**3GPP TSG-SA WG2 Meeting #143E e-meetingS2-21XXXXX**

**Elbonia, February 24 – March 09, 2021**

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| *CR-Form-v12.0* |
| **CHANGE REQUEST** |
|  |
|  | **23.501** | **CR** | **XXXX**  | **rev** | **-** | **Current version:** | **17.x.x (temporary 16.7.0)** |  |
|  |
| *For* [***HE******LP***](http://www.3gpp.org/3G_Specs/CRs.htm#_blank)*on using this form: comprehensive instructions can be found at* [*http://www.3gpp.org/Change-Requests*](http://www.3gpp.org/Change-Requests)*.* |
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| ***Proposed change affects:*** | UICC apps |  | ME |  | Radio Access Network |  | Core Network | **X** |

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|  |
| ***Title:***  | Network Slice Quota Control Function (NSQCF) definition |
|  |  |
| ***Source to WG:*** | NEC. Apple |
| ***Source to TSG:*** | S2 |
|  |  |
| ***Work item code:*** | eNS\_Ph2 |  | ***Date:*** | 2021-01-12 |
|  |  |  |  |  |
| ***Category:*** | **B** |  | ***Release:*** | Rel-17 |
|  | *Use one of the following categories:****F*** *(correction)****A*** *(mirror corresponding to a change in an earlier release)****B*** *(addition of feature),* ***C*** *(functional modification of feature)****D*** *(editorial modification)*Detailed explanations of the above categories canbe found in 3GPP [TR 21.900](http://www.3gpp.org/ftp/Specs/html-info/21900.htm). | *Use one of the following releases:Rel-8 (Release 8)Rel-9 (Release 9)Rel-10 (Release 10)Rel-11 (Release 11)Rel-12 (Release 12)**Rel-13 (Release 13)Rel-14 (Release 14)Rel-15 (Release 15)Rel-16 (Release 16)* |
|  |  |
| ***Reason for change:*** | New eNS\_Ph2 feature addition (KI#1, KI#2) |
|  |  |
| ***Summary of change:*** |  |
|  |  |
| ***Consequences if not approved:*** |  |
|  |  |
| ***Clauses affected:*** | 3.2; 4.2.2; 4.2.3; 4.2.6; 4.2.7; 5.15.11 |
|  |  |
|  | **Y** | **N** |  |  |
| ***Other specs*** |  | **X** |  Other core specifications  | TS/TR ... CR ...  |
| ***affected:*** |  | **X** |  Test specifications | TS/TR ... CR ...  |
| ***(show related CRs)*** |  | **X** |  O&M Specifications | TS/TR ... CR ...  |
|  |  |
| ***Other comments:*** |  |
|  |  |
| ***This CR's revision history:*** |  |

**\* \* \* \* Start of the 1st change \* \* \* \***

## 3.2 Abbreviations

For the purposes of the present document, the abbreviations given in TR 21.905 [1] and the following apply. An abbreviation defined in the present document takes precedence over the definition of the same abbreviation, if any, in TR 21.905 [1].

5GC 5G Core Network

5G-VN 5G Local Area Network

5GS 5G System

5G-AN 5G Access Network

5G-AN PDB 5G Access Network Packet Delay Budget

5G-EIR 5G-Equipment Identity Register

5G-GUTI 5G Globally Unique Temporary Identifier

5G-BRG 5G Broadband Residential Gateway

5G-CRG 5G Cable Residential Gateway

5G GM 5G Grand Master

5G-RG 5G Residential Gateway

5G-S-TMSI 5G S-Temporary Mobile Subscription Identifier

5G VN 5G Virtual Network

5QI 5G QoS Identifier

AF Application Function

AMF Access and Mobility Management Function

AS Access Stratum

ATSSS Access Traffic Steering, Switching, Splitting

ATSSS-LL ATSSS Low-Layer

AUSF Authentication Server Function

BMCA Best Master Clock Algorithm

BSF Binding Support Function

CAG Closed Access Group

CAPIF Common API Framework for 3GPP northbound APIs

CHF Charging Function

CN PDB Core Network Packet Delay Budget

CP Control Plane

DAPS Dual Active Protocol Stacks

DL Downlink

DN Data Network

DNAI DN Access Identifier

DNN Data Network Name

DRX Discontinuous Reception

DS-TT Device-side TSN translator

ePDG evolved Packet Data Gateway

EBI EPS Bearer Identity

EUI Extended Unique Identifier

FAR Forwarding Action Rule

FN-BRG Fixed Network Broadband RG

FN-CRG Fixed Network Cable RG

FN-RG Fixed Network RG

FQDN Fully Qualified Domain Name

GFBR Guaranteed Flow Bit Rate

GMLC Gateway Mobile Location Centre

GPSI Generic Public Subscription Identifier

GUAMI Globally Unique AMF Identifier

HR Home Routed (roaming)

