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Considerations for defining a Transport Slice NBI
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Abstract

The transport network is an essential component in the end-to-end delivery of services and, consequently, with the advent of network slicing it is necessary to understand what could be the way in which the transport network is consumed as a slice. This document analyses the needs of potential transport slice consumers in order to identify the functionality required on the North Bound Interface (NBI) of a transport slice producer for satisfying such transport slcie requests.

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Table of Contents

1. Introduction

A number of new technologies, such as 5G, NFV and SDN are not only evolving the network from a pure technological perspective but also are changing the concept in which new services are offered to the customers [I-D.homma-slice-provision-models] by introducing the concept of network slicing.

The transport network is an essential component in the end-to-end delivery of services and, consequently, it is necessary to understand what could be the way in which the transport network is consumed as a slice.

In this document it is assumed that there exists a (logically) centralized component in the transport network, namely Transport Slice Producer (TSP) with the responsibilities on the control and management of the transport slices invoked for a given service, as requested by Transport Slice Consumers (TSC).

This document analyses the needs of potential transport slice consumers in order to identify the functionality required on the North Bound Interface (NBI) of the TSP to be exposed towards such transport slice consumers. Solutions to construct the requested transport slices are out of scope of this document.

This document addresses some of the discussions of the TEAS Slice Design Team. However it is not at this stage an official outcome of the Design Team.

2. Conventions used in this document

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "MAY", and "OPTIONAL" in this document are to be interpreted as described in RFC2119 [RFC2119].

3. Northbound interface for transport slices

In a general manner, the transport network supports different kinds of services. These services consume the transport network provided capabilities for deploying end-to-end services, interconnecting network functions or applications spread across the network and providing connectivity toward the final users of these services.

Under the slicing approach, a transport slice consumer requests to a transport slice producer a slice with certain characteristics and parametrization. Such request it is assumed here to be done through an NBI exposed by the TSP to the consumer, as reflected in Fig. 1.

```
                     +--------------------+
                     |                    |
                     |      Transport     |
                     |   Slice Consumer   |
                     |                    |
                     +--------------------+
                               A
                               |
                               | Transport
                               | Slice
                               | NBI
                               |
                               V
                     +--------------------+
                     |                    |
                     |      Transport     |
                     |   Slice Producer   |
                     | (Transport Slicer) |
                     |                    |
                     +--------------------+
```

Figure 1: Transport slice NBI concept

The functionality supported by the NBI depends on the requirements that the slice consumer has to satisfy. It is then important to understand the needs of the slice consumers as well as the way of expressing them.

4. Transport slice use cases

Different use cases for slice consumers can be identified, as described in the following sections.

4.1. 5G Services

5G services natively rely on the concept of network slicing. 5G is expected to allow vertical customers to request slices in such a manner that the allocated resources and capabilities in the network appear as dedicated for them.

In network slicing scenarios, a vertical customer requests a network operator to allocate a network slice instance (NSI) satisfying a particular set of service requirements. The content/format of these requirements are highly dependent on the networking expertise and use cases of the customer under consideration. To deal with this heterogeneity, it is fundamental for the network operator to define a a unified ability to interpret service requirements from different

vertical customers, and to represent them in a common language, with the purposes of facilitating their translation/mapping into specific slicing-aware network configuration actions. In this regard, model-based network slice descriptors built on the principles of reproducibility, reusability and customizability can be defined for this end.

As a starting point for such a definition, GSMA developed the idea of having a universal blueprint that can be used by any vertical customer to order the deployment of an NSI based on a specific set of service requirements. The result of this work has been the definition of a baseline network slice descriptor called Generic Slice Template (GST). The GST contains multiple attributes that can be used to characterize a network slice. A Network Slice Type (NEST) describes the characteristics of a network slice by means of filling GST attributes with values based on specific service requirements. Basically, a NEST is a filled-in version of a GST. Different NESTs allow describing different types of network slices. For slices based on standardized service types, e.g. eMBB, uRLLC and mIoT, the network operator may have a set of readymade, standardized NESTs (S-NESTs). For slices based on specific industry use cases, the network operator can define additional NESTs.

