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Foreword

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Introduction

The present document is part of a TS-family covering the 3rd Generation Partnership Project Technical Specification Group Services and System Aspects Management and orchestration of networks, as identified below:

TS 28.540: Management and orchestration of 5G networks; Network Resource Model (NRM); Stage 1.

TS 28.541: Management and orchestration of 5G networks; Network Resource Model (NRM); Stage 2 and stage 3.

1 Scope

The present document specifies the requirements for the Network Resource Model (NRM) definition of NR, NG-RAN, 5G Core Network (5GC) and network slice, to support the management for:

- variety of 5G radio access network functions and features, covering management for NR connectivity options defined in 3GPP TS 37.340 [5] and NG-RAN architectural options defined in 3GPP TS 38.401 [4].
- variety of 5GC network functions and features defined in 3GPP TS 23.501 [2].
- network slice and network slice subnet.

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".
- [3] 3GPP TS 38.300: "NR; Overall description; Stage-2".
- [4] 3GPP TS 38.401: "NG-RAN; Architecture description".
- [5] 3GPP TS 37.340: "NR; Multi-connectivity; Overall description; Stage 2".
- [6] 3GPP TS 28.531: "Management and orchestration of 5G networks; Provisioning".
- [7] 3GPP TS 23.502: "Procedures for the 5G System; Stage 2".
- [8] GSMA NG.116 – "Generic Network Slice Template" v1.0 (2019-05-23).
- [9] 3GPP TS 28.533: "Management and orchestration; Architecture framework".

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].

5G Core Network: Defined in 3GPP TS 23.501 [2].

AMF Region: Defined in 3GPP TS 23.501 [2].

AMF Set: Defined in 3GPP TS 23.501 [2].

en-gNB: Defined in 3GPP TS 37.340 [5].

gNB: Defined in 3GPP TS 38.300 [3].

gNB Central Unit (gNB-CU): Defined in 3GPP TS 38.401 [4].

gNB-CU-Control Plane (gNB-CU-CP): Defined in 3GPP TS 38.401 [4].

gNB-CU-User Plane (gNB-CU-UP): Defined in 3GPP TS 38.401 [4].

gNB Distributed Unit (gNB-DU): Defined in 3GPP TS 38.401 [4].

ng-eNB: Defined in 3GPP TS 38.300 [3].

NG-RAN: Defined in 3GPP TS 23.501 [2].

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].

5GC	5G Core network
5GS	5G System
AMF	Access and Mobility Management Function
EN-DC	E-UTRA-NR Dual Connectivity
EPS	Evolved Packet System
MR-DC	Multi-RAT Dual Connectivity
NG-RAN	NG Radio Access Network
NR	New Radio
PCF	Policy Control Function
UDM	Unified Data Management
UDR	Unified Data Repository
UDSF	Unstructured Data Storage Function

4 Concepts and background

4.1 NR and NG-RAN deployment scenarios

According to NG-RAN architecture defined in 3GPP TS 38.300 [3], An NG-RAN node is either a gNB or an ng-eNB connected to 5GC.

A gNB may consist of a gNB-CU and one or more gNB-DU(s), and a gNB-CU may consist of a gNB-CU-CP and one or more gNB-CU-UP. From functional split point of view, there have following gNB deployment scenarios which are specified in 3GPP TS 38.401 [4]:

- 1) gNB which does not consist split function.
- 2) gNB which consists of gNB-CU and gNB-DU(s).
- 3) gNB which consists of gNB-CU-CP, gNB-CU-UP(s) and gNB-DU(s).

Abovementioned deployment scenarios apply to en-gNB also.

Part of gNB (e.g. gNB-CU) can be deployed as virtualized network function.

4.2 MR-DC

Besides single connectivity operation, E-UTRAN, NR and NG-RAN support Multi-RAT Dual Connectivity (MR-DC) operation defined in 3GPP TS 37.340 [5], which can be further divided into following two categories based on connected core network types.

- 1) MR-DC with the EPC via EN-DC, the NR node in EN-DC is called en-gNB.
- 2) MR-DC with the 5GC via either NG-RAN E-UTRA-NR Dual Connectivity (NGEN-DC) or NR-E-UTRA Dual Connectivity (NE-DC).

There are different user plane connectivity options of the master node and secondary node involved in MR-DC (see detail in 3GPP TS 37.340 [5]).

4.3 5GC architecture

The 5G architecture is defined as service-based and the interaction between network functions is represented in the following two ways:

- Service-based representation
- Reference point representation

The network functions composed 5GC is specified in 3GPP TS 23.501 [2], network functions within the 5GC control plane shall only use service-based interfaces for their interactions.

4.4 Data storage architecture

5G system architecture allows UDM, PCF and NEF to store their data in the Unified Data Repository (UDR), and allows any NF to store and retrieve its unstructured data (e.g. UE context) into/from a UDSF.