IAB Integrated access and backhaul

IMEI/TAC IMEI Type Allocation Code

IPUPS Inter PLMN UP Security

I-SMF Intermediate SMF

I-UPF Intermediate UPF

LADN Local Area Data Network

LBO Local Break Out (roaming)

LMF Location Management Function

LoA Level of Automation

LPP LTE Positioning Protocol

LRF Location Retrieval Function

MCX Mission Critical Service

MDBV Maximum Data Burst Volume

MFBR Maximum Flow Bit Rate

MICO Mobile Initiated Connection Only

MPS Multimedia Priority Service

MPTCP Multi-Path TCP Protocol

N3IWF Non-3GPP InterWorking Function

N5CW Non-5G-Capable over WLAN

NAI Network Access Identifier

NEF Network Exposure Function

NF Network Function

NGAP Next Generation Application Protocol

NID Network identifier

NPN Non-Public Network

NR New Radio

NRF Network Repository Function

NSQCF Network Slice Quota Control Function

NSI ID Network Slice Instance Identifier

NSSAA Network Slice-Specific Authentication and Authorization

NSSAAF Network Slice-Specific Authentication and Authorization Function

NSSAI Network Slice Selection Assistance Information

NSSF Network Slice Selection Function

NSSP Network Slice Selection Policy

NW-TT Network-side TSN translator

NWDAF Network Data Analytics Function

PCF Policy Control Function

PDB Packet Delay Budget

PDR Packet Detection Rule

PDU Protocol Data Unit

PEI Permanent Equipment Identifier

PER Packet Error Rate

PFD Packet Flow Description

PNI-NPN Public Network Integrated Non-Public Network

PPD Paging Policy Differentiation

PPF Paging Proceed Flag

PPI Paging Policy Indicator

PSA PDU Session Anchor

PTP Precision Time Protocol

QFI QoS Flow Identifier

QoE Quality of Experience

RACS Radio Capabilities Signalling optimisation

(R)AN (Radio) Access Network

RG Residential Gateway

RIM Remote Interference Management

RQA Reflective QoS Attribute

RQI Reflective QoS Indication

RSN Redundancy Sequence Number

SA NR Standalone New Radio

SBA Service Based Architecture

SBI Service Based Interface

SCP Service Communication Proxy

SD Slice Differentiator

SEAF Security Anchor Functionality

SEPP Security Edge Protection Proxy

SMF Session Management Function

SMSF Short Message Service Function

SN Sequence Number

SNPN Stand-alone Non-Public Network

S-NSSAI Single Network Slice Selection Assistance Information

SSC Session and Service Continuity

SSCMSP Session and Service Continuity Mode Selection Policy

SST Slice/Service Type

SUCI Subscription Concealed Identifier

SUPI Subscription Permanent Identifier

SV Software Version

TNAN Trusted Non-3GPP Access Network

TNAP Trusted Non-3GPP Access Point

TNGF Trusted Non-3GPP Gateway Function

TNL Transport Network Layer

TNLA Transport Network Layer Association

TSC Time Sensitive Communication

TSCAI TSC Assistance Information

TSN Time Sensitive Networking

TSN GM TSN Grand Master

TSP Traffic Steering Policy

TT TSN Translator

TWIF Trusted WLAN Interworking Function

UCMF UE radio Capability Management Function

UDM Unified Data Management

UDR Unified Data Repository

UDSF Unstructured Data Storage Function

UL Uplink

UL CL Uplink Classifier

UPF User Plane Function

URLLC Ultra Reliable Low Latency Communication

URRP-AMF UE Reachability Request Parameter for AMF

URSP UE Route Selection Policy

VID VLAN Identifier

VLAN Virtual Local Area Network

W-5GAN Wireline 5G Access Network

W-5GBAN Wireline BBF Access Network

W-5GCAN Wireline 5G Cable Access Network

W-AGF Wireline Access Gateway Function

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**\* \* \* \* Start of the 2nd change \* \* \* \***

### 4.2.2 Network Functions and entities

The 5G System architecture consists of the following network functions (NF).