Service requirements from a given vertical customer are mapped to a NEST, which provides a self-contained description of the network slice to be provisioned for that vertical customer. According to this reasoning, the NEST can be used by the network operator as input to the NSI preparation phase, which is defined in [TS28.530]. 3GPP is working on the translation of the GST/NEST attributes into NSI related requirements, which are defined in the "ServiceProfile" data type from the Network Slice Information Object Class (IOC) in [TS28.541]. These requirements are used by the 3GPP Management System to allocate the NSI across all network domains, including transport network. The transport slice defines the part of that NSI that is deployed across the transport network.

Despite the translation is an on-going work in 3GPP it seems convenient to start looking at the GST attributes to understand what kind of parameters could be required for the transport slice NBI.

4.1.1. Generic Slice Template

The structure of the GST is defined in [GSMA]. The template defines a total of 35 attributes. For each of them, the following information is provided:

- o Attribute definition, which provides a formal definition of what the attribute represents.

- o Attribute parameters, including:

  * Value, e.g. integer, float.

  * Measurement unit, e.g. milliseconds, Gbps

  * Example, which provides examples of values the parameter can take in different use cases.

  * Tag, which allow describing the type of parameter, according to its semantics. An attribute can be tagged as a characterization attribute or a scalability attribute. If it is characterization attribute, it can be further tagged as a performance-related attribute, a functionality-related attribute or an operation-related attribute.

* Exposure, which allow describing how this attribute interact with the slice consumer, either as an API or a KPI.

- Attribute presence, either mandatory, conditional or optional.

Attributes from GST can be used by the network operator (slice producer) and a vertical customer (slice consumer) to agree SLA.

GST attributes are generic in the sense that they can be used to characterize different types of network slices. Once those attributes become filled with specific values, it becomes a NEST which can be ordered by slice consumers.

4.1.2. Categorization of GST attributes

Not all the GST attributes as defined in [GSMA] have impact in the transport network since some of them are specific to either the radio or the mobile core part.

In the analysis performed in this document, the attributes have been categorized as:

- Attributes that directly impact the definition of the transport slice, i.e., attributes that can be directly translated into requirements required to be satisfied by a transport slice.

- Attributes that indirectly impact the definition of the transport slice, i.e., attributes that indirectly impose some requirements to a transport slice.

- Attributes that do not have impact on the transport slice.

The following sections describe the attributes falling into the three categories.

4.1.2.1. Attributes with direct impact on the transport slice definition

The following attributes impose requirements in the transport slice

- Availability
- Deterministic communication
- Downlink throughput per network slice
- Energy efficiency
- Group communication support
- Isolation level
- Maximum supported packet size
- Mission critical support
- Performance monitoring
- Reliability
- Slice quality of service parameters
- Support for non-IP traffic
- Uplink throughput per network slice
- User data access (i.e., tunneling mechanisms)

4.1.2.2. Attributes with indirect impact on the transport slice definition

The following attributes indirectly impose requirements in the transport slice to support the end-to-end service.

- Coverage
- Delay tolerance (i.e., if the service can be delivered when the system has sufficient resources)
- Downlink throughput per UE

- Network Slice Customer network functions

- Number of connections

- Performance prediction (i.e., capability to predict the network and service status)

- Root cause investigation

- Session and Service Continuity support

- Simultaneous use of the network slice

- Supported device velocity

- Terminal density

- Uplink throughput per UE

- User management openness (i.e., capability to manage users' network services and corresponding requirements)

4.1.2.3. Attributes with no impact on the transport slice definition

The following attributes do not impact the transport slice.

- Location based message delivery (not related to the geographical spread of the network slice itself but with the localized distribution of information)

- MMTel support, i.e. support of and Multimedia Telephony Service (MMTel)as well as IP Multimedia Subsystem (IMS) support.

- Number of terminals

- Positioning support

- Radio spectrum

- Synchronicity (among devices)

- V2X communication mode

4.2. NFV-based services

To do.

5. Security Considerations

This draft does not include any security considerations.

6. IANA Considerations

This draft does not include any IANA considerations

7. References

7.1. Normative References

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