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Technical Domain / Task Number 2 Working Group 3 (Emerging Digital Technology)

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Introduction of 3GPP global standards organisation and 5G standardisation in 3GPP

# Summary

This document introduces the 3GPP (3rd Generation Partnership Project) global standards organisation and 5G standardisation that 3GPP have been working on from 3GPP Release 15 Technical Specifications.

## Purpose of the document

This document is to inform IALA of 5G standardisation in 3GPP as well as the introduction of 3GPP global standards organisation.

## Related documents

None.

# Background

3GPP have developed 3GPP Technical Report and are working on a 3GPP Technical Specification to be applicable to maritime usage. Therefore, it seems to be necessary to form the official partnership between IALA and 3GPP to collaborate on the development of global standards for maritime digitalisation and mobilisation.

# Introduction of 3GPP global standards organisation and 5G standardisation in 3GPP

This clause describes 3GPP global standards organisation and 5G standardisation in 3GPP based on the official information provided in [1].

## Introduction of 3GPP Global Standards Organisation

### 3GPP overview

3GPP was created in December 1998 by the signing of the "The 3rd Generation Partnership [Project Agreement](http://www.3gpp.org/ftp/Inbox/2008_web_files/3gppagre.pdf)". 3GPP unites seven telecommunications standard development organizations (ARIB, ATIS, CCSA, ETSI, TSDSI, TTA, TTC), known as “Organizational Partners” and provides their members with a stable environment to produce the Reports and Specifications that define 3GPP technologies.

The original scope of 3GPP in 1998 year was to produce Technical Specifications and Technical Reports for a 3G Mobile System based on evolved GSM core networks and the radio access technologies that they support (i.e., Universal Terrestrial Radio Access (UTRA) both Frequency Division Duplex (FDD) and Time Division Duplex (TDD) modes).

The scope was subsequently amended to include the maintenance and development of the Global System for Mobile communication (GSM) Technical Specifications and Technical Reports including evolved radio access technologies.

The project covers cellular telecommunications network technologies, including radio access, the core transport network, and service capabilities - including work on codecs, security, quality of service - and thus provides complete system specifications. The specifications also provide hooks for non-radio access to the core network, and for interworking with Wi-Fi networks.

3GPP specifications and studies are contribution-driven, by member companies, in Working Groups and at the Technical Specification Group level.

Detailed information about 3GPP can be found in http://www.3gpp.org/about-3gpp.

### Structure of 3GPP

There are three Technical Specification Groups (TSGs) in 3GPP and their Working Groups meet regularly and come together for the quarterly TSG Plenary meeting, where the work is presented for approval. Each TSG has a particular area of responsibility for the technical Report s and Specifications falling within its Terms of Reference.

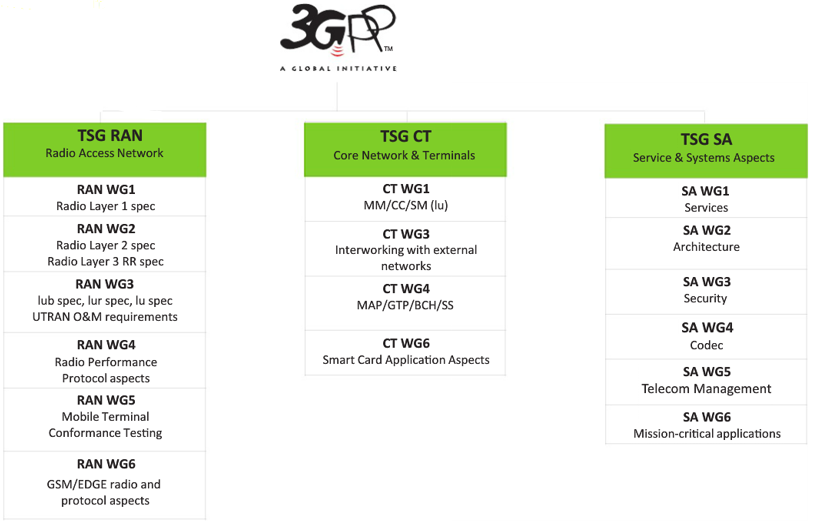


Figure 1 Structure of 3GPP organisation

Detailed information about 3GPP can be found in http://www.3gpp.org/specifications-groups.

