

# ETSI TS 128 540 V17.3.0 (2023-01)



**5G;  
Management and orchestration;  
5G Network Resource Model (NRM);  
Stage 1  
(3GPP TS 28.540 version 17.3.0 Release 17)**



---

**Reference**

RTS/TSGS-0528540vh30

---

**Keywords**

5G

**ETSI**

---

650 Route des Lucioles  
F-06921 Sophia Antipolis Cedex - FRANCE

Tel.: +33 4 92 94 42 00 Fax: +33 4 93 65 47 16

Siret N° 348 623 562 00017 - APE 7112B  
Association à but non lucratif enregistrée à la  
Sous-Préfecture de Grasse (06) N° w061004871

---

**Important notice**

The present document can be downloaded from:

<http://www.etsi.org/standards-search>

The present document may be made available in electronic versions and/or in print. The content of any electronic and/or print versions of the present document shall not be modified without the prior written authorization of ETSI. In case of any existing or perceived difference in contents between such versions and/or in print, the prevailing version of an ETSI deliverable is the one made publicly available in PDF format at [www.etsi.org/deliver](http://www.etsi.org/deliver).

Users of the present document should be aware that the document may be subject to revision or change of status.

Information on the current status of this and other ETSI documents is available at

<https://portal.etsi.org/TB/ETSIDeliverableStatus.aspx>

If you find errors in the present document, please send your comment to one of the following services:

<https://portal.etsi.org/People/CommitteeSupportStaff.aspx>

If you find a security vulnerability in the present document, please report it through our  
Coordinated Vulnerability Disclosure Program:

<https://www.etsi.org/standards/coordinated-vulnerability-disclosure>

---

**Notice of disclaimer & limitation of liability**

The information provided in the present deliverable is directed solely to professionals who have the appropriate degree of experience to understand and interpret its content in accordance with generally accepted engineering or other professional standard and applicable regulations.

No recommendation as to products and services or vendors is made or should be implied.

No representation or warranty is made that this deliverable is technically accurate or sufficient or conforms to any law and/or governmental rule and/or regulation and further, no representation or warranty is made of merchantability or fitness for any particular purpose or against infringement of intellectual property rights.

In no event shall ETSI be held liable for loss of profits or any other incidental or consequential damages.

Any software contained in this deliverable is provided "AS IS" with no warranties, express or implied, including but not limited to, the warranties of merchantability, fitness for a particular purpose and non-infringement of intellectual property rights and ETSI shall not be held liable in any event for any damages whatsoever (including, without limitation, damages for loss of profits, business interruption, loss of information, or any other pecuniary loss) arising out of or related to the use of or inability to use the software.

---

**Copyright Notification**

No part may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm except as authorized by written permission of ETSI.

The content of the PDF version shall not be modified without the written authorization of ETSI.

The copyright and the foregoing restriction extend to reproduction in all media.

© ETSI 2023.  
All rights reserved.

---

# Intellectual Property Rights

## Essential patents

IPRs essential or potentially essential to normative deliverables may have been declared to ETSI. The declarations pertaining to these essential IPRs, if any, are publicly available for **ETSI members and non-members**, and can be found in ETSI SR 000 314: "*Intellectual Property Rights (IPRs); Essential, or potentially Essential, IPRs notified to ETSI in respect of ETSI standards*", which is available from the ETSI Secretariat. Latest updates are available on the ETSI Web server (<https://ipr.etsi.org/>).

Pursuant to the ETSI Directives including the ETSI IPR Policy, no investigation regarding the essentiality of IPRs, including IPR searches, has been carried out by ETSI. No guarantee can be given as to the existence of other IPRs not referenced in ETSI SR 000 314 (or the updates on the ETSI Web server) which are, or may be, or may become, essential to the present document.

## Trademarks

The present document may include trademarks and/or tradenames which are asserted and/or registered by their owners. ETSI claims no ownership of these except for any which are indicated as being the property of ETSI, and conveys no right to use or reproduce any trademark and/or tradename. Mention of those trademarks in the present document does not constitute an endorsement by ETSI of products, services or organizations associated with those trademarks.

