Generic Network Slice Template
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1 Introduction

1.1 Overview

The purpose of this document is to provide the standardised list of attributes that can characterise a type of network slice. Network slicing is the key feature of the 5G networks and enables to build dedicated logical networks on a shared infrastructure. These dedicated networks would permit the implementation of tailor-made functionality and network operation specific to the needs of each slice customer, rather than a one-size-fits-all approach as witnessed in the current and previous mobile generations which would not be economically viable.

1.2 Relationship to existing standards

3GPP

Unless otherwise stated, the attributes listed in this document are based on the open and published 3GPP specifications as listed in the Section 0. 3GPP Release 16 is taken as the basis.

1.3 Scope

The scope of this document is to provide the description of:

- Generic network Slice Template (GST); attributes that can characterise a type of network slice.
- Examples of Network Slice Types (NESTs) with a recommended minimum set of attributes and their suitable values.

The GST attributes apply to any access unless they are defined to apply to a specific access only. If a NEST includes attributes specific to an access network, those apply only to that access network.

The GST attributes apply for a Network Slice whether it is accesses in the HPMN or in a VPMN, unless otherwise specified.

1.4 Definitions

Term	Description
Network Slice	A logical network that provides specific network capabilities and network characteristics [1]
Network Slice Instance	A set of Network Function instances and the required resources (e.g. compute, storage and networking resources) which form a deployed Network Slice as defined in Section 3.1 of [1]
Network Slice Subnet	A representation of the management aspects of a set of Managed Functions and the required resources (e.g. compute, storage and networking resources) [25]
Network Slice Subnet Instance	An instance of Network Slice Subnet representing the management aspects of a set of Managed Function instances and the used resources (e.g. compute, storage and networking resources) [25]

Term	Description
Service Continuity	The uninterrupted user experience of a service, including the cases of IP address and/or anchoring point change [1]

1.5 Abbreviations

Term	Description
5GAA	5G Automotive Association
5GS	5G System
5QI	5G QoS identifier
AECID	Adaptive Enhanced Cell Identity
AN	Access Network
AoA	Angle of Arrival
API	Application programming interface
APN	Access Point Name
BS	Base Station
CID	Cell ID
CN	Core Network
CPE	Customer premises equipment
CSC	Communication Service Customer
CSP	Communication Service Provider
CUPS	Control and User Plane Separation
DL	Down Link
DN	Data Network
DNN	Data Network Name
DSL	Digital Subscriber Line
DV	Data Volume
E2E	End to End
EC	Energy Consumption
ECID	Enhanced Cell ID
EPC	Evolved Packet Core
EPS	Evolved Packet System
E-UTRAN	Evolved Universal Terrestrial Radio Access Network
FFS	For Further Study
FGML5G	Machine Learning for Future Networks including 5G
GBR	Guaranteed Bit Rate
GERAN	GSM/Edge Radio Access Network
GFBR	Guaranteed Flow Bit Rate
GNSS	Global Navigation Satellite Systems
GPS	Global Positioning System

Term	Description
GRE	Generic Routing Encapsulation
GST	Generic Slice Template
HARQ	Hybrid automatic repeat request
IMS	IP Multimedia System
IOPS	Isolated E-UTRAN Operation for Public Safety
IoT	Internet of Things
KPI	Key Performance Indicators
KQI	Key Quality Indicators
L2TP	Layer 2 Tunnelling Protocol
LTE-M	Long Term Evolution for Machines
MDBV	Maximum Data Burst Volume
MC	Mission-Critical
MCC	Mobile Country Code
MCD	Mission-Critical Data
MCI	Mission-Critical Interworking
MCPTT	Mission-Critical Push-To-Talk
MCVideo	Mission-Critical Video
MEC	Multi-access Edge Computing
MFBR	Maximum Flow Bit Rate
MIoT	Massive IoT
MMTel	Multimedia Telephony Service
MNC	Mobile Network Code
MNO	Mobile Network Operator
MPS	Multimedia Priority Service
MTU	Maximum Transmission Unit
NB-IoT	Narrowband IoT
NEF	Network Exposure Function
NEST	NEtwork Slice Type
NF	Network Function
NOP	Network Operator
NR	New Radio
NSC	Network Slice Customer
NSI	Network Slice Instance
NSP	Network Slice Provider
NSS	Network Slice Subnet
NSSI	Network Slice Subnet Instance
NSST	Network Slice Subnet Template
OTDOA	Observed Time Difference of Arrival

Term	Description
PDB	Packet Delay budget
PER	Packet Error Rate
PDU	Protocol Data Unit
QoS	Quality of Service
RAN	Radio Access Network
RAT	Radio Access Type
RF	Radio Frequency
RSTD	Reference Signal Time Difference
SC-PTM	Single Cell Point to Multipoint
SDO	Standards developing organizations
SLA	Service Level Agreement
SMF	Session Management Function
SSC	Session Service Continuity
SST	Slice/Service Type
TN	Transmission Network
TRxP	Transmission Reception Point
TSN	Time-Sensitive Networking
UAS	Uncrewed Aerial Systems
UE	User Equipment
UDM	User Data Management
UL	Uplink
UDR	User Data Register
UL	Up Link
UPF	User Plan Function
URLLC	Ultra-Reliable Low Latency Communication
UTRAN	Universal Terrestrial Radio Access Network
VM	Virtual Machine
VPN	Virtual Private Network
ZSM	Zero-touch network and Service Management

1.6 References

Ref	Doc Number	Title
1	3GPP TS 23.501	System Architecture for the 5G System; Stage 2 (Rel-15)
2	RFC2119	“Key words for use in RFCs to Indicate Requirement Levels”, S. Bradner, March 1997. Available at http://www.ietf.org/rfc/rfc2119.txt
3	3GPP TR 22.804	Study on Communication for Automation in Vertical domains (CAV)
4	3GPP TS 38.101	NR; User Equipment (UE) radio transmission and reception; Part 1: Range 1 Standalone

Ref	Doc Number	Title
5	3GPP TS 36.104	Evolved Universal Terrestrial Radio Access (E-UTRA); Base Station (BS) radio transmission and reception
6	3GPP TR 22.904	Study on user centric identifiers and authentication
7	IEEE 1588	Precision Time Protocol
8	IEEE 802.1	TSN
9	ETSI GS MEC 016	Mobile Edge Computing (MEC); UE application interface
10	3GPP TS 23.214	Architecture enhancements for control and user plane separation of EPC nodes
11	3GPP TS 29.244	Interface between the Control Plane and the User Plane nodes
12	3GPP TS 29.561	5G System; Interworking between 5G Network and external Data Networks; Stage 3
13	3GPP TS 23.032	Universal Geographical Area Description (GAD)
14	3GPP TS 33.501	Security architecture and procedures for 5G System
15	3GPP TS 23.379	Functional architecture and information flows to support Mission Critical Push To Talk (MCPTT); Stage 2
16	3GPP TS 23.282	Functional architecture and information flows to support Mission Critical Data (MCData); Stage 2
17	3GPP TS 23.281	Functional architecture and information flows to support Mission Critical Video (MCVideo); Stage 2
18	3GPP TS 23.401	General Packet Radio Service (GPRS) enhancements for Evolved Universal Terrestrial Radio Access Network (E-UTRAN) access
19	3GPP TS 33.401	3GPP System Architecture Evolution (SAE); Security architecture
20	3GPP TS 23.283	Mission Critical Communication Interworking with Land Mobile Radio Systems
21	ETSI EN 302 636-4-1	Intelligent Transport Systems (ITS); Vehicular Communications; GeoNetworking; Part 4: Geographical addressing and forwarding for point-to-point and point-to-multipoint communications; Sub-part 1: Media-Independent Functionality
22	GSMA NG.114	IMS Profile for Voice, Video and Messaging over 5GS
23	3GPP TS 38.101-1	NR; User Equipment (UE) radio transmission and reception; Part 1: Range 1 Standalone
24	3GPP TR 23.799	Study on Architecture for Next Generation System
25	3GPP TS 28.530	Aspects; Management and orchestration; Concepts, use cases and requirements
26	ETSI ES 203 228	Environmental Engineering (EE); Assessment of mobile network energy efficiency
27	3GPP TS 22.261	Service requirements for the 5G system; Stage 1
28	3GPP TS 22.104	Service requirements for cyber-physical control applications in vertical domains
29	3GPP TS 28.541	5G Network Resource Model (NRM); Stage 2 and stage 3
30	GSMA PRD NG.113	5GS Roaming Guidelines

Ref	Doc Number	Title
31	3GPP TS 22.153	Technical Specification Group Services and System Aspects; Multimedia priority service
32	3GPP TS 28.554	Management and orchestration. 5G end to end Key Performance Indicators (KPI)
33	ETSI ZSM001	Zero-touch network and Service Management (ZSM); Requirements
34	ETSI ZSM002	Zero-touch network and Service Management (ZSM); Reference Architecture
35	ETSI ZSM003	Zero-touch network and Service Management (ZSM); End-to-end management and orchestration of network slicing
36	3GPP TS 24.501	Non-Access-Stratum (NAS) protocol for 5G System (5GS); Stage 3
37	3GPP TS 22.280	Mission Critical Services Common Requirements (MCCoRe)
38	3GPP TS 23.256	Support of Uncrewed Aerial Systems (UAS) connectivity, identification and tracking; Stage 2

1.7 Conventions

If the document includes binding material, this section shall contain the following statement, and RFC 2119 shall be included as a reference:

“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 [2].”

2 Network Slicing

Network slicing is a mandatory feature of the 5G System (5GS). As defined in 3GPP TS 23.501 [1], a network slice as a logical network that provides specific network capabilities and network characteristics. The network slice can be tailored based on the specific requirements agreed between Network Slice Customer (NSC) and Network Slice Provider (NSP), see also below.

A network slice could span across multiple network domains used by a NSP (e.g. access network, core network and transport network). A network slice is comprised of dedicated and/or shared resources, e.g. in terms of functionality, processing power, storage, and bandwidth. Dedicated resources can be isolated from other network slices. A network slice available in the HPMN to their own subscribers, may also be available when the UE is roaming.

2.1 Roles in network slicing

Multiple roles related to network slicing are displayed in Figure 1 and specified in 3GPP TS 28.530 [25]. In this document the following roles are used:

- **Communication Service Customer (CSC)**: Uses communication services, e.g. end user, tenant, vertical.

- **Communication Service Provider (CSP)** : Provides communication services. Designs, builds and operates its communication services. The CSP provided communication service can be built with or without network slice.
- **Network Operator (NOP)**: Provides network services. Designs, builds and operates its networks to offer such services.
- **Network Slice Customer (NSC)**: The Communication Service Provider (CSP) or Communication Service Customer (CSC) who uses Network Slice as a Service.
- **Network Slice Provider (NSP)**: The Communication Service Provider (CSP) or Network Operator (NOP) who provides Network Slice as a Service.

Depending on actual scenarios an organisation can play one or several roles simultaneously, e.g.:

- CSP only provided by NOP
    - One company is CSP, NOP, and NSP, and
    - One company is CSC and NSC, or
- CSP only provided by CSC
    - One company is CSC, CSP and NSC and
    - One company is NOP and NSP.
- Both NOP and CSC are CSP for different services:
    - One company is CSC, CSP (Service B) and NSC, and
    - One company is CSP (Service A), NOP and NSP.