4.5 AMF load balancing insides AMF Region/AMF Set

When deploying AMF Region or AMF Set, AMF load balancing insides AMF Region/AMF Set is achieved by setting a weight factor for each AMF according to its relative capacity compared to other AMFs, see detail in clause 5.19.3 of 3GPP TS 23.501 [2].

4.6 5GC NFs supporting edge computing

Edge computing enables operator and 3rd party services to be hosted close to the UE's access point of attachment, so as to achieve an efficient service delivery through the reduced end-to-end latency and load on the transport network, see details in clause 5.13 of 3GPP TS 23.501 [2].

4.7 General information for network slice instance and network slice subnet instance

The general information used to describe network slice instance and network slice subnet instance are specified in TS 28.531 [6].

4.8 Remote Interference Management

A remote interference scenario may involve a number of victim and aggressor cells, where the gNBs execute Remote Interference Management (RIM) coordination on behalf of their respective cells. Aggressor and victim gNBs or cells can be grouped into semi-static sets, where each cell is assigned a set ID, and is configured with a RIM Reference Signal (RIM-RS) and the radio resources associated with the set ID. As defined in TS 38.300 [3].

4.9 Void

4.10 Management of NTN

4.10.1 Management of transparent mode feature

Satellite Transparent Mode is a communication mode where a satellite functions as a simple relay or "bent-pipe" that merely forwards signals between the user equipment (UE) and the terrestrial network, without any signal processing or modification by the satellite. The 3GPP management system should provide the satellite ephemeris parameters to the gNB providing non-terrestrial access as outlined in TS 38.300 [3] to support management of NTN function. Satellite assistance information (e.g. ephemeris information) can be used for the handling of coverage holes or discontinuous satellite coverage in a power efficient way.

For a UE using a Non-Terrestrial Network that provides discontinuous coverage, 3GPP management system needs to support UE location verification, NTN access restriction and NTN mobility management.

4.10.2 Management of Backhaul feature

The AMF reports the satellite backhaul category and indicates the satellite backhaul category change to SMF as outlined in TS 23.501 [2]. And the AMF can determine the Satellite backhaul category based on the information within Global RAN Node IDs associated with satellite backhaul. The 3GPP management system should provide a capability to allow the MnS consumer to configure satellite backhaul information for NTN node.

5 Requirements

5.1 Requirements for management of NG-RAN

The following specific requirements apply to NG-RAN:

REQ-NGRAN_NRM-CON-001: The NRM definitions shall support management of NG-RAN, containing gNB or/and ng-eNB.

REQ-NGRAN_NRM-CON-002: The NRM definitions shall support management of either gNB without split function or gNB with split functions defined in 3GPP TS 38.401 [4].

REQ-NGRAN_NRM-CON-003: The NRM definitions shall support management of virtualized network functions that are part of gNB, e.g. virtualized gNB-CU.

REQ-NGRAN_NRM-CON-004: The NRM definitions shall support management of intra-NG-RAN handover between any combinations of gNB and ng-eNB.

REQ-NGRAN_NRM-CON-005: The NRM definitions shall support management of inter-system handover between 5GS and EPS.

REQ-NGRAN_NRM-CON-006: The NRM definitions shall support management of network slicing feature in NG-RAN.

REQ-NGRAN_NRM-CON-007: The NRM definitions shall have a read-only representation of NR beam properties in NG-RAN.

REQ-NGRAN_NRM-CON-008: The NRM definitions shall support configuration of sector carrier coverage properties in NG-RAN.

REQ-NGRAN_NRM-CON-009: The NRM definitions shall support management of radio access network sharing feature in NG-RAN.

5.2 Requirements for management of MR-DC

The following specific requirements apply to MR-DC management, including management of NR in EN-DC and other MR-DC operations.

REQ-MRDC_NRM-CON-001: The NRM definitions shall support management of NR node in EN-DC operation (en-gNB).

REQ-MRDC_NRM-CON-002: The NRM definitions shall support management of en-gNB with different user plane connectivity options defined in 3GPP TS 37.340 [5].

REQ-MRDC_NRM-CON-003: The NRM definitions shall support management of NG-RAN nodes in NGEN-DC operation.

REQ-MRDC_NRM-CON-004: The NRM definitions shall support management different user plane connectivity options in NGEN-DC operation defined in 3GPP TS 37.340 [5].

REQ-MRDC_NRM-CON-005: The NRM definitions shall support management of NG-RAN nodes in EN-DC operation.

REQ-MRDC_NRM-CON-006: The NRM definitions shall support management different user plane connectivity options in NE-DC operation defined in 3GPP TS 37.340 [5].

