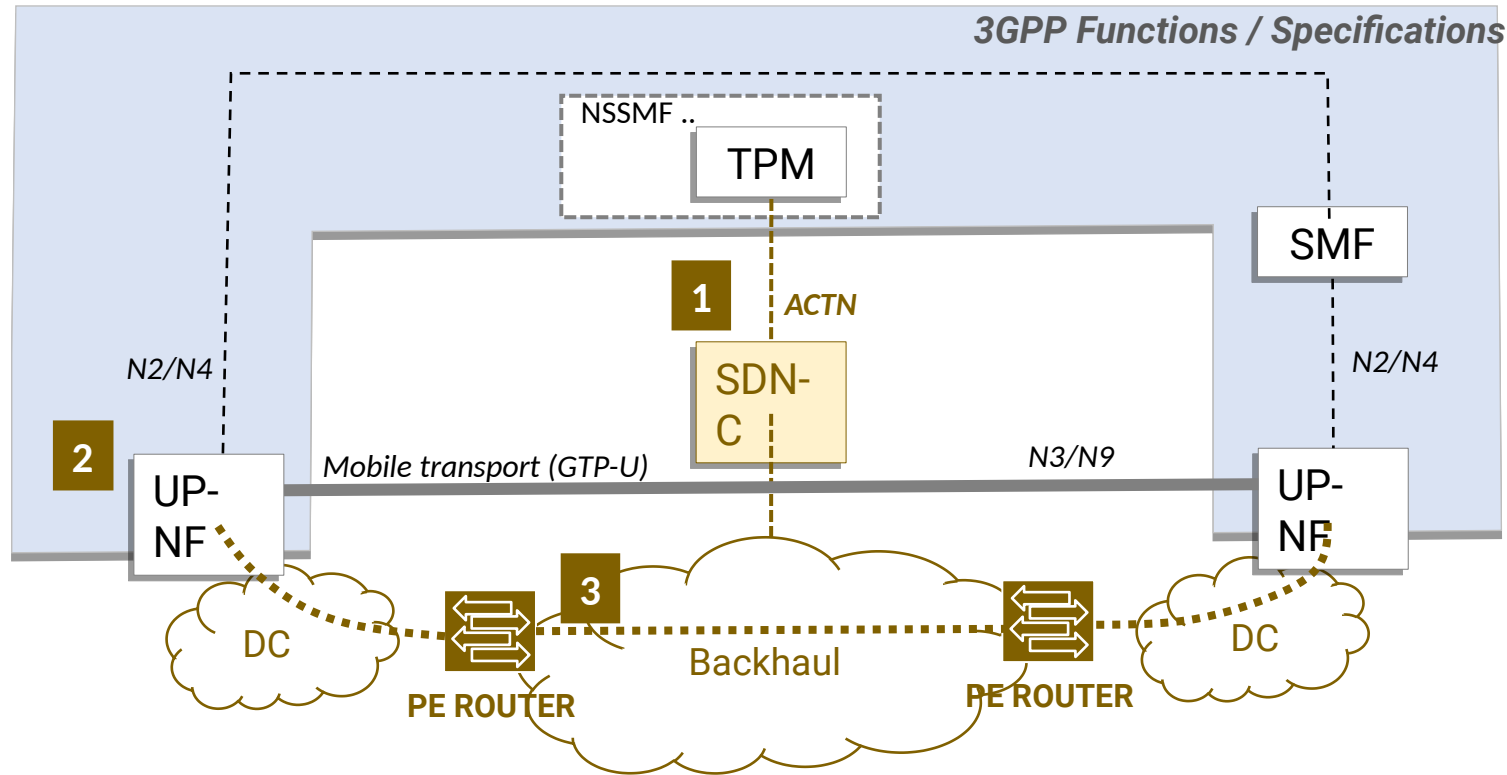
VN Network

VN Slicing Model enables customer to create its VN
(in this case the customer is 3GPP network)

Constraints include bandwidth, latency, load balancing, protection, etc. per VN/VN-member.

