**3GPP TSG-SA2 Meeting #130 *S2-1900429***

**Kochi, India, 21st Jan 2019 - 25th Jan 2019**

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| *CR-Form-v11.4* | | | | | | | | |
| **CHANGE REQUEST** | | | | | | | | |
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|  | **23.501** | **CR** | **0836** | **rev** | **-** | **Current version:** | **15.4.0** |  |
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| *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 | **X** | Radio Access Network | **X** | Core Network | **X** |

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| ***Title:*** | TS 23.501: NPN support for PLMN services via N3IWF | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Source to WG:*** | Qualcomm Incorporated | | | | | | | | | |
| ***Source to TSG:*** | SA2 | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Work item code:*** | Vertical\_LAN | | | | |  | ***Date:*** | | | 2019-01-07 |
|  |  | | | |  | |  | | |  |
| ***Category:*** | **B** |  | | | | | ***Release:*** | | | Rel-16 |
|  | *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 can be 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:*** | | FS\_Vertical\_LAN study has concluded to introduce support for non-public networks, including support for access to PLMN services via N3IWF:   * access to subscribed PLMN services via a non-public network * access to selected non-public network services via a PLMN | | | | | | | | |
|  | |  | | | | | | | | |
| ***Summary of change:*** | | Enables the use of N3IWF for NPN RAN in addition to untrusted non-3GPP access. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Consequences if not approved:*** | | No support for use of N3IWF. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Clauses affected:*** | | 3.1, 3.2, 6.2.9, 6.3.6.1, 8.2.1, 8.2.4, 8.3.2 | | | | | | | | |
|  | |  | | | | | | | | |
|  | | **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:*** | |  | | | | | | | | |

## FIRST CHANGE

# 3 Definitions and abbreviations

## 3.1 Definitions

For the purposes of the present document, the terms and definitions given in TR 21.905 [1] and the following apply. A term defined in the present document takes precedence over the definition of the same term, if any, in TR 21.905 [1].

**5G Access Network:** An access network comprising a NG-RAN and/or non-3GPP AN connecting to a 5G Core Network.

**5G Core Network:** The core network specified in the present document. It connects to a 5G Access Network.

**5G QoS Flow:** The finest granularity for QoS forwarding treatment in the 5G System. All traffic mapped to the same 5G QoS Flow receive the same forwarding treatment (e.g. scheduling policy, queue management policy, rate shaping policy, RLC configuration, etc.). Providing different QoS forwarding treatment requires separate 5G QoS Flow.

**5G QoS Identifier:** A scalar that is used as a reference to a specific QoS forwarding behaviour (e.g. packet loss rate, packet delay budget) to be provided to a 5G QoS Flow. This may be implemented in the access network by the 5QI referencing node specific parameters that control the QoS forwarding treatment (e.g. scheduling weights, admission thresholds, queue management thresholds, link layer protocol configuration, etc.).

**5G System:** 3GPP system consisting of 5G Access Network (AN), 5G Core Network and UE.

**Allowed NSSAI**: NSSAI provided by the Serving PLMN during e.g. a Registration procedure, indicating the S-NSSAIs values the UE could use in the Serving PLMN for the current registration area.

**Allowed Area:** Area where the UE is allowed to initiate communication as specified in clause 5.3.2.3.

**AMF Region:** An AMF Region consists of one or multiple AMF Sets.

**AMF Set:** An AMF Set consists of some AMFs that serve a given area and Network Slice(s). AMF Set is unique within an AMF Region and it comprises of AMFs that support the same Network Slice(s). Multiple AMF Sets may be defined per AMF Region.

**Application identifier:** An identifier that can be mapped to a specific application traffic detection rule.

**AUSF Group ID:** This refers to one or more AUSF instances managing a specific set of SUPIs.

**Configured NSSAI:** NSSAI provisioned in the UE applicable to one or more PLMNs.

**DN Access Identifier (DNAI):** Identifier of a user plane access to one or more DN(s) where applications are deployed.

**Emergency Registered:** A UE is considered Emergency Registered over an Access Type in a PLMN when in limited service state and registered for emergency services only over this Access Type in this PLMN.