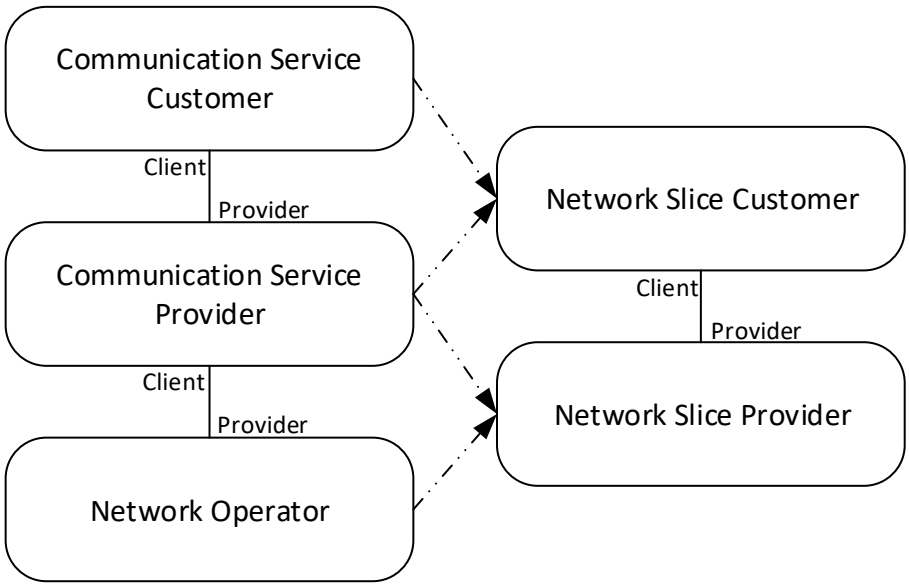

Figure 1: Model roles in network slicing

2.2 Generic network Slice Template (GST)

The Generic Network Slice Template (GST) is a set of attributes that can characterise a type of network slice/service. GST is generic and is not tied to any specific network deployment.

The NEtwork Slice Type (NEST) is a GST filled with values. The values are assigned to express a given set of requirements to support a network slice customer use case. The NEST is an input to the network slice preparation performed by the Network Slice Provider (NSP). All of this is depicted in Figure 2.

A UE can use a network slice when the related S-NSSAI, together with any applicable information mapping to the NEST-related attributes and parameter values, is included in the subscription information for the UE. NEST-related attributes can be differentiated by a Service Category. For instance, when an attribute of a NEST includes a Service Category parameter and the UE subscription information includes a parameter value associated with that Service Category, then the UE will be subject to the differentiated service associated with the Service Category in the network slice.

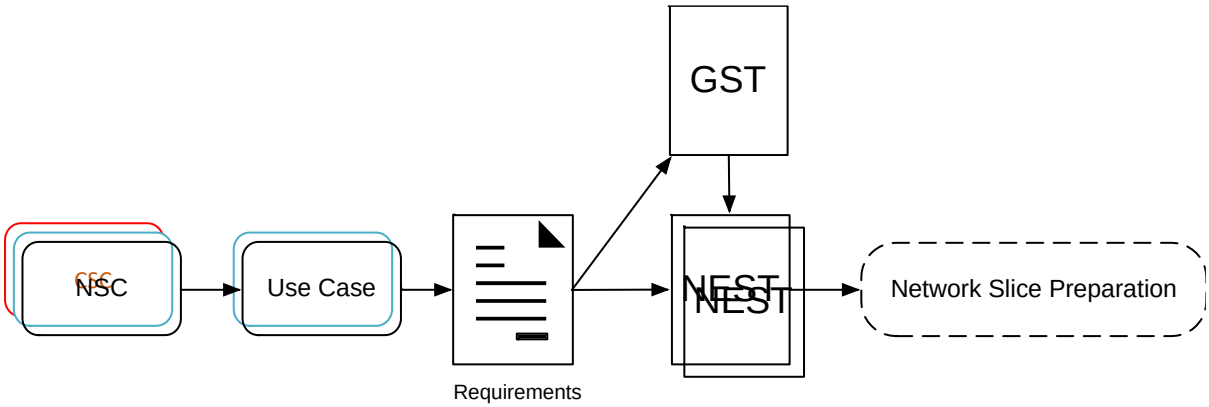

Figure 2 : GST and NEST in context of the network slice lifecycle

2.3 Network slices and roaming

Every NSP deploying 5GS will deploy network slices fitting its business. These may be network slices based on NESTs defined in clause 4 or NSP-defined NEST.

In order for NSP to ensure that the service requirements for the service are met while roaming, a roaming agreement to support network slicing between NSP A and NSP B must be in place that covers the related network functionality and required services.

Guidance on roaming architecture, Inter-PMN security deployment models and general technical roaming guidelines are found in GSMA PRD NG.113 [30].

Note: Interaction with the HPMN for attributes requiring such an interaction while roaming should be optimized to maintain performance.

3 GST Attributes

3.1 Attribute presence

Each attribute has a defined presence in the GST:

- Mandatory – the attribute's value must be present
- Conditional – the attribute's value is mandatory if a certain condition exists
- Optional – the attribute's value doesn't need to be present

3.2 Attribute categories and tagging

In general, attributes can be categorised into character attributes and scalability attributes. An attribute can be either a character or a scalability attribute but not both:

- **Character attributes** - characterise a slice (e.g. throughput, latency, Application Program Interfaces (APIs), etc.) and are independent of the Network Slice Customer (NSC) and the Network Slice Provider (NSP).
- **Scalability attributes** - provide information about the scalability of the slice (e.g. number of UEs, etc.) and are specific for the NSC and the NSP.

Note: Different use cases and network slice designs could result in some attributes being a character or a scalability attribute (e.g. area of service), but never both at the same time.

Character attributes can be further tagged. Tags are used as labels attached to the attributes to give additional information about the nature of each attribute. Each attribute could have multiple tags. The following tags apply to the character attributes:

- **Performance related** - specify the KPIs (Key Performance Indicators) supported by a slice (e.g. throughput, latencies, etc.). Performance related attributes are relevant before the slice is instantiated.
- **Function related** – specify functionality provided by the slice (e.g. positioning, prediction, etc.). Function related attributes are relevant before the slice is instantiated.
- **Control and management related** - specify which methods are provided to the NSC in order to control and manage the slice. These attributes are relevant after the slice is instantiated.

Exposure Attributes

The way the attributes interact with the NSC can be used for tagging:

- **API** – these attributes provide an API to the NSC in order to get access to the slice capabilities. Many of the functional- and operational related attributes provide APIs to the NSC.
- **KPI** – these attributes provide certain performance capabilities (e.g. throughput and delay).

3.2.1 Access Type considerations in Attributes

Some attributes may include an access type (e.g. 3GPP, Non 3GPP) applied to them in the attribute description. When an access type is specified for the attribute, it implies that the attribute is only considered for SLA enforcement when this access type is used to access the network.

When no specific access type is specified for an attribute, it implies that SLA enforcement applies when any access is used to access the network.

3.3 Void

3.4 Attributes

3.4.1 Availability

(Communication service) availability: percentage value of the amount of time the end-to-end communication service is delivered according to an agreed QoS, divided by the amount of time the system is expected to deliver the end-to-end service according to the specification in a specific area, see also 3GPP TS 22.261 [27].

Typical values:

- Low: <90%
- Medium: 90-95%
- High: >95-99.999%
- Very high: >99.999%

Availability	
Measurement unit	percent
Allowed Values	Any desired value
Tags	Character attribute / Functional

Presence	
Mandatory	
Conditional	
Optional	X

Table 1 Availability Table

3.4.2 Area of service

This attribute specifies the area where the UEs can access a particular network slice.

Therefore, the attribute specifies the list of the countries where the service will be provided. The list is specific to NSPs and their roaming agreements.

In case the list comprises more than one entry, roaming agreements between the HPMN and the VPMNs are required.

As a part of region specification, requirements for altitude can be provided. Altitude is needed for airborne devices communication where the devices can be from simple UEs or Uncrewed Aerial Systems (UAS) at lower aviation height and up to helicopters and small aeroplanes at higher aviation height. The values for the height may be impacted by the regional regulation and other aspects limiting the use of the full range of the indicated values in practice.

Note: Comma separated multiple values are allowed.

Editor's note: This attribute is FFS in 3GPP Rel17.

Area of service	
Measurement unit	NA
Allowed Values	All ISO 3166-1 Alpha-2 country codes (two letter country codes)
Tags	Character Attribute/ Operation Scalability Attribute* KPI

*Depends on the use case, this attribute can be also scalability attribute.

Presence	
Mandatory	
Conditional	
Optional	X

Table 2 Area of Service Table

Region specification

For every single country listed in the area of service attribute it needs to be indicated if the service will be provided in the whole country or just in part of the country.

If the NSC requires a specific location, this parameter can be used to specify the regions of the country where the service will be provided. It needs to be completed for every country listed in the Area of service attribute.

The list of regions is specific for each country and the way to define these regions is the decision of the NSC and NSP. Examples of how the regions could be specified is provided in the clause on "Additional information" here below.

Region specification	
Measurement unit	NA
Allowed Values	Full country List of regions
Tags	Character Attribute/ Operation Scalability Attribute* KPI

*Depending on the use case, this parameter can also be scalability attribute.

Presence	
Mandatory	
Conditional	X
Optional	

Table 3 Region Specification Table

Minimum altitude

This parameter describes the minimum height required for the service that the network slice should support. If the NSC requires a different minimum altitude per region, this parameter needs to be provided for every region listed in Region specification parameter.

Examples

- 450 m – helicopters
- 610 m – planes

Minimum altitude	
Measurement unit	m
Allowed Values	Any desired value
Tags	Character attribute / Functional

Presence	
Mandatory	
Conditional	
Optional	X

Table 4 Minimum altitude Table

Maximum altitude

This parameter describes the maximum height required for the service that network slice should support. If the NSC requires a different maximum altitude per region, this parameter needs to be provided for every region listed in Region specification parameter.

Examples

- 4500 m – helicopters
- 4500 m – planes

Maximum altitude	
Measurement unit	m
Allowed Values	Any desired value
Tags	Character attribute / Functional

Presence	
Mandatory	
Conditional	
Optional	X

Table 5 Maximum altitude Table

Additional Information

The regions specification, which is defined based on agreement between NSC and NSP, specifies per county the area of service. This can be done for example by:

1. Geodetic shapes (defining 2D or 3D shapes of coverage) as defined in 3GPP TS 23.032: "Universal Geographical Area Description (GAD)" [13].
2. Civic addresses or identification of known locations (e.g. name of a stadium, or location of a certain enterprise site etc.)
3. Specification of a geographic region/location by means of string of text which defines it univocally (e.g. a city, a Postcode or list of postcodes, a county, a state)

Mission critical users use aircrafts and helicopters for operational purpose. Being able to communicate in real time with helicopters and aircraft is a basic need [37].

The architecture enhancements for supporting Uncrewed Aerial Systems (UAS) connectivity, identification, and tracking are described in 3GPP Release 17 TS 23.256 [38].

3.4.3 Delay tolerance

Provide the NSC with service delivery flexibility, especially for the vertical services that are not chasing a high system performance. For instance, the service will be delivered once the mobile system has sufficient resources or during the off-peak hours. For this type of traffic, it

is not too critical how long it takes to deliver the amount of data, e.g. within hours, days, weeks, etc.

Note: Not including this attribute is equal to setting it to Not supported.

Editor's note: This attribute is FFS in 3GPP.

Delay tolerance	
Measurement unit	NA
Allowed Values	Not supported Supported
Tags	Character attribute / Functional KPI

Presence	
Mandatory	
Conditional	
Optional	X

Table 6 Delay Tolerance Table

Additional information

In principle, relevant mechanisms are available for Application Function (AF). For instance, this type of traffic could be scheduled for transmission to the UE in dedicated times of the day when the traffic load is low, or this traffic could get an own traffic class which is de-prioritized over all other traffic.

Certain traffic flows should reach the end user within certain latency boundary. At the same time, there are use cases that are less sensitive to delay variations, giving AF some level of flexibility in scheduling downlink traffic. For instance, in automotive industry, (non-critical) software/firmware update could be deprioritised and delivered when traffic is low such as during off-peak hours.

This attribute applies to 3GPP access type only.