### 3GPP procedure of the development of Technical Reports and Specifications

3GPP uses a system of parallel “Release” which provides developers with a stable platform for the implementation of features at a given point and then allow for the addition of new functionality in subsequent Releases.

Once functionally frozen, only essential corrections are permitted to the Release or the Specification within the Release. Further functionality will go to the next Release, with new functionality resulting in an entirely new specification. This allows operators and equipment manufacturers to choose which Release to build their systems to.

3GPP also use the term “Stage” that derives from the ITU-T method for categorizing specifications [2].

* “Stage 1” refers to the service description from a service-user’s point of view.
* “Stage 2” is a logical analysis, devising an abstract architecture of functional elements and the information flows amongst them across reference points between functional entities.
* “Stage 3” is the concrete implementation of the functionality and of the protocols appearing at physical interfaces between physical elements onto which the functional elements have been mapped.

In addition, 3GPP often performs feasibility studies the results of which are made available in Technical Reports (normally 3GPP-internal TRs, numbered xx.8xx, not intended for transposition by the Organizational Partner SDOs). The feasibility study might be considered as a sort of “Stage 0”. Furthermore, some Stage 3 specifications require test specifications to be prepared: effectively a “Stage 4”.

3GPP have broadly aligned Working Groups with these Stages. 3GPP SA WG1 set the service and feature requirements (Stage 1) while 3GPP SA WG2, the architecture group carries out Stage 2 work, based on those service requirements. 3GPP TSG CT is then responsible for the non-radio protocol work (Stage 3), with RAN groups doing their own Stage 3 work. In recent years, with the 3GPP RAN group’s role evolving - they have taken a lot of the Stage 1 and Stage 2 radio work. However, a great deal of coordination between SA and RAN is done – to ensure that new features are consistently defined across the project.

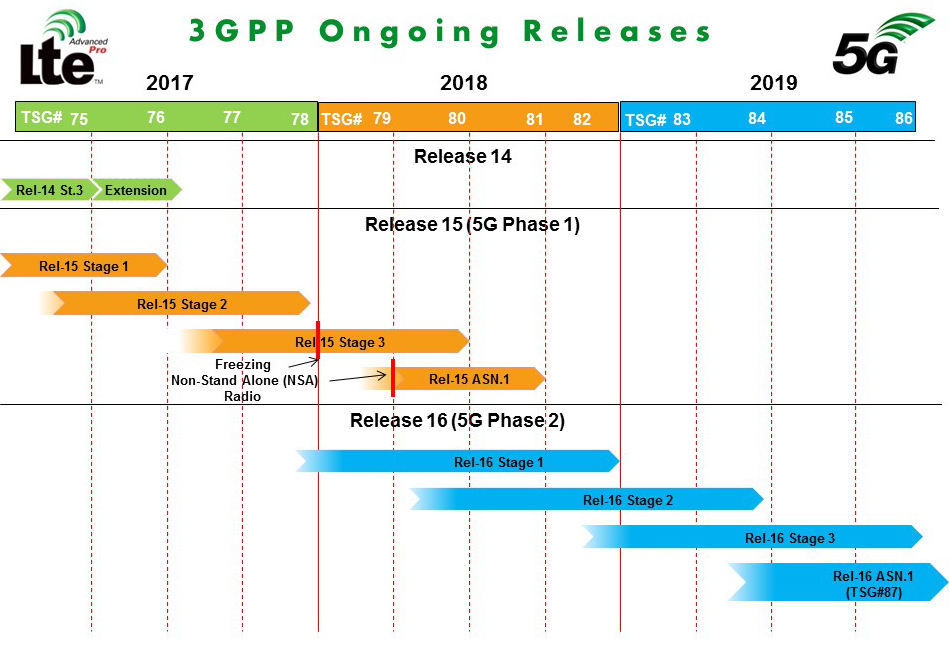


Figure 2 Example of 3GPP Release and Stage

The mechanisms for creating and maintaining specifications are described in TR 21.900 [3].

