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TECHNICAL SPECIFICATION

5G;
Access to the 3GPP 5G Core Network (5GCN)
via non-3GPP access networks
(3GPP TS 24.502 version 19.3.0 Release 19)

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Foreword

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1 Scope

The present document specifies non-3GPP access network discovery and selection procedures, the access authorization procedure used for accessing non-3GPP access networks. These non-3GPP access networks can be trusted non-3GPP access networks, untrusted non-3GPP access networks or wireline access networks.

The present document also specifies the security association management procedures used for establishing IKEv2 and IPsec security associations:

- between the UE and the N3IWF and the procedures for transporting messages between the UE and the N3IWF over the non-3GPP access networks; and
- between the UE and the TNGF and the procedures for transporting messages between the UE and the TNGF over the non-3GPP access networks.

The present document also specifies the EAP-5G procedures used for exchange of NAS messages via trusted non-3GPP access before the UE is authenticated and authorized to use the trusted non-3GPP access.

The present document is applicable to the UE, the 5G-RG, the W-AGF acting on behalf of the FN-RG or the W-AGF acting on behalf of the N5GC device and the network. In this technical specification the network refers to the 3GPP 5GCN and the trusted non-3GPP access, untrusted non-3GPP access, or wireline access network.

NOTE 1: The present document is not applicable to the FN-RG.

NOTE 2: The W-AGF acting on behalf of the FN-BRG, accessing an SNPN is not defined in the present version of the present document.

2 References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

- References are either specific (identified by date of publication, edition number, version number, etc.) or non-specific.
- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, the latest version applies. In the case of a reference to a 3GPP document (including a GSM document), a non-specific reference implicitly refers to the latest version of that document *in the same Release as the present document*.

- [1] 3GPP TR 21.905: "Vocabulary for 3GPP Specifications".
- [2] 3GPP TS 23.501: "System Architecture for the 5G System; Stage 2".
- [3] 3GPP TS 23.502: "Procedures for the 5G System; Stage 2".
- [4] 3GPP TS 24.501: "Access-Stratum (NAS) protocol for 5G System (5GS); Stage 3".
- [4A] 3GPP TS 24.301: "Non-Access-Stratum (NAS) protocol for Evolved Packet System (EPS); Stage 3".
- [5] 3GPP TS 33.501: "Security architecture and procedures for 5G System".
- [6] IETF RFC 7296: "Internet Key Exchange Protocol Version 2 (IKEv2)".
- [7] 3GPP TS 24.302: "Access to the 3GPP Evolved Packet Core (EPC) via non-3GPP access networks; Stage 3".
- [8] 3GPP TS 23.003: "Numbering, addressing and identification".
- [9] IETF RFC 3748: "Extensible Authentication Protocol (EAP)".