3.4.4 Deterministic communication

This attribute defines if the network slice supports deterministic communication for periodic UE traffic. Periodic traffic refers to the type of traffic with periodic transmissions.

Editor's note: This attribute is FFS in 3GPP.

Availability

This parameter describes if the network slice supports deterministic communication.

Note: Not including this parameter is equal to setting it to Not supported.

Availability	
Measurement unit	NA
Allowed Values	Not supported Supported
Tags	Character attribute / Performance KPI

Presence	
Mandatory	
Conditional	
Optional	X

Table 7 Deterministic Communication Table

Periodicity

This parameter provides a list of periodicities supported by the network slice.

This parameter must be present when the “Availability” is set to Supported.

Examples:

- 200s - motion control - printing machine
- 600s - temperature sensors
- $1*10^{-3}$s - motion control - machine tool

Periodicity	
Measurement unit	Seconds
Allowed Values	Any desired value
Tags	Character attributes / Performance KPI

Presence	
Mandatory	
Conditional	X
Optional	

Table 8 Periodicity Table

Additional information

Periodic traffic has a transmission interval (in which a single packet is transmitted) that is repeated. For example, a transmission occurs every 15 ms. Reasons for a periodic uplink transmission can be the periodic update of a position or the repeated monitoring of a characteristic parameter.

Note: Transmission of a temperature every 15 minutes is a periodical transmission. However, most periodic intervals in communication for automation are rather short. The transmission is started once and continues unless a stop command is provided [3].

Determinism refers to whether the delay between transmission of a packet and receipt of the packet at the destination address is stable (within bounds). Usually, communication is called deterministic if it is bounded by a given threshold for the latency/transit time [3].

It should be noted that multiple periodicities could be supported. It is then a matter of resource scheduling and the identification of the different packets in order to treat them in a way to not disturb their periodicity.

This attribute should not be mixed up with periodic communication demand in which periodically a specific amount of data (not only a single packet) needs to be transmitted. Hence, there is no periodicity between individual data packets but there is a periodicity between activities of a customer or device.

(R)AN/TN/CN (Radio Access Network/Transport Network/Core Network) may use this attribute to optimize the scheduling and performance.

This attribute applies to 3GPP access type only.

3.4.5 Downlink throughput per network slice

This attribute relates to the aggregated data rate in downlink for all UEs together in the network slice (this is not per UE).

This attribute applies to 3GPP access type only.

Guaranteed downlink throughput quota

This parameter describes the guaranteed throughput/data rate supported by the network slice for the aggregate of all GBR QoS flows in downlink belonging to the set of all UEs using the network slice. This only corresponds to the provisioned resources (i.e. there is no expectation that this guarantee is met irrespective of the instantaneous distribution of the UEs using the network slice).

Not including this parameter or if the value is 0, best effort traffic is expected where no minimum throughput is guaranteed.

Examples:

- 0 (best effort)
- 10 000 kbps
- 1 000 000 kbps

Guaranteed downlink throughput quota	
Measurement unit	kbps
Allowed Values	Any desired value

Guaranteed downlink throughput quota	
Tags	Scalability attribute KPI

Presence	
Mandatory	
Conditional	
Optional	X

Table 9 Guaranteed Downlink Throughput Table

Maximum downlink throughput

This parameter defines the maximum data rate supported by the network slice for all UEs together in downlink.

Examples:

- 100 000 kbps
- 20 000 000 kbps

Note: The sum of all data rates in downlink for all UEs does not exceed this value.

Maximum downlink throughput	
Measurement unit	kbps
Allowed Values	Any desired value
Tags	Scalability attributes KPI

Presence	
Mandatory	
Conditional	
Optional	X

Table 10 Maximum Downlink Throughput Table

3.4.6 Downlink maximum throughput per UE

This attribute describes the maximum data rate supported by the network slice per UE in downlink.

The attribute is comprised of a list of Service Category parameters with the associated Maximum Downlink Throughput per UE value.

If no Service Category parameter is present all devices in the network slice, experience the same Maximum Downlink Throughput per UE value. If Service Category parameters are present, then the UEs will be associated with a specific Maximum Downlink Throughput per UE parameter value depending on which Service Category the UE is associated with for the network slice. In this case, different UEs within a network slice can experience a different maximum data rate.

Examples:

- 50 000 (Service Category 1)
- 400 000 (Service Category 2)
- 1 000 000 (Service Category 3)

Maximum downlink throughput per UE value

This parameter defines the Maximum Downlink Throughput per UE value. This may be associated with a Service Category parameter.

Maximum downlink throughput per UE value	
Measurement unit	kbps
Allowed Values	Any desired value
Tags	Character attribute /Performance KPI

Presence	
Mandatory	
Conditional	
Optional	X

Table 11 Maximum Downlink Throughput per UE Table

Service category

This parameter defines a service category which may be assigned to certain groups of devices using the network slice. If present, it shall be associated with a Maximum Downlink Throughput Value parameter.

Service category	
Measurement unit	NA
Allowed Values	Any text identifying the Service Category
Tags	Character attribute / Functional

Presence	
Mandatory	
Conditional	
Optional	X

Table 12 Downlink Maximum Rate Service Category Table

Additional information

Maximum throughput can be used to offer different service categories which have different maximum throughput values.

This attribute applies to 3GPP access type only, across GBR and Non-GBR QoS flows.

3.4.7 Energy efficiency

This attribute describes whether the network slice supports the energy efficiency KPI.

The energy efficiency is evaluated only when the network is running.

Editor's note: This attribute is FFS in 3GPP Rel17.

Network slice energy efficiency KPI

Network slice energy efficiency KPI is defined in 3GPP Release 17 TS 28.554 Section 6.7 [32]. It is defined as a ratio between the performance of a network slice and its energy consumption.

Note: Not including this parameter is equal to setting it to Not supported.

Energy efficiency	
Measurement unit	NA
Allowed Values	Not Supported Supported
Tags	Character attributes / Operational KPI

Presence	
Mandatory	
Conditional	
Optional	X

Table 13 Energy Efficiency Table

3.4.8 Group communication support

This attribute describes which type of group communication is provided by the network slice. This attribute applies to 3GPP access type only.

Note: Not including this attribute is equal to setting it to Not supported.

3Group communication support	
Measurement unit	NA
Allowed Values	Not supported Single Cell Point to Multipoint (SC-PTM) Broadcast/Multicast Broadcast/Multicast + SC-PTM Unicast
Tags	Character attribute / Functional

Presence	
Mandatory	
Conditional	
Optional	X

Table 14 Group Communication Support Table

3.4.9 Isolation level

Editor's note: This attribute is FFS.

3.4.10 Void

3.4.11 Maximum supported packet size

This attribute describes the maximum packet size supported by the network slice and may be important for URLLC (Ultra-Reliable Low Latency Communication) and MIoT (Massive IoT), or to indicate a supported maximum transmission unit (MTU).

Note: Not including this attribute is equal to setting it to value 1500 Bytes.

Examples

- 40 Bytes - IoT

- 160 Bytes URLLC for 5 ms latency
- 1 500 Bytes – eMBB

Maximum supported packet size	
Measurement unit	Bytes
Allowed Values	Any desired value
Tags	Character attribute /Performance KPI

Presence	
Mandatory	
Conditional	
Optional	X

Table 15 Maximum Packet Size Table

Additional Information

This attribute might serve different purposes:

- Limitation of the packet size to achieve the required latencies for instance in Industry 4.0 or energy use cases
- To improve the radio performance in case many very small packets are transmitted by a large number of devices as like for MIoT use cases
- To indicate the MTU provided by the network slice

A UE or a server that uses this network slice needs to be aware of the limitation, which could be operational, or performance nature. For instance, the network does not guarantee the SLA if packets are bigger than the specified size or too large packets could be fragmented which will increase latency.

(R)AN/CN may use this attribute to optimize scheduling and performance, especially for URLLC case and very small packets. Transport of very small packets is very inefficient in some technologies. Knowledge about the maximum supported packet size might help to improve the efficiency, e.g. by scheduling resources more efficiently.

3.4.12 Mission critical support

Mission-critical (MC) leads to a priority of the network slice relative to others, for C-plane (Control Plane) and U-plane (User Plane) decisions. This is relative to a customer provider relationship and to a PMN (Public Mobile Network).

Note: Not including this attribute is equal to setting it to Non-mission critical.

Mission critical support	
Measurement unit	NA

Mission critical support	
Allowed Values	Non-mission-critical Mission-critical
Tags	Character attribute / Functional

Presence	
Mandatory	
Conditional	
Optional	X

Table 16 Mission Critical Support Table

Mission-critical capability support

This parameter specifies what capabilities are available to support mission-critical services. More than one capability may be supported at once. This parameter must be present if Mission critical support is set to Mission-critical.

Note: Comma separated multiple values are allowed.

Mission-critical capability support	
Measurement unit	NA
Allowed Values	Inter-user prioritization Pre-emption Local control
Tags	Character attribute / Functional

Presence	
Mandatory	
Conditional	X
Optional	

Table 17 Mission Critical Capabilities Table

Inter-user prioritization capability provides admission and the scheduling of priorities for PS (Packet Service) users over non-PS users, and different priorities among PS users.

Pre-emption capability allows non-PS users to be pre-empted by PS users, and a PS user to be pre-empted by another PS user.

Local control capability allows dynamic and temporary assignment of inter-user prioritization and pre-emption levels to local PS users (e.g. local to an incident).

Mission-critical service support

This parameter specifies whether or not the network slice supports mission-critical push-to-talk (MCPTT) [15], mission-critical data (MCData) [16], mission-critical video (MCVideo) [17], or mission-critical interworking [20].

Editor's note: IOPS is FFS; MC interworking may need further study.

This parameter is present when Mission critical support is set to Mission-critical.

This parameter applies to 3GPP access type only.

Note: Comma separated multiple values are allowed.

Mission-critical service support	
Measurement unit	NA
Allowed Values	MCPTT MCData MCVideo MC interworking
Tags	Character attribute / Functional

Presence	
Mandatory	
Conditional	X
Optional	

Table 18 Mission Critical Service Support

3.4.13 MMTel support

This attribute describes whether the network slice supports IP Multimedia Subsystem (IMS) and Multimedia Telephony Service MMTel. This attribute describes whether the GSMA PRD NG.114 [22] compliant MMTel deployment is supported in the network slice.

Note: Not including this attribute is equal to setting it to value Not Supported.

MMTel support	
Measurement unit	NA
Example	Not supported Supported
Tags	Character attribute / Functional

Presence	
Mandatory	
Conditional	
Optional	X

Table 19 MMTel Support Table

3.4.14 NB-IoT Support

This attribute describes whether NB-IoT is supported in the RAN in the network slice.

This attribute applies to 3GPP access type only.

Note: Not including this attribute is equal to setting it to value Not supported.

NB-IoT Support	
Measurement unit	NA
Example	Not supported Supported
Tags	

Presence	
Mandatory	
Conditional	
Optional	X

Table 20 NB-IoT Support Table

3.4.15 Network functions owned by Network Slice Customer

A NSC can own some network functions. This attribute provides a list of network functions to be provided by the NSC. If the list is empty, or this attribute is not included, the NSC is not providing any network function relevant for the network slice.

Examples:

- UDM
- AUSF
- AF

Note: Comma separated multiple values are allowed.

3.4.15 Network functions owned by Network Slice Customer	
Measurement unit	NA
Allowed Values	Any desired list of functions

3.4.15 Network functions owned by Network Slice Customer	
Tags	Character attribute / Functional / Operational

Presence	
Mandatory	
Conditional	
Optional	X

Table 21 Network Functions Table

Additional information

The NSC like a MVNO, who owns a unique Mobile Country Code (MCC) and a unique Mobile Network Code (MNC), stores all the subscriber information in its own User Data Management (UDM). This UDM can also be connected to multiple networks within the same country.