CNC is the entity responsible for coordination with 3GPP networks.
(TPM in 3GPP – next page)
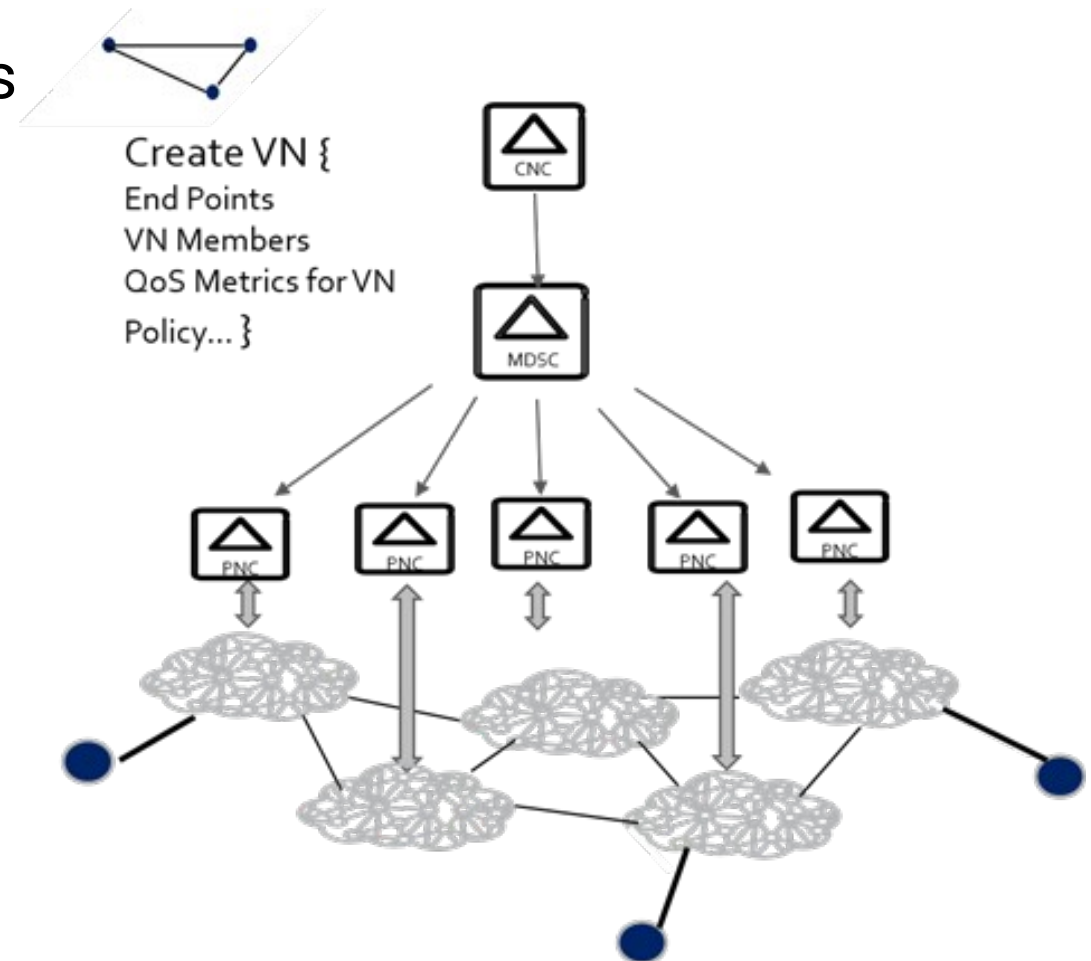
Mapping 5G slice/QoS to Transport Network path

