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Contents

Foreword

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1 Scope

The present document is an introduction to the 3GPP TS 38.41x series of technical specifications that define the NG interface for the interconnection of an NG-RAN node to the 5GC (5G Core Network).

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 38.411: "NG-RAN; NG layer 1".

[3] 3GPP TS 38.412: "NG-RAN; NG signalling transport".

[4] 3GPP TS 38.413: "NG-RAN; NG Application Protocol (NGAP) ".

[5] 3GPP TS 38.414: "NG-RAN; NG data transport".

[6] 3GPP TS 23.502: "Procedures for the 5G system".

[7] 3GPP TS 38.300: "NR; Overall Description; Stage 2".

[8] 3GPP TS 23.501: "System Architecture for the 5G system".

[9] 3GPP TS 38.415: "PDU Session User Plane Protocol".

[10] 3GPP TS 38.455: "NR Positioning Protocol A (NRPPa)".

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].

gNB: as defined in TS 38.300 [7].

ng-eNB: as defined in TS 38.300 [7].

NG-RAN node: as defined in TS 38.300 [7].

UPF: as defined in TS 23.501 [8].

3.2 Abbreviations

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].

5GC	5G Core Network
AMF	Access and Mobility Management Function
SMF	Session Management Function

UPF User Plane Function

4 General aspects

4.1 NG Architecture

The NG-RAN is layered into a Radio Network Layer (RNL) and a Transport Network Layer (TNL). The NG-RAN architecture, i.e. the NG-RAN logical nodes and interfaces between them, are defined as part of the RNL.

The NG-RAN architecture consists of a set of gNBs and ng-eNBs which are connected to the 5GC through the NG interface and is specified in TS 38.300 [7].

The NG-RAN may have several NG access points towards the 5GC. As a minimum, each NG access point (in NG-RAN or 5GC) shall independently fulfil the requirements of the relevant NG specifications (3GPP 38.41x series - see clause 7).

NG is a logical interface.

There may be multiple NG-C logical interfaces towards the 5GC from any one NG-RAN node. The selection of the NG-C interface is then determined by the NAS Node Selection function as described in clause 5.

There may be multiple NG-U logical interfaces towards the 5GC from any one NG-RAN node. The selection of the NG-U interface is done within the 5GC and signalled to the NG-RAN node by the AMF.

4.2 NG interface general principles

The general principles for the specification of the NG interface are as follows:

- the NG interface is open;
- the NG interface supports the exchange of signalling information between the NG-RAN and 5GC;
- from a logical standpoint, the NG is a point-to-point interface between an NG-RAN node and a 5GC node. A point-to-point logical interface is feasible even in the absence of a physical direct connection between the NG-RAN and 5GC;
- the NG interface supports control plane and user plane separation;
- the NG interface separates Radio Network Layer and Transport Network Layer;
- the NG interface is future proof to fulfil different new requirements and support of new services and new functions;
- the NG interface is decoupled with the possible NG-RAN deployment variants;
- the NG Application Protocol supports modular procedures design and uses a syntax allowing optimized encoding /decoding efficiency.

4.3 NG interface specification objectives

The NG interface specification facilitates the following:

- inter-connection of NG-RAN nodes with AMFs supplied by different manufacturers;
- separation of NG interface Radio Network functionality and Transport Network functionality to facilitate introduction of future technology.

4.4 NG interface capabilities

The NG interface supports:

- procedures to establish, maintain and release NG-RAN part of PDU sessions;

- procedures to perform intra-RAT handover and inter-RAT handover;
- the separation of each UE on the protocol level for user specific signalling management;
- the transfer of NAS signalling messages between UE and AMF;
- mechanisms for resource reservation for packet data streams.

5 Functions of the NG interface

5.1 General

The following clauses describe the functions supported over the NG interface.

5.2 Paging function

The paging function supports the sending of paging requests to the NG-RAN nodes involved in the paging area e.g. the NG-RAN nodes of the TA(s) the UE is registered.

