



TECHNICAL SPECIFICATION

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Interworking between 5G Network and external Data Networks;
Stage 3
(3GPP TS 29.561 version 19.5.0 Release 19)**



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1 Scope

The present specification defines the stage 3 interworking procedures for 5G Network interworking between PLMN and external DN or Network Slice Specific AAA.

The stage 2 requirements and procedures are contained in 3GPP TS 23.501 [2] and 3GPP TS 23.502 [3].

For interworking between 5G PLMN and external DNs, the present document is valid for both 3GPP accesses and non-3GPP accesses.

2 References

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

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- [1] 3GPP TR 21.905: "Vocabulary for 3GPP Specifications".
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- [3] 3GPP TS 23.502: "Procedures for the 5G System; Stage 2".
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- [7] IETF RFC 3579: "RADIUS (Remote Authentication Dial In User Service) Support For Extensible Authentication Protocol (EAP)".
- [8] IETF RFC 2865: "Remote Authentication Dial In User Service (RADIUS)".
- [9] IETF RFC 3162: "RADIUS and IPv6".
- [10] IETF RFC 4818: "RADIUS Delegated-IPv6-Prefix Attribute".
- [11] IETF RFC 5216: "The EAP-TLS Authentication Protocol".
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- [14] IETF RFC 2132: "DHCP Options and BOOTP Vendor Extensions".
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- [19] IETF RFC 1542: "Clarification and Extensions for the Bootstrap Protocol".
- [20] IETF RFC 4039: "Rapid Commit Option for the Dynamic Host Configuration Protocol version 4 (DHCPv4)".
- [21] IETF RFC 8415: "Dynamic Host Configuration Protocol for IPv6 (DHCPv6)".
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- [23] IETF RFC 7155: "Diameter Network Access Server Application".
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- [28] 3GPP TS 23.003: "Numbering, addressing and identification".
- [29] IETF RFC 1825: "Security Architecture for the Internet Protocol".
- [30] IETF RFC 1826: "IP Authentication Header".
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- [32] IETF RFC 4291: "IP Version 6 Addressing Architecture".
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- [34] IETF RFC 4862: "IPv6 Stateless Address Autoconfiguration".
- [35] IETF RFC 1027: "Using ARP to Implement Transparent Subnet Gateways".
- [36] 802.3-2015 - IEEE Standard for Ethernet.
- [37] IETF RFC 5281: "Extensible Authentication Protocol Tunneled Transport Layer Security Authenticated Protocol Version 0 (EAP-TTLSv0)".
- [38] 3GPP TS 23.380: "IMS Restoration Procedures".
- [39] 3GPP TS 29.571: "5G System; Common Data Types for Service Based Interfaces; Stage 3".
- [40] 3GPP TS 29.502: "5G System; Session Management Services; Stage 3".
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- [52] BBF WT-470: "5G FMC Architecture".
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- [65] IETF RFC 9114: "Hypertext Transfer Protocol Version 3 (HTTP/3)"
- [66] IETF RFC 9868: "Transport Options for UDP".
- [67] draft-ietf-masque-quick-proxy: "QUIC-Aware Proxying Using HTTP".
- Editor's note: The above reference will be revised to RFC when finalized by IETF.**
- [68] IETF RFC 9000: "QUIC: A UDP-Based Multiplexed and Secure Transport"
- [69] draft-ietf-moq-transport: "Media over QUIC Transport".
- Editor's note: The above reference will be revised to RFC when finalized by IETF.**
- [70] 3GPP TS 26.522: "5G Real-time Media Transport Protocol Configurations".
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- [73] IETF RFC 5705: "Keying Material Exporters for Transport Layer Security (TLS)"

3 Definitions 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].

MA PDU Session: A PDU Session that provides a PDU connectivity service, which can use one access network at a time, or simultaneously one 3GPP access network and one non-3GPP access network.

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].

5G-BRG	5G Broadband Residential Gateway
5G-CRG	5G Cable Residential Gateway
AMF	Access and Mobility Management Function
AS	Application Server
BBF	Broadband Forum
CH	Credentials Holder
CHAP	Challenge Handshake Authentication Protocol
CHF	Charging Function
CSMA/CD	Carrier Sense Multiple Access/Collision Detection
DCS	Default Credentials Server
DHCPv4	Dynamic Host Configuration Protocol version 4
DHCPv6	Dynamic Host Configuration Protocol version 6
DN	Data Network
DNAI	DN Access Identifier
DR	Designated Router
DSL	Digital Subscriber Line
FN-BRG	Fixed Network Broadband RG
FN-CRG	Fixed Network Cable RG
FQDN	Fully Qualified Domain Name
GCI	Global Cable Identifier
GLI	Global Line Identifier
GPSI	Generic Public Subscription Identifier
HFC	Hybrid Fiber Coax
I-SMF	Intermediate SMF
L2TP	Layer Two Tunneling Protocol
LAC	L2TP Access Concentrator
LNS	L2TP Network Server
MBS	Multicast/Broadcast Service.
MBSTF	Multicast/Broadcast Service Transport Function.
MB-UPF	Multicast/Broadcast User Plane Function
MRI	Media Related Information
MSK	Master Session Key
N3IWF	Non-3GPP InterWorking Function
NGAP	NG Application Protocol
NRM	Network Resource Management
NSS	Network Slice Specific
NSSAAF	Network Slice-Specific Authentication and Authorization Function
ON-SNPN	Onboarding Standalone Non-Public Network
PAP	Password Authentication Protocol
P-GW	PDN Gateway
PGW-C	PDN Gateway Control plane function
PGW-U	PDN Gateway User plane function