Detailed information about 3GPP procedure of the development of Technical Reports and Specification can be found in http://www.3gpp.org/specifications/67-releases.

### 3GPP procedure of the creation of revised versions of 3GPP specifications after their initial approval

3GPP uses the Change Request (CR) procedure to create revised versions of 3GPP specifications after their initial approval. The three main reasons why a change might be required are to:

* Add a new feature
* Correct, clarify and enhance an existing feature of a Release still under development
* Correct an error in a specification which is functionally frozen

A CR is a document (a "temporary document" - tdoc - to a meeting) which specifies in precise detail changes which are proposed to the specification. A Change Request can be proposed by any 3GPP member organization. It is normally submitted for discussion to the Working Group (WG) responsible for the specification. Once the WG has agreed that the Change Request is both valid and required (often it may be revised several times before reaching this stage), it is presented, on behalf of the WG (rather than the originating member organization) as an agreed proposal to the parent TSG plenary for final approval. After approval at TSG level, the 3GPP Support Team (MCC) incorporates it and any other CRs into a new version of the specification, and makes the new version of the specification available.

A solid working knowledge of the CR mechanism is one of the essential elements of a 3GPP delegate’s know-how.

Detailed information about the Change Request of 3GPP specifications can be found in <http://www.3gpp.org/specifications/change-requests>.

### 3GPP specifications

All of the specifications and drafts are freely available from the 3GPP Portal and the website. Recent specifications have a number consisting of 5 digits (e.g. TS 22.119).

The first two digits define the series shown in the table 1.

1. Subject of specification series (3G and beyond – from Release 99)

|  |  |
| --- | --- |
| Requirements | [21 series](http://www.3gpp.org/ftp/Specs/html-info/21-series.htm) |
| Service aspects ("stage 1") | [22 series](http://www.3gpp.org/ftp/Specs/html-info/22-series.htm) |
| Technical realization ("stage 2") | [23 series](http://www.3gpp.org/ftp/Specs/html-info/23-series.htm) |
| Signalling protocols ("stage 3") - user equipment to network | [24 series](http://www.3gpp.org/ftp/Specs/html-info/24-series.htm) |
| Radio aspects | [25 series](http://www.3gpp.org/ftp/Specs/html-info/25-series.htm) |
| CODECs | [26 series](http://www.3gpp.org/ftp/Specs/html-info/26-series.htm) |
| Data | [27 series](http://www.3gpp.org/ftp/Specs/html-info/27-series.htm) |
| Signalling protocols ("stage 3") -(RSS-CN) and OAM&P and Charging (overflow from 32.- range) | [28 series](http://www.3gpp.org/ftp/Specs/html-info/28-series.htm) |
| Signalling protocols ("stage 3") - intra-fixed-network | [29 series](http://www.3gpp.org/ftp/Specs/html-info/29-series.htm) |
| Programme management | [30 series](http://www.3gpp.org/ftp/Specs/html-info/30-series.htm) |
| Subscriber Identity Module (SIM / USIM), IC Cards. Test specs. | [31 series](http://www.3gpp.org/ftp/Specs/html-info/31-series.htm) |
| OAM&P and Charging | [32 series](http://www.3gpp.org/ftp/Specs/html-info/32-series.htm) |
| Security aspects | [33 series](http://www.3gpp.org/ftp/Specs/html-info/33-series.htm) |
| UE and (U)SIM test specifications | [34 series](http://www.3gpp.org/ftp/Specs/html-info/34-series.htm) |
| Security algorithms (3) | [35 series](http://www.3gpp.org/ftp/Specs/html-info/35-series.htm) |
| LTE (Evolved UTRA), LTE-Advanced, LTE-Advanced Pro radio technology | [36 series](http://www.3gpp.org/ftp/Specs/html-info/36-series.htm) |
| Multiple radio access technology aspects | [37 series](http://www.3gpp.org/ftp/Specs/html-info/37-series.htm) |
| Radio technology beyond LTE | [38 series](http://www.3gpp.org/ftp/Specs/html-info/37-series.htm) |

Detailed information about the full set of specifications can be found in http://www.3gpp.org/specifications/specification-numbering.