5.3 UE Context Management function

The UE Context management function allows the AMF to establish, modify or release a UE Context in the AMF and the NG-RAN node e.g. to support user individual signalling on NG.

The function also enables the AMF to manage RRC state notifications of a CM-CONNECTED UE.

5.4 Mobility Management function

The mobility function for UEs in CM-CONNECTED includes the intra-system handover function to support mobility within NG-RAN and inter-system handover function to support mobility from/to EPS system. It comprises the preparation, execution and completion of handover via the NG interface.

5.5 PDU Session Management function

The PDU Session function is responsible for establishing, modifying and releasing the involved PDU sessions NG-RAN resources for user data transport once a UE context is available in the NG-RAN node.

NGAP supports transparent relaying of PDU Session related information by the AMF as described in TS 23.502 [6].

5.6 NAS Transport function

The NAS Signalling Transport function provides means to transport or reroute a NAS message (e.g. for NAS mobility management) for a specific UE over the NG interface.

5.7 NAS Node Selection function

The interconnection of NG-RAN nodes to multiple AMFs is supported in the 5GS architecture.

Therefore, a NAS node selection function is located in the NG-RAN node to determine the AMF association of the UE, based on the UE's temporary identifier, which was assigned to the UE by the AMF. When the UE's temporary identifier has not been yet assigned or is no longer valid the NG-RAN node may instead take into account slicing information to determine the AMF.

This functionality is located in the NG-RAN node and enables proper routing via the NG interface. On NG, no specific procedure corresponds to the NAS Node Selection Function.

5.8 NG Interface Management function

The NG-interface management functions provide

- means to ensure a defined start of NG-interface operation (reset);

- means to handle different versions of application part implementations and protocol errors (error indication).

5.9 Warning Message Transmission function

The warning message transmission function provides means to transfer warning messages via NG interface or cancel ongoing broadcast of warning messages. It also provides the capability for the NG-RAN to inform the AMF that ongoing PWS operation has failed for one or more areas, or that one or more areas may be reloaded by the CBC.

5.10 Configuration Transfer function

The Configuration Transfer function is a generic mechanism that allows the request and transfer of RAN configuration information (e.g. SON information) between two RAN nodes via the core network.

5.11 Trace function

The Trace function provides means to control trace sessions in the NG-RAN node.

5.12 AMF Management function

The AMF management function supports AMF planned removal and AMF auto-recovery as specified in TS 23.501 [8].

5.13 Multiple TNL Associations Support Function

When there are multiple TNL associations between a NG-RAN node and an AMF, the NG-RAN node selects the TNL association for NGAP signalling based on the usage and the weight factor of each TNL association received from the AMF, and uses the TNL association as specified in TS 23.501 [8] and TS 23.502 [6]. If an AMF releases a TNL association or a TNL association has failed, the NG-RAN node selects a new one as specified in TS 23.501 [8] and TS 23.502 [6].

5.14 AMF Load Balancing function

The NG interface supports the indication by the AMF of its relative capacity to the NG-RAN node in order to achieve load-balanced AMFs within the pool area.

5.15 Location Reporting function

This function enables the AMF to request the NG-RAN node to report the UE's current location, or the UE's last known location with timestamp, or the UE's presence in a configured area of interest.

5.16 AMF Re-allocation function

This function allows to redirect an initial connection request issued by an NG-RAN node from an initial AMF towards a target AMF selected by 5GC. In this case the NG-RAN node initiates an Initial UE Message procedure over one NG interface instance and receives the first downlink message to close the UE-associated logical connection over a different NG interface instance.

5.17 UE Radio Capability Management function

The UE Radio Capability Management function is related to the UE radio capability handling.

5.18 NRPPa Signaling Transport function

The NRPPa (NR Positioning Protocol A) Signalling Transport function provides means to transport an NRPPa (3GPP TS 38.455 [10]) message transparently over the NG interface.

5.19 Overload Control function

The overload function provides means to enable AMF controls the load that the NG-RAN node(s) are generating.