3.4.16 Maximum number of PDU sessions

This attribute describes the maximum number of concurrent PDU supported by the network slice as specified by the "Maximum number of PDU sessions" parameter. If the network slice also requires taking into account PDN connections that can be handed over to the 5GS while the UEs are in the EPS, this is specified in the optional attribute "EPS counting required". If the parameter " EPS counting required" is missing, then no counting happens of any PDN connections in EPS. In roaming case (i.e. when the Area of Service attribute includes roaming partners' PMNs), the number of PDU sessions includes any Local Breakout PDU sessions if the Parameter "LBO PDU Sessions Counting Required" is set to "Yes". Otherwise (including the case where this parameter is not present), Local Breakout PDU sessions are not counted.

Examples:

- 100 000 PDU sessions
- 10 000 000 PDU sessions

Maximum number of PDU sessions

This parameter specifies how many PDU sessions can simultaneously use the network slice.

Maximum number of PDU sessions	
Measurement unit	PDU sessions
Allowed Values	Any desired value
Tags	Scalability attribute

Presence	
Mandatory	
Conditional	
Optional	X

Table 22 Number of PDU Session Table

EPS counting required

If this parameter indicates that EPS counting is required, the PDU sessions counting shall also take into account the PDN connections in the EPS connected to an APN that maps to a DNN/S-NSSAI of the network slice.

EPS counting required	
Measurement unit	NA
Allowed Values	Yes No
Tags	Scalability attribute

Presence	
Mandatory	
Conditional	
Optional	X

Table 23 EPS counting required Table

LBO PDU Sessions Counting required

This parameter specifies whether the LBO PDU sessions are counted. If the value is "Yes", then LBO sessions are counted also, if the value is set to "No", then LBO sessions are not counted. If this parameter is not present, then the LBO PDU sessions are not counted.

LBO PDU Sessions Counting required	
Measurement unit	N/A
Allowed Values	Yes No
Tags	Scalability attribute

Presence	
Mandatory	
Conditional	

Presence	
Optional	X

Table 24 LBO PDU Session Counting Required Table

3.4.17 Maximum number of UEs

This attribute describes the maximum number of UEs that can use the network slice simultaneously as specified by the "Maximum number of UEs" parameter. If the network slice also requires taking into account UEs using PDN connections that can be handed over to the 5GS while they are in the EPS, this is specified in the optional parameter "EPS counting required". If the parameter " EPS counting required" is missing, then no counting of UEs happens while they are in EPS. In roaming case (i.e. when the Area of Service attribute includes roaming partners' PMNs), the number of UEs includes any roaming UEs if the parameter "Roaming UEs Counting Required" is set to "Yes". Otherwise (including the case where this parameter is not present), roaming UEs are not counted.

Examples:

- 100 000 UEs
- 10 000 000 UEs

Maximum number of UEs

This parameter specifies how many UEs can simultaneously use the network slice.

Maximum number of UEs	
Measurement unit	NA
Allowed Values	Any desired value
Tags	Scalability attribute

Presence	
Mandatory	
Conditional	
Optional	X

Table 25 Number of UEs Table

EPS counting required

If this parameter indicates that EPS counting is required, the counting of UEs shall take into account the UEs in the EPS with at least one PDN connection in the network slice, i.e., it is required to count the UEs that have at least one PDN connection connected to an APN that is associated with the DNN/S-NSSAI of the network slice.

EPS counting required	
Measurement unit	NA
Allowed Values	Yes No
Tags	Scalability attribute

Attribute Presence	
Mandatory	
Conditional	
Optional	X

Table 26 EPS counting required Table

Roaming UEs Counting required

This parameter specifies whether roaming UEs are counted. If the value is "Yes", then roaming UEs are counted also, if the value is set to "No", then roaming UEs are not counted. If this parameter is not present, then the roaming UEs are not counted.

Roaming UEs Counting Required	
Measurement unit	N/A
Allowed Values	Yes No
Tags	Scalability attribute

Presence	
Mandatory	
Conditional	
Optional	X

Table 27 Roaming UEs Counting Required Table

3.4.18 Performance monitoring

This attribute provides the capability for NSC and NOP to monitor Key Quality Indicators (KQIs) and Key Performance Indicators (KPIs). KQIs reflect the end-to-end service performance and quality while KPIs reflect the performance of the network.

Availability

This parameter contains a list of KQIs and KPIs available for monitoring. If the list is empty this parameter is not available in the network slice and the other parameters might be ignored.

Availability	
Measurement unit	NA
Allowed Values	Service Request Success Rate
Tags	Character attribute / Functional / Operational

Presence	
Mandatory	
Conditional	
Optional	X

Table 28 Performance Availability Table

Monitoring sample frequency

This parameter describes how often the KQIs and KPIs are monitored.

Only the KQIs of communication services offered by the NSP can be monitored. For over-the-top services, the NSP is not able to access the KQIs.

Monitoring sample frequency	
Measurement unit	NA
Allowed Values	Per second Per minute Per-hour
Tags	Character attribute / Functional / Operational KPI

Presence	
Mandatory	
Conditional	
Optional	X

Table 29 Monitoring Frequency Table

Additional information

Only the KQIs of communication services offered by the network operator can be monitored. For over-the-top services, the network operator is not able to access the KQIs.

3.4.19 Performance prediction

This attribute defines the capability to allow the mobile system to predict the network and service status. Predictive QoS (Quality of Service) can be done for various Key Quality Indicators (KQIs) and Key Performance Indicators (KPIs). KQIs reflect the end-to-end service performance and quality, while KPIs reflect the performance of the network. The prediction is done for a specific point of time in the future and for a specific geolocation.

Only the KQIs of communication services offered by the NSP can be predicted. For over-the-top services, the NSP is not able to access the KQIs.

Availability

This parameter contains a list of KQIs and KPIs available for prediction. If the list is empty, the parameter is not available in the network slice and the other parameters might be ignored.

Note: Comma separated multiple values are allowed.

Availability	
Measurement unit	NA
Allowed Values	Throughput Latency Service Request Success Rate
Tags	Character attribute / Functional / Operational KPI

Presence	
Mandatory	
Conditional	
Optional	X

Table 30 Performance Availability Table

Prediction frequency

This parameter describes how often KQIs and KPIs prediction values are provided.

Prediction frequency	
Measurement unit	NA
Allowed Values	Per second Per minute Per hour
Tags	Character attribute / Functional / Operational KPI

Presence	
Mandatory	
Conditional	
Optional	X

Table 31 Performance Prediction Frequency Table

Additional information

This attribute recently raised a lot of attention and different organisations as like 5GAA (5G Automotive Association) and ITU-T (Machine Learning for Future Networks including 5G (FG ML5G)) are looking at it. Towards the NSC, an API would be provided allowing the NSC to send a request (e.g. KPI prediction for a certain geo-location and a certain time in the future) and receiving the prediction.

Predictive QoS is an important feature allowing NSP to inform the service in advance about a quality drop. Predictive QoS can be applied to various KPIs, e.g. area of service, throughput, latency, etc. and KQIs.

Performance prediction could be implemented in different ways:

- Active prediction – network actively informs the NSC and/or the UE proactively about the predicted values. Alternatively, the NSC and/or UE are only informed in case the predicted KPI or KQI value crossed a defined threshold.
- Passive prediction – the NSC and/or UE requests prediction from the network via APIs provided by the network.

It should be noted that performance prediction is not a pure action between NSC and the mobile system, but between UE (like the car) and the mobile system.

A prediction (request as well as reply) is always associated with a point of time in the future and a geolocation. A prediction provided by the network slice to the UE and/or customer (prediction reply) should always be associated with a confidence interval to give an idea about how reliable the prediction is. The reliability depends on many parameters, e.g. which KPI to predict, look ahead of time, etc.

3.4.20 Positioning support

This attribute describes if the network slice provides geo-localization methods or supporting methods.

Availability

This parameter describes if this parameter is provided by the network slice and contains a list of positioning methods provided by the slice. If the list is empty this parameter is not available in the network slice and the other parameters might be ignored.

Note: Comma separated multiple values are allowed.

Availability	
Measurement unit	NA
Allowed Values	CIDE-CID (LTE and NR) OTDOA (LTE and NR) RF fingerprinting AECID Hybrid positioning NET-RTK
Tags	Character attribute / Functional API

Presence	
Mandatory	
Conditional	
Optional	X

Table 32 Positioning Support Table

Prediction frequency

This parameter describes how often location information is provided. This parameter simply defines how often the customer is allowed to request location information. This is not related to the time it takes to determine the location, which is a characteristic of the positioning method.

Prediction frequency	
Measurement unit	NA
Allowed Values	Per second Per minute Per-hour
Tags	Character attribute / Functional API

Presence	
Mandatory	
Conditional	
Optional	X

Table 33 Prediction Frequency Table

Accuracy

This parameter describes the accuracy of the location information. Accuracy depends on the respective positioning solution applied in the network slice.

Examples:

- 1m
- -1m
- 0.01m
- -0.01m

Accuracy	
Measurement unit	meter
Allowed Values	Any desired value
Tags	Character attribute / Functional KPI

Presence	
Mandatory	
Conditional	
Optional	X

Table 34 Prediction Accuracy Table

Additional Information

Many use cases have a strong demand for the capability of positioning (geo-localisation) devices. Different NSC may have different requirements in terms of accuracy, energy efficiency, indoor/outdoor support, and cost, etc. For some of the use cases, positioning techniques will have to work reliably under challenging conditions, e.g. deep indoors.

It should be noted that either for some use cases, such as many IoT use cases, GPS (Global Positioning Service) or other Global Navigation Satellite Systems (GNSS) are not an option because of the high energy consumption or because simple devices are not equipped with the suitable receiver.

For other use cases, e.g. automotive, GNSS is a suitable positioning solution for most of the times although there are a number of situations where this is not accessible e.g. tunnels, indoors, etc. Hence, it is beneficial to combine the advantages of these systems with the positioning capabilities of 5G to provide a solution that meets the NSC scenarios.

In general, the different positioning methods can be categorized into precise positioning, cellular-based positioning and new radio (NR)-based positioning.

Cellular positioning refers to positioning methods in which the cellular network is determining the position of the UE. The following cellular positioning technologies can be used:

- Cell ID (CID) is the basic method which utilizes cellular system knowledge about the serving cell of a specific user; the user location area is thus associated with the serving CID.
- Enhanced Cell ID (E-CID) refers to a network-based method assisted by the UE. This method utilizes CIDs, Radio Frequency RF measurements from multiple cells, timing advance, and Angle of Arrival (AoA) measurements.
- Observed Time Difference of Arrival (OTDOA) is a UE-assisted method based on reference signal time difference (RSTD) measurements conducted on downlink positioning reference signals received from multiple locations, where the user location is calculated by multi-alteration.
- RF fingerprinting is a method of finding a user position by mapping RF measurements obtained from the UE onto an RF map, where the map is typically based on detailed RF predictions or site surveying results
- Adaptive Enhanced Cell Identity (AECID) is a method that enhances the performance of RF fingerprinting by extending the number of radio properties that are used, where at least CIDs, timing advance, RSTD, and AoA may be used in addition to received signal strengths, and where the corresponding databases are automatically built up by collecting high-precision OTDOA and A-GNSS positions, tagged with measured radio properties.

The following table provides an overview about the characteristics of the different cellular positioning methods.