PIM	Protocol-Independent Multicast
PIM-DM	Protocol-Independent Multicast- Dense Mode
PIM-SM	Protocol-Independent Multicast- Sparse Mode
PON	Passive Optical Network
PtP	Point-to-Point
RG	Residential Gateway
RP	Rendezvous Point
RSN	Redundancy Sequence Number
RTP	Real-time Transport Protocol
SD	Slice Differentiator
SEAL	Service Enabler Architecture Layer for Verticals
SFD	Start Frame Delimiter
SMF	Session Management Function
S-NSSAI	Single Network Slice Selection Assistance Information
SNPN	Stand-alone Non-Public Network
SO-SNPN	Subscription Owner Standalone Non-Public Network
SSC	Session and Service Continuity
SST	Slice/Service Type
TCP	Transmission Control Protocol
TNAP	Trusted Non-3GPP Access Point
TWAP	Trusted WLAN Access Point
UDP	User Datagram Protocol
UPF	User Plane Function
V-SMF	Visited SMF
VAL	Vertical Application Layer
WAN	Wide Area Network

4 Network Characteristics

4.1 Key characteristics of PLMN

The PLMN is fully defined in the 3GPP technical specifications. The 5G Network related key characteristics are defined in 3GPP TS 23.501 [2].

4.2 Key characteristics of IP Networks

The Internet is a conglomeration of networks utilising a common set of protocols. IP protocols are defined in the relevant IETF RFCs. The networks topologies may be based on LANs (e.g. Ethernet), Point to Point leased lines, PSTN, ISDN, X.25 or WANs using switched technology (e.g. SMDS, ATM).

4.3 Key characteristics of Ethernet

The Ethernet is a family of computer networking technologies commonly used in LAN and is often used to refer to all Carrier Sense Multiple Access/Collision Detection (CSMA/CD) LANs that generally conform to Ethernet Specifications, including IEEE 802.3 [36]. The key characteristics for Ethernet are defined in IEEE 802.3 [36].

5 Interworking Classifications

5.1 Service Interworking

Service interworking is required when the Teleservice at the calling and called terminals are different. No service interworking is specified in this specification.

5.2 Network Interworking

Network interworking is required whenever a PLMN is involved in communications with another network to provide end-to-end communications. The PLMN shall interconnect in a manner consistent with that of a normal Data Network (type defined by the requirements e.g. IP). Interworking appears exactly like that of Data Networks.

6 Reference Architecture

Figure 6-1 shows the access interfaces for the 5G Network. Figure 6-2 shows the access interfaces for the 5G and EPC interworking network.

The 5G Network includes both the 3GPP access and the non-3GPP access.

The NSS-AAA may belong to the H-PLMN in the 5G Network (without AAA-P interworking) or a 3rd party (with AAA-P interworking).