**Endpoint Address:** An address used by a NF service consumer to access the NF service (i.e. to invoke service operations) provided by a NF service provider. An Endpoint Address is represented in the syntax of Uniform Resource Identifier (e.g. part of Resource URI of the NF service API).

**Expected UE Behaviour:** Set of parameters provisioned by an external party to 5G network functions on the foreseen or expected UE behaviour, see clause 5.20.

**Forbidden Area:** An area where the UE is not allowed to initiate communication as specified in clause 5.3.2.3.

**GBR QoS Flow:** A QoS Flow using the GBR resource type or the Delay-critical GBR resource type and requiring guaranteed flow bit rate.

**Initial Registration:** UE registration in RM-DEREGISTERED state as specified in clause 5.3.2.

**Local Area Data Network:** a DN that is accessible by the UE only in specific locations, that provides connectivity to a specific DNN, and whose availability is provided to the UE.

**Local Break Out (LBO):** Roaming scenario for a PDU Session where the PDU Session Anchor and its controlling SMF are located in the serving PLMN (VPLMN).

**Mobility Pattern:** Network concept of determining within the AMF the UE mobility parameters as specified in clause 5.3.2.4.

**Mobility Registration Update:** UE re-registration when entering new TA outside the TAI List as specified in clause 5.3.2.

**MPS-subscribed UE:** A UE having a USIM with MPS subscription.

**NGAP UE association:** The logical per UE association between a 5G-AN node and an AMF.

**NGAP UE-TNLA-binding:** The binding between a NGAP UE association and a specific TNL association for a given UE.

**Network Function:** A 3GPP adopted or 3GPP defined processing function in a network, which has defined functional behaviour and 3GPP defined interfaces.

NOTE 2: A network function can be implemented either as a network element on a dedicated hardware, as a software instance running on a dedicated hardware, or as a virtualised function instantiated on an appropriate platform, e.g. on a cloud infrastructure.

**Network Instance**: Information identifying a domain. Used by the UPF for traffic detection and routing.

**Network Slice:** A logical network that provides specific network capabilities and network characteristics.

**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.

**Non-GBR QoS Flow:** A QoS Flow using the Non-GBR resource type and not requiring guaranteed flow bit rate.

**NSI ID:** an identifier for a Network Slice instance.

**NF instance:** an identifiable instance of the NF.

**NF service:** a functionality exposed by a NF through a service based interface and consumed by other authorized NFs.

**NF service instance:** an identifiable instance of the NF service.

**NF service operation:** An elementary unit a NF service is composed of.

**NG-RAN:** A radio access network that supports one or more of the following options with the common characteristics that it connects to 5GC:

1) Standalone New Radio.

2) New Radio is the anchor with E-UTRA extensions.

3) Standalone E-UTRA.

4) E-UTRA is the anchor with New Radio extensions.

**Non-Allowed area:** Area where the UE is allowed to initiate Registration procedure but no other communication as specified in clause 5.3.2.3.

**Non-Public Network:** The definition in TS 22.261 [2] applies.

**Non-Public Network RAN:** an NG-RAN deployed by a Non-Public Network.

**Non-Seamless Non-3GPP offload:** The offload of user plane traffic via non-3GPP access without traversing either N3IWF or UPF.

**PDU Connectivity Service:** A service that provides exchange of PDUs between a UE and a Data Network.

**PDU Session:** Association between the UE and a Data Network that provides a PDU connectivity service.

**PDU Session Type:** The type of PDU Session which can be IPv4, IPv6, IPv4v6, Ethernet or Unstructured.

**Periodic Registration Update:** UE re-registration at expiry of periodic registration timer as specified in clause 5.3.2.

**(Radio) Access Network**: See 5G Access Network.

**Requested NSSAI:** NSSAI provided by the UE to the Serving PLMN during registration.

**Routing Indicator:** Indicator that allows together with SUCI/SUPI Home Network Identifier to route network signalling to AUSF and UDM instances capable to serve the subscriber.