Positioning Method	Environment Limitations	UE Impact	Site Impact	System Impact	Response Time (RAN)	Horizontal uncertainty	Vertical Uncertainty
CID Proximity location	No	No	No	Small	Very low	High	NA
E-CID	No	Small	Small	Medium	Low	Medium	NA
E-CID/AoA	Rich multipath	Small	Large	Medium	Low	Medium	NA
RF fingerprinting	Rural	Small	Small	Large	Low/medium	Low/medium	Medium

Positioning Method	Environment Limitations	UE Impact	Site Impact	System Impact	Response Time (RAN)	Horizontal uncertainty	Vertical Uncertainty
AECID	No	Small	Small	Medium	Low	Low/medium	Medium
UTDOA	Suburban/Rural	Small	Large	Large	Medium	<100m	Medium
OTDOA	Rural	Medium	Medium	Medium	Medium	<100m	Medium
A-GNSS	Indoor	Large	Small	Medium	Medium/high	<5m	<20m

Table 35 Characteristics of cellular positioning methods

3.4.21 Radio spectrum

Defines the radio spectrum in which the network slice should be supported. This is important information, as

- some UEs of the NSC might be capable of using certain frequency bands only.
- The NSC may only own or have access to certain frequency bands.

Note: This attribute does not limit the use of the listed frequency bands for other use cases, i.e., there is no exclusive use of the listed frequency bands for the network slice.

Examples of allowed values:

- n1
- n77

Note: Comma separated multiple values are allowed.

Radio spectrum	
Measurement unit	NA
Allowed Values	See NR operating band identifiers in 3GPP TS 38.101-1 [4]
Tags	Scalability attribute

Presence	
Mandatory	
Conditional	
Optional	X

Table 36 Radio Spectrum Table

Additional information

This attribute applies to 3GPP access type only.

This attribute simply tells which frequency bandscan be used to access the network slice.

5G NR operating bands are defined in 3GPP TS 38.101-1 [4].

3.4.22 Void

3.4.23 Root cause investigation

Root cause investigation is the capability provided to NSC to understand or investigate the root cause of network service performance degradation or failure.

Note: Not including this attribute is equal to setting it to Not supported.

Editor's note: This attribute is FFS in 3GPP.

Root cause investigation	
Measurement unit	NA
Allowed Values	Not supported Passive investigation Active investigation
Tags	Character attribute / Functional / Operational API

Presence	
Mandatory	
Conditional	
Optional	X

Table 37 Root Cause Investigation Table

Additional information

This attribute could be implemented in different facets: passive investigation or activate investigation.

In passive investigation, the NSC is informed about the root cause of the network service performance degradation or failure in case there is a problem with the network slice.

In active investigation, if something is wrong in the network, a NSC could perform investigation itself, for instance call for the log files of different technical domain, to

understand where the problem is, then it is not just an API telling the NSC if there is a problem or not.

It should be clear that this attribute is only about the investigation of a problem. This attribute does not provide any means to solve the problem.

3.4.24 Session and Service Continuity support

The attribute defines the continuity of a Protocol Data Unit (PDU) session. The following three Session and Service Continuity (SSC) modes are specified [1]:

- SSC mode 1 - the network preserves the connectivity service provided to the UE (for the case of IPv4, IPv6 or IPv4v6 type, the IP address is preserved)
- SSC mode 2 - the network may release the connectivity service delivered to the UE and release the corresponding PDU Session. For the case of IPv4 or IPv6 or IPv4v6 type, the release of the PDU Session induces the release of IP address(es) that had been allocated to the UE.
- SSC mode 3 - changes to the user plane can be visible to the UE, while the network ensures that the UE suffers no loss of connectivity. A connection through new PDU Session Anchor point is established before the previous connection is terminated in order to allow for better service continuity. For the case of IPv4 or IPv6 or IPv4v6 type, the IP address is not preserved in this mode when the PDU Session Anchor changes.

Session and Service Continuity support	
Measurement unit	NA
Allowed Values	SSC mode 1 SSC mode 2 SSC mode 3
Tags	Character attribute / Functional KPI

Presence	
Mandatory	
Conditional	
Optional	X

Table 38 Service Continuity Table

3.4.25 Simultaneous use of the network slice

This attribute describes whether a network slice can be simultaneously used by a UE together with other network slices and if so, with which other classes of network slices. The

attribute is comprised of a list of Service Category Parameters with the associated Simultaneous Use Class parameter value.

If no Service Category parameters are present, all UEs in the network slice are associated with the same Simultaneous Use Class.

Note: Not including this attribute in a NEST is equal to setting it to “Can be used simultaneously with any network slice”.

Note: “use of a network slice” starts from the time a UE is successfully registered with a network slice.

Note: Simultaneous use of a network slice is not associated with physical or logical isolation requirements.

Example:

- {Service Category = Service Category 1, Simultaneous Use Class = " Can be used simultaneously with any network slice"}
- {Service Category = Service Category 2, Simultaneous Use Class = " Cannot be used simultaneously with any another network slice"}

Simultaneous Use Class

This parameter defines which class of simultaneous use applies. This may be associated with a Service Category parameter.

Simultaneous Use Class	
Measurement unit	NA
Allowed Values	Can be used simultaneously with any network slice Can be used simultaneously with any network slices with same SST value but different SD values Can be used simultaneously with any network slice with the same SD value but different SST value Cannot be used simultaneously with any another network slice Operator defined class
Tags	Character attribute / Functional

Presence	
Mandatory	
Conditional	
Optional	X

Table 39 Simultaneous Use Class Table

Service category

This parameter defines a service category which may be assigned to a UE. If present, it shall be associated with a Simultaneous Use Class parameter value.

Service category	
Measurement unit	NA
Allowed Values	Any text identifying the service category
Tags	Character attribute / Functional

Attribute Presence	
Mandatory	
Conditional	
Optional	X

3.4.26 Slice quality of service

This attribute defines all the QoS relevant parameters supported by the network slice. For the 5G QoS Identifier (5QI) parameter, 3GPP has already defined standardised values (see 3GPP TS 23.501 [1]). By preselecting a standardised 5QI value, QoS characteristics values for that 5QI will be automatically filled out using the default QoS characteristics value as listed in Table 5.7.4-1 of 3GPP TS 23.501 [1]. However, QoS characteristics values must be specified in this attribute (by using respective parameters in this attribute) for Operator-specific 5QIs [36] or for standardised 5QIs using non default QoS characteristics values.

This attribute applies to 3GPP access type only.

3GPP 5QI

A 5QI is a scalar, used as a reference to 5G QoS characteristics defined in clause [1], i.e. access node-specific parameters that control QoS forwarding treatment for the QoS Flow (e.g. scheduling weights, admission thresholds, queue management thresholds, link layer protocol configuration, etc.).

The 5G QoS characteristics for pre-configured 5QI values are pre-configured in the Access Network (AN). The 5G QoS characteristics for QoS Flows with dynamically assigned 5QI are signalled as part of the QoS profile (see 3GPP TS 23.501 [1]).

Examples:

- 1,2,3: standardised 5QI values, in Table 5.7.4-1 of 3GPP TS 23.501 [1]

- 134, 156, 230: operator-specific 5QI values in the range defined in Table 9.11.4.12.1 of 3GPP TS 24.501 [36]

Note: Comma separated multiple values are allowed.

3GPP 5QI	
Measurement unit	NA
Allowed Values	standardised 5QI values in Table 5.7.4-1 of 3GPP TS 23.501 [1] and/or any desired Operator-specific 5QI values in the range defined in Table 9.11.4.12.1 of 3GPP TS 24.501 [36]
Tags	Character attribute / Functional / Operational KPI

Presence	
Mandatory	
Conditional	
Optional	X

Table 40 Slice Quality Table

Resource Type

The Resource Type determines if dedicated network resources related to the QoS Flow-level Guaranteed Flow Bit Rate (GFBR) value, are permanently allocated (see clause 5.7.3.2 of 3GPP TS 23.501[1]).

This value needs to be provided for each Operator-specific 5QI value selected.

Examples:

- GBR - Mission Critical Video user plane
- Delay critical GBR - Intelligent Transport Systems
- Non-GBR - Voice, AR

Resource Type	
Measurement unit	NA
Allowed Values	GBR Delay critical GBR Non-GBR
Tags	Character attribute / Functional / Operational KPI

Presence	
Mandatory	
Conditional	X
Optional	

Table 41 Resource Type Table

Priority Level

The Priority level associated with 5G QoS characteristics indicates a priority in scheduling resources among QoS Flows. The Priority level shall be used to differentiate between all QoS Flows of the same UE, and it also shall be used to differentiate between QoS Flows from different UEs. Once all QoS requirements up to GFBR are fulfilled for all the Guaranteed Bit Rate (GBR) QoS Flows, the Priority Level may also be used to distribute resources between GBR QoS Flows (for rates above GFBR up to MFBR, Maximum Flow Bit Rate) and non-GBR QoS Flows, in an implementation specific manner. The lowest Priority level value corresponds to the highest Priority (see clause 5.7.3.3 of 3GPP TS 23.501 [1]).

This value needs to be provided for each Operator-specific 5QI value selected.

Examples:

- 10 - IMS signalling
- 30 - Real time gaming

Priority Level	
Measurement unit	NA
Allowed Values	Any desired value
Tags	Character attribute / Functional / Operational KPI

Presence	
Mandatory	
Conditional	X
Optional	

Table 42 Priority Level Table

Packet Delay Budget

The Packet Delay Budget (PDB) defines an upper bound for the time that a packet may be delayed between the UE and the UPF, and that terminates the N6 interface. For a certain 5QI the value of the PDB is the same for UL (Uplink) and DL (Downlink). In the case of 3GPP access, the PDB is used to support the configuration of scheduling and link layer functions (e.g. the setting of scheduling priority weights and HARQ (Hybrid Automatic Repeat request) target operating points) (see clause 5.7.3.4 of 3GPP TS 23.501 [1]).

If the value is set to 0, no special measures are used to bring latency down to a minimum required by low-latency use cases.

This value needs to be provided for each Operator-specific 5QI value selected.

Examples:

- $20*10^{-3}$ s - Cooperative driving
- $30*10^{-3}$ s - Virtual reality

Packet Delay Budget	
Measurement unit	Seconds
Allowed Values	Any desired value
Tags	Character attribute / Functional / Operational KPI

Presence	
Mandatory	
Conditional	X
Optional	

Table 43 Packet Delay Budget Table

Packet Error Rate

The Packet Error Rate (PER) defines an upper bound for the rate of the PDUs (e.g. IP packets) that have been processed by the sender but that are not successfully delivered by the corresponding receiver. The purpose of the PER is to allow for the appropriate link layer, protocol configurations (e.g. RLC and HARQ in RAN of a 3GPP access). For all 5QIs the value of the PER is the same in the UL and the DL. For the GBR QoS Flows with Delay critical GBR resource type, a packet which is delayed more than the PDB (but which complies with the GFBR and the MDBV (Maximum Data Burst Volume) requirements) is counted as lost, and included in the PER. Delayed packets are not included in the PER if a GBR QoS Flow with a Delay critical resource type is exceeding the GFBR and the Maximum Data Burst Volume (see clause 5.7.3.4 of 3GPP TS 23.501 [1]).

This value needs to be provided for each Operator-specific 5QI value selected.

Examples:

- 10^{-6} - mission critical data
- 10^{-2} - V2X messaging

Packet Error Rate	
Measurement unit	NA

Packet Error Rate	
Allowed Values	Any desired value
Tags	Character attribute / Functional / Operational KPI

Presence	
Mandatory	
Conditional	X
Optional	

Table 44 Packet Error Rate Table

Averaging Window

Each GBR QoS Flow shall be associated with an Averaging window. The Averaging window represents the duration over which the GFBR and MFBR shall be calculated (e.g. in the (R)AN, UPF, UE). (see clause 5.7.3.6 of 3GPP TS 23.501 [1]).

This value needs to be provided for each Operator-specific 5QI value selected.

Averaging Window	
Measurement unit	millisecond
Allowed Values	Any desired value
Tags	Character attribute / Functional / Operational KPI

Presence	
Mandatory	
Conditional	
Optional	X

Table 45 Average Window Table

Maximum Data Burst Volume

Each GBR QoS Flow with Delay-critical resource type shall be associated with a Maximum Data Burst Volume (MDBV). MDBV denotes the largest amount of data that the 5G-AN is required to serve within a period of 5G-AN PDB (i.e. 5G-AN part of the PDB) (see clause 5.7.3.7 of 3GPP TS 23.501 [1]).