- Authentication Server Function (AUSF).

- Access and Mobility Management Function (AMF).

- Data Network (DN), e.g. operator services, Internet access or 3rd party services.

- Unstructured Data Storage Function (UDSF).

- Network Exposure Function (NEF).

- Network Repository Function (NRF).

- Network Slice Quota Control Function (NSQCF).

- Network Slice Specific Authentication and Authorization Function (NSSAAF).

- Network Slice Selection Function (NSSF).

- Policy Control Function (PCF).

- Session Management Function (SMF).

- Unified Data Management (UDM).

- Unified Data Repository (UDR).

- User Plane Function (UPF).

- UE radio Capability Management Function (UCMF).

- Application Function (AF).

- User Equipment (UE).

- (Radio) Access Network ((R)AN).

- 5G-Equipment Identity Register (5G-EIR).

- Network Data Analytics Function (NWDAF).

- CHarging Function (CHF).

NOTE: The functional description on architecture and principles of the CHF is specified in TS 32.240 [41].

The 5G System architecture also comprises the following network entities:

- Service Communication Proxy (SCP).

- Security Edge Protection Proxy (SEPP).

The functional descriptions of these Network Functions and entities are specified in clause 6.

- Non-3GPP InterWorking Function (N3IWF).

- Trusted Non-3GPP Gateway Function (TNGF).

- Wireline Access Gateway Function (W-AGF).

- Trusted WLAN Interworking Function (TWIF).

**\* \* \* \* End of the 2nd change \* \* \* \***

**\* \* \* \* Start of the 3rdh change \* \* \* \***

### 4.2.3 Non-roaming reference architecture

Figure 4.2.3-1 depicts the non-roaming reference architecture. Service-based interfaces are used within the Control Plane.



Figure 4.2.3-1: 5G System architecture

NOTE: If an SCP is deployed it can be used for indirect communication between NFs and NF services as described in Annex E. SCP does not expose services itself.

Figure 4.2.3-2 depicts the 5G System architecture in the non-roaming case, using the reference point representation showing how various network functions interact with each other.



NOTE 1: N9, N14 are not shown in all other figures however they may also be applicable for other scenarios.

NOTE 2: For the sake of clarity of the point-to-point diagrams, the UDSF, NEF and NRF have not been depicted. However, all depicted Network Functions can interact with the UDSF, UDR, NEF and NRF as necessary.

NOTE 3: The UDM uses subscription data and authentication data and the PCF uses policy data that may be stored in UDR (refer to clause 4.2.5).

NOTE 4: For clarity, the UDR and its connections with other NFs, e.g. PCF, are not depicted in the point-to-point and service-based architecture diagrams. For more information on data storage architectures refer to clause 4.2.5.

NOTE 5: For clarity, the NWDAF and its connections with other NFs, e.g. PCF, are not depicted in the point-to-point and service-based architecture diagrams. For more information on network data analytics architecture refer to TS 23.288 [86].

Figure 4.2.3-2: Non-Roaming 5G System Architecture in reference point representation

Figure 4.2.3-3 depicts the non-roaming architecture for UEs concurrently accessing two (e.g. local and central) data networks using multiple PDU Sessions, using the reference point representation. This figure shows the architecture for multiple PDU Sessions where two SMFs are selected for the two different PDU Sessions. However, each SMF may also have the capability to control both a local and a central UPF within a PDU Session.



Figure 4.2.3-3: Applying non-roaming 5G System architecture for multiple PDU Session in reference point representation

Figure 4.2.3-4 depicts the non-roaming architecture in the case of concurrent access to two (e.g. local and central) data networks is provided within a single PDU Session, using the reference point representation.



Figure 4.2.3-4: Applying non-roaming 5G System architecture for concurrent access to two (e.g. local and central) data networks (single PDU Session option) in reference point representation

Figure 4.2.3-5 depicts the non-roaming architecture for Network Exposure Function, using reference point representation.