**Service based interface:** It represents how a set of services is provided/exposed by a given NF.

**Service Continuity:** The uninterrupted user experience of a service, including the cases where the IP address and/or anchoring point change.

**Service Data Flow Filter:** A set of packet flow header parameter values/ranges used to identify one or more of the packet (IP or Ethernet) flows constituting a Service Data Flow.

**Service Data Flow Template:** The set of Service Data Flow filters in a policy rule or an application identifier in a policy rule referring to an application detection filter, required for defining a Service Data Flow.

**Session Continuity:** The continuity of a PDU Session. For PDU Session of IPv4 or IPv6 or IPv4v6 type "session continuity" implies that the IP address is preserved for the lifetime of the PDU Session.

**Subscribed S-NSSAI**: S-NSSAI based on subscriber information, which a UE is subscribed to use in a PLMN

**UDM Group ID:** This refers to one or more UDM instances managing a specific set of SUPIs.

**UDR Group ID:** This refers to one or more UDR instances managing a specific set of SUPIs.

**UPF Service Area**: The area within which PDU Session associated with the UPF can be served by (R)AN nodes via a N3 interface between the (R)AN and the UPF without need to add a new UPF in between or to remove/re-allocate the UPF.

**Uplink Classifier:** UPF functionality that aims at diverting Uplink traffic, based on filter rules provided by SMF, towards Data Network.

## NEXT 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

5GS 5G System

5G-AN 5G Access Network

5G-EIR 5G-Equipment Identity Register

5G-GUTI 5G Globally Unique Temporary Identifier

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

5QI 5G QoS Identifier

AF Application Function

AMF Access and Mobility Management Function

AS Access Stratum

AUSF Authentication Server Function

BSF Binding Support Function

CAPIF Common API Framework for 3GPP northbound APIs

CP Control Plane

DL Downlink

DN Data Network

DNAI DN Access Identifier

DNN Data Network Name

DRX Discontinuous Reception

ePDG evolved Packet Data Gateway

EBI EPS Bearer Identity

FAR Forwarding Action Rule

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)

LADN Local Area Data Network

LBO Local Break Out (roaming)

LMF Location Management Function

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

N3IWF Non-3GPP InterWorking Function

NAI Network Access Identifier

NEF Network Exposure Function

NF Network Function

NGAP Next Generation Application Protocol

NPN Non-Public Network

NPN-RAN Non-Public Network RAN

NR New Radio

NRF Network Repository Function

NSI ID Network Slice Instance Identifier

NSSAI Network Slice Selection Assistance Information

NSSF Network Slice Selection Function

NSSP Network Slice Selection Policy

NWDAF Network Data Analytics Function

PCF Policy Control Function

PDR Packet Detection Rule

PEI Permanent Equipment Identifier

PER Packet Error Rate

PFD Packet Flow Description

PPD Paging Policy Differentiation

PPF Paging Proceed Flag

PPI Paging Policy Indicator

PSA PDU Session Anchor

QFI QoS Flow Identifier

QoE Quality of Experience

(R)AN (Radio) Access Network

RQA Reflective QoS Attribute

RQI Reflective QoS Indication

SA NR Standalone New Radio

SBA Service Based Architecture

SBI Service Based Interface

SD Slice Differentiator

SEAF Security Anchor Functionality

SEPP Security Edge Protection Proxy

SMF Session Management Function

SMSF Short Message Service Function

SN Sequence Number

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

TNL Transport Network Layer

TNLA Transport Network Layer Association

TSP Traffic Steering Policy

UDM Unified Data Management

UDR Unified Data Repository

UDSF Unstructured Data Storage Function

UL Uplink

UL CL Uplink Classifier

UPF User Plane Function

URRP-AMF UE Reachability Request Parameter for AMF

URSP UE Route Selection Policy

VID VLAN Identifier

VLAN Virtual Local Area Network

## NEXT CHANGE

### 6.2.9 N3IWF

The functionality of N3IWF in the case of untrusted non-3GPP access and NPN-RAN includes the following:

- Support of IPsec tunnel establishment with the UE: The N3IWF terminates the IKEv2/IPsec protocols with the UE over NWu and relays over N2 the information needed to authenticate the UE and authorize its access to the 5G Core Network.