## Introduction of 5G Standardisation in 3GPP

### Overview of 5G standardisation in 3GPP

3GPP 5G standards kicked-off at the RAN group’s consultative workshop that was held in September 2015. The workshop concluded that 3GPP 5G standards would address three major use cases families: Enhanced mobile broadband; Massive machine type communications; Ultra-reliable low latency communications that ITU-R defined for IMT-2020. The intention of supporting these families from the outset for 5G standardisation in 3GPP was to ensure new industry sectors might make use of 3GPP 5G specifications to meet their particular needs. [4]

3GPP have been under standardisation on 5G standards since 2016 with a phased approach to the delivery of the standards. The first phase of 5G standards was delivered in June 2018 as 3GPP Release 15 specifications and a second phase would be delivered by the end of 2019 as 3GPP Release 16 specifications.

Completing the 5G work will take at least two ‘phases’ and multiple 3GPP Releases [4].

### 5G standardisation on 5G service requirements

3GPP SA WG1 started in 2015 to look at potential 5G requirements resulting in 3GPP Technical Report 22.891 [5] which contains more than 70 different use cases, now categorised into four different groups; massive Internet of Things, Critical Communications, enhanced Mobile Broadband and Network Operation – which are also the titles of the four Technical Reports [6][7][8][9]. Four Technical Reports outline the New Services and Markets Technology Enablers (SMARTER) for next generation mobile communications.

Based on the outcome of four Technical Reports, 3GPP SA WG1 completed its first normative specification on “Service requirements for the 5G system”, 3GPP Stage 1 Technical Specification (TS) 22.261 [10] as the first phase of 5G standards in 3GPP Release 15 in March 2017.

The 3GPP TS 22.261 contains requirements on performance targets and basic capabilities – characterised by:

* Support for fixed, mobile, wireless and satellite access technologies
* A scalable and customizable network that can be tailored to requirements from multiple services and vertical markets (e.g., network slicing, Network Function Virtualization)
* Resource efficiency for services ranging from low data IoT services to high bitrate multimedia services
* Energy efficiency and battery power optimization
* Network capability exposure to allow 3rd party Internet Service Providers and Internet Content Providers to e.g. manage network slices, and deploy applications in the operator’s Service Hosting Environment
* Indirect connectivity from a Remote UE via a Relay UE to the network, and service continuity between indirect connections and direct connections.

The service requirements in the 3GPP TS 22.261 was used as inputs for the 5G normative work in other 3GPP working groups.

In 3GPP Release 16 timeline, 3GPP SA WG1 has been specifying additional 5G normative works to satisfy new requirements from diverse vertical domains and service requirements developed from those 5G normative works are under standardisation to be added in 3GPP Release 16 Stage 1 TS 22.261.

Some new feasibility studies started in 3GPP SA WG1 by targeting the normative work in 3GPP Release 17 next year so it is expected to develop more new service requirements that satisfy demands from vertical industries.

Detailed information about the status of 5G standardisation in 3GPP SA WG1 can be found in www3gpp.org.

### Service Based Architecture and Network Slicing

Compared to previous generations, the 3GPP 5G system architecture is service based. It means wherever suitable the architecture elements are defined as network functions that offer their services via interfaces of a common framework to any network functions that are permitted to make use of these provided services [4]. The various architecture diagram can be found in 3GPP TS 23.501 [11].

A distinct key feature of the 5G system architecture is network slicing. The previous generations supported certain aspects of this with the functionality for dedicated Core Networks. Compared to this, 5G network slicing is a more powerful concept and includes the whole PLMN. Within the scope of the 3GPP 5G system architecture, a network slice refers to the set of 3GPP defined features and functionalities that together form a complete PLMN for providing services to UEs. Network slicing allows for controlled composition of a PLMN from the specified network functions with their specifics and provided services that are required for a specific usage scenarios [4].

