3GPP Highlights

ISSUE 08
June 2024

the 3GPP Newsletter

Technical News

WG SA4 articles on delivering AR & xR media capabilities to users in real time.

Why the 3GPP system will play a growing role in how smart energy is delivered (NSOEU).

WG SA3 Security Assurance (SCAS), to avoid vulnerability.

WG CT4 Completion of the Rel-18 work on NG-RTC.

WG SA5 work on Management and Orchestration in Rel-19.

Partner Focus

The SCF tell us about their standards collaborations beyond 3GPP.

The TSDSI member IIT Kanpur have contributed an India perspective on the benefits of Ambient IoT.

We also have a TCCA article on procurement practices for Mission Critical equipment.

A look inside

The view from inside is spread liberally throughout the newsletter. We have news about the 6G Stage 1 Workshop and about why 3GPP NTN is the Satellite technology of the year.

There is also a high level calendar of meetings, news of the 2023 Excellence Awards and a look at our new 6G logo.

Plus, an interview with the WG RAN2 Chair.

FORE - WORD

In Highlights #8 we hear about how 5G Advanced is still front-and-centre of the work of the groups in 3GPP, but also about how planning for 3GPP 6G is being addressed.

During the recent WG SA1 stage 1 requirements workshop for 6G (Rotterdam, May 8-10) a light was shone on the needs of the operator, service provider and the service user community. In this issue of Highlights we have an article by our TSG SA Chair, Puneet Jain – with his feedback on the workshop.

In the Technology section we have a variety of view-points. With two articles from our WG SA4 experts on delivering Augmeted Reality and Extended Reality media capabilities to users in real time. We also learn how the 3GPP system will play a growing role in energy delivery – with our article on Network and Service Operations for Energy Utilities (NSOEU) – defining how energy utility service providers and MNOs can exchange information in a standardized way.

Also in the technical section, we have a WG SA3 article on the influence of 3GPP Security Assurance (SCAS), which is helping to ensure that network nodes are implemented and are behaving according to the specifications.

There is more, from our experts, with articles on TSG CT Rel-18 stage 3 completion, on Next Generation Real Time Communication (NG-RTC), on WG RAN3 work for Rel-18 and the WG SA5 work on Management and Orchestration in Rel-19.

The partners have helped greatly in Highlights Issue 8, with three diverse articles. The SCF have shared news of their latest collaboration with other open groups. We also have an India perspective on the benefits of Ambient IoT and last up, we have a piece on the procurement practices for critical communications MCx kit from the TCCA.

Saving the best for last again, we finish this issue with 'A look inside', where we have an interview with Diana Pani, RAN2 Chair. Diana shares with us some great insights into the inner workings of the technical groups and how they get the job done.

As always, we hope that you enjoy this new issue of 'Highlights'. If so, please tell a friend to subscribe. If not, please tell me and I will work to be better next time.

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6G Stage 1 Workshop

The jauntily named '3GPP Stage-1 Workshop on IMT2030 Use Cases' attracted over 200 participants to the Dutch city of Rotterdam, 8 – 10 May 2024, to share beautiful spring weather and two and a half days of presentations from the emerging 6G initiatives, 3GPP market partners (MRPs) and the ITU.

3GPP WG SA1 now has the task to define the 6G stage 1 requirements to be met by future 3GPP specifications. The presentations from the workshop can be downloaded from the 3GPP website. See also Puneet Jain's article about the event on page 25 of this issue of Highlights.

IMAGE: Left to right; Alain Sultan (MCC, SA1 Secretary), Jose Almodovar (SA1 Chair) and Puneet Jain (SA Chair)

Satellite technology of the year

On March 20, 2024 the work of the 3GPP members and delegates on NTN specifications has been recognised with '3GPP NTN Standards' selection as satellite technology of the year in a 'Via Satellite' poll. The announcement was made during the SATELLITE 2024 conference in Washington in March, with the publication singling out the 3GPP NTN Standards nomination for its "proactive engagement of the satellite industry with 3GPP and other forums - to ensure that satellite technologies can be fully integrated into the 5G ecosystem."

CONTENTS

Device Media Capabilities for Augmented Reality Services

by Gilles Teniou (Tencent), Emmanuel Thomas (Xiaomi), Thomas Stockhammer (Qualcomm)

Over the past few years, popular applications have made Augmented Reality (AR) experiences common for smartphone users. At the same time, there has been the emergence of a wide range of AR capable devices beyond smartphones - such as AR Glasses and Mixed Reality Head-Mounted Displays (HMD).

For service providers and application developers, addressing this wide spectrum of devices and their capabilities represents a challenge that could slow down the wider deployment of AR services. 3GPP TS 26.119 specification aims at creating a higher degree of interoperability between application providers, content creator and manufacturers by consolidating the media capabilities of AR-capable devices in a handful of well-defined device categories.

The XR baseline terminal architecture

Because AR is considered as one modality on the XR (eXtended Reality) spectrum, and to ensure consistency across the different AR-capable device categories, 3GPP TS 26.119 specifies an XR client in UE supporting a common architecture called the XR Baseline client, shown on Figure 1.

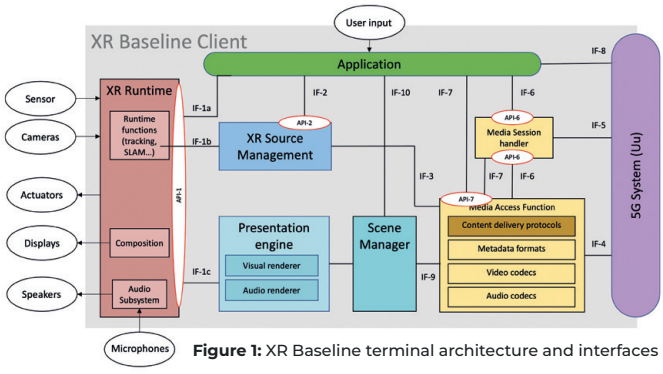


Figure 1: XR Baseline terminal architecture and interfaces

This XR client in UE terminal architecture developed for AR but also suitable any XR experience is inline with industry standards such as the OpenXR specification (1.0) defined by the Khronos group which addresses jointly AR, MR (Mixed Reality) and VR (Virtual Reality) experiences. At the top of the architecture sits the Application which is responsible for orchestrating the various components to provide the AR experience.

It is worthwhile highlighting three parts of XR Baseline terminal architecture here:

- The **XR Runtime** is responsible for the final audio and visual rendering based on the views supplied by the Presentation Engine. The XR Runtime is typically defined by XR industry framework such as OpenXR.
- The XR Runtime also exposes sensor data such as the pose prediction which can be retrieved and packaged before transport by the **XR Source Management**.
- The **Media Access Function** is the media powerhouse to process the delivered scene description and to decompress the audio and video data received via the 5G System which composes the immersive experience.

Device categories and capabilities

Based on the XR client in UE terminal architecture shown in Figure 1, TS 26.119 defines four categories of devices targeting various types of form factors. These are Thin AR glasses, AR glasses, XR phone and XR Head Mounted Display (HMD). The thin AR glasses device type represents power-constrained devices (typically fashionable form factors) and with limited computing power, as opposed to the AR glasses which have higher computing power.

The XR phone device type covers smartphones with capabilities and resources sufficient to offer AR experiences.

Lastly, the XR HMD device type corresponds to HMDs at least capable of offering AR experiences but not precluding other types of XR experiences.

For each device type, TS 26.119 specifies the mandatory and optional media capabilities to be supported by the UE. Those media capabilities pertain to audio, video, scene processing and XR systems capabilities and are defined in terms of their support of **Audio codecs;** (Enhanced Voice Services - EVS, Immersive Voice and Audio Services - IVAS and Advanced video coding for generic audiovisual services - AAC-ELDv2, **Video codecs;** AVC and HEVC (both ITU-T), **Scene description formats;** glTF 2.0 and its extension in MPEG-I Scene Description (both ISO/IEC).

Regarding metadata, common metadata are defined in TS 26.119 that are predicted pose information, the action object representing actions performed by a user of an AR application and the available visualization space object representing a 3D space within the user's real-word space that is suitable for rendering virtual objects.

TS 26.119 has been designed with the intent to serve as a common platform to build upon specifications that address application and services. In this spirit, 3GPP TSG SA WG4 (SA4) has been concurrently developing two specifications which refer to TS 26.119: TS 26.565 on Split Rendering Media Service Enabler and TS 26.264 on IMS-based AR Real-Time Communication.

5G Real-time Media Transport Protocol Configurations for XR services

By Razvan-Andrei Stoica (Lenovo), Igor D.D. Curcio (Nokia)

Multiple Extended Reality (XR) enhancements have been added across the communication layers for high data rate and low latency XR traffic.

These enablers empowered XR content awareness in QoS handling of media delivery from application down to radio layer for an improved QoE of XR immersive content. Working Group SA4 defined transport protocol extensions and configurations to help 5G XR developers to leverage the potential of these new cross-layer optimizations.

The WG SA4 XR investigations revealed the relevance of the concept of Application Data Units (ADUs) granularity, e.g., video frame/slice, metadata, etc., in XR traffic transport optimizations. Working Groups RAN2 and SA2 integrated this core concept into their radio resource allocation and QoS flows mechanisms under the "PDU Set" guise, i.e., one or more PDUs carried by an ADU.

The 5GS PDU Set awareness is based on acquiring different PDU Set information: PDU Set Sequence Number (PSSN), End PDU of the PDU Set (E), PDU Sequence Number within a PDU Set (PSN), PDU Set Size (PSSize) and PDU Set Importance (PSI).

WG SA4 enabled XR services and applications to expose such information to the 5GS through the media transport by an RTP header extension (HE) for PDU Set marking.

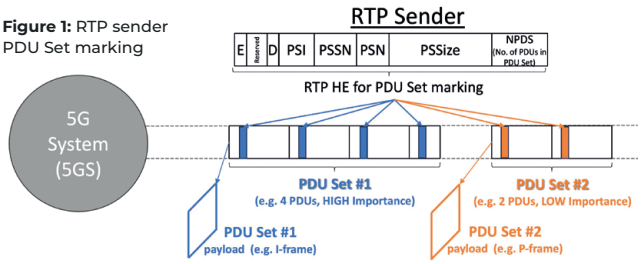


Figure 1: RTP sender PDU Set marking

The RTP HE is using the general RTP HE mechanism in IETF RFC 8285, applicable to (S)RTP and WebRTC, to mark the boundaries of a PDU Set, its size and its importance, whereas the marking is applied to all PDUs of the PDU Set, as in Figure 1.

The PSI indicates the importance of a PDU Set relative to other PDU Sets within the same multimedia session. This information may support RAN-based informed discard of PDUs and PDU Sets when needed, e.g., during air-interface congestion. In TS 26.522, WG SA4 provides general guidelines for XR services and application developers in setting the PSI field for the H.264 and H.265 video codecs. In general, the concept assigns higher importance to Intra-coded frames/slices relative to P/B-frames or P/B-slices.