**DECT™**, **PLUGTESTS™**, **UMTS™** and the ETSI logo are trademarks of ETSI registered for the benefit of its Members. **3GPP™** and **LTE™** are trademarks of ETSI registered for the benefit of its Members and of the 3GPP Organizational Partners. **oneM2M™** logo is a trademark of ETSI registered for the benefit of its Members and of the oneM2M Partners. **GSM®** and the GSM logo are trademarks registered and owned by the GSM Association.

---

# Legal Notice

This Technical Specification (TS) has been produced by ETSI 3rd Generation Partnership Project (3GPP).

The present document may refer to technical specifications or reports using their 3GPP identities. These shall be interpreted as being references to the corresponding ETSI deliverables.

The cross reference between 3GPP and ETSI identities can be found under <http://webapp.etsi.org/key/queryform.asp>.

---

# Modal verbs terminology

In the present document "**shall**", "**shall not**", "**should**", "**should not**", "**may**", "**need not**", "**will**", "**will not**", "**can**" and "**cannot**" are to be interpreted as described in clause 3.2 of the [ETSI Drafting Rules](#) (Verbal forms for the expression of provisions).

"**must**" and "**must not**" are **NOT** allowed in ETSI deliverables except when used in direct citation.

# Contents

Intellectual Property Rights .....	2
Legal Notice .....	2
Modal verbs terminology.....	2
Foreword.....	4
Introduction .....	4
1 Scope .....	5
2 References .....	5
3 Definitions and abbreviations.....	5
3.1 Definitions .....	5
3.2 Abbreviations .....	6
4 Concepts and background .....	6
4.1 NR and NG-RAN deployment scenarios.....	6
4.2 MR-DC.....	6
4.3 5GC architecture .....	7
4.4 Data storage architecture .....	7
4.5 AMF load balancing insides AMF Region/AMF Set .....	7
4.6 5GC NFs supporting edge computing .....	7
4.7 General information for network slice instance and network slice subnet instance .....	7
4.8 Remote Interference Management .....	7
4.9 Access Control .....	7
5 Requirements.....	8
5.1 Requirements for management of NG-RAN .....	8
5.2 Requirements for management of MR-DC.....	8
5.3 Requirements for management of 5GC NFs .....	8
5.4 Requirements for management of AMF Set.....	9
5.5 Requirements for management of edge computing .....	9
5.6 Requirements for management of network slice and network slice subnet.....	9
5.7 Requirements Remote Interference Management .....	9
5.8 Requirements MnS Access Control.....	9
<b>Annex A (informative): Change history .....</b>	<b>11</b>
History .....	12

---

# Foreword

This Technical Specification has been produced by the 3<sup>rd</sup> Generation Partnership Project (3GPP).

The contents of the present document are subject to continuing work within the TSG and may change following formal TSG approval. Should the TSG modify the contents of the present document, it will be re-released by the TSG with an identifying change of release date and an increase in version number as follows:

Version x.y.z

where:

- x the first digit:
  - 1 presented to TSG for information;
  - 2 presented to TSG for approval;
  - 3 or greater indicates TSG approved document under change control.
- y the second digit is incremented for all changes of substance, i.e. technical enhancements, corrections, updates, etc.
- z the third digit is incremented when editorial only changes have been incorporated in the document.

---

# Introduction

The present document is part of a TS-family covering the 3<sup>rd</sup> 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 Access Control

Access control ensures that an MnS provided by an MnS producer can be consumed only by an authenticated entity with appropriate authorization as specified in TS 28.533 [9].



---

## 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 Requirements MnS Access Control

**REQ-MSAC\_NRM-CON-001:** The NRM definitions should support MnS Access Control.

**REQ-MSAC\_NRM-CON-002:** The NRM definitions should support MnS Access Control identity information.

**REQ-MSAC\_NRM-CON-003:** The NRM definitions should support MnS authentication services.

**REQ-MSAC\_NRM-CON-004:** The NRM definitions should support MnS authorization services.

**REQ-MSAC\_NRM-CON-005:** The MnS Access Control policies should support authorization at MOI level.

**REQ-MSAC\_NRM-CON-006:** The MnS Access Control policies should support authorization at MOI attribute level.

**REQ-MSAC\_NRM-CON-007:** The MnS Access Control policies should support authorization of operations.

**REQ-MSAC\_NRM-CON-008:** The MnS Access Control policies should support authorization of notifications.

## 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

---

# History

<b>Document history</b>		
V17.2.0	May 2022	Publication
V17.3.0	January 2023	Publication