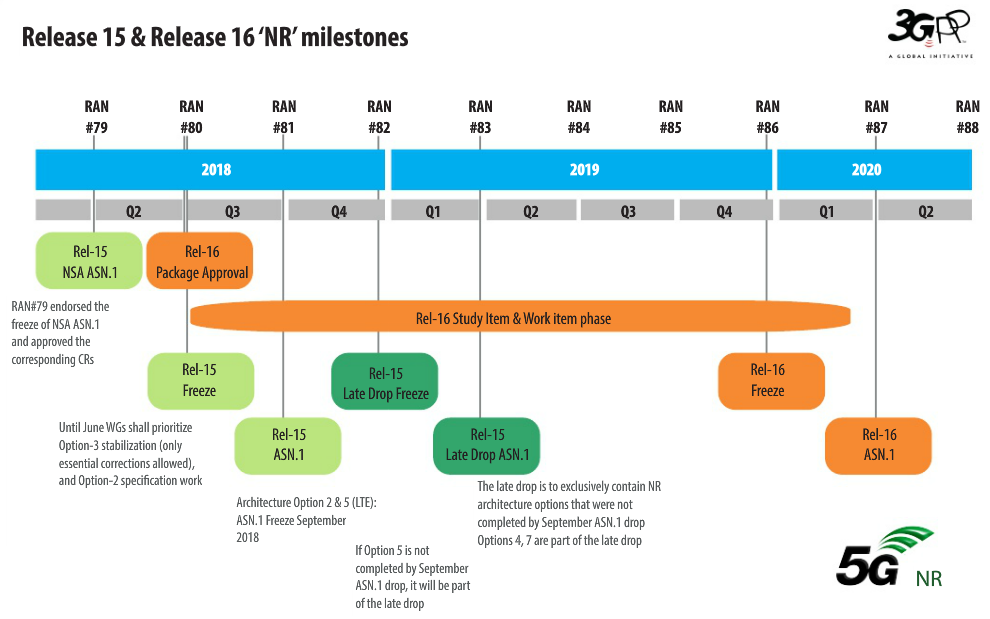
Earlier system architectures from previous generations enabled what was typically a single deployment of a PLMN to provide all features, capabilities and services required for all wanted usage scenarios. Much of the capabilities and features provided by the single, common deployment was in fact required for only a subset of the PLMN’s users/UEs (User Equipments). Network slicing enables the network operator to deploy multiple, independent PLMNs where each is customized by instantiating only the features, capabilities and services required to satisfy the subset of the served users/UEs or a related business customer needs [4].

Detailed information about the 5G system architecture in 3GPP can be found in www3gpp.org.

### New 5G Radio in 3GPP RAN

3GPP RAN groups have been identifying and developing the technology components needed for the NR system to meet market needs and the long-term requirements of the ITU-R IMT-2020 process. The NR system should be able to use any spectrum band that - ranging at least up to 100 GHz – that may be made available for wireless communication in the future [12].

3GPP RAN completed the Non-Standalone (NSA) 5G radio specifications, with an LTE anchor for control plane communications and NR to boost the user data capacity in December 2018 and then completed a Standalone (SA) system with full control plane support for the new 5G radio as a first phase of 5G system from radio aspects.



*Figure 3 New Radio (NR) milestones in 3GPP Release 15 and Release 16*

Detailed information about the status of 5G standardisation in 3GPP RAN groups can be found in www3gpp.org.