The RTP HE for PDU Set marking also includes an indication of the end of a data burst (D), i.e., one or more PDU Sets. This information may be utilized by the RAN to optimize power savings and configure XR devices in a deeper sleep state.

XR services often incorporate split rendering to maintain low energy consumption on XR devices while still delivering immersive experiences. In a nutshell, a dedicated XR split rendering server receives, e.g., at a network edge, from an XR client user pose information capturing user motion, pre-renders content based on the available pose information, encodes the pre-rendered content, and delivers it back to the XR client. The latter decodes the content and performs a power-efficient rendering to the user.

To preserve low (50-70 ms) motion-to-render-to-photon (M2R2P) latency for XR services and to enable XR split rendering, WG SA4 has specified a RTP HE for exchanging XR pose information, eg. to indicate rendered pose for split rendered media. This HE piggybacks on available media streams using the (S)RTP HE general format of RFC 8285. The RTP HE for XR pose provides thus a real-time XR pose transport mechanism including 3DoF or 6DoF coordinates, an XR timestamp associated with the XR pose in the context of the XR service, and a list of action identifiers determining the XR action spaces correspondent to the XR pose coordinates. The XR client may so use the rendered pose to optimize for QoE the late stage reprojection and on-device rendering routines at runtime.

Two RTP HEs for E2E delay measurements are also specified in order to support XR immersive experiences. One HE is meant to measure the one-way delay between time-synchronized XR endpoints communicating via (S)RTP, based on single timestamp, T1, i.e., the "Originate Timestamp". The second HE is a response to the first HE indexed by the timestamp T1 and includes two more timestamps, T2, i.e., the "Receive Timestamp", and T3, i.e., the "Transmit Timestamp".

By recording a fourth timestamp T4, i.e., the "Destination Timestamp", one of the XR endpoints can thus calculate the loaded data flow traffic in terms of one-way delay (uplink or downlink), round-trip delay and processing delay metrics. Figure 2 displays the RTP HE pairs for XR pose and E2E delay measurement in a split rendering scenario.

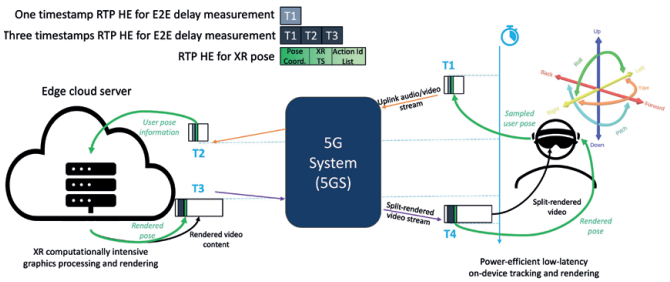
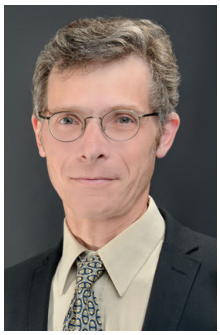


Figure 2: RTP HEs for E2E delay measures and XR pose in a split rendering context

Additional timing reporting for split rendering is enabled by RTCP extended reports for QoE measurements. These include XR server timing information allowing XR devices to determine QoE metrics such as round-trip delay, server processing delay, user interaction delay, age of content and round-trip interaction delay.

The 3GPP XR RTP protocol extensions are a toolset for service providers and application developers to unlock immersive XR media delivery over the 5GS and will be further complemented and enhanced with additional features in Rel-19.




3GPP functionality for Energy Utilities

By Erik Guttman, Alberto Sendin, Vincent Audebert, Julian Stafford

5G standards aim in part to address specific requirements of different vertical business sectors. This is the first feature standardized in 3GPP specifically addressing the needs of energy utilities

Reliability is crucial for energy utilities, to satisfy regulatory, business and public health & safety requirements. To achieve this reliability, a range of 'smart energy services' are employed by the energy system. These services, largely standardized by IEC and IEEE, require communication. As greater degrees of efficiency, resiliency, responsiveness and other capabilities are sought in the delivery of energy to consumers, more and more communications services are required by the energy sector to build what the sector refers to as a Smart Grid [C].

There are many options for delivery of communication services today – power line communications, fibre optics, fixed networks, microwave transmission, satellite communications and mobile telecommunications. The appropriate means, or rather mix of communications services, depends on several factors including the location, the possibility of leveraging existing assets (e.g. power lines,) and the 'total cost of operations,' and the properties of the communication service.

To the extent that the 3GPP system can provide services that meet the needs of the energy sector, telecommunications will be an increasingly prominent part of the technical ecosystem by which energy is delivered. Also, MNOs will benefit from improved electricity service availability.

Energy distribution service operators

Energy utilities benefits from smart energy services, not least for greater efficiency and reliability. By far the most complex aspect of energy utility operations, whose requirements for communication are increasing most rapidly, are distribution services - responsible for all aspects of energy delivery between long-range high voltage transmission and consumers. Activity in 3GPP has focussed on the requirements of distribution service operators (DSOs.)

The Network Services and Operations for Energy Utility (NSOEU) feature defines how energy utility service providers and MNOs can exchange information in a standardized format to improve the availability of communication services and facilitate rapid recovery in the case of energy system outage.

In the feasibility study on 5G Smart Energy and Infrastructure (TR 22.867) use cases were investigated that motivated NSOEU. Corresponding functional requirements were added to specifications that capture service requirements of the 5G system (TS22.261, TS 22.104). A follow-up study on support for several of these requirements (TR28.829) was undertaken in the telecom management working group of 3GPP, SA5. This led to normative specification of the NSOEU feature (TS 28.318).

Network performance monitoring for proactive response

Network performance monitoring is possible today, using a range of defined KPIs and an established set of services and interfaces. This capability is used by a mobile network operator. The NSOEU feature exposes a limited set of this functionality to third parties, as a service, to DSOs. The goal of exposure of this information is to enable the DSO to achieve higher energy service availability, as described below.

The highest possible availability of energy service is in the interest of mobile network operators. Within the power system, distribution networks are the origin of over 90% of end-consumer outages [B]. There is significant interest by energy distribution service operators to improve energy service availability. This can be achieved by smart energy services. Telecommunications enable these services in many situations (where fixed network access to distribution network equipment is not possible.) However, telecommunication service today itself is not, in practice, of sufficiently high availability to offer 5 or 6 '9s' of availability.

Distribution network substations (primary and secondary) have communication networks that communicate via routers to the DSO operation centres. These routers can employ UEs to obtain network access, and often support multiple USIMs.

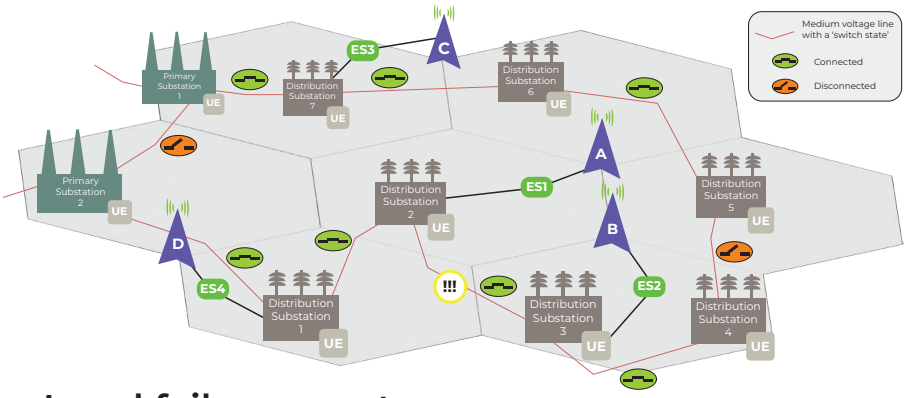
Switching between two PLMNs effectively requires two or more minutes, as routers need to be rebooted. For 99.999% service reliability, we can only expect 5.26 minutes of down time per year. Thus, waiting for a service outage and responding to it reactively is not sufficient for services that require 99.999% reliability or more. If a critical event were to occur during this time, smart energy services could neither detect nor respond. This could result in very serious conditions that would render one or more energy distribution substations inoperable.

The DSO needs information regarding outages and performance degradation of the communication system, as it may be possible for the DSO to proactively establish and use an alternative means of communication. Instead of waiting for communication service failure to react, DSOs monitor the quality of the network service to identify service quality decline. This allows a proactive switch to another provider. Monitoring 'over the top' has several disadvantages: it has to be done at a very coarse granularity to avoid using significant resources, and as a result, it provides only sparse data to serve as an indication of approaching outages.

3GPP TS 28.318 on NSOEU defines the exposure of PerfMetricJob and ThresholdMonitor (see TS 28.622 - Telecommunication

management; Generic Network Resource Model Integration Reference Point; Information Service). These are included in procedures to be used in diverse deployment scenarios in informative annex A of TS28.318. These procedures are indicative; there could be many other sequences of actions performed using the framework. Of principle interest to DSOs are 'average delay', 'delay' and 'packet loss' both for downlink and uplink traffic in a cell. In addition, cell and network availability can be monitored.

These network monitoring capabilities rely on the 3GPP standardized Network Resource Model (NRM), an extensive object-oriented system that corresponds in practice to the mobile network operator's network. The operator does not expose this NRM information to the DSO. Instead, a very simple subset of the NRM is assumed to be known to the DSO in advance, requiring off-line prior configuration in an implementation-specific manner. Using this model, performance monitoring of a limited set of cells can be initiated by the DSO.



Local failure event

Coordinated energy service recovery

The service-customer relationship is bi-directional: MNOs require energy services, and energy utilities require communication services. Power cuts were found to be the second most common cause of lack of availability of telecommunication service, a primary or secondary cause in over a fifth of major incidents.[A] The energy system, in turn, can rely on the telecommunication system to perform remote smart energy services.

Recovery from energy outages by a DSO can be performed in many cases in a small number of minutes by means of 'distribution automation,' a general term that expresses smart energy services that enable automated remote monitoring and control. When remote operations are not possible, e.g. when the mobile telecommunication network is not available as a result of the energy outage, recovery requires much longer.

When either a planned or unplanned power outage occurs, there is some time in which MNO sites continue to function, by means of autonomous energy capacity, either through generation or uninterruptable power supplies.

Today the DSO lacks knowledge of the constraints on recovery, and are affected by lack of sufficient autonomous energy capacity in the MNO network.

The NSOEU feature provides a means by which an MNO can provide information concerning the correspondence of energy supply and their essential sites to the DSO. Further, information concerning the location and timing outages and recovery times can be provided by the DSO to the MNO.

This exchanged information can greatly improve the coordination between the DSO and MNO and lead to more rapid recovery of energy service. One scenario supported by NSOEU is illustrated and summarized here, as an example of how improved information sharing can facilitate recovery.