Figure 4.2.3-5: Non-roaming architecture for Network Exposure Function in reference point representation

NOTE 1: In figure 4.2.3-5, Trust domain for NEF is same as Trust domain for SCEF as defined in TS 23.682 [36].

NOTE 2: In figure 4.2.3-5, 3GPP Interface represents southbound interfaces between NEF and 5GC Network Functions e.g. N29 interface between NEF and SMF, N30 interface between NEF and PCF, etc. All southbound interfaces from NEF are not shown for the sake of simplicity.

**\* \* \* \* End of the 3rd change \* \* \* \***

**\* \* \* \* Start of the 4th change \* \* \* \***

### 4.2.6 Service-based interfaces

The 5G System Architecture contains the following service-based interfaces:

**Namf:** Service-based interface exhibited by AMF.

**Nsmf:** Service-based interface exhibited by SMF.

**Nnef:** Service-based interface exhibited by NEF.

**Npcf:** Service-based interface exhibited by PCF.

**Nudm:** Service-based interface exhibited by UDM.

**Naf:** Service-based interface exhibited by AF.

**Nnrf:** Service-based interface exhibited by NRF.

**Nnsqcf** Service-based interface exhibited by NSQCF.

**Nnssaaf:** Service-based interface exhibited by NSSAAF.

**Nnssf**: Service-based interface exhibited by NSSF.

**Nausf:** Service-based interface exhibited by AUSF.

**Nudr:** Service-based interface exhibited by UDR.

**Nudsf:** Service-based interface exhibited by UDSF.

**N5g-eir:** Service-based interface exhibited by 5G-EIR.

**Nnwdaf:** Service-based interface exhibited by NWDAF.

**Nchf:** Service-based interface exhibited by CHF.

**Nucmf:** Service-based interface exhibited by UCMF.

NOTE: The Service-based interface exhibited by CHF is defined in TS 32.290 [67].

**\* \* \* \* End of the 4th change \* \* \* \***

**\* \* \* \* Start of the 5th change \* \* \* \***

### 4.2.7 Reference points

The 5G System Architecture contains the following reference points:

**N1:** Reference point between the UE and the AMF.

**N2:** Reference point between the (R)AN and the AMF.

**N3:** Reference point between the (R)AN and the UPF.

**N4:** Reference point between the SMF and the UPF.

**N6:** Reference point between the UPF and a Data Network.

NOTE 1: The traffic forwarding details of N6 between a UPF acting as an uplink classifier and a local data network are not specified in this Release of the specification.

**N9:** Reference point between two UPFs.

The following reference points show the interactions that exist between the NF services in the NFs. These reference points are realized by corresponding NF service-based interfaces and by specifying the identified consumer and producer NF service as well as their interaction in order to realize a particular system procedure.

**N5:** Reference point between the PCF and an AF.

**N7:** Reference point between the SMF and the PCF.

**N8:** Reference point between the UDM and the AMF.

**N10:** Reference point between the UDM and the SMF.

**N11:** Reference point between the AMF and the SMF.

**N12:** Reference point between AMF and AUSF.

**N13:** Reference point between the UDM and Authentication Server function the AUSF.

**N14:** Reference point between two AMFs.

**N15:** Reference point between the PCF and the AMF in the case of non-roaming scenario, PCF in the visited network and AMF in the case of roaming scenario.

**N16:** Reference point between two SMFs, (in roaming case between SMF in the visited network and the SMF in the home network).

**N16a:** Reference point between SMF and I-SMF.

**N17:** Reference point between AMF and 5G-EIR.

**N18:** Reference point between any NF and UDSF.

**N19:** Reference point between two PSA UPFs for 5G LAN-type service.

**N22:** Reference point between AMF and NSSF.

**N23:** Reference point between PCF and NWDAF.

**N24:** Reference point between the PCF in the visited network and the PCF in the home network.

**N27:** Reference point between NRF in the visited network and the NRF in the home network.

**N28:** Reference point between PCF and CHF.

**N29:** Reference point between NEF and SMF.

**N30:** Reference point between PCF and NEF.

NOTE 2: The functionality of N28 and N29 and N30 reference points are defined in TS 23.503 [45].