- [10] 3GPP TS 33.402: "3GPP System Architecture Evolution (SAE); Security aspects of non-3GPP accesses."
- [11] IETF RFC 4303: "IP Encapsulating Security Payload (ESP)".
- [12] IETF RFC 4301: "Security Architecture for the Internet Protocol".
- [13] 3GPP TS 23.122: "Non-Access-Stratum (NAS) functions related to Mobile Station (MS) in idle mode".
- [14] IETF RFC 2784: "Generic Routing Encapsulation (GRE)".
- [15] IETF RFC 2890: "Key and Sequence Number Extensions to GRE".
- [16] 3GPP TS 23.503: "Policy and Charging Control Framework for the 5G System".
- [17] 3GPP TS 24.526: "User Equipment (UE) policies for 5G System (5GS); Stage 3".
- [18] 3GPP TS 23.402: "Architecture enhancements for non-3GPP accesses".
- [19] IEEE Std 802.11-2020: "IEEE Standard for Information technology - Telecommunications and information exchange between systems - Local and metropolitan area networks - Specific requirements - Part 11: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) Specifications".
- [20] Wi-Fi Alliance: "Hotspot 2.0 (Release 2) Technical Specification, version 1.0.0", 2014-08-08.
- [21] ITU-T Recommendation E.212: "The international identification plan for public networks and subscriptions", 2016-09-23.
- [22] 3GPP TS 24.007: "Mobile radio interface signalling layer 3; General aspects".
- [23] IETF RFC 4555: "IKEv2 Mobility and Multihoming Protocol (MOBIKE)".
- [24] IETF RFC 791: "INTERNET PROTOCOL".
- [25] IETF RFC 8200: "Internet Protocol, Version 6 (IPv6) Specification".
- [26] IETF RFC 2474: "Definition of the Differentiated Services Field (DS Field) in the IPv4 and IPv6 Headers".
- [27] IETF RFC 793: "Transmission Control Protocol".
- [28] 3GPP TS 24.008: "Mobile radio interface Layer 3 specification; Core network protocols; Stage 3".
- [29] 3GPP TS 38.413: "NG Application Protocol (NGAP)".
- [30] IEEE Std 802.1X™-2020: "IEEE Standard for Information technology - Telecommunications and information exchange between systems - Local and metropolitan area networks - Port-based Network Access Control".
- [31] IETF RFC 4284 (January 2006): "Identity Selection Hints for the Extensible Authentication Protocol (EAP)".
- [32] IETF RFC 1661: "The Point-to-Point Protocol (PPP)".
- [33] IETF RFC 1570: "PPP LCP Extensions".
- [34] IETF RFC 2410: "The NULL Encryption Algorithm and Its Use With IPsec".
- [35] 3GPP TS 31.102: "Characteristics of the Universal Subscriber Identity Module (USIM) application".
- [36] CableLabs WR-TR-5WWC-ARCH-V02-200430: "5G Wireless Wireline Converged Core Architecture Technical Report".
- [37] IETF RFC 7542: "The Network Access Identifier".

- [38] 3GPP TS 24.368: "Non-Access Stratum (NAS) configuration Management Object (MO)".
- [39] 3GPP TS 29.413: "Application of the NG Application Protocol (NGAP) to non-3GPP access".
- [40] 3GPP TS 23.316: "Wireless and wireline convergence access support for the 5G System (5GS)".
- [41] 3GPP TS 23.304: "Proximity based Services (ProSe) in the 5G System (5GS); Stage 2".
- [42] BBF TR-456 issue 2 (March 2022): "AGF Functional Requirements".

3 Definitions, symbols and abbreviations

3.1 Definitions

For the purposes of the present document, the terms and definitions given in 3GPP 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 3GPP TR 21.905 [1].

SNPN access operation mode for 5G NSWO: A UE operating in SNPN access operation mode for 5G NSWO only selects SNPNs for 5G NSWO. The UE using 5G NSWO authenticates using credentials in the selected entry of "list of subscriber data" or using credentials in the USIM, if PLMN subscription is selected.

MTU: Maximum transmission unit (MTU) is the largest PDU size which can be transmitted and received by a network entity in one single IP packet without any need for IP fragmentation.

NWt: NWt is the reference point between the UE and the TNGF for establishing secure tunnel(s) between the UE and the TNGF so that control-plane and user-plane exchanged between the UE and the 5G core network is transferred securely over trusted non-3GPP access.

NWu: NWu is the reference point between the UE and the N3IWF for establishing secure tunnel(s) between the UE and the N3IWF so that control-plane and user-plane exchanged between the UE and the 5G core network is transferred securely over untrusted non-3GPP access.

For the purposes of the present document, the following terms and definitions given in 3GPP TS 23.501 [2] apply:

5G Access Network
5G Core Network
5G NSWO
5G QoS flow
5G QoS identifier
5G System
5G-RG
Credentials Holder (CH)
FN-RG
Network identifier (NID)
PDU Session
Stand-alone Non-Public Network
ON-SNPN
TNGF
W-AGF

For the purposes of the present document, the following terms and definitions given in 3GPP TS 23.003 [8] apply:

Global Line Identifier (GLI)
Global Cable Identifier (GCI)
NAI

For the purposes of the present document, the following terms and definitions given in 3GPP TS 33.501 [5] apply:

SUPI
SUCI

For the purposes of the present document, the following terms and definitions given in 3GPP TS 24.302 [7] apply:

S2a connectivity

For the purposes of the present document, the following terms and definitions given in 3GPP TS 24.501 [4] apply:

Non 5G capable over WLAN (N5CW) device
SNPN access operation mode
W-AGF acting on behalf of the N5GC device

For the purposes of the present document, the following terms and definitions given in 3GPP TS 23.316 [40] apply:

Authenticable Non-3GPP (AUN3) device
Non-Authenticable Non-3GPP (NAUN3) device
Wireline access control plane protocol (W-CP)
Wireline access user plane protocol (W-UP)

For the purposes of the present document, the following terms and definitions given in 3GPP TS 23.122 [13] apply:

Registered SNPN
Subscribed SNPN

3.2 Abbreviations

For the purposes of the present document, the abbreviations given in 3GPP 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 3GPP TR 21.905 [1].

5GCN	5G Core Network
5GS	5G System
5G-AN	5G Access Network
5G-RG	5G Residential Gateway
5QI	5G QoS Identifier
AMF	Access and Mobility Management Function
AN	Access Network
ANDS	Access Network Discovery and Selection
ANDSP	Access Network Discovery and Selection Policy
ANQP	Access Network Query Protocol
AUN3	Authenticable Non-3GPP
AUSF	Authentication Server Function
CH	Credentials Holder
CP	Control Plane
CRG	Cable Residential Gateway
DHCP	Dynamic Host Configuration Protocol
DL	Downlink
DNS	Domain Name System
DSCP	Differentiated Services Code Point
ePDG	Evolved Packet Data Gateway
ESP	Encapsulating Security Payload
FN-BRG	Fixed Network Broadband Residential Gateway
FN-CRG	Fixed Network Cable Residential Gateway
FN-RG	Fixed Network Residential Gateway
FQDN	Fully Qualified Domain Name
FT	Fast BSS Transition
H-PCF	A PCF in the HPLMN
IP	Internet Protocol
IPsec	Internet Protocol Security
MPS	Multimedia Priority Service
N3AN	Non-3GPP Access Network
N3IWF	Non-3GPP InterWorking Function
N5CW	Non 5G Capable over WLAN
N5GC	Non-5G Capable

NAI	Network Access Identifier
NAPTR	Naming Authority Pointer
NAUN3	Non-Authenticable Non-3GPP
NAS	Non Access Stratum
NID	Network Identifier
NSWO	Non-Seamless WLAN Offload
NSWOF	Non-Seamless WLAN Offload Function
PCF	Policy control Function
PDU	Protocol Data Unit
QFI	QoS Flow Identifier
RQI	Reflective QoS Indicator
SA	Security Association
SNPN	Stand-alone Non-Public Network
SPI	Security Parameters Index
SSID	Service Set Identifier
SUPI	Subscription Permanent Identifier
SUCI	Subscription Concealed Identifier
TCP	Transmission Control Protocol
TNAN	Trusted Non-3GPP Access Network
TNAP	Trusted Non-3GPP Access Point
TNGF	Trusted Non-3GPP Gateway Function
TWAN	Trusted WLAN Access Network
TWAP	Trusted WLAN Access Point
TWIF	Trusted WLAN Interworking Function
UL	Uplink
UP	User Plane
UPF	User Plane Function
V-PCF	A PCF in the VPLMN
W-AGF	Wireline Access Gateway Function
WLAN	Wireless Local Area Network
WLANSF	WLAN Selection Policy

4 General

4.1 Overview

The 5G core network (5GCN) supports the connectivity of the UE via non-3GPP access networks. These non-3GPP access networks can be trusted non-3GPP access networks, untrusted non-3GPP access networks or wireline access networks. A trusted or untrusted non-3GPP access network can advertise the PLMNs for which it supports trusted connectivity and the type of supported trusted connectivity. Different types of trusted connectivity can be advertised so that the UE can discover the non-3GPP access networks that can provide trusted connectivity to one or more PLMNs:

- a) information about PLMN list with 5G connectivity using trusted non-3GPP access;
- b) information about PLMN list with 5G connectivity without NAS using trusted non-3GPP access;
- c) information about PLMN list with S2a connectivity using trusted non-3GPP access (access via non-3GPP access to EPC); or
- d) information about SNPN list with 5G connectivity using trusted non-3GPP access.