In the figure, different MNO infrastructure, represented by the elements A, B, C and D, are supplied with energy. MNO site B is supplied by Distribution Substation 3.

In this example, an outage occurs between Distribution Substation 2 and 3, e.g. due to an underground transmission line being accidentally cut by construction equipment. Distribution Substation 3 is no longer supplied with energy, and site B cannot be served. Site B provides mobile service to Distribution Substation 3 and 4, but only as long as site B has autonomous energy supply.

Fortunately, there is a redundant topology between Distribution Substations. In order to reestablish energy service, Distribution Substation 2 and 3 will disconnect the medium voltage line between them. Distribution Substation 5 and then 4 will connect the medium voltage line (currently shown as disconnected in the figure.) All of this can be accomplished remotely, within minutes, using smart energy mechanisms.

NSOEU enables the DSO to be aware of the autonomous operation duration possible of site B, and that site B serves Distribution Substations 3 and 4. The DSO will prioritize performing operations in Distribution Substations 3 and 4 before site B's autonomous energy supply is exhausted. This is in contrast to the current situation, without the NSOEU feature: DSOs must send technicians to Distribution Substation sites to manually connect and disconnect stations to recover from energy outages.

Conclusion

While significant progress has been made on enhancement of the 5G system to support requirements of energy utilities, there are more capabilities to add in the future. The functionality provided in Release 18, based on exposure of management services, needs to be further specified, as documented in 3GPP TS 28.318 Annex D [5]. Study has begun in Release 19 on how to standardize exposed management service interfaces, including their configuration and security. It is hoped that this development will benefit the NSOEU feature with support of standardized mechanisms.

There are two areas which have not yet been addressed that remain of high interest to the DSOs. These could be developed in a future 3GPP release. In Release 18, information exposure concerns service to a cell. To obtain detailed information concerning the communication status of a single UE, additional information exposure is needed. This would improve the ability of the energy utility operator to determine whether, due to a concerning trend or reduction in performance, to make use of an alternative communication service proactively.

References

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Security Assurance (SCAS) specifications

The basis for Network Equipment & Cyber security certification programs

By Suresh P. Nair, 3GPP SA3 Chair

The need for Security Assurance

As technology advances bring many benefits derived from the increased modes of communication, they also bring challenges to communication network infrastructure in the form of security threats. No wonder, in today's cyber connected world, cyber security is of paramount importance for everyone connected with the design, operation, regulation and maintenance of the networks.

Many governments have already declared their Public Land Mobile Networks (PLMN) as national assets, recognizing the need to ensure the safety of their critical infrastructure and to protect them against potential catastrophic attacks.

The 5G network has a very distributed set of network functions consisting of RAN nodes to provide radio connectivity, supported by 5G Core network functions to ensure the users connectivity, mobility and policy control session management and applications. Smartphones can do more complex things than the earlier technologies and these devices are connected to an equally complex network which enables these services. Proper and secure functioning of network functions are needed to ensure the legitimate behavior and sanity of the network.

The 3GPP Security WG has defined Security Assurance (SCAS) specifications for the 3GPP defined network nodes to test and ensure that they are implemented and behave according to the specifications to ensure the security and privacy of everyone involved, i.e. end users, operators etc and do not have any security vulnerability. 3GPP started this activity of developing SCAS sometime ago, since then other industry organizations, have taken up further test and certification programs taking SCAS as the basis.

Security Assurance Specifications

A SCAS Specification contains security requirements and test cases for a defined Network Function or a group of Network Functions. Each Network Function SCAS contains a description of the Network Product and the Security problem definition. The Security problem definition identifies the assets in the description of the network product class that require protection and describes how these assets can be exploited by an attacker. This step also contains the threat analysis employed to understand how an attacker performing the identified potential attacks could misuse the identified assets of the network product class. This provides a concrete security problem that is to be solved, which facilitates the selection of security requirements that are necessary and sufficient to solve the identified security problem.

A series of specifications have been developed over the years to cover all Network Functions in the 5G Core. A brief summary is given the table opposite.

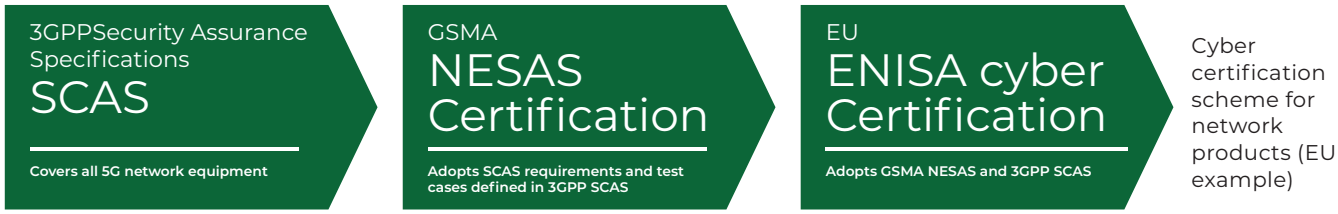
3GPP TS/TR No.	Description
TR 33.916	Security Assurance Methodology (SECAM) for 3GPP network products. Defines Security Assurance Methodology (SECAM) evaluation process (evaluation, relation to SECAM Accreditation Body, roles, etc.) as well as the components of SECAM that are intended to provide the expected security assurance.
TR 33.926	Specifies the network product class descriptions, threats and critical assets that have been identified in the course of the work on 3GPP security assurance specifications. The main body of the document contains generic aspects that are believed to apply to more than one network product class, while Annexes cover the aspects specific to one network product class.
TS 33.117	Catalogue of general security assurance requirements. Contains objectives, requirements and test cases that are deemed applicable, possibly after adaptation, to several network product classes.
TS 33.511	Security Assurance Specification (SCAS) for the next generation Node B (gNodeB) network product class
TS 33.512	Specifies objectives, requirements and test cases that are specific to the AMF network product class.
TS 33.513	Specifies requirements and test cases that are specific to the UPF network product class.
TS 33.514	Specifies requirements and test cases that are specific to the UDM network product class.
TS 33.515	Specifies requirements and test cases that are specific to the SMF network product class
TS 33.516	Specifies objectives, requirements and test cases that are specific to the AUSF network product class
TS 33.517	Specifies objectives, requirements and test cases that are specific to the Security Edge Protection Proxy (SEPP) network product class
TS 33.518	Specifies objectives, requirements and test cases that are specific to the Network Repository Function (NRF) network product class
TS 33.519	Specifies requirements and test cases that are specific to the NEF network product class
TS 33.520	Specifies objectives, requirements and test cases that are specific to the Non-3GPP Interworking Function (N3IWF) network product class.
TS 33.521	Specifies requirements and test cases that are specific to the NWDAF network product class.
TS 33.522	Specifies objectives, requirements and test cases that are specific to the SCP network product class.
TS 33.523	Specifies objectives, requirements and test cases that are specific to the various split gNB network product classes. The gNB can be deployed as more than one entity by splitting the gNB into gNB-CU and gNB-DU(s) and possibly further splitting the gNB-CU into gNB-CU-CP and gNB-CU-UP(s).
TS 33.326	Specifies requirements and test cases that are specific to the NSSAAF network product class.
TS 33.526	Specifies objectives, requirements and test cases that are specific to the MnF network product class
TS 33.527	Specifies objectives, requirements and test cases to virtualized network product classes. Several virtualized network product classes share very similar security requirements for some aspects. Therefore, these are collected in the present document applicable to many virtualized network product classes.
TS 33.528	Specifies requirements and test cases that are specific to the PCF network product class.
TS 33.529	Specifies objectives, security assurance requirements and test cases specific to the SMSF network product class.
TS 33.530	Specifies requirements and test cases that are specific to the UDR network product class.
TS 33.537	Specifies requirements and test cases that are specific to the AAnF network product class

SCAS in the GSMA scheme

The GSMA Network Equipment Security Assurance Scheme (NESAS) has adopted the 3GPP specified Security Assurance Specifications for its security assurance program. A NESAS assessment consists of two parts, the first is an audit of the vendor's development and product lifecycle process; and the second is an evaluation of a specific product release and its related documents against test-cases defined in 3GPP SCAS. For adoption by GSMA NESAS, the SCAS needs to follow the requirements in GSMA's FS.50. The adoption policy is contained in Annex A of FS.47

Cyber certification scheme for network products

Regional regulatory bodies such as the EU's ENISA have enacted Cyber security certification laws in recent years to establish and maintain trust and security on cybersecurity products, services and processes. EU ENISA has adopted 3GPP and GSMA into the certification framework.



Cyber certification scheme for network products (EU example)

In addition to the European Union, there are other countries also that re-use 3GPP SCASs for their own national assurance schemes. This is the case in India, where the Indian Telecommunication Security Assurance Requirements (ITSAR) use the generic SCAS requirements (TS 33.117) and Network Function specific SCAS as the basis for its scheme.

Rel-18 Stage3 Completion in TSG CT

By Peter Schmitt, 3GPP TSG CT Chair

At the CT#103 Plenary meeting of the Core Network and Terminals Technical Specification Group (TSG CT), held in Maastricht, Netherlands, the CT Working Groups have reached stage3 completion for Rel-18 - the first release for 5G Advanced. The release contains 75 features, making it difficult to cover them all here, but I would mention a few to give a flavour of what has been achieved.

The Support of Architecture Enhancements for XR (Extended Reality) and media service (e.g. uplink downlink coordination) is now in place.

This release also started to add the Next Generation Real Time Communication (NG_RTC) extension to the IMS network, to support data channel and augmented reality communication.

Regarding AI, two topics are covered. The support of System Support for Artificial Intelligence (AI)/Machine Learning (ML) - based Services and the Architecture evolution and use case enrichment for Enablers for Network Automation (Phase 3).

With most of the work items successfully completed, attention turns to the Rel-18 work left to do in TSG CT.

Here is a quick look at the remaining outstanding issues, where 'Exception sheets' have been raised by each of the effected working groups:

EVS Codec Extension for Immersive Voice and Audio Services (IVAS_codec)

SA4 has developed a new codec for Immersive Voice and Audio Services (IVAS codec) in Rel-18, which is an extension of the 3GPP Enhanced Voice Services (EVS) codec, to address the increasing demand for rich and immersive multimedia services. CT WGS agreed to add support of the new codec in the core network. The work is intended to be started and completed in Q2 2024.

Network Slice Capability Exposure for Application Layer Enablement (NSCALE)

Network Slice Capability Exposure for Application Layer Enablement service API definition provided by the NSCE server needs to be completed. The NSCE API definition between the NSCE client and the NSCE server needs to be completed as well.

> It is expected that a minimum of nine months will be needed to perform the necessary [6G] studies in the CT working groups."

Architecture for enabling Edge Applications Phase 2 (EDGEAPP_Ph2)

CT3 has to cover security aspects of ECS-ER and ECS services. They have contacted SA3, seeking security clarifications related to ECS-ER and ECS services.