- Termination of N2 and N3 interfaces to 5G Core Network for control - plane and user-plane respectively.

- Relaying uplink and downlink control-plane NAS (N1) signalling between the UE and AMF.

- Handling of N2 signalling from SMF (relayed by AMF) related to PDU Sessions and QoS.

- Establishment of IPsec Security Association (IPsec SA) to support PDU Session traffic.

- Relaying uplink and downlink user-plane packets between the UE and UPF. This involves:

- De-capsulation/ encapsulation of packets for IPSec and N3 tunnelling

- Enforcing QoS corresponding to N3 packet marking, taking into account QoS requirements associated to such marking received over N2

- N3 user-plane packet marking in the uplink.

- Local mobility anchor within untrusted non-3GPP access networks using MOBIKE per IETF RFC 4555 [57].

- Supporting AMF selection.

## NEXT CHANGE

### 6.3.6 N3IWF selection

#### 6.3.6.1 General

When the UE supports connectivity with N3IWF but does not support connectivity with ePDG, as specified in TS 23.402 [43], the UE shall perform the procedure in clause 6.3.6.2 for selecting an N3IWF.

When the UE supports connectivity with N3IWF, as well as with ePDG, as specified in TS 23.402 [43], the UE shall perform the procedure in clause 6.3.6.3 for selecting either an N3IWF or an ePDG, i.e. for selecting a non-3GPP access node.

In both cases above the UE can be configured by the HPLMN with the same information that includes:

1) ePDG identifier configuration: It contains the FQDN or IP address of the ePDG in the HPLMN, as specified in TS 23.402 [43], clause 4.5.4.3. This is used only when the UE supports connectivity with ePDG and attempts to select an ePDG. It is ignored in all other cases.

2) N3IWF identifier configuration: It contains the FQDN or IP address of the N3IWF in the HPLMN.

3) Non-3GPP access node selection information: It contains a prioritized list of PLMNs and for each PLMN it includes (i) a "Preference" parameter which indicates if ePDG or N3IWF is preferred in this PLMN and (ii) an FQDN parameter which indicates if the Tracking/Location Area Identity FQDN or the Operator Identifier FQDN (as specified in TS 23.402 [43], clause 4.5.4.4) should be used when discovering the address of an ePDG or N3IWF in this PLMN. The list of PLMNs shall include the HPLMN and shall include an "any PLMN" entry, which matches any PLMN the UE is connected to except the HPLMN.

The ePDG identifier configuration and the N3IWF identifier configuration are optional parameters, while the Non-3GPP access node selection information is required and shall include at least the HPLMN and the "any PLMN" entry.

If the ePDG identifier configuration is configured in the UE, then, when the UE decides to select an ePDG in the HPLMN (according to the procedure in clause 6.3.6.3), the UE shall use the ePDG identifier configuration to find the IP address of the ePDG in the HPLMN and shall ignore the FQDN parameter of the HPLMN in the Non-3GPP access node selection information.

If the N3IWF identifier configuration is configured in the UE, then, when the UE decides to select an N3IWF in the HPLMN (according to the procedure in clause 6.3.6.3 for combined N3IWF/ePDG selection and the procedure in clause 6.3.6.2 for Stand-alone N3IWF selection), the UE shall use the N3IWF identifier configuration to find the IP address of the N3IWF in the HPLMN and shall ignore the FQDN parameter of the HPLMN in the Non-3GPP access node selection information.

The N3IWF selection procedure described in this clause is not performed by the UE when connecting to PLMN services via an NPN-RAN or to NPN services via an NG-RAN.

## NEXT CHANGE

# 8 Control and User Plane Protocol Stacks

## 8.1 General

Clause 8 specifies the overall protocol stacks between 5GS entities, e.g. between the UE and the 5GC Network Functions, between the 5G-AN and the 5GC Network Functions, or between the 5GC Network Functions.