This value needs to be provided for each Operator-specific 5QI value selected.

Maximum Data Burst Volume	
Measurement unit	Bytes
Allowed Values	Any desired value
Tags	Character attribute / Functional / Operational KPI

Presence	
Mandatory	
Conditional	
Optional	X

Table 46 Maximum Data Burst Volume Table

Maximum Packet Loss Rate

The Maximum Packet Loss Rate (UL, DL) indicates the maximum rate for lost packets of the QoS flow that can be tolerated in the uplink (UL) and downlink (DL) direction.

The Maximum Packet Loss Rate (UL, DL) can only be provided for a GBR QoS flow belonging to voice media.

This is a QoS parameter that may optionally be supported for a 5QI indicated in this parameter.

Maximum Packet Loss Rate	
Measurement unit	NA
Allowed Values	Any desired value
Tags	Character attribute / Functional / Operational KPI

Presence	
Mandatory	
Conditional	
Optional	X

Table 47 Max Packet Loss Rate Table

Additional Information

3GPP has defined standardized 5QI to QoS characteristics mapping (see Table 5.7.4-1 of 3GPP TS 23.501 [1]). As long as these classes are used, the 5G (or the 3GPP) system is

able to support these requirements. For different combinations of QoS characteristics it needs to be checked if and how they can be supported.

The parameters of this attribute can be filled separately. However, by selecting an already specified standardized 5QI the relevant parameters might be filled automatically. For some QoS characteristics of these 5QIs default values apply as shown in Table 5.7.4-1 of 3GPP TS 23.501 [1]. Non default values can be signalled if needed. Therefore, a NEST may include non-default values to be signalled for 5QI.

3.4.27 Support for non-IP traffic

This attribute provides non-IP Session support (Ethernet session and forwarding support) of communication devices.

Note: Not including this attribute is equal to setting it to Not Supported.

Support for non-IP traffic	
Measurement unit	NA
Allowed Values	Not supported Supported
Tags	Character attribute / Functional KPI

Presence	
Mandatory	
Conditional	
Optional	X

Table 48 Non-IP traffic Support Table

Additional information

The most important case is to support packet exchange in the power deferential protection:

- Transmission between a mobile device, customer premises equipment (CPE) and UPF
- Between adjacent UPF.

Core Network (UPF) may use Ethernet session and forwarding to transmit package as customized network slice ability to fully meet the communication requirement of some vertical industries application scenarios.

There are mechanisms for DNN (data network name) described in 3GPP TS 23.501 [1].

A DNN is equivalent to an APN and both identifiers have an equivalent meaning and carry the same information.

The DNN may be used e.g. to:

- Select a Session Management Function or SMF and UPF(s) for a PDU Session.
- Select N6 interface(s) for a PDU Session.
- Determine policies to apply to this PDU Session.

Today some scenarios of industries have requirements for which protocol transport between communications devices need to support Non-IP sessions, such as, power differential protection.

End to End 5G network slicing needs to support the Ethernet session and forwarding to transmit package as customized network slice ability to fully meet the communication requirement of the power differential protection.

This attribute applies to 3GPP access type only.

3.4.28 Supported device velocity

Maximum speed supported by the network slice at which a defined QoS and seamless transfer between TRxPs (Transmission Reception Point(s)), which may belong to different deployment layers and/or radio access technologies (multi-layer /-RAT), can be achieved.

Editor's note: This attribute is FFS in 3GPP.

Examples:

- 0 km/h - Stationary
- 10 km/h - Pedestrian
- 120 km/h - Vehicular
- 500 km/h - High speed vehicular

Supported device velocity	
Measurement unit	Kilometres per hour (km/h)
Allowed Values	Any desired value
Tags	Character attribute / Performance KPI

Presence	
Mandatory	
Conditional	
Optional	X

Table 49 Device Velocity Table

Additional information

For non-low latency requirements, the expected speeds might not be a problem. More important is the support of URLLC services under high mobility scenarios.

Orchestrator may use this attribute to orchestrate the resources and network functions. If value is set to 0 km/h, it means no mobility is supported (e.g., the UE is not moving).

This attribute applies to 3GPP access type only.

3.4.29 Synchronicity

This attribute provides synchronicity of communication devices. Two cases are most important in this context:

- Synchronicity between a base station and a mobile device and
- Synchronicity between mobile devices.

Editor's note: This attribute is FFS in 3GPP.

Availability

The synchronicity between devices over PC5 in absence of the network is not in scope of this parameter.

Note: Not including this parameter is equal to setting it to Not supported.

Availability	
Measurement unit	NA
Allowed Values	Not supported Between BS and UE Between BS and UE & UE and UE
Tags	Character attribute / Functional

Presence	
Mandatory	
Conditional	
Optional	X

Table 50 Synchronicity Availability Table

Accuracy

This parameter describes the accuracy of the synchronicity.

Examples:

- $1*10^{-6}$(1µs)

Accuracy	
Measurement unit	second

Accuracy	
Allowed Values	Any desired value
Tags	Character attribute / Functional

Presence	
Mandatory	
Conditional	
Optional	X

Table 51 Synchronicity Accuracy Table

Additional Information

Today these requirements are met by the deploying cable connections/networks as like industrial Ethernet systems or fieldbuses. These networks are normally closed solutions by a single vendor in which all the equipment is perfectly aligned. Based on standards like IEEE 802.1 AS [9] or IEEE 1588 [8] very high synchronicity can be achieved in the networks.

This attribute applies to 3GPP access type only.

3.4.30 UE density

This attribute describes the maximum number of connected and/or accessible devices per unit area (per km^2) supported by the network slice.

Examples:

- 10 000 devices per km^2 - industry 4.0
- 1 000 000 devices per km^2 - MIoT

UE density	
Measurement unit	Number per km2
Allowed Values	Any desired value
Tags	Scalability attribute

Presence	
Mandatory	
Conditional	
Optional	X

Table 52 UE Density Table

Additional information

Most of the required densities can be supported with 5G. Most challenging is the MIoT use cases for which it is not sure if the required device densities can be fulfilled.

This attribute describes the maximum number of users/UEs supported per area. In case fewer users are present at moment, the network slice can be scaled down, e.g. resources can be released and for instance be used by other network slices.

This attribute applies to 3GPP access type only.

3.4.31 Uplink throughput per network slice

This attribute relates to the aggregated data rate in uplink for all UEs together in the network slice (this is not per UE).

This attribute applies to 3GPP access type only.

Guaranteed uplink throughput quota

This parameter describes the guaranteed throughput/data rate supported by the network slice for the aggregate of all GBR QoS flows in uplink belonging to the set of all UEs using the network slice.

Not including this parameter or if the value is 0, best effort traffic is expected where no minimum throughput is guaranteed. This only corresponds to the provisioned resources. (i.e. there is no expectation that this guarantee is met irrespective of the instantaneous distribution of the UEs using the network slice).

Examples:

- 0 (best effort)
- 10 000 kbps
- 1 000 000 kbps

Guaranteed uplink throughput quota	
Measurement unit	kbps
Allowed Values	Any desired value
Tags	Scalability attribute

Presence	
Mandatory	
Conditional	
Optional	X

Table 53 Guaranteed Uplink Throughput Table

Maximum uplink throughput

This parameter describes the maximum data rate supported by the network slice for all UEs together in uplink.

Note: The sum of all data rates in uplink for all UEs does not exceed this value.

Examples:

- 100 000 kbps
- 10 000 000 kbps

Maximum uplink throughput	
Measurement unit	kbps
Allowed Values	Any desired value
Tags	Scalability attribute

Presence	
Mandatory	
Conditional	
Optional	X

Table 54 Maximum Uplink Throughput Table

3.4.32 Uplink maximum throughput per UE

This attribute describes the maximum data rate supported by the network slice per UE in uplink.

The attribute is comprised of a list of Service Category parameters with the associated Maximum Uplink Throughput per UE value.

If no Service Category parameter is present, all devices in the network slice experience the same Maximum Uplink Throughput per UE value. If Service Category parameters are present, then the UEs will be associated with a specific Maximum Uplink Throughput per UE parameter value depending on which Service Category the UE is associated with for the network slice. In this case, different UEs within a network slice can experience a different maximum data rate.

Examples:

- 10 000 (Service Category 1)
- 100 000 (Service Category 2)
- 200 000 (Service Category 3)

Maximum Uplink Throughput per UE value

This parameter defines the Maximum Uplink Throughput per UE value. This may be associated with a Service Category parameter.

Maximum Uplink Throughput per UE value	
Measurement unit	kbps
Allowed Values	Any desired value
Tags	Character attribute / Functional KPI

Presence	
Mandatory	
Conditional	
Optional	X

Table 55 Maximum Uplink Throughput per UE Table

Service category

This parameter defines a service category which may be assigned to certain groups of devices using the network slice. If present, it shall be associated with a Maximum Uplink Throughput Value parameter.

Service category	
Measurement unit	NA
Allowed Values	Any text identifying the Service Category
Tags	Character attribute / Functional

Presence	
Mandatory	
Conditional	
Optional	X

Table 56 Uplink Rate Service Category Table

Additional information

Maximum throughput can be used to offer different service categories which have different maximum throughput values.

This attribute applies to 3GPP access type only, across GBR and Non-GBR QoS flows.

3.4.33 User management openness

This attribute describes the capability for the NSC to manage their users or groups of users' network services and corresponding requirements. For instance, if NSC Y orders a network slice which is capable to support X users of Y, then Y should be capable to decide which X users could use this network slice. Hence, Y could manage the users, in terms of add, modify or delete users to receive network services provided by the specific network slice.

Note: Not including this attribute is equal to setting it to Not supported.

Editor's note: This attribute is FFS in 3GPP.

User management openness	
Measurement unit	NA
Allowed Values	Not supported Supported
Tags	Character attribute / Functional / Operational API

Presence	
Mandatory	
Conditional	
Optional	X

Table 57 User Management Table

3.4.34 Data network access

For each Supported data network list value in the Supported data networks attribute (see clause 3.4.39). This attribute defines how the network slice supported data networks handle the user data.

Examples:

- Data Network access:
  - Data access per Data Network = {DataNetwork1, Termination in the private network}, {DataNetwork2, Internet}
  - Tunnelling mechanism per Data network = {DataNetwork1, L2TP}
  - LBO Allowed: {DataNetwork1, No}, {DataNetwork2, Yes}

Data access per data network

The options for a specific Supported data network are as follows:

- Direct access to the Internet
- Termination in a private network (e.g. via tunnelling mechanism such as L2TP, VPN Virtual Private Network, tunnel, etc.)
- All data traffic stays local to an operator network and the devices do not have access to the Internet or private network

Data access per data network	
Measurement unit	NA
Allowed Values	List of {[Text identification of one data network], [one of "Direct internet access" or "Termination in the private network" or "Local traffic (no internet access)"]}
Tags	Character attribute / Functional

Presence	
Mandatory	
Conditional	
Optional	X

Table 58 Data Access Table

Tunnelling mechanism

The parameter, if present, defines the tunnelling mechanism used to connect to a private data network. 3GPP TS 29.561 [12] lists the interworking with data networks and tunnelling mechanism used.

This parameter must be present if Data access per data network is set to Termination in the private network.

Note: Comma separated multiple values are allowed.

Parameters	
Measurement unit	NA
Allowed Values	List of {[Text identification of one data network], [one of "L2TP Tunnel" or "GRE Tunnel “or "VPN Tunnel" or "Label bases routing" or "Other"]}
Tags	Character attribute / Functional

Parameter Presence	
Mandatory	

Parameter Presence	
Conditional	X
Optional	

Table 59 Tunnelling Mechanism Table

LBO Allowed

The parameter, if present, defines whether a data network is available in Local Breakout whilst roaming.