Application Data Analytics Enablement Service (ADAES)

CT3 has to cover a number of small issues on Application Data Analytics Enablement Service.

Enhancements to location services Phase 3 (5G_eLCS_Ph3)

Two major issues need to be resolved under this work item.

a) how to link the association between the TLS connection and the UE;

b) how the LMF associates the LCS service request to the TLS connection of the UE.

Enhanced Service Enabler Architecture Layer for Verticals Phase 3 (SEAL_Ph3)

Implementation of features related to Network resource management services and Corrections to location management services have to be completed.

SEAL data delivery enabler for vertical applications (SEALDD)

For the SEAL data delivery enabler for vertical applications the CoAP (Constrained Application Protocol) the resource representation and encoding is partly defined and needs to be completed.

Mission Critical (MC) Extensions:

- **Enh4MCPTT** (Enhanced Mission Critical Push-to-talk architecture phase 4), MC Location Management needs to be enhanced to provide location information of MC users requested by and transmitted to other MC users.
- **MCGWUE** (MC Gateway UE function for Mission Critical Communication), MC gateway UE QoS aspects needs to be completed and security considerations from stage 2 needs to be considered in stage 3
- **MC_AHGC** (Mission Critical ad hoc group communications), Ad hoc group emergency alert for MCPTT needs to be addressed.

During the second quarter of 2024, CT Working groups will give priority to these Rel-18 topics. This entails checks that stage 2 and stage 3 specifications align by providing contributions to bring the specification into line with the CT requirements at the time of code freeze in June. In principle this means that the primary target of CT groups is to ensure the quality of the Rel-18 version of the specification.

TSG CT has also taken some time to discuss the 6G timeline. The intention is to start studies in the CT working groups once the stage 2 groups have provided sufficient input to start the work in CT. It is expected that a minimum of nine months will be needed to perform the necessary studies in CT working groups.

Further reading

- 3GPP Work Plan: For details of specifications and reports impacted by the work. The WP also has the latest status for each feature and links to the T-docs for it (eg. 'NG_RTC').
- SP-240445 CT Status Report to TSG SA#103 (Annex – Approved Exceptions).

For more on TSG CT groups: www.3gpp.org/3gpp-groups

Image: TSG CT Chair - Lionel Morand (right) hands over the Chair's bell to the group's new leader, Peter Schmitt, following the election process during TSG CT#99, March 2023.

NG-RTC Opens New Opportunities

By Yue Song, 3GPP CT4 Chair

In March 2024, CT#103 approved new technical specifications TS 29.175 and TS 29.330, which marked the completion of the Release 18 work on NG-RTC (Next Generation Real Time Communication).

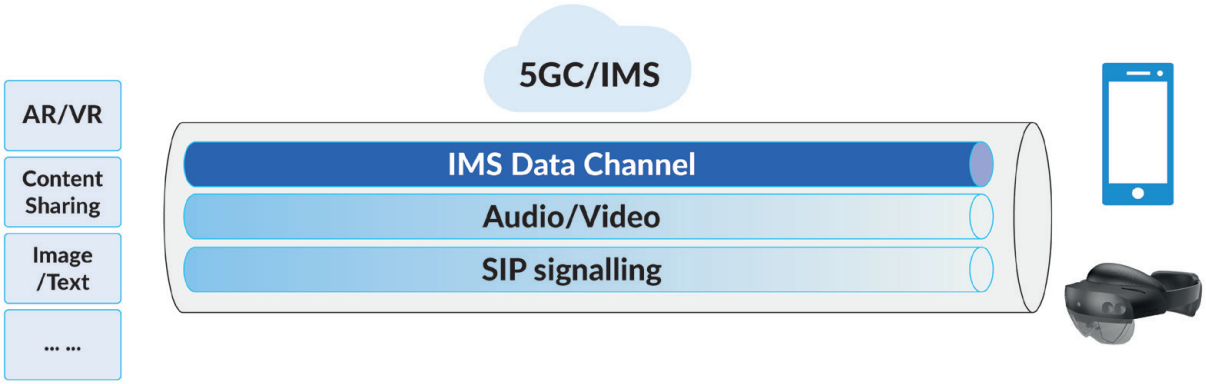
NG-RTC is a technology stack for real-time communication services, it is based on the architecture of IMS (IP Multimedia Subsystem), by involving technologies like IMS Data Channel, AI media processing and Service Based Interface, NG-RTC provides users with a richer interactive and ultra-high-definition intelligent calling experience.

Meanwhile, the introduction of a more flexible and open architecture facilitates the entry of third-party calling applications and builds a new ecosystem for multi-dimensional and interactive real-time communication.

IMS Data Channel

The mechanism of IMS Data Channel was defined in Release 16, the key purpose is to introduce a content agnostic data transmission tunnel to IMS. The IMS Data Channel has several advantages over the existing data channel directly provided by EPC/5GC:

- It is created along with an IMS session and therefore the content transmitted within IMS Data Channel can be naturally linked with a voice/video call, which makes it much easier to design enhanced voice/video features;
- The IMS Data Channel is correlated with an authenticated user identity by nature, thus it is much easier for the applications facilitated by IMS Data Channel to obtain the user identity whenever it is needed;
- Similar to IMS audio/video media, dedicated bearers/QoS flows can be established for IMS Data Channel by which the QoS can be guaranteed.



Enhancement to IMS Architecture

To facilitate the IMS Data Channel based applications, 3GPP has enhanced IMS architecture by standardizing several new network functions:

Media Function (MF): It acts as the media plane function for IMS Data Channel, by terminating IMS Data Channel from the UE and establishing further IMS Data Channel towards DC Application Server or another Media Function. Besides proxying the IMS Data Channel payload, MF can also process the content of the media flow, e.g. video rendering, speech to text, image recognition.

DC Signaling Function (DCSF): It acts as the control plane function for IMS Data Channel. The DCSF subscribes to the IMS session events from the IMS AS, accordingly it instructs the MF to perform media plane handling, i.e. IMS DC forwarding and media processing. Also, the DCSF exposes APIs on IMS Data Channel and media processing towards the DC Application Servers, by consuming the APIs, the application servers can fulfill the service logics.

DC Application Server: It does not refer to a specific network function but a kind of application servers, which consume the capabilities exposed by the network and provide the service logics to the subscribers or the enterprise users.

DC Application Repository (DC AR): To process with certain service logic, there needs to be an application (taking the form as applet) running on the UE. The applications need not to be pre-installed on the UE but downloaded and launched during runtime, and DC AR is the repository from where the UE can download the applications. The UE does not download applications directly from DC AR, but via DCSF and MF.

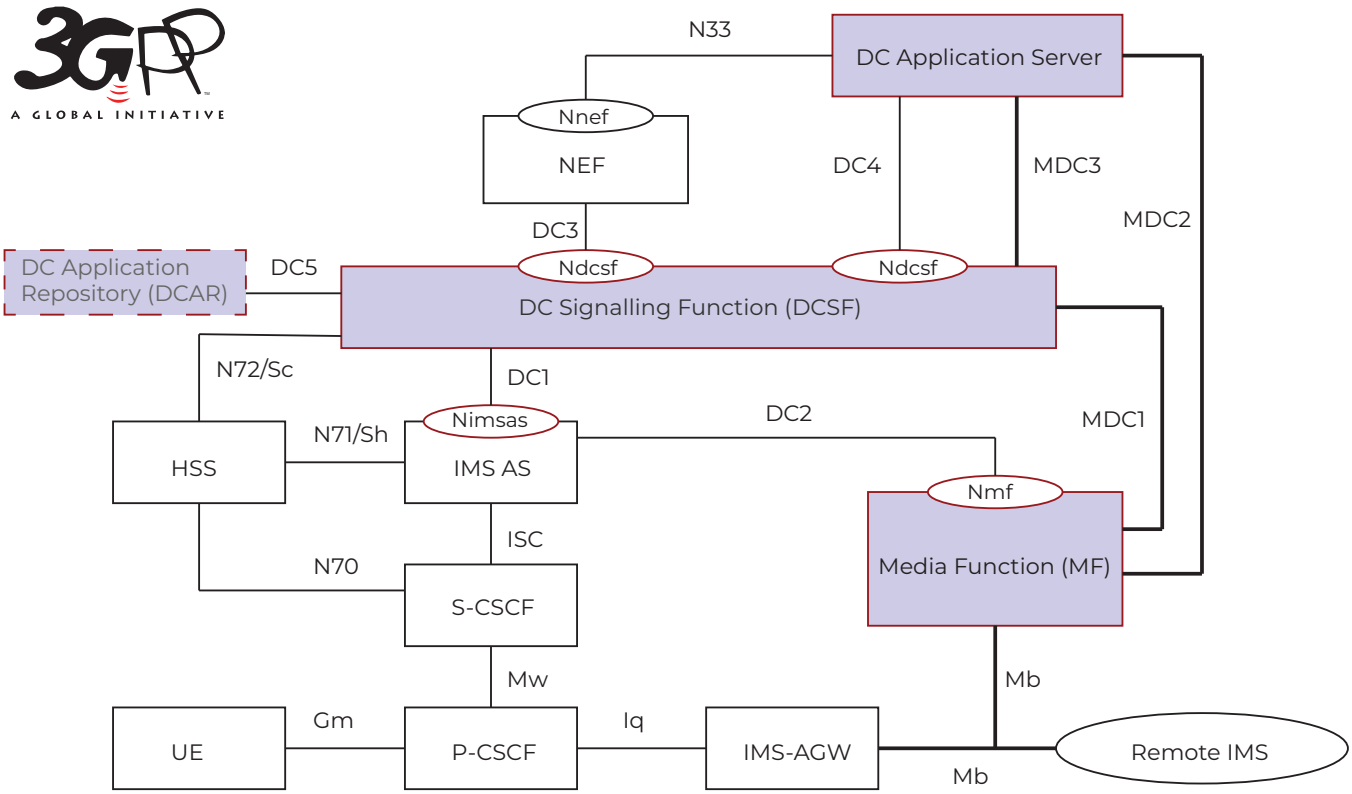


Figure from TS 23.228 "IP Multimedia Subsystem (IMS); Stage 2"

Service Based Interface

Another key enhancement to IMS architecture is the introduction of Service Based Interface (SBI). IMS has been using SIP protocol for most of the interfaces, the strict state machine behind SIP protocol does not fit well the various new services emerging rapidly nowadays. A new SBI (Nimsas) has been defined for IMS AS, by consuming the APIs over Nimsas the DCSF can subscribe to the IMS session events, flexible service triggering is achieved via such mechanism. Furthermore, the DCSF exposes APIs towards DC applications via Ndcsf interface, the application servers can therefore dynamically discover and invoke the APIs provided by the network. All intentions behind the introduction of SBI into IMS is to make the real-time communication network more open and flexible.