NOTE 1: A wireline access network does not indicate PLMNs or SNPNS for which it supports connectivity.

In wireline access, the 5G-RG can provide connectivity for:

- a) a UE behind the 5G-RG to access the 5GCN via untrusted non-3GPP access network or trusted non-3GPP access network;

NOTE 2: For a UE behind the 5G-RG, the 5G-RG can also be connected to the 5GC through 3GPP access, i.e. not only through wireline access.

- b) an AUN3 device behind the 5G-RG to access the 5GCN via wireline access network; and
- c) an NAUN3 device behind the 5G-RG to access the 5GCN via wireline access.

NOTE 3: For an NAUN3 device behind the 5G-RG, the 5G-RG can also be connected to the 5GC through 3GPP access, i.e. not only through wireline access.

4.2 Untrusted access

For an untrusted non-3GPP access network, the communication between the UE and the 5GCN is not trusted to be secure.

For an untrusted non-3GPP access network, to secure communication between the UE and the 5GCN, a UE establishes secure connection to the 5G core network over untrusted non-3GPP access via the N3IWF. The UE performs registration to the 5G core network during the IKEv2 SA establishment procedure as specified in 3GPP TS 24.501 [4] and IETF RFC 7296 [6]. After the registration, the UE supports NAS signalling with 5GCN using the N1 reference point as specified in 3GPP TS 24.501 [4]. The N3IWF interfaces the 5GCN CP function via the N2 interface to the AMF and the 5GCN UP functions via N3 interface to the UPF as described in 3GPP TS 23.501 [2].

4.3 Identities

4.3.1 User identities

When the UE accesses the 5GCN over non-3GPP access networks, the same permanent identities for 3GPP access are used to identify the subscriber for non-3GPP access authentication, authorization and accounting services.

The Subscription Permanent Identifier (SUPI) is defined in 3GPP TS 33.501 [5]. The SUPI can contain an IMSI, a network specific identifier, a GCI or a GLI as specified in 3GPP TS 23.501 [2]. A SUPI containing an IMSI is defined in 3GPP TS 23.003 [8]. A SUPI containing a network specific identifier, a GCI or a GLI always takes the form of a NAI as defined in 3GPP TS 23.003 [8].

The Subscription Concealed Identifier (SUCI) is a privacy preserving identifier containing the concealed SUPI as specified in 3GPP TS 33.501 [5]. SUCI is calculated from SUPI. When the SUPI contains an IMSI, the corresponding SUCI is derived as specified in 3GPP TS 23.003 [8]. When the SUPI contains a network specific identifier, a GCI or a GLI, the corresponding SUCI in NAI format is derived as specified in 3GPP TS 23.003 [8].

User identification in non-3GPP accesses can require additional identities that are out of the scope of 3GPP.

4.3.2 FQDN for N3IWF Selection

An N3IWF FQDN is either provisioned by the home operator or constructed by the UE in:

- a) the Operator Identifier FQDN format or the Tracking Area Identity FQDN format; or
- b) the Prefixed Operator Identifier FQDN format or the Prefixed Tracking Area Identity FQDN format if the UE is configured with slice-specific N3IWF prefix configuration,
as specified in clause 6.3.6.2 in 3GPP TS 23.501 [2].

The N3IWF FQDN for onboarding services in SNPN is pre-configured in the UE to select an N3IWF to register the onboarding SNPN via untrusted non-3GPP access.

The detailed format of the N3IWF FQDN is specified in clause 28.3.2.2 of 3GPP TS 23.003 [8].

The N3IWF FQDN is used as input to the DNS mechanism for N3IWF selection.

In order to access PLMN services via an SNPN, a UE operating in SNPN access operation mode registered to an SNPN has the following restrictions on N3IWF FQDN:

- a) the UE shall only use TAIs from a PLMN to construct a Tracking Area Identity based N3IWF FQDN; and
- b) the UE shall not consider an N3IWF FQDN for N3IWF selection configured by an SNPN.