Parameters	
Measurement unit	NA
Allowed Values	List of { [Text identification of one data network], [one of "Yes", “No”]}
Tags	Character attribute / Functional

Parameter Presence	
Mandatory	
Conditional	
Optional	X

Table 60 LBO allowed Table

3.4.35 V2X communication mode

This attribute describes if the V2X communication mode is supported by the network slice.

This attribute applies to 3GPP access type only.

Note: Not including this attribute is equal to setting it to Not supported.

Parameters	
Measurement unit	NA
Allowed Values	Not supported YES-EUTRA YES- NR YES -NR and E-UTRA
Tags	Character attribute / Functional

Attribute Presence	
Mandatory	
Conditional	
Optional	X

Table 61 V2X Communication Mode Table

3.4.36 Latency from (last) UPF to Application Server

This optional attribute specifies maximum or worst-case one-way latency between UPF, and application server offered by the slice. This does not include latency introduced by the application server. In the case of chained UPFs, this refers to the last UPF (in the chain) towards the application server. This attribute extends what is covered by the 3GPP QoS PDB attribute (see GST QoS attribute) which is only between UE and UPF. This is an optional attribute for network slices that offer latency objectives between UPF and application server residing within the operator network.

Examples:

- $1.5.10^{-3}$ s
- 5.10^{-3} s

Latency from UPF to Application Server	
Measurement unit	second
Allowed Values	Any desired value
Tags	Character attribute / Performance KPI

Presence	
Mandatory	
Conditional	
Optional	X

Table 62 Latency to Application Server Table

The boundary of the “application server” is defined by the application domain, which may simply be a server, or may for example be front ended by a load balancer provided by the application. For example, if the application provides its own load balancer to front-end the server, then the latency is between UPF and the load balancer; on the other hand, if the slice provider (e.g. an operator) provides the load balancer, then the latency is between UPF and the application server.

3.4.37 Network Slice Specific Authentication and Authorization (NSSAA) Required

This attribute specifies whether for the Network Slice, devices need to be also authenticated and authorized by a AAA server using additional credentials different than the ones used for the primary authentication (see Rel-16 of 3GPP TS 23.501 [1] clause 5.15.10 for a definition of the Network Slice Specific Authentication and Authorization feature).

Note: Not including this attribute is equal to setting it to Not supported.

NSSAA required	
Measurement unit	N/A
Allowed Values	Not supported Supported
Tags	Character attribute / Functional

Presence	
Mandatory	
Conditional	
Optional	X

Table 63: Network Slice-Specific Authentication and Authorization Required Table

3.4.38 Multimedia Priority Service

Multimedia Priority Service (MPS) leads to priority of traffic relative to other traffic.

Note: Not including this attribute is equal to setting it to Non-MPS.

Multimedia Priority Service	
Measurement unit	NA
Allowed Values	Non-MPS MPS
Tags	Character attribute / Functional

Presence	
Mandatory	
Conditional	
Optional	X

Table 64 Multimedia Priority Service Support Table

As specified in 3GPP TS 22.153 [31] an MPS session is a session that has priority treatment applied for allocating and maintaining radio and network resources.

Priority treatment for MPS requires an appropriate ARP and 5QI (plus 5G QoS characteristics) for QoS Flows. The default values for standardized 5QIs described in clause 3.4.26 could be overridden according to the operator policy, as defined in 3GPP TS 23.501 [1].

Multimedia Priority Service capability support

This parameter specifies what capabilities are available to support MPS. More than one capability may be supported at once. This parameter must be present if Multimedia Priority Service support is set to “MPS”.

Note: Comma separated multiple values are allowed.

Multimedia Priority Service capability support	
Measurement unit	NA
Allowed Values	User prioritization Pre-emption
Tags	Character attribute / Functional

Presence	
Mandatory	
Conditional	X
Optional	

Table 65 Multimedia Priority Service Capabilities Table

User prioritization is the admission and the scheduling of different priorities among MPS users.

Pre-emption allows for an established session to be pre-empted for admission of a higher-priority session.

Multimedia Priority Service support

This parameter specifies whether or not the network slice supports MPS for MMTel voice, MPS for MMTel video, and/or MPS for Data as specified in 3GPP TS 22.153 [31].

This parameter must be present if Multimedia Priority Service support is set to “MPS”.

Note: Comma separated multiple values are allowed.

Multimedia Priority Service support	
Measurement unit	NA
Allowed Values	MPS for MMTel voice MPS for MMTel video MPS for Data
Tags	Character attribute / Functional

Presence	
Mandatory	
Conditional	X
Optional	

Table 66 Multimedia Priority Service Table

3.4.39 Supported data network

This attribute describes the data networks the network slice provides access to. The attribute is comprised of a list of Service category parameters with the associated network or networks list.

If no Service category parameters are present, all UEs in the network slice are associated with the same network or list of networks.

Example:

{Service category = Service category 1, Supported networks list = " DataNetwork1, DataNetwork2"}
{Service category = Service category 2, Supported networks list = " DataNetwork1"}

Supported data networks list

This parameter defines which data networks the network slice provides access to. This may be associated with a Service Category parameter.

For every Supported data network, a Data network access (see clause 3.4.34) needs to be provided.

Supported data network list	
Measurement unit	NA
Allowed Values	Text identification of one data network or a list of data networks
Tags	Character attribute / Functional

Presence	
Mandatory	

Presence	
Conditional	
Optional	x

Table 67 Supported Networks Table

Service category

This parameter defines a service category which may be assigned to a UE. If present, it shall be associated with a Supported data networks list parameter.

Service category	
Measurement unit	NA
Allowed Values	Any text identifying the service category
Tags	Character attribute / Functional

Presence	
Mandatory	
Conditional	
Optional	X

Table 68 Service Category Supported Networks Table

3.4.40 Maximum number of UEs with at least one PDU session/PDN connection

This attribute, which applies for network slices where EPS interworking is supported, describes the maximum number of UEs that can use the network slice simultaneously with at least one PDU session/PDN connection as specified by the "Maximum number of UEs with at least one PDU session and PDN connection" parameter. The counting of UEs shall consider the UEs in 5GS with at least one PDU Session in the network slice, and the UEs in the EPS with at least one PDN connection in the network slice, i.e., it is required to count the UEs that have at least one PDN connection connected to an APN that is associated with the S-NSSAI of the network slice.

NOTE: A UE registered in a 5GS slice with no PDU session established is not counted in this case. In addition, this attribute is not used together with attribute “Maximum number of UEs” depicted in clause 3.4.17 in the same NEST.

Examples:

- 100 000 UEs with at least one PDU session/PDN connection
- 10 000 000 UEs with at least one PDU session/PDN connection

Maximum number of UEs with at least one PDU session/PDN connection

This parameter specifies how many UEs can simultaneously use the network slice with at least one PDU session/PDN connection.

Maximum number of UEs with at least one PDU session/PDN connection	
Measurement unit	NA
Allowed Values	Any desired value
Tags	Scalability attribute

Presence	
Mandatory	
Conditional	
Optional	X

Table 69 Number of UEs with at least one PDU session/PDN connection Table

4 NEST

Different requirements for the services to be supported result in different NESTs. This section defines NESTs that address common use cases in the industry, i.e. GSMA-defined NESTs, and, where applicable, a mapping to the standardised SST values defined in 3GPP TS 23.501[1]. The values defined here are to be assumed as "minimum requirements" for the Network Slice Type. A NSP may provide Network Slices that meet or exceed the requirements defined for a NEST in this clause.

4.1 NEST for enhanced Mobile Broadband with IMS support

Table 70 describes the NEST for enhanced Mobile Broadband (eMBB) SST defined in 3GPP TS 23.501[1], where IMS services (MMTel and RCS) are supported, along with Internet DNN. Both of these supported data networks are home routed as a baseline. To provide the seamless service continuity, SSC mode 1 must be supported.

Attribute		Value
Availability		99,999
MMTel support		Supported
Session and Service Continuity support		SSC mode 1
Data Network access	Data access per data network	{Internet DNN, Direct access to the internet}, {IMS, Local traffic (no internet access)}
Supported data network	Supported data network list	Internet DNN, IMS
Slice quality of service	3GPP 5QI	1,2,5,6,7,8,9

Table 70 List of attributes needed for NEST with IMS support

4.2 NEST for ultra-reliable and ultra-low latency communication

Table 71 describes the NEST for ultra-reliable low latency communication (URLLC) SST defined in 3GPP TS 23.501[1].

Bounded latency, ultra-reliable data delivery and ultra-low latency characterise this use case.

Attribute		Value
Availability		99.999
Session and Service Continuity Support		1
Slice quality of service	3GPP 5QI	82
Supported device velocity		2

Table 71 List of attributes needed for NEST for URLLC SST

4.3 NEST for Massive IoT

Table 72 describes the NEST for Massive IoT (MIoT) SST defined in 3GPP TS 23.501[1].

Small data volumes per UE, high density of devices, and extreme coverage characterise this use case.

Attribute		Value
Availability		99,9
Slice quality of service	3GPP 5QI	9
Supported device velocity		2
UE density		100000

Table 72 List of attributes needed for NEST for MIoT SST

4.4 NEST for High-Performance Machine-Type Communications

Table 73 lists the minimum set of attributes needed for NEST for High-Performance Machine-Type Communications (HMTC) SST defined in 3GPP Release 17 TS 23.501[1].

IoT devices that require high throughput characterise this use case.

Attribute		Value
Availability		99.999
Device Velocity		0
UE density (per km^2)		1000
Mission critical support		Mission critical
	Mission-critical capability support	Inter-user prioritization
	Mission-critical service support	MCData
Slice quality of service	3GPP 5QI	83

Table 73 List of attributes needed for HMTC

4.5 NEST for Public Safety

Table 74 describes NEST for Public Safety that supports highly complex use cases seen by police, fire, ambulance, disaster relief, customs, special forces, airborne units, sea and mountain rescue, armed forces. Yellow light units (gas, water, electric, etc.) may be considered as well in the future. These use cases require a high number of UEs with a high density together with the attributes listed below.

Editor's note: This is work in progress.

Attribute		Value
Availability		99,999
Delay tolerance		Supported
Deterministic communication	Availability	Supported
	Periodicity	2 sec
Group communication support		Broadcast/Multicast + SC-PTM
Mission critical support		Mission-critical
	Mission Critical Capability Support	Inter-user prioritization
	Mission Critical Service Support	MCPTT MCData MCVideo
MMTel support		Supported
Performance monitoring	Availability	Service Request Success Rate
	Monitoring sample frequency	Per minute
Performance Prediction	Availability	Throughput Latency Service Request Success Rate
	Prediction Frequency	Per minute
Positioning support	Availability	CIDE-CID (LTE and NR) OTDOA (LTE and NR) AECID
	Prediction frequency	Per minute
Session and Service Continuity Support		SSC mode 1
Support for Non-IP traffic		Supported
Supported device velocity		450
Synchronicity	Availability	Between BS and UE & UE and UE
User Management Openness		Supported
V2X communication mode		YES -NR and E-UTRA
Multimedia Priority Service Support		MPS

Table 74 List of attributes needed for Public Safety

4.6 NEST for enhanced Mobile Broadband with IMS and MPS support

Table 75 describes the NEST for enhanced Mobile Broadband (eMBB) SST defined in 3GPP TS 23.501[1], where IMS and MPS services are supported along with Internet DNN. This NEST is the same NEST defined in clause 4.1 where the only difference is the inclusion of

the MPS attribute in support of MPS services. This NEST is intended for operators supporting MPS (see note).