AI Media Processing

In the legacy network, the processing with the media flows is quite limited, i.e. media forwarding, transcoding and announcement playing. While in the NG-RTC network, the Media Function is designed to perform much more extended media processing, by introducing more media processing functionalities to MF. Here are some examples:

- With NLP functionality, the MF can convert the real-time speech into text and subsequently transmit the converted text to the UE via IMS Data Channel. This can make a service that provides subtitles for the audio/video calls, which will help the people with hearing impairments.
- With image recognition and 3D rendering functionalities, the MF can generate a digital avatar of the subscriber, then the avatar can be further driven by speech and movement of the subscriber, which can facilitate metaverse services.
- With the assistance of LLM, the MF can even comprehensively process the speech of the subscriber. By understanding the intention of the user, MF can subsequently invoke APIs provided by various application servers, which makes it an AI assistant.

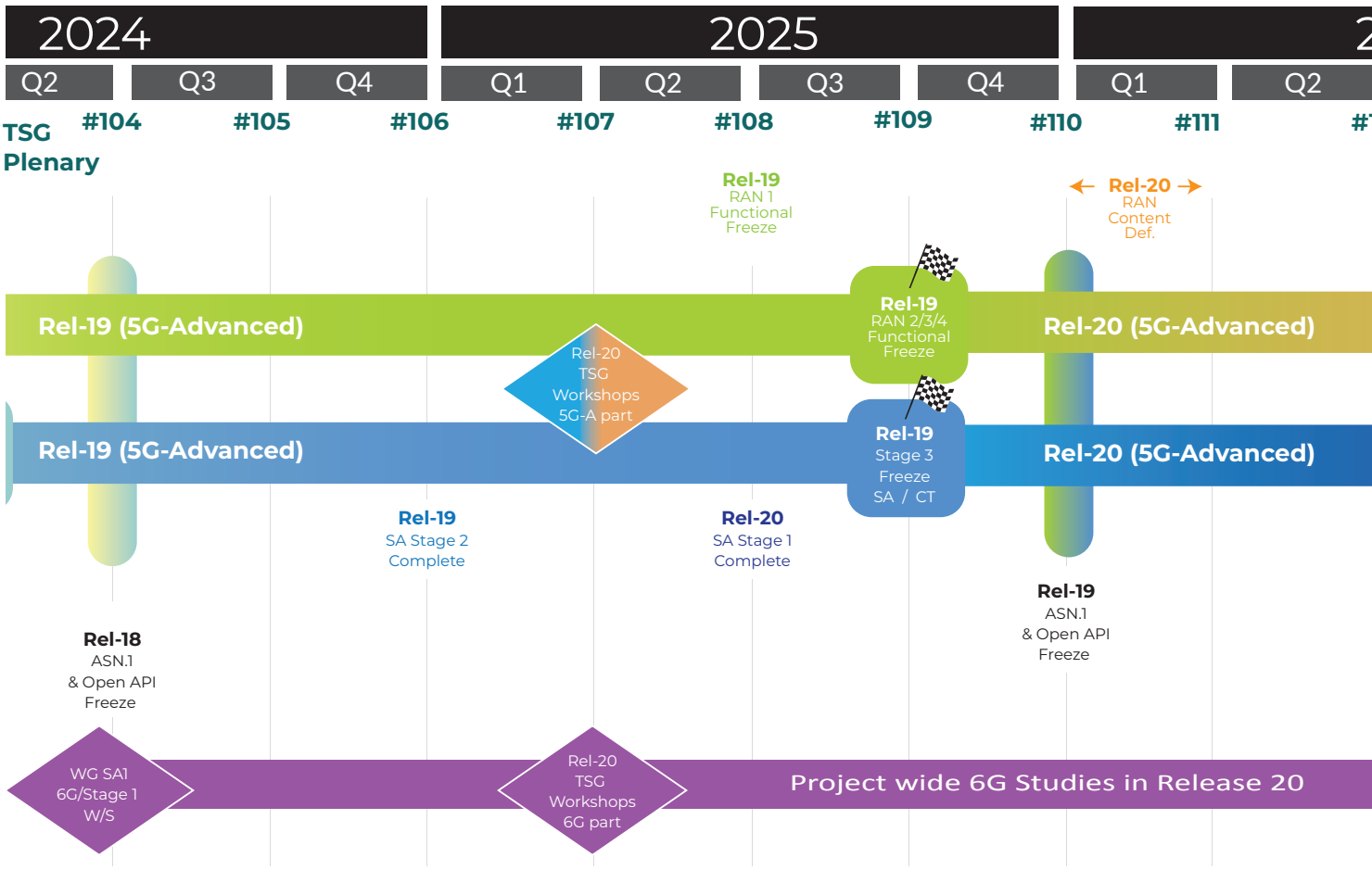
Future Outlook

NG-RTC phase 2 is now under developing of SA2 in Rel-19, new mechanisms such as standalone IMS Data Channel, interworking of IMS Data Channel between PLMNs are to be standardized. The target of NG-RTC is not to just define several specific services, it is to create a platform on which various enriched real-time communication services can be built, a more creative ecosystem of real-time communication can be established. NG-RTC has open new opportunities for the real time services.

For more on WG CT4: www.3gpp.org/3gpp-groups

> By involving technologies like IMS Data Channel, AI media processing and Service Based Interface, NG-RTC provides users with a richer interactive and ultra-high-definition intelligent calling experience.

Three Year Timeline



Data source: SP-230382

Rel-19 takes shape (TSG RAN)

Major topics:

AI/ML Air Interface, MIMO Ev., Duplex Ev., Ambient IoT, Network Energy Saving Enh., Mobility Enh., NTN Ev., XR Ev., AI/ML for NG-RAN, SON/MDT, Channel Modeling (& possibly additional aspects e.g. for ISAC) for further Ev.

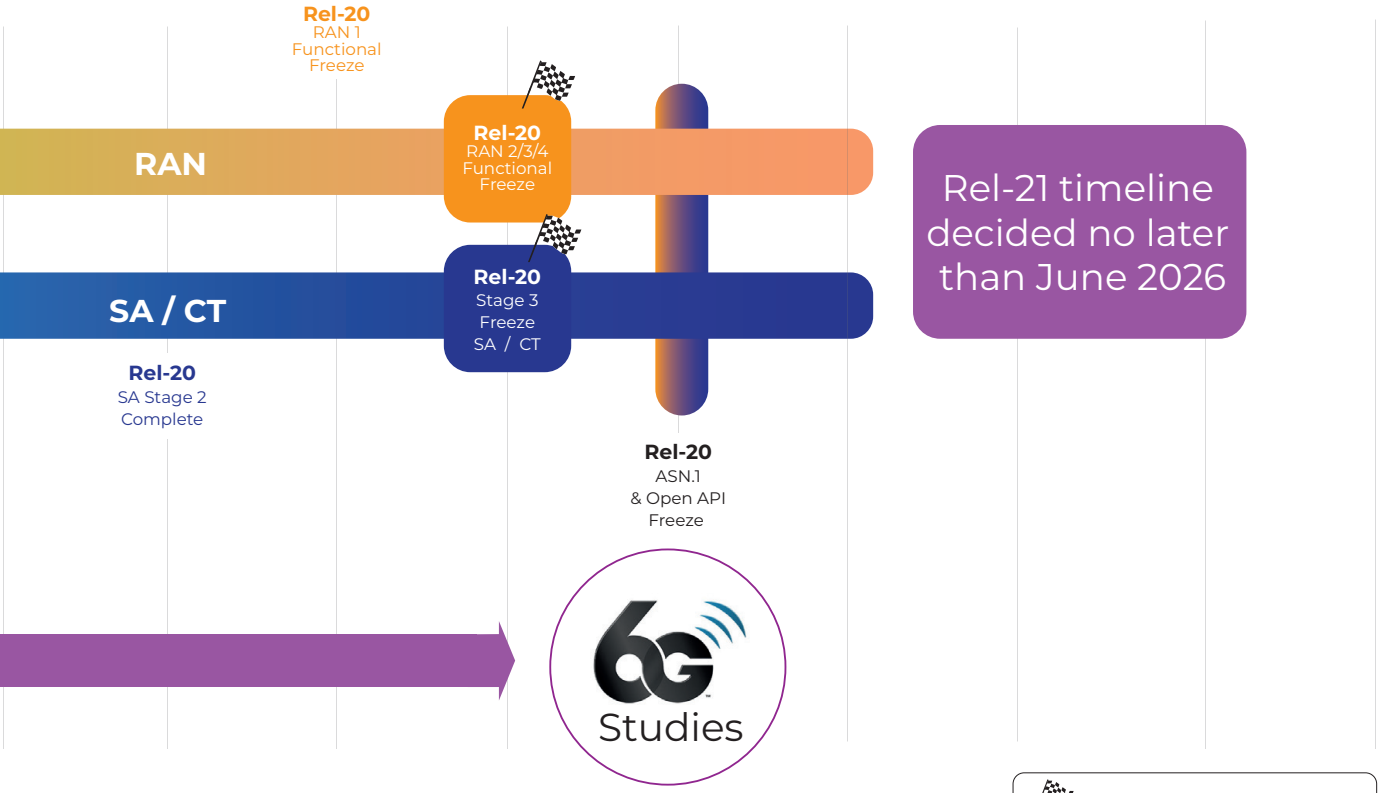
TSG SA Guidance to SA2 on Rel-19 work planning

Headline “core” topics:

Satellite Access, Energy Efficiency / Energy Saving as a Service, XRM and Metaverse, IMS and NG_RTC enh.

AI / ML Enh, Multi-access (Dual 3GPP + ATSSS Enh.)Integrated Sensing and Communication, Ambient IoT, Edge Computing Enh., Proximity Services Enh., TSC/URLLC/TRS Enh., Network Sharing, User Identities + Id of device behind RG/AP, 5G Femto, UAS Enh., VMR Enh., UPEAS Enh., Network Slicing, Traffic Management, Roaming, Value-Added Services.

& Rel-19 major topics



Functional Freeze date

Plus, other RAN1, RAN2 & RAN3 led topics.

Plus, others listed in **RWS-230488,** slide 7.