6 Signalling procedures of the NG interface

6.1 PDU Session Management Procedures

The following list of PDU Session management procedures are used to establish, release or modify NG-RAN resources for a PDU session:

- PDU Session Resource Setup;
- PDU Session Resource Release;
- PDU Session Resource Modify;
- PDU Session Resource Notify;
- PDU Session Resource Modify Indication.

6.2 UE Context Management Procedures

The following list of UE Context management procedures are used to establish, release or modify the UE context.

- Initial Context Setup;
- UE Context Release Request;
- UE Context Release;
- UE Context Modification;
- RRC Inactive Transition Report.

6.3 NAS transport procedures

The NAS transport procedures enable transparent transfer of NAS signalling data between the AMF and the UE. The procedures providing this functionality are:

- Initial UE Message (NG-RAN node initiated);
- Uplink NAS transport (NG-RAN node initiated);
- Downlink NAS transport (AMF initiated);
- NAS non delivery indication (NG-RAN node initiated);
- Reroute NAS Request (AMF initiated).

6.4 UE Mobility Management Procedures

The following list of UE Mobility management procedures are used to prepare, execute or cancel handovers.

- Handover Preparation;
- Handover Resource Allocation;
- Handover Notification;
- Path Switch Request;
- Uplink RAN Status Transfer;
- Downlink RAN Status Transfer;
- Handover Cancellation.

6.5 Paging procedure

The following paging procedure is used to send paging requests to the NG-RAN nodes involved in the paging area:

- Paging.

6.6 AMF Management procedures

The following list of AMF management procedures are used by the AMF to inform the NG-RAN node about an AMF's status, and to release the UE TNLA binding for specific UE(s):

- AMF Status Indication;
- UE TNLA binding release.

6.7 NG Interface Management procedures

The following list of procedures are used to manage the NG interface:

- NG Setup;
- RAN Configuration Update;
- AMF Configuration Update;
- NG Reset;
- Error Indication.

6.8 Warning message transmission procedures

The following procedures are used to manage the broadcasting of warning messages:

- Write-Replace Warning;
- PWS Cancel;
- PWS Restart Indication;
- PWS Failure Indication.

6.9 Location Reporting procedures

The following procedures are used to report the location of the UE:

- Location Reporting Control;
- Location Report;
- Location Reporting Failure Indication.

6.10 UE Radio Capability Management procedures

The following procedures are related to the UE radio capability handling:

- UE Radio Capability Check;
- UE Radio Capability Info Indication.

6.11 UE Tracing procedures

The following procedures are used to trace the UE:

- Trace Start;

- Trace Failure Indication;
- Deactivate Trace;
- Cell Traffic Trace.

6.12 NR Positioning Protocol A (NRPPa) procedures

The following procedures are used for NRPPa signalling:

- Downlink UE Associated NRPPa Transport;
- Uplink UE Associated NRPPa Transport;
- Downlink non-UE Associated NRPPa Transport;
- Uplink non-UE Associated NRPPa Transport.

6.13 Overload Control procedures

The following procedures are used by the AMF to start or stop overload control.

- Overload Start procedure;
- Overload Stop procedure.

7 NG interface protocol structure

7.1 NG Control Plane

The control plane protocol stack of the NG interface is shown on Figure 7.1-1. The transport network layer is built on IP transport. For the reliable transport of signalling messages, SCTP is added on top of IP. The application layer signalling protocol is referred to as NGAP (NG Application Protocol).

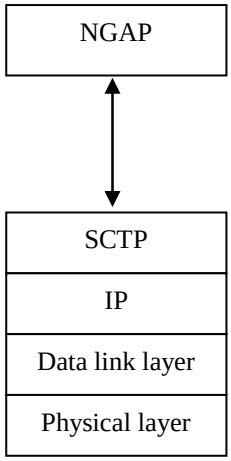

Figure 7.1-1: NG Interface Control Plane

7.2 NG User Plane

The NG user plane (NG-U) interface is defined between a NG-RAN node and a UPF. The NG-U interface provides non guaranteed delivery of PDU Session user plane PDUs between the NG-RAN node and the UPF.