Attribute		Value
Availability		99,999
MMTel support		Supported
Session and Service Continuity support		SSC mode 1
Data Network access	Data access per data network	{Internet DNN, Direct access to the internet}, {IMS, Local traffic (no internet access)}
Supported data network	Supported data network list	Internet DNN, IMS
Slice quality of service	3GPP 5QI	1,2,5,6,7,8,9
Multimedia Priority Service		MPS
	Multimedia Priority Service capability support	User prioritization Pre-emption
	Multimedia Priority Service support	MPS for MMTel voice MPS for MMTel video MPS for Data

Table 75 List of attributes needed for an eMBB NEST with IMS and MPS support

Note: Multimedia Priority Service (MPS) is described in 3GPP TS 22.153 [31]. It is intended to be used by qualified and authorized users, i.e., emergency service personnel, only during times of emergency situations and network congestion. For example, in the USA, MPS is used for National Security Emergency Preparedness (NSEP) in accordance with FCC rules provided in Title 47 Appendix A to Part 64 - Telecommunications Service Priority (TSP) System for National Security Emergency Preparedness (NSEP).

Annex A Relation between GST and network slice NRM ServiceProfile

The GST defined by GSMA, and the service performance requirements defined in 3GPP TS 22.261 [27] and 3GPP TS 22.104 [28] are all considered as input for the network slice related requirements.

Figure 3 shows how GST attributes are used by 3GPP as inputs to network slice Network Resource Model (NRM) ServiceProfle [29] and then further translated into relevant attributes of constituted network slice subnets SliceProfile (i.e. 5GC SliceProfile and NG-RAN SliceProfile) and TN requirements, and finally, being translated into different 5G domain configuration parameters (i.e. 5GC domain and NG-RAN domain).

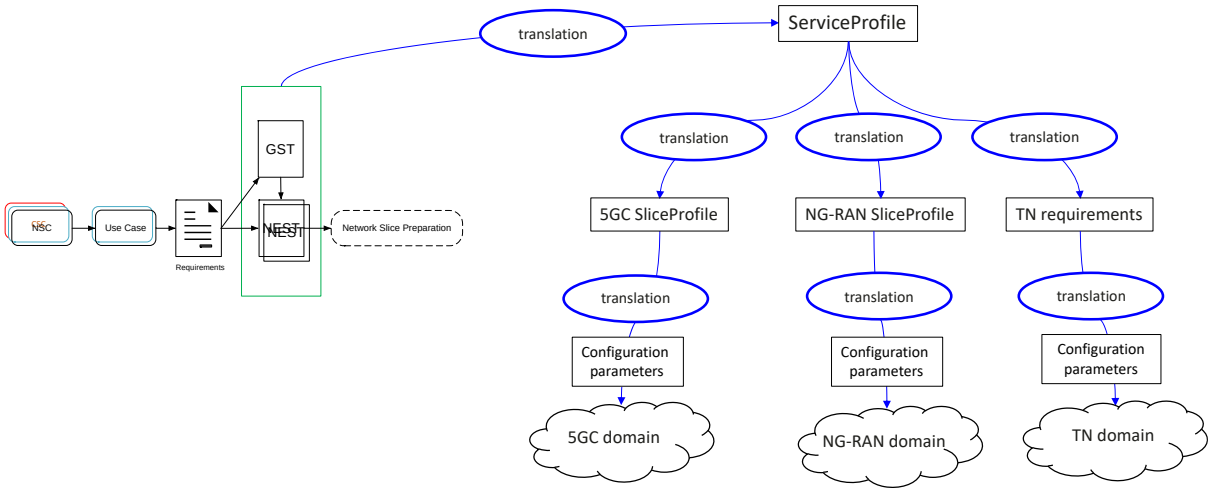

Figure 3: Relation between GST and network slice NRM ServiceProfile

Figure 4 shows 3GPP network slice information model NRM fragment relationship.

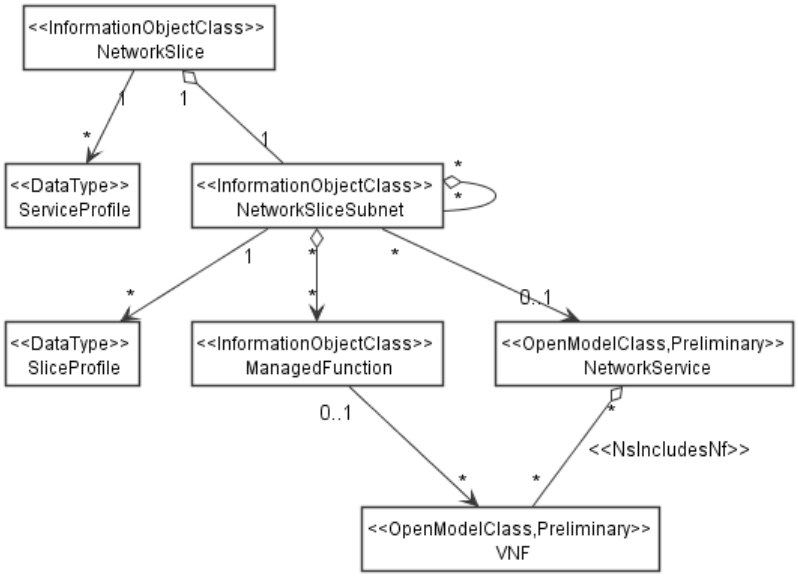

Figure 4: 3GPP network slice information model

Annex B Information: Zero-touch management of the network slice

ETSI Zero-touch network and Service Management (ZSM) group examined many business cases and their requirements in ETSI ZSM001 [33] and designed ZSM architecture framework [34] to satisfy them. Figure 5 shows the example for network slicing management.

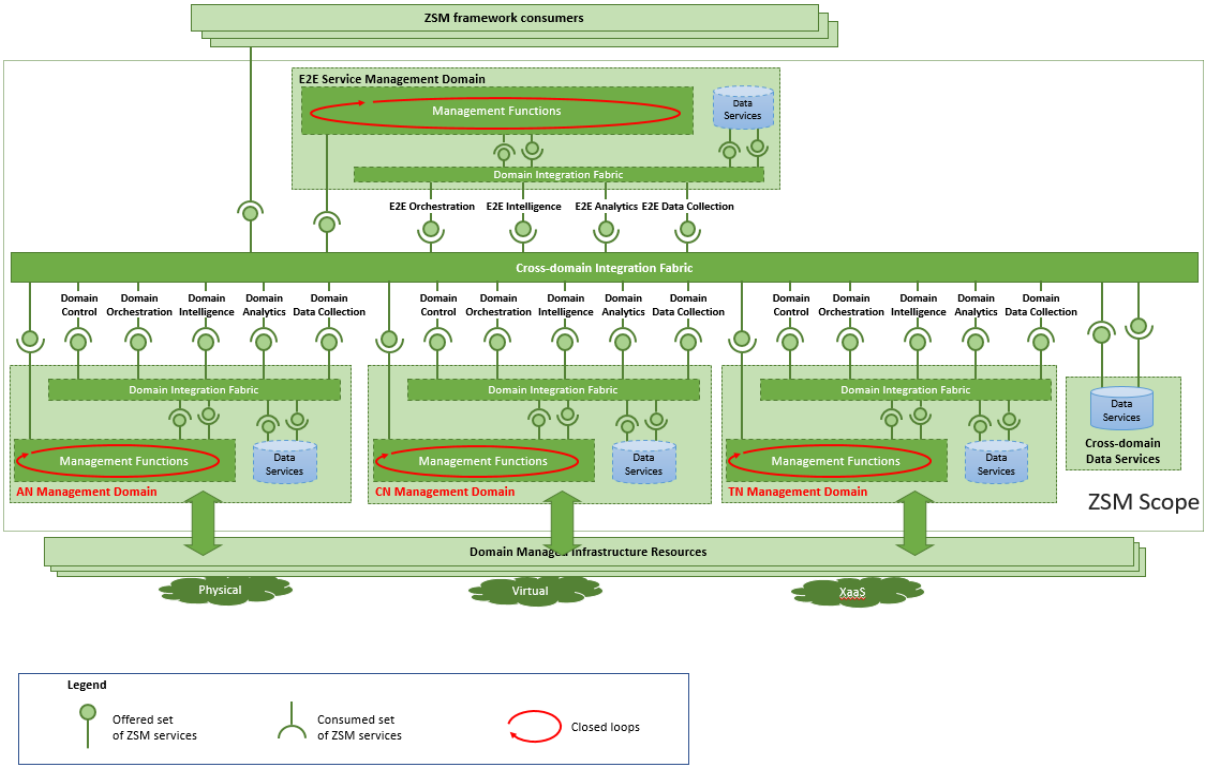

Figure 5 ZSM architecture deployment example for network slicing management [35]

ETSI ZSM003 [35] shows an example of E2E network slicing management solutions and related management interfaces in relation to the ETSI ZSM architecture, with reference to and reuse of available standards. Some attributes of the GST are translated into the 3GPP defined service profile for E2E Service Management Domain (MD) and the corresponding profiles of AN, CN and TN Management Domain (MD). Figure 6 shows the relation between GSMA GST, 3GPP NRM ServiceProfile and ETSI ZSM architecture.

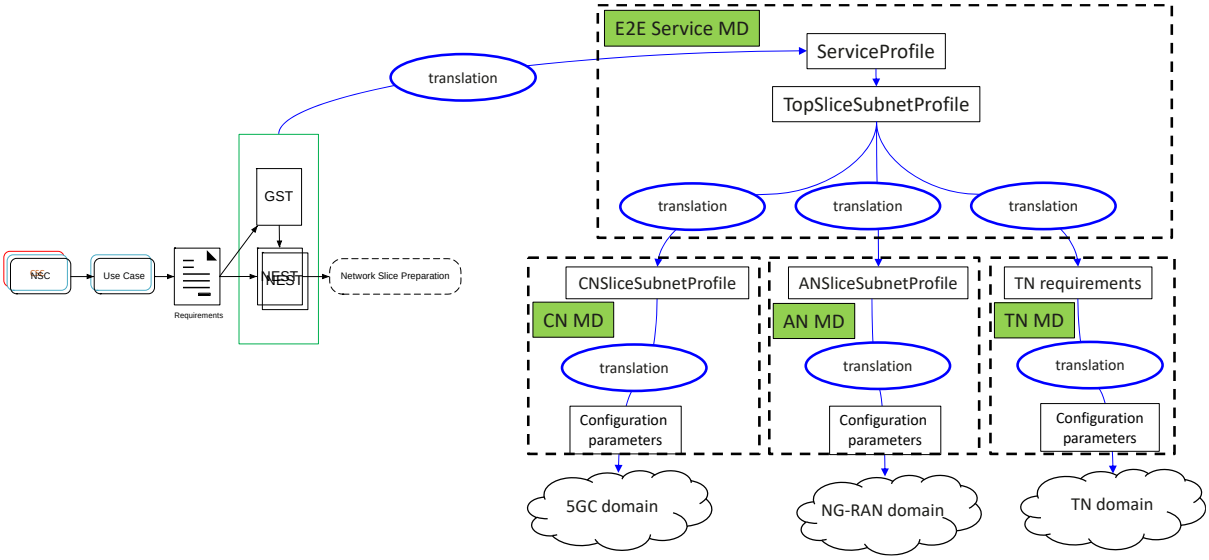

Figure 6 Relation between GST, 3GPP NRM ServiceProfile and ETSI ZSM architecture

Document Management

Document History

Version	Date	Brief Description of Change	Approval Authority	Editor / Company
1.0	11-March-2019	Final version for approval 5GJA#7, NG	5GJA#7 NG#9	Sandra Ondrusova / CK Hutchison
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3.0	21-May-2020	CR1014, CR1015, CR1016, CR1017, CR1018, CR1019, CR1020, CR1022, CR1023, CR1025, CR1026, CR1028, CR1029, CR1030, CR1031, CR1032, CR1034, CR1037, CR1039 incorporated	NG#11	Sandra Ondrusova / CK Hutchison
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