(Source: SP-230765, SP-230759)

Technical Specification Groups

TSG RAN – Radio Access Network

- RAN1 – Radio Layer 1 (Physical Layer)
- RAN2 – Radio Layer 2 and Radio Layer 3 RRC
- RAN3 – UTRAN/E-UTRAN/NG-RAN Architecture and Related Network Interfaces
- RAN4 – Radio Performance and Protocol Aspects
- RAN5 – Mobile Terminal Conformance Testing
- RAN AH1 – TSG RAN ITU-R Ad Hoc

TSG SA – Service and System Aspects

- SA WG1 - Services
- SA WG2 - System Architecture and Services
- SA WG3 - Security and Privacy
- SA WG4 - Multimedia Codecs, Systems and Services
- SA WG5 - Management, Orchestration and Charging
- SA WG6 - Application Enablement and Critical Communication Applications

TSG CT – Core Network and Terminals

- CT WG1 - User Equipment - Core Network Protocols
- CT WG3 - Interworking with External Networks & Policy and Charging Control
- CT WG4 - Core Network Protocols
- CT WG6 - Smart Card Application Aspects



RAN3 Led Features in Release 18

WG RAN3 Leadership: Yin Gao, Angelo Centonza, Gen Cao

RAN3 has completed all Release 18 (Rel-18) Work items during the fourth quarter of 2023, continuing the maintenance work in Q1 of 2024. The release is now frozen in terms of functionality, with ASN.1 (Abstract Syntax Notation One – describing the interface between any two entities) scheduled to be frozen by June.

During technical discussions for the normative phase of Rel-18, RAN3 took a leading role for some Work items, including; AI/ML for NG-RAN, SON/MDT, QoE and mobile IAB. This article provides an overview of the RAN3-led features that were included in the Rel-18 package, mainly from - but not restricted to - the perspective of RAN3.

SON/MDT enhancements

The Self-Organising Networks and Minimization of Drive Tests (SON/MDT) feature was first introduced in LTE for the support of system deployment and performance optimization, in Rel-16 and further enhanced in Rel-17 for NR. The Rel-18 SON/MDT enhancements continued the work on features that were not fulfilled in the earlier releases.

The main objective of this Work Item is to specify the data collection mechanism in NR for the purpose of performing SON/MDT, including enhancements for inter-RAT Successful Handover Report (inter-RAT SHR) and Successful PScell Change Report (SPR), MRO for NR-DC Conditional PSCell Change (CPC) and Conditional PSCell Addition (CPA), Fast MCG recovery, Inter-system handover voice fallback, RACH Enhancements, SON/MDT enhancements for Non-Public Networks (NPN), SON for NR-U.

The Rel-18 SON/MDT enhancements help further optimization of service continuity and robustness during mobility and contribute to the construction of wireless network automation capabilities through enhanced data collection mechanisms, which can help operators to gradually improve network performance and maintenance efficiency, leading to the evolution of network automation.

The Rel-19 SON/MDT Work item is expected to tackle some further improvements based on Rel-18 mobility mechanisms, as well as some new features or use cases left from previous releases.

NR QoE enhancement

The support for Quality of Experience (QoE) measurement collection was first introduced in both UMTS and LTE. The NR QoE measurement collection mechanism was standardized in Rel-17, while in Rel18 some new features were introduced and the remaining issues from Rel-17 addressed. For Rel-17, the QoE measurement collection is only supported in RRC_CONNECTED state and standalone architecture.

In Rel-18, QoE measurement collection for application sessions delivered via multicast communication service for UEs in RRC_CONNECTED is supported. QoE measurement collection for application sessions delivered via broadcast communication service is supported in RRC_CONNECTED, RRC_INACTIVE, and RRC_IDLE states. For the NR-DC scenario, the QoE configuration and measurement reporting via MN/SN and QMC (QoE Measurement Collection) continuity during mobility are supported, with the necessary coordination between MN and SN specified over XnAP. Some other left-over issues from Rel-17 (e.g., the F1AP enhancement for RAN visible QoE, intra-system inter-RAT Handover) are also solved in Rel-18.

With higher requirements from various new applications, the way to evaluate the quality of different services becomes more important to the users as well as to the service providers.

Mobile IAB for NR

Mobile IAB (Integrated Access and Backhaul) for NR is introduced to support the scenario of IAB-nodes onboard vehicles, to provide 5G coverage/capacity to onboard or surrounding UEs. The Rel-18 framework builds upon the architecture and procedures from Rel-16 and Rel-17 IAB. Rel-18 supports a dedicated network integration procedure for the mobile IAB-node and introduces procedures for mobile IAB-node mobility, including mobile IAB-MT migration and inter-donor mobile IAB-DU migration. The support for NCGI reconfiguration for mobile IAB-DU cells is introduced to solve the issue of NCGI collision during movement of the mobile IAB-nodes.

In addition, enhancements are introduced to improve the performance of mobile IAB-node mobility together with its served UEs, e.g., the support for RACH-less UE handover between source and target logical mobile IAB-DUs, and frequency prioritization for mobile IAB cell reselection can be performed by UEs based on the mobile IAB cell indicator broadcast by the mobile IAB cell and the assistance information about neighboring mobile IAB cells in system information.

The mobile IAB functionality, as a new topology deployment solution for 5G wireless communication, can guarantee the service of onboard UEs such as passengers in public transportation, and it allows a quick deployment of new cells to provide/improve connectivity in areas with high demand.

AI/ML for NG-RAN

The support of Artificial Intelligence (AI) and Machine Learning (ML) for NG-RAN is based on the outcome of the corresponding study item (TR37.817) in Rel-18. The data collection enhancements and signaling support over existing network interfaces are specified in the Rel-18 AI/ML for NG-RAN Work item, specifically for three use cases, i.e., network energy saving, load balancing and mobility optimization. In order to support the use cases by means of AI/ML functionalities, input information from neighbor NG-RAN nodes is required. Detailed configuration related to the AI/ML data collection and reporting are transferred over the Xn interface via the Data Collection Reporting Initiation procedure, and the reporting mechanism is performed via the Data Collection Reporting procedure. As AI/ML techniques develop and with the deployment of AI/ML in the 5G mobile network architecture, it is believed that AI/ML processing will assist the operators to improve network management and user experience in a remarkable and proactive way.

After the completion of Rel-18 AI/ML Work item, a new study item is launched in Rel-19 to investigate AI/ML support for new use cases, namely Network Slicing and Coverage and Capacity Optimization (CCO), and also to support the use cases in scope for the case of split RAN architecture, which was not fulfilled in Rel-18. The further study of AI/ML in Rel-19 contributes to a better technical support for the deployment of AI/ML in NG-RAN.

NR Timing Resiliency and URLLC

During normative phase, tight coordination between RAN, SA and CT Working groups was maintained, which guaranteed an efficient coordination of standard impacts for the established requirements among different WGs jointly contributing to the completion of this Rel-18 feature

The NR Timing Resiliency and URLLC Work item is aimed at providing RAN support for the corresponding WG SA2 normative work on several aspects of this topic. The three main aspects with RAN impacts are 5GS timing synchronization and reporting, interworking with TSN network deployed in the transport network, and adapting downstream and upstream scheduling based on RAN feedback for low latency communication. Enhancements on NGAP, XnAP and F1AP are introduced, in support to the time resiliency and low latency requirements discussed in WG SA2. For instance, when it comes to RAN TSS reporting, timing synchronization status reporting procedures are defined over NGAP and F1AP, allowing for node level and cell level reporting of RAN TSS, as well as for updating of clock quality information to UEs. During normative phase, tight coordination between RAN, SA and CT Working groups was maintained, which guaranteed an efficient coordination of standard impacts for the established requirements among different WGs jointly contributing to the completion of this Rel-18 feature.

Since robust synchronization and low latency are always the main goal of service providers, positive expectation is held for this feature with respect to further applications, especially with the fast uptake of more diverse services requiring ultra-low latency in future.

Network Slicing

The work on Rel-18 RAN slicing enhancements is introduced with the aim to standardize the RAN impacts of further RAN slicing enhancement based on the discussion and progress in WG SA2. A study item prior to the normative phase of the Rel-18 Work item is carried out in Rel-17 (TR38.832). With the specification of network slicing enhancements on the RAN side, the network slice service continuity is supported, allowing the replacement of an S-NSSAI by an alternative S-NSSAI. The NG-RAN node may also receive the signaling from the AMF which carries the information of partial allowed NSSAI, which can be used to make decisions related to mobility at RRC_CONNECTED mode. When the service area of a network slices does not match the set of cells for a-deployed tracking area, the cells out of the service area could be configured with zero resources for the concerned slices. Information about zero resources configured for a slice in one or more cells can be exchanged between neighbor NG-RAN nodes via the Xn interface.

The enhancement of Network slicing allows a more dynamic allocation and management of radio resources across different slices, and it guarantees the performance of various services.

Non-public Networks Phase 2

The Rel-18 NPN is aimed at supporting RAN functionalities for the corresponding WG SA2 enhancements on non-public networks. According to the Rel-18 enhancements, the UE shall maintain an equivalent SNPN list for equivalent SNPN (re) selection, to support idle mode mobility between SNPNs. In the case of handover, the selected SNPN ID is indicated to the target NG-RAN node for both Xn and NG based handover, so that equivalent SNPNs is supported in connected mode. NR-DC across equivalent SNPNs is also supported. Non-3GPP access for SNPNs is also supported in Rel-18 with the enhancement on NGAP signaling.

The completion of the Rel-18 NPN Work item provides support for the establishment and enhancements of 5G private networks, as well as bringing benefits to industry deployments.

Conclusion

As wireless communication networks will be evolved continuously, network management and optimization are an ever relevant theme in the development of 5G Advanced. These techniques e.g., AL/ML, SON/MDT, URLLC, Slicing, NPN will empower wireless networks to operate autonomously, predictively, on-demand, and to offer flexible and efficient resource allocation further allowing the ‘vertical’ industries to flourish.

For more on WG RAN3: www.3gpp.org/3gpp-groups

Management and Orchestration in Rel-19

By Lan Zou, 3GPP SA5 Chair

3GPP WG SA5 Rel-19 standardization work includes management and orchestration requirements, management stage 2 and management procedures, and stage 3 OpenAPI and YANG solution sets to provide complete management interoperability capabilities for the 5G network in a multi-vendor environment.

SA5 takes the WG SA1 defined service requirements as input and focuses on the details of management requirements. By closely following the progress of other 3GPP WGs which produce new network features, SA5 also provides timely stage 2 and stage 3 management capabilities to allow operators to be able to manage the new network functions via standardized management solutions.

SA5 Rel-19 Management and Orchestration topics

There are twenty-one Rel-19 management and orchestration topics currently, categorized by the following four technical areas; Intelligence & automation, Support of new services, Management architecture & mechanism-management feature enhancement and for new networks features.

1. Intelligence and automation

AI/ML management, management data analytics, enhancement of intent driven management, closed control loop management and network digital twin:

- **AI/ML management (AIML)** studies the mechanisms of how to enable and facilitate the efficient deployment, operation of the relevant AI/ML features located in 5GC, RAN or management functions. It is targeted to provide manageable capability to perceive how AIML model works with lifecycle management, giving the operator the confidence of taking advantage of AIML technology under their own supervision.
- **Management data analytics (MDA)** investigates the potential management analytics solutions for Energy efficiency analytics, End-to-End performance analytics including Edge computing domain, Data correlation analytics, ATSSS performance analytics, Non-3GPP access performance analytics, UE throughput analytics, Fault management related analytics and alarm prediction, Software Upgrade Validation.
- **Intent driven management (IDM)** SA5 specified basic intent management features in Rel-18 to enable operators to express standardized intent expectation and targets to the intent handler, so that the intent handler can continuously use intelligence and automation mechanisms to seek optimal solutions for the requested intents. In Rel-19, more enhanced management functionalities

like Intent negotiation mechanisms, network intent to support new business opportunities, adopting natural language to express intent will be discussed. With the new enhancement features, operators could interact with the intent handler more efficiently and extend the intent capability to support new services.