**N31:** Reference point between the NSSF in the visited network and the NSSF in the home network.

NOTE 3: in some cases, a couple of NFs may need to be associated with each other to serve a UE.

In addition to the reference points above, there are interfaces/reference point(s) between SMF and the CHF. The reference point(s) are not depicted in the architecture illustrations in this specification.

NOTE 4: The functionality of these interface/reference points are defined in TS 32.255 [68].

**N32:** Reference point between SEPP in the visited network and the SEPP in the home network.

NOTE 5: The functionality of N32 reference point is defined in TS 33.501 [29].

**N33:** Reference point between NEF and AF.

**N34:** Reference point between NSSF and NWDAF.

**N35:** Reference point between UDM and UDR.

**N36:** Reference point between PCF and UDR.

**N37:** Reference point between NEF and UDR.

**N38:** Reference point between I-SMFs.

**N40:** Reference point between SMF and the CHF.

NOTE 6: The reference points from N40 up to and including N49 are reserved for allocation and definition in TS 23.503 [45].

**N50:** Reference point between AMF and the CBCF.

**N51:** Reference point between AMF and NEF.

**N52:** Reference point between NEF and UDM.

**N55:** Reference point between AMF and the UCMF.

**N56:** Reference point between NEF and the UCMF.

**N57:** Reference point between AF and the UCMF.

**N41:** Reference point between AMF and the CHF in HPLMN.

**N42:** Reference point between AMF and the CHF in VPLMN.

NOTE 7: The Public Warning System functionality of N50 reference point is defined in TS 23.041 [46].

**N58:** Reference point between AMF and the NSSAAF.

**N59:** Reference point between UDM and the NSSAAF.

**N60:** Reference point between AMF and NSQCF.

**N61:** Reference point between SMF and NSQCF

The reference points to support SMS over NAS are listed in clause 4.4.2.2.

The reference points to support Location Services are listed in TS 23.273 [87].

The reference points to support SBA in IMS (N5, N70 and N71) are described in TS 23.228 [15].

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**\* \* \* \* Start of the 6th change \* \* \* \***

### 5.15.11 Network Slice Quota Control Function

The Network Slice Quota Control Function (NSQCF) controls the SLA agreed network slice quotas – the max number of registered UEs per network slice quota and the max number of PDU sessions per network slice per UE quota.

#### 5.15.11.1 Max number of registered UEs per network slice quota control

The NSQCF controls the number the UEs registered with a network slice so that it does not exceed the max number of registered UEs per network slice quota. The NSQCF function has the following responsibilities:

1. Number of registered UEs per network slice quota availability check – The AMF triggers request to NSQCF for quota availability check at the beginning of the UE registration procedure (i.e. after successful authentication and authorisation of the UE). The AMF checks with the NSQCF the network slice availability for each network slice that the UE requires registration for. The AMF passes to the NSQCF the network slices for which the UE requires registration. The NSQCF checks the network slice quota availability for each of the requested network slices and the registration is not allowed for the network slices for which the max number of registered UEs per network slice quota has been reached;
2. Number of registered UEs per network slice quota update – The NSQCF holds the number of UEs registered with a network slice and updates it each time the number of UEs registered per network slice changes. The AMF triggers a request for quota update:
* at the end of the UE registration procedure the AMF passes to the NSQCF the UE Identity and the S-NSSAI(s) for which the UE requires registration. The NSQCF uses the UE Identity to check whether the UE is already in the list of UEs registered with that network slice. If not, the NSQCF adds the UE Identity in the list of the UEs registered with that network slice and the NSQCF also increases the number of UEs registered with that network slice (i.e. decreases the available quota);
* at the end of the UE deregistration procedure. The AMF passes to the NSQCF the UE Identity and the S-NSSAI(s) for which the UE is currently registered for. The NSQCF removes the UE Identity from the list of the registered UEs for each network slice the UE is registered for and the NSQCF also decreases the number of UEs registered with that network slice (i.e. increases the available quota);
* each time a network slice changes its registration status (e.g. due to network trigered authentication or subscription change).

#### 5.15.11.2 Max number of PDU sessions per network slice per UE quota control

[work pending]

**\* \* \* \* End of the 6th change \* \* \* \***