## 8.2 Control Plane Protocol Stacks

### 8.2.1 Control Plane Protocol Stacks between the 5G-AN and the 5G Core: N2

#### 8.2.1.1 General

NOTE 1: N2 maps to NG-C as defined in TS 38.413 [34].

Following procedures are defined over N2:

- Procedures related with N2 Interface Management and that are not related to an individual UE, such as for Configuration or Reset of the N2 interface. These procedures are intended to be applicable to any access but may correspond to messages that carry some information only on some access (such as information on the default Paging DRX used only for 3GPP access).

- Procedures related with an individual UE:

- Procedures related with NAS Transport. These procedures are intended to be applicable to any access but may correspond to messages that for UL NAS transport carry some access dependent information such as User Location Information (e.g. Cell-Id over 3GPP access or other kind of User Location Information for Untrusted Non 3GPP access).

- Procedures related with UE context management. These procedures are intended to be applicable to any access. The corresponding messages may carry:

- some information only on some access (such as Mobility Restriction List used only for 3GPP access).

- some information (related e.g. with N3 addressing and with QoS requirements) that is to be transparently forwarded by AMF between the 5G-AN and the SMF.

- Procedures related with resources for PDU Sessions. These procedures are intended to be applicable to any access. They may correspond to messages that carry information (related e.g. with N3 addressing and with QoS requirements) that is to be transparently forwarded by AMF between the 5G-AN and the SMF.

- Procedures related with Hand-Over management. These procedures are intended for 3GPP access only.

The Control Plane interface between the 5G-AN and the 5G Core supports:

- The connection of multiple different kinds of 5G-AN (e.g. 3GPP RAN, N3IWF) to the 5CG via an unique Control Plane protocol: A single NGAP protocol is used for both the 3GPP access and non-3GPP access;

- There is a unique N2 termination point in AMF per access for a given UE regardless of the number (possibly zero) of PDU Sessions of the UE;

- The decoupling between AMF and other functions such as SMF that may need to control the services supported by 5G-AN(s) (e.g. control of the UP resources in the 5G-AN for a PDU Session). For this purpose, NGAP may support information that the AMF is just responsible to relay between the 5G-AN and the SMF. The information can be referred as N2 SM information in TS 23.502 [3] and this specification.

NOTE 2: The N2 SM information is exchanged between the SMF and the 5G-AN transparently to the AMF.

## NEXT CHANGE

### 8.2.4 Control Plane for N3IWF

The following applies to Access Networks including untrusted non-3GPP access, access to NPN services via a PLMN NG-RAN, and access to PLMN services via an NPN-RAN.



Figure 8.2.4-1: Control Plane before the signalling IPsec SA is established between UE and N3IWF



Figure 8.2.4-2: Control Plane after the signalling IPsec SA is established between UE and N3IWF

Large NAS messages are fragmented by the "inner IP" layer. If there is a protocol between the NAS layer and the "inner IP" in the UE, is defined in stage-3 specifications.



Figure 8.2.4-3: Control Plane for establishment of user-plane via N3IWF

In the above figures 8.2.4-1, 8.2.4-2 and 8.2.4-3, the UDP protocol may be used between the UE and N3IWF to enable NAT traversal for IKEv2 and IPsec traffic.

The "signalling IPsec SA" is defined in TS 23.502 [3], clause 4.12.2.

## NEXT CHANGE

### 8.3.2 User Plane for untrusted non 3GPP Access

The following applies to Access Networks including untrusted non-3GPP access, access to NPN services via a PLMN NG-RAN, and access to PLMN services via an NPN-RAN.



Figure 8.3.2-1: User Plane via N3IWF

Large GRE packets are fragmented by the "inner IP" layer.

Details about the PDU Layer, the N3 stack and the N9 stack are included in clause 8.3.1. The UDP protocol may be used below the IPsec layer to enable NAT traversal.

## END OF CHANGES