- **Closed control loop (CCL)** investigates the dynamic closed control loop creation for communication service assurance, Conflict Detection and Resolution across multiple CCLs. Considering the CCL could be disintegrated into multiple parts each coming from different vendors, a study on whether there would be any advantages or constraints for the use of multi-vendor CCL could provide evaluation insights to the industry.
- **Network Digital Twin (NDT)** is a new concept recently introduced in the telecommunication area. It could help operators to efficiently verify changes in network operation's potential impact on the real network before it takes effect. The network behavior with the new configuration and policy can be emulated in the digital twin environment, operators could adjust the decision based on the emulation result. Network digital twin could also construct a full view of network topology and traffic, which can help the operator with efficient end-to-end or single-domain fault localization, traffic path optimization, prediction and avoidance of signaling storms. In Rel-19 study, the investigation on how RAN optimization and service assurance could potentially benefit from network digital twin technology will also be taken into account.

2. Support of new services

Management capability exposure and energy efficiency management:

- **Management capability exposure (MExpo)** focuses on defining a generic approach for discovery and exposure of SA5 management service capabilities to external consumers including verticals. The study will also investigate exposing network slice capability in network sharing scenarios for communicating with external consumers.
- **Energy efficiency management (EE)** aims to study new or enhanced Energy Consumption (EC) and Energy Efficiency (EE) KPIs and measurements while considering various granularities, and also provide the estimation of Carbon emissions efficiency and information on renewable energy consumption to operators. This study also addresses how to measure or estimate the energy consumption of containerized network functions.

3. Management architecture and mechanism-management feature enhancement

Management and orchestration of cloud, Service based management architecture enhancement, Plan management, Data Management, Data subscriptions and reporting, Enablers for Security Monitoring:

- **Management and orchestration of cloud (CMO)** plans to analyze the use cases which utilize the VNF generic OAM functions, study the use cases that utilize the newly developed industry solutions for management of cloud native network functions which leverage industry standards not limited to ETSI NFV MANO, and solutions for 3GPP management system to support different cloud deployment scenarios.
- **Service based management architecture (SBMA)** focuses on elaboration on usage guidance of model driven service, and also target to provide collection of the management capabilities and advertise management capability mechanisms.
- **Plan Management (PlanM)** studies the possibility for the operator to build the complete future configuration in a step-by-step approach. An operator could create and update a planned configuration that may be activated in the future. By validating the planned configuration in advance, it's possible to increase the likelihood of success when activating it in the real network.
- **Data Management (MADCOL)** specifies methods to discover and collect historical management data and standardized mechanism to manage external management data.
- **Data subscriptions and reporting (SREP)** studies the potential solutions to avoid redundant subscriptions for the same data in the NFs and 3GPP management system. It will help to improve operational efficiency when the data collection is requested by an increasing number of automation functions in the 3GPP system.
- **Enablers for Security Monitoring (MSEC)** studies the collection, management and correlation of security alarms collected from 5GC, RAN, MnFs and UEs.

4. Management architecture and mechanism-management of new network features

Performance measurements and KPIs, the network resource modeling to manage the new network features of the 5G core and RAN, Subscriber and Equipment Trace and QoE collection management, Management of NTN, IAB node, Redcap, NWDAF and network sharing:

- **Performance measurements and KPIs (PMKPI)** specifies new 5G performance measurements and KPIs for Mobility Enhancements, XR (Extended Reality) and media service, Mobile Terminated-Small Data Transmission, NR Multicast and Broadcast Services, Access Traffic Steering, Switch and Splitting (ATSSS) and UE level measurements.
- **Network resource modeling (adNRM)** specifies 5GC and NR network resource models to allow operators to manage new network features, also provide 3GPP defined slicing solution to satisfy GSMA developed network slice service requirements in NG.116.
- **Subscriber and Equipment Trace and QoE collection management (TMQ)** continues the enhancement of the trace collection measurements and QoE data collection information as the RAN and 5GC progress.
- **Management of NTN (NTNM)** studies the management requirement and potential solution to manage regenerative satellite, Store and Forward (S&F) satellite, and end to end network (including RAN domain and CN domain) in NTN scenarios.
- **Management of IAB node (IABM)** studies mechanism on how IAB node connects to OAM system, enhancement to Plug and Connect NE to OAM system, continuity of OAM connectivity during IAB node mobility and MBSR roaming over PLMNs, IAB FCAP management.
- **Management of Redcap (RedcapM)** studies configuration to support RedCap related initial BWP and eDRX, new performance measurements and KPI to measure resource load of RedCap network and Inactive UEs.
- **Management of NWDAF (NWDAFM)** studies configuration to support NWDAF accuracy checking capability, Analytics Exposure in Roaming Case and Federated Learning, and evaluates the the network data collection efficiency of NWDAF.
- **Management of network sharing (NSM)** studies trace job and collection requirements for participating operators, scenarios related to access rights of MOCN management data, and support of Indirect Network Sharing scenarios.

SA5 Rel-19 Management and Orchestration Cooperation

WG SA5 works in close cooperation within 3GPP and also with external non-3GPP working groups (e.g. ETSI, GSMA, ITU-T, CAMARA, TM Forum, O-RAN, ONAP, etc.), which are related to management technology.

Examples of potential cooperation in Rel-19 include; the management exposure topic, cooperation with GSMA OPG, CAMARA, TM Forum and 3GPP WG SA6 to construct end to end management exposure solution by integrating the vertical customers' requests with the network solutions.

For the Energy efficiency topic, cooperation with 3GPP WG SA2 & WG RAN3, ETSI EE, ITU-T, ETSI NFV could give us a broader overview of network energy consumption and efficiency.

Summary

WG SA5 management and orchestration takes an important role in the network and service ecosystem. Inside 3GPP, SA5 closely maintains the network and service management of the 3GPP network. Outside 3GPP, SA5 shares its work and actively contributes to end-to-end management solutions.

In Rel-19, in addition to the management of new network features, operators may also get more management features to improve operational efficiency and achieve performance assurance by using intelligence, and build good basis for operators to provide new agile services to their customers.

Useful links for SA5 Rel-19 topics

- SA5 Rel-19 approved WIDs/SIDs: https://forge.3gpp.org/rep/sa5/MnS/-/wikis/SA5/Rel-19-Moderated-Topics
- Management and Orchestration APIs: https://forge.3gpp.org/rep/sa5/MnS

For more on WG CT4: www.3gpp.org/3gpp-groups

Collaboration between SCF, OAI and O-RAN Alliance

By Simon Fletcher, CSO, SCF

In a market and ecosystem of increasing complexity, partnership and cooperation are vital ingredients for success, and principles that sit at the core of SCF. Our mission is to support interoperability and ensure architectural and supplier choice across a range of scalable infrastructure for an evolving ecosystem of service providers and network deployers. SCF has been a Market Representation Partner (MRP) of 3GPP ever since working closely with 3GPP on the defining of 3G and 4G in-building consumer basestations.

Although our interests have broadened – as we outline below – we do see a necessary coming together between the 3GPP memberships and our own diverse industry membership as the Open RAN market starts to help shape the next generation of 3GPP and non-3GPP systems. We pride ourselves on offering an environment focused on collaboration. I hope that this article will be of interest to the 3GPP community.

Recently, we have strengthened our collaborations with OpenAirInterface (OAI) and the O-RAN Alliance by the signing of a comprehensive Cooperation Agreement with the O-RAN Alliance.

This has been a long standing partnership, with our shared membership and common commitment to the Open RAN ecosystem. The SCF work program now includes close cooperation with the O-RAN Alliance to support specification development and activities to accelerate commercialization of small-cell open RAN solutions.

In-flight work and emerging market dynamics

SCF has a robust technical work program which includes close cooperation with the O-RAN Alliance to support specification development and activities to accelerate commercialization of small-cell open RAN solutions.

FAPI (Functional application platform interface) is a common standard agreed between chipset and component suppliers and mobile base station integrators. It is an API for hardware components implementing 3GPP physical layer functions and “software stacks” implementing higher layers. Since SCF created the standard, FAPI has been widely adopted in the vast majority of 2G, 3G and 4G system-on-a-chip based small cells.

SCF has now published five specifications within 5G FAPI, its landmark family of common interfaces. The suite is regularly updated to ensure it meets industry needs and aligns with 3GPP standards. Significant work is already underway with SCF and the O-RAN Alliance to mature the FAPI and nFAPI (for virtualization) split-6 options.

The new Cooperation Agreement with the O-RAN Alliance identifies key areas of collaboration, including: requirements, workplans, development of 5G/6G-(n)FAPI interface specification, disaggregated architectures, RAN Intelligent Controller (RIC) interactions, management solutions, test and verification, and reference implementations.

Near-term technical goals under the agreement include the continued alignment of specifications and the development of management solutions for Split-6 (FAPI/nFAPI) RAN.

But the collaboration on the 5G/6G-(n)FAPI interface specification extends beyond merely signing documents.

> With work underway to start defining the standards for 6G, the industry inevitably turns its attention to what’s coming next. But we cannot wait for 6G – with a putative date of 2030+ - to realise broad-scale Open RAN market adoption.

At the end of 2023, SCF, OAI and the O-RAN Alliance convened in Boston for a hands-on workshop which explored common interests in each organization’s activity roadmaps and in particular how split 7.x and split6 in the disaggregated RAN could evolve. SCF develops FAPI by reference to both 3GPP and O-RAN Alliance technical specifications depending on the features that are being developed in FAPI at the time.

Realising Open RAN, more quickly

The hoped for benefits of Open RAN are well established yet much of the industry remains frustrated by the slow rate of deployment. At the recent Small Cells World Summit (SCWS), market analysts explored the reasons behind this, specifically the absence in mature market macro networks for green field opportunities and the long-term nature of commercial contracts between suppliers and Operators which will inevitably create the impression of inertia for a while.

By contrast, special and multi-purpose networks using smaller form factor base stations (including compact macro) are typically driven by green field densification and cost sensitive coverage solutions. As a result, the notable exception in the Open RAN deployment story to date is small cells, where progress has been earlier and faster than elsewhere. Indeed, BT and Wireless Infrastructure Group at SCWS were able to point to concrete steps forward and a roadmap to harness Open RAN and improve the economics of densification.

Against this backdrop of market reality, the closer alliance between our organizations makes perfect sense. Beyond the specifics of technical endeavours – of which there are plenty – our deepening partnership enables us to more effectively share knowledge and collaborate for the benefit of the entire Open RAN ecosystem.