The protocol stack for NG-U is shown in Figure 7.2-1.

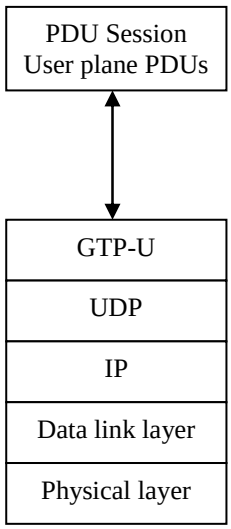

Figure 7.2-1: NG-U protocol structure

8 Other NG interface specifications

8.1 NG-RAN NG interface: NG layer 1 (TS 38.411)

TS 38.411 [2] specifies the physical layer technologies that may be used to support the NG interface.

8.2 NG-RAN NG interface: NG signalling transport (TS 38.412)

TS 38.412 [3] specifies how the NGAP signalling messages are transported over NG.

8.3 NG-RAN NG interface: NG application protocol (NGAP) (TS 38.413)

TS 38.413 [4] specifies the radio network layer signalling procedures of the control plane between the NG-RAN node and the AMF.

8.4 NG-RAN NG interface: NG data transport (TS 38.414)

TS 38.414 [5] specifies the standards for user data transport protocols over the NG interface.

8.5 NG-RAN NG interface: NG PDU Session user plane protocol (TS 38.415)

TS 38.415 [9] specifies the PDU Session user plane protocol procedures over the NG interface.

Annex A (informative): Change history

Change history							
Date	**Meeting**	**TDoc**	**CR**	**Rev**	**Cat**	**Subject/Comment**	**New version**
2017-04	R3#95b	R3-171127				TS skeleton	0.0.0
2017-04	R3#95b	R3-171397				Update including TP from R3-171375 with text reduction from rapporteur	0.0.1
2017-05	R3#96	R3-171218				Update of title page and change history	0.0.2
2017-05	R3#96	R3-171965				Addition of section 4 and 6. Deletion of the content of section 5 with detailed PDU session management procedure. Update of change history	0.1.0
2017-05	R3#96	R3-172019				Integration of R3-171981 with NAS Transport procedures. Update of change history.	0.2.0
2017-07	R3 NR AH# 2	R3-172632				Integration of R3-172597 and R3-172598 respectively adding of a list of functions in section 5 and adding references to other NG specifications in sections 2 and 8.	0.3.0
2017-09	R3#97	R3-173448				Integration of R3-173319 and R3-173325 respectively adding a list of procedures and the AMF transparency for PDU session related information. Integration of R3-173318 for terminology alignment with NG-RAN node.	0.4.0
2017-10	R3#97bis	R3-174238				Integration of R3-174104 modifying the NG architecture section. Integration of 3784 adding a list of procedures. Integration of 4151 adding AMF management function and procedures.	0.5.0
2017-12	R3#98	R3-175055				Integration of R3-174527.	0.6.0
2018-01	R3 NR AH#1801	R3-180648				Integration of R3-180540 removing NG-RAN from the abbreviations. Integration of R3-180095 correcting the description style of some procedures.	0.7.0
2018-03	R3#99	R3-181585				Integration of R3-181486 for stage 2 of PWS support. Integration of R3-181412 on NGAP support of multiple SCTP associations.	0.8.0
2018-04	R3#99bis	R3-182523				Integration of R3-181981 introducing TS 38.415. Integration of R3-182273 introducing explicit per UE TNLA binding release.	0.9.0
2018-05	R3#100	R3-183590				Integration of R3-183343 with location reporting function and procedures. Integration of R3-183479 with AMF re-allocation function. Correction of some editorials according to drafting rules.	0.10.0
2018-06	RAN#80	RP-180739				For approval	1.0.0
2018-06	RAN#80					Specification approved at TSG-RAN and placed under change control	15.0.0
2018-09	RAN#81	RP-181922	0001	4	F	NR Corrections (38.410 Baseline CR covering RAN3#101 agreements)	15.1.0

History

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