1. Program MTNC identifier: TPM ⮀ SDN-C ⮀ PE Router (data plane programming)

2. UP-NF classifies PDU session packet; inserts MTNC identifier

3. PE router inspects MTNC identifier; grants provisioned resources (segments/labels, ...)
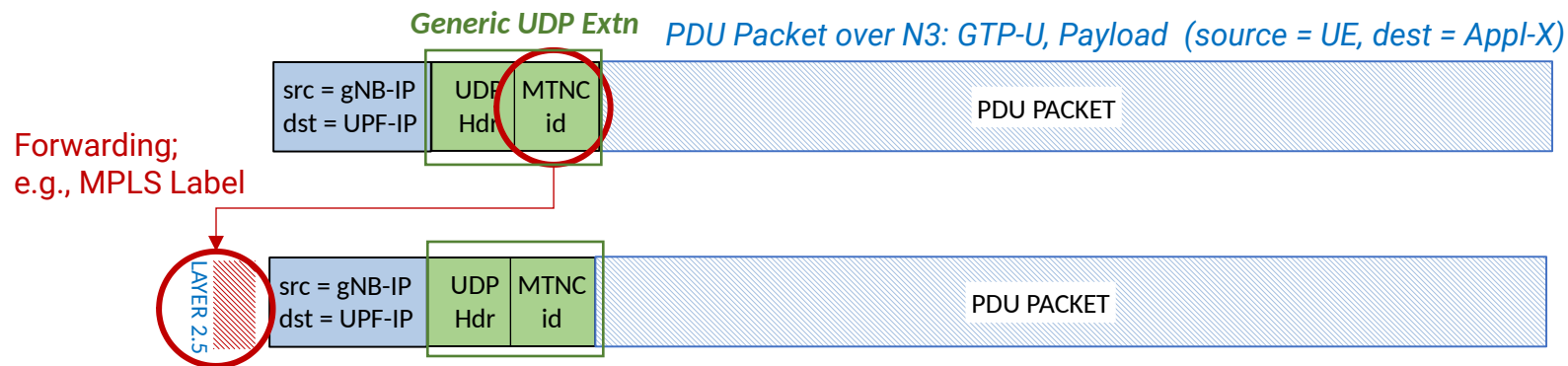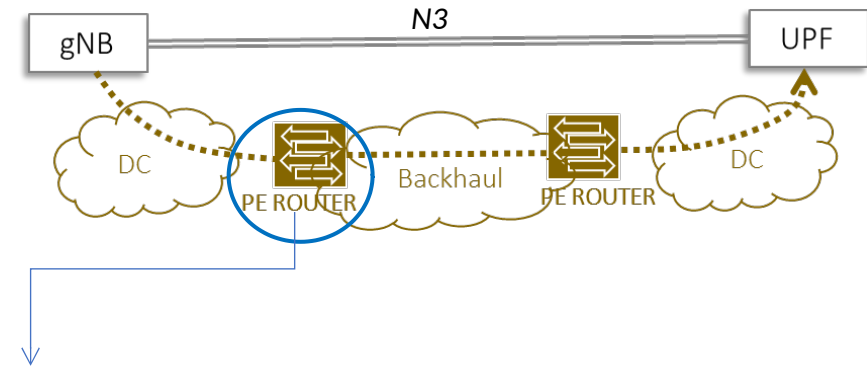
Carrying Transport Context in IP Packet Header Extensions

- L2 not suitable: More than one L2 networks between 5G functions
  - GTP-U Extension not ideal: this is for signaling between 3GPP functionality
  - DSCP, IPv6 Flow label fields are not immutable (thus not suitable)

GUE, SRv6 are potential candidates for carrying this data.

Example: Processing at PE Router with GUE:
    (gNB classifies and inserts MTNC identifier)

Generic UDP Extn *PDU Packet over N3: GTP-U, Payload (source = UE, dest = Appl-X)*

| src = gNB-IP dst = UPF-IP | UDP Hdr | MTNC id | PDU PACKET |

Forwarding; e.g., MPLS Label

| LAYER 2.5 | src = gNB-IP dst = UPF-IP | UDP Hdr | MTNC id | PDU PACKET |

(NOTE - Similar mechanism with SRv6 and SR-MPLS and MPLS are possible)

Next Steps

This draft outlines the applicability of ACTN architecture in collaboration with 3GPP 5G network architecture and suggests some work to be done in TEAS WG for enhancing VN/TE& SVC Mapping models and other WGs for solutions for data plane programmability and transporting MTNC ID.

Looking for comments and suggestions.

Also note related draft:
draft-clt-dmm-tn-aware-mobility-04 in DMM WG
Addresses provisioning concerns from an DMM / Mobile Transport view.