Increasingly, we're seeing that the group of alternative network operators some of which enable shared network infrastructure (referred to as Neutral Hosts) are emerging as influential buyers of equipment from the product sectors that SCF represents. Initiatives like Joint Operators Telecom Specification (JOTS), which started in the UK and is being explored in other markets, show that it is possible for MNOs to define the acceptable deployable specifications of systems, providing the groundwork which third parties can then build on to create the deployment market.

At a market level however we're observing that RAN sharing architectures may need to evolve as the long established Multi Operator Core Network (MOCN) and Multi Operator RAN (MORAN) approaches have been standardized for some time, but when combined with new thinking on disaggregation towards 5G-Adv - and beyond - and NTN product platform changes may be needed. The JOTS forum has recently developed additional specifications for addressing security and related aspects, and similar initiatives are being pursued by ATIS. Security is of solutions is of great import to the SCF.

Led by our MNO and neutral host members, SCF is therefore working to explore whether a baseline blueprint for a global sharing framework is possible or even desirable. Such a framework would leverage global best practice and highlights perfectly the critical value of collaborations between SCF and organizations such as OAI and the O-RAN Alliance, plus other bodies.

Closer working relations not only enables wider understanding, but can also ensure consistency, and avoid fragmentation or duplication of efforts. In an increasingly complex and multi-layered ecosystem with new types of service providers, the value of this cannot be overstated. It is through partnerships, alliances and collaborations that we jointly have the opportunity to enact real-world, measurable progress to realising the ever-increasing demands for advanced connectivity.

Security and Management (SMO) provides another opportunity for – and example of - alignment and partnership between SCF and other organizations. We see SMO becoming increasingly essential to smooth the integration of multi-purpose networks into public, hybrid and private network deployments, and are consequently exploring and then exploiting the synergies between the works of OAI, O-RAN Alliance & OnGo Alliance.

The pathways to 6G

With work underway to start defining the standards for 6G, the industry inevitably turns its attention to what's coming next. But we cannot wait for 6G – with a putative date of 2030+ - to realise broad-scale Open RAN market adoption.

Instead, as both a Market Representation Partner of 3GPP and an industry partner with the O-RAN Alliance, SCF is focusing on driving the adoption of 5G towards 5G-Advanced, maximising the return on investment for R&D developments that we've seen being made for a number of years. The approach to inclusion of space-based systems and densification that is inclusive of new spectrum bands creates opportunities during 5G deployment to create value. Nevertheless, as the economically viable pathways of industry members towards 6G become apparent, SCF anticipates a rethink on disaggregation in the RAN and perhaps in other areas of the networks. With that in mind - we have been observers of the recent SA1 6G Use Cases workshop and plan to focus on the path to architectures through engagement with 3GPP and O-RAN Alliance future architecture deliberations when appropriate. Contributions from SCF through PCG of 3GPP are anticipated over the coming year.

Looking ahead, we have identified longer-term technical goals to tackle with OAI and the O-RAN Alliance, including the development of reference implementations and integrated test and verification processes.

Softwarization is a trend expected to be significant in the future of networks and OAI sets a template for the open source model in RAN. There are of course commercial models linked to Open Source but these need to mature and SCF emerges as a trade organization able to help the ecosystem commoditize solutions.

We also recognize that the pathways to 6G will be paved with innovations in silicon at the techno-economic edge of national operator networks. Achieving cost and power optimal solutions, that work for the economics of special and multi-purpose networks, addressing the varied needs from coverage in remote and rural locations to densification for capacity and full service availability area networks needs a variety of chip options for product developers.

Our sector is a complex and multi-faceted one: the risks of duplication, fragmentation and confusion are great. Strategic partnerships and collaborations offer a clear route forward to more effectively meet latent demand, overcome challenges and realise the potential of Open RAN, emerging technologies and future networks.

We have a deeply embedded pragmatism that runs throughout SCF as we strive to get real about the future and identify how we can shape and promote new product development and practical solutions to monetizing telco investments. As in the past work on Femto-cells, we hope that we can be a catalyst for future work in 3GPP, that harnesses the power of the 3GPP RAN and growing potential for an Open RAN.

SCF https://www.smallcellforum.org/

As both a Market Representation Partner of 3GPP and an industry partner with the O-RAN Alliance, SCF is focusing on driving the adoption of 5G towards 5G-Advanced, maximising the return on investment for R&D developments that we've seen being made for a number of years

Ambient IoT: Redefining Wireless Communication for Industry 4.0

By Jyotirmay Saini, Suman Malik, Shyam Vijay Gadhai, Rohit Budhiraja, IIT Kanpur / TSDSI

The concept of Industry 4.0 represents the ongoing trend of automation and digitalization within manufacturing and other industries. Internet of Things (IoT) technologies can meet the sector's requirements for future wireless technologies over the cellular network.

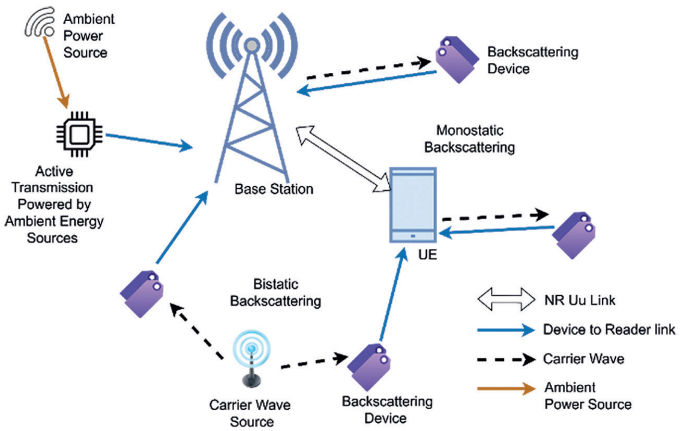
The potential of Ambient IoT

For the massive deployment of IoT devices and the growth of the IoT market, future wireless technologies must be sustainable and energy efficient. However, the existing cellular IoT technology, relying on battery-powered devices, poses maintenance, environmental impact, and safety challenges, especially in critical industries.

Addressing these issues requires IoT technologies supporting battery-less or low-energy devices. Devices operating on energy harvesting technology have the potential to address the problems of scaling up the battery-powered IoT network. These devices are expected to be battery-free, harvesting the energy from ambient sources such as electromagnetic, thermal, and solar. They will operate with limited energy storage capacity and will not require battery charging or replacement. 3GPP is currently studying this new class of IoT devices, termed as 'Ambient IoT' (AIoT) devices, which will be integrated with cellular technology to meet the requirements mentioned above.

In an AIoT network, as shown in Figure 1, a device communication is powered by the energy harvested from an ambient energy source. The device interacts with the network via a reader node, which could be a base station or a user equipment (UE), which is capable of AIoT operation. Considering a device complexity and power consumption, ambient IoT Technology encompasses energy-harvesting devices, which are capable of active signal generation or backscattering for their data transmission.

Devices capable of active transmission are expected to use the harvested energy for their signal generation and transmission. Backscattering devices will rely on an externally-provided carrier wave for their signal transmission.



These devices will modulate data on an externally provided carrier wave and reflect it toward the reader node. From the reader node's perspective, backscattering ambient IoT devices can be in both monostatic and bistatic modes of operation.

For monostatic operation, the reader node serving a particular AIoT device will provide the carrier wave to the AIoT device for signal transmission. For bistatic operation, the carrier wave source for AIoT signal transmission is a node which is different than a reader node that serves a particular AIoT device.

All these device types are envisioned for different use cases based on the quality-of-service requirements.

Ambient IoT is envisioned to operate without having a dedicated power source to cater to very low-end IoT applications, such as inventory management and command, where the requirements include ultra-low complexity devices with ultra-low power consumption and a small form factor. Existing cellular IoT technologies cannot meet an AIoT device's low cost/complexity and power consumption requirements. This requires standardizing new technologies in Release 19 or later.

AIoT in 3GPP today

So far, to bridge this gap in available technologies, in the Release 19 specifications, 3GPP initiated a study on AIoT in Service and Systems Aspect working group 1 (SA1) to capture use case, traffic scenarios, service requirements, and KPIs. The results of this study were captured in TR 22.840. Other SA working groups are currently looking into service architecture, security aspects, and the charging aspects of Ambient IoT devices.

Apart from the SA1 study, a parallel study at the RAN Plenary level was carried out to check the feasibility of meeting the design targets for relevant use cases of this new 3GPP IoT technology for deployment in a 3GPP system. The results of this study were captured in TR 38.848. Based on the results of the RAN Plenary study, in Release 19, a RAN working group-level study on Ambient IoT is on-going.

TSG RAN working groups are currently studying the air interface design for AIoT and the coexistence aspect of AIoT with NR technologies. Ambient IoT technology is anticipated to enhance current 3GPP IoT technologies by expanding into new markets, to create opportunities to serve low-end use cases with a significantly high local device density. Moreover, AIoT also aims to offer devices with substantially reduced complexity and power consumption. This emerging cellular IoT technology has the potential to address connectivity challenges, facilitating real-time data collection, analysis, and decision-making processes.

The Digital India Initiative by the Government of India and the future looking Bharat 6G vision encourage the early rapid deployment of 5G/6G networks across the country, giving considerable support for the design, development and deployment of network technologies that will enable Industry 4.0. The cost-effectiveness and massive scalability of Ambient IoT make it a strong candidate for widespread adoption across the Indian landscape.

Meeting the users' needs

Broadband communication as the lifeline for PPDR users

By Nina Myren, Chair, TCCA Legal and Regulatory Working Group

During the last decade, 3GPP has included the requirements for mission critical communication as part of the 4G/5G standards making the mobile broadband services available for PPDR (Public Protection and Disaster Relief) users. These users can therefore take part in further technological development driven through the 3GPP standardisation work.

These users expect their communication services to be secure and available - everywhere and always. Broadband mission critical communication will to a larger degree than narrowband rely on commercial Mobile Network Operators (MNO) services and infrastructure. Implementation of the Quality of Service, Priority and Pre-Emption (QPP) mechanisms are needed to secure the PPDR users' service access in the commercial networks in cases of congestion.

While standards, technology and products for mission critical communication have become available, the regulation in this area appears to be lagging behind. There is no EU-level legislation requiring MNOs to prioritise critical communication for emergency services. This needs to be addressed. The implementation of the QPP prioritisation mechanisms seem to be in conflict with the European Union regulation on open internet access (2015/2120)[1]. National exemptions are needed, as made in countries like Finland, France and Belgium. In TCCA's white paper 'Legal and Regulatory aspects regarding the realisation of Quality of Service, Priority and Pre-emption (QPP) in commercial networks'[2], TCCA's Legal and Regulatory Working Group has revealed that both the interpretation of the European regulations and the practical implementation of the QPP may