5.3 Requirements for management of 5GC NFs

The following specific requirements apply to management of 5GC NFs:

REQ-5GC_NRM-CON-001: The NRM definitions shall support management of 5GC containing variety of network functions defined in 3GPP TS 23.501 [2].

REQ-5GC_NRM-CON-002: The NRM definitions should support management of all the relationships between network functions and corresponding data storage functions where the network functions store/retrieve their data.

REQ-5GC_NRM-CON-003: The NRM definitions shall support management of interworking between 5GC and EPC.

REQ-5GC_NRM-CON-004: The NRM definitions shall support management of network slicing feature in 5GC.

REQ-5GC_NRM-CON-005: The NRM definitions shall support management of 5GC network function services independently to align with requirements of 3GPP TS 23.501 [2].

REQ-5GC_NRM-CON-006: The NRM definitions shall support NF service instance registration, deregistration, update, etc., with NRF during NF service instance lifecycle to align with requirements of 3GPP TS 23.501 [2] and 3GPP TS 23.502 [x].

REQ-5GC_NRM-CON-007: The NRM definitions shall support configuration of NF profile for NF Service registration and discovery to align with requirements of 3GPP TS 23.501 [2] and 3GPP TS 23.502 [7].

5.4 Requirements for management of AMF Set

REQ-AMFSET_NRM-CON-001: The NRM definitions shall support management of AMF Region and AMF Set, including AMF load balancing management.

5.5 Requirements for management of edge computing

REQ-ECM_NRM-CON-001 The NRM definitions shall support management of 5GC NFs supporting edge computing.

5.6 Requirements for management of network slice and network slice subnet

The following requirements apply to network slice and network slice subnet:

REQ-NS_NRM-CON-001: The NRM definitions shall support management of network slice.

REQ-NS_NRM-CON-002: The NRM definitions shall support management of network slice subnet.

REQ-NS_NRM-CON-003: The NRM definitions shall support the attributes of the Generic network Slice Template (GST) defined by GSMA [8].

NOTE: The NEST attributes values represent the SLS requirements for a network slice. These attribute values are used as input for network slice SLA management related activities.

5.7 Requirements Remote Interference Management

REQ-NGRAN_NRM-CON-001: The NRM definitions should support Remote Interference Management.

5.8 Void

5.9 Requirements for management of NTN

5.9.1 Management of transparent mode feature

5.9.1.1 Management of transparent mode feature for NG-RAN

REQ-NTN_TRANS_NRNRM-001: The NR NRM definitions should support management of NTN NG-RAN node.

REQ-NTN_TRANS_NRNRM-002: The NR NRM definitions should support NTN mobility management.

5.9.1.2 Management of transparent mode feature for 5GC

REQ-NTN_TRANS_5GCNRM-001: The 5GC NRM definitions should support NTN UE location verification.

REQ-NTN_TRANS_5GCNRM-002: The 5GC NRM definitions should support NTN access restriction.

REQ-NTN_TRANS_5GCNRM-003: The 5GC NRM definitions should support NTN mobility management.

5.9.2 Management of Backhaul feature

REQ-NTN_BACKHAUL-001: The 5GC NRM definitions should support a capability to allow the MnS consumer to configure satellite backhaul information for NTN node.

Annex A (informative): Change history

Change history							
Date	Meeting	TDoc	CR	Rev	Cat	Subject/Comment	New version
2018-12	SA#82	SP-181046	0001	2	C	Support read-only representation of NR beam properties in NG-RAN NRM definitions	15.1.0
2019-06	SA#84	SP-190373	0002	1	B	Update NRM requirement to support SBA management	16.0.0
2019-12	SA#86	SP-191166	0003	2	B	Add OAM support for RIM parameters	16.1.0
2019-12	SA#86	SP-191170	0004	1	C	Add GSMA GST mapping related requirements	16.1.0
2019-12	SA#86	SP-191166	0007	1	B	Add requirement on NR sector carrier coverage configuration	16.1.0
2020-03	SA#87E	SP-200169	0009	-	F	Correction of requirement number	16.2.0
2020-09	SA#89e	SP-200748	0011	-	B	Add requirements for NR NRM to support RAN sharing scenario	17.0.0
2021-06	SA#92e	SP-210410	0014	1	B	Update the requirements for management of network slice and network slice subnet	17.1.0
2021-12	SA#94e	SP-211468	0016	-	B	Add NRM requirements for authentication and authorization	17.2.0
2022-12	SA#98e	SP-221167	0019	-	F	EditorialCorrections	17.3.0
2024-04	-	-	-	-	-	Update to Rel-18 version (MCC)	18.0.0
2024-12	SA#106	SP-241657	0022	1	F	Rel-18 CR TS 28.540 add missing requirements for NTN management	18.1.0
2025-03	SA#107	SP-250175	0027	1	F	Rel-18 CR TS 28.540 Remove requirements of MSAC	18.2.0

History

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