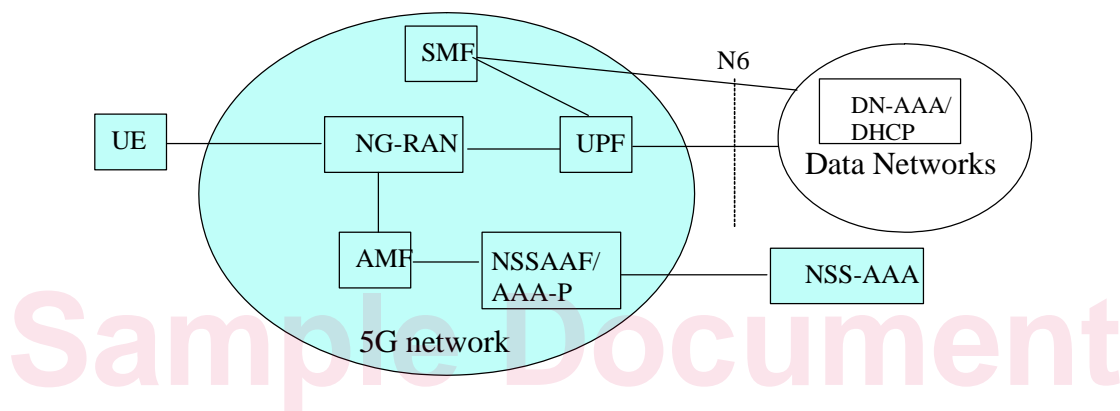


Figure 6-1: Reference Architecture for 5G Network Interworking

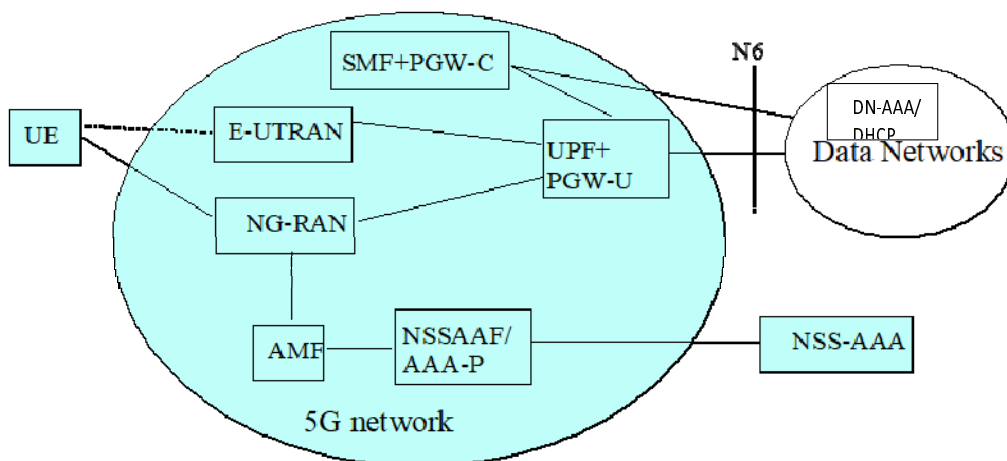


Figure 6-2: Reference Architecture for 5G and EPC Interworking

NOTE 1: The SMF represents the H-SMF and the SMF+PGW-C represents the H-SMF+ H-PGW-C in the home routed scenario.

NOTE 2: If the DN-AAA server or the DHCP server located in 5GC or in the external PDN is reachable directly, then the SMF or SMF+PGW-C can communicate with the DN-AAA server directly without involving the UPF or UPF+PGW-U, applicable to all the message flows on N6 interface in clause 11 and clause 12 in this specification.

NOTE 3: In the follow clauses, the description on SMF also applies to SMF+PGW-C, the description on UPF also applies to UPF+PGW-U, unless otherwise specified.

7 Interface to 5G Network services (User Plane)

The user plane for 5G Network services is defined in clause 8.3 of 3GPP TS 23.501 [2] and 3GPP TS 29.281 [4].

8 Interworking with DN (IP)

8.1 General

5GS shall support interworking with DNs based on the Internet Protocol (IP). These interworked networks may be either intranets or the Internet.

8.2 DN Interworking Model

8.2.1 General

When interworking with the IP networks, the 5GS can operate IPv4 and/or IPv6. The interworking point is shown in clause 6.

The UPF for interworking with the IP network is the 5GS access point (see figure 8.2.1-1).

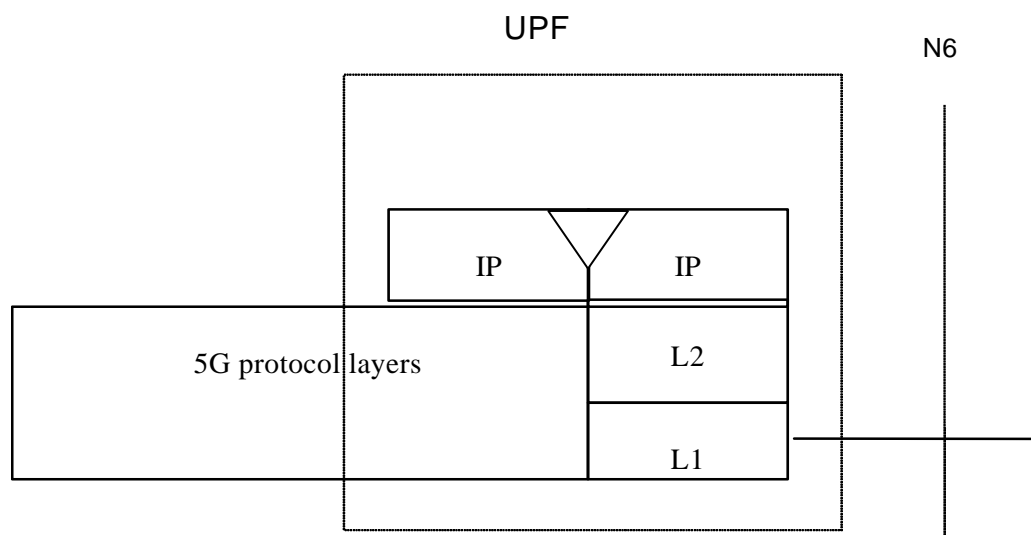


Figure 8.2.1-1: The protocol stacks of UPF for the IP network interworking

Typically, in the IP networks, the interworking with subnetworks is done via IP routers. The N6 reference point is between the UPF and the external IP network. From the external IP network's point of view, the UPF is seen as a normal IP router. The L2 and L1 layers are operator specific.

It is out of the scope of the present document to standardise the router functions and the used protocols in the N6 reference point.