### ITU-R IMT-2020 status

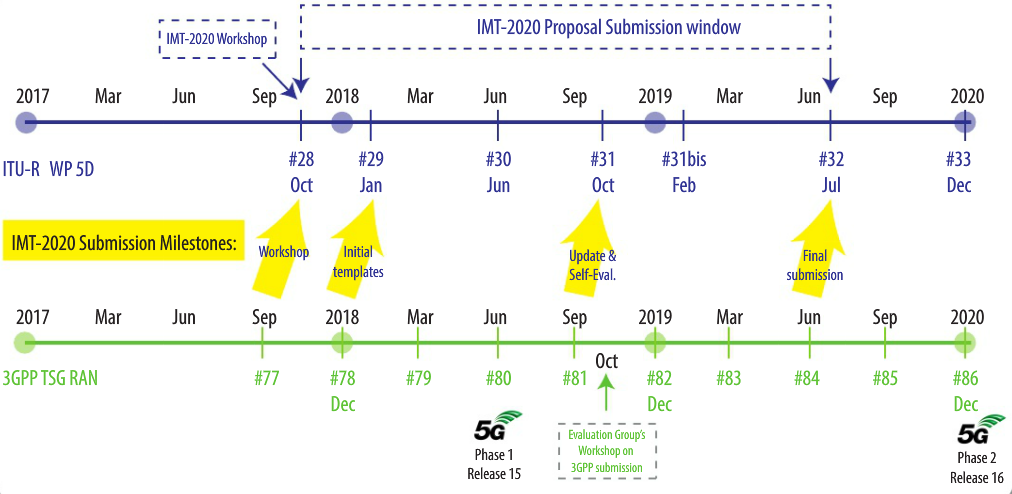
In December 2017, 3GPP RAN and SA agreed on the plan for 3GPP 5G candidate technologies for inclusion in the ITU’s IMT-2020 family of ‘Approved’ 5G radio interfaces, to be in place by WRC-19 in 2019. The 3GPP schedule for IMT-2020 proposal submission is summarised in the figure 4 [13].

3GPP groups are now working on LTE evolution and 5G NR specifications and have submitted the initial 3GPP “Description template of 3GPP 5G candidate for inclusion in IMT-2020 – outlining the technical characteristics of the 3GPP 5G solution – to the ITU. The initial summary was not complete and final, but it already provided a good overview of the contents of 3GPP Release 15, as the version delivered in December 2017 and will allow ITU-R and Independent Evaluation Groups to better understand the 3GPP proposal, when starting their evaluation process.

Three versions of 3GPP specifications are to be sent only when milestones of high relevance are achieved as follows.

* Release 15 December 2017 version
* Release 15 June 2017 version
* Release 16

The final and fully comprehensive 3GPP IMT-2020 submission (encompassing both Release 15 and Release 16) is planned for July 2019.



*Figure 4 Schedule of IMT-2020 proposal submission in 3GPP*

Detailed information about IMT-2020 submission in 3GPP can be found in www3gpp.org.

# References

1. [www.3gpp.org](http://www.3gpp.org)
2. ITU-T Recommendation I.130
3. 3GPP TR 21.900 Technical Specification Group working methods that is downloadable from <http://www.3gpp.org/DynaReport/21900.htm>
4. Flip-brochure-About 3GPP that is available from www.3gpp.org
5. TR 22.891 Study on New Services and Markets Technology Enablers
6. TR 22.861 FS\_SMARTER – massive Internet of Things
7. TR 22.862 Feasibility study on new services and markets technology enablers for critical communications; Stage 1
8. TR 22.863 Feasibility study on new services and markets technology enablers for enhanced mobile broadband; Stage 1
9. TR 22.864 Feasibility study on new services and markets technology enablers for network operation; Stage 1
10. 3GPP Stage 1 TS 22.261 that is downloadable from http://www.3gpp.org/DynaReport/22261.htm
11. 3GPP TS 23.501, System Architecture for the 5G System; Stage 2 that is downloadable from http://www.3gpp.org/DynaReport/23501.htm
12. RP-160617, RAN Time Budget RAN#71
13. SP-171082, LS to PCG: Draft LTI on 3GPP 5G Initial Description Template

# Action requested of the Committee

None

1. Input document number, to be assigned by the Committee Secretary [↑](#footnote-ref-1)
2. Leave open if uncertain [↑](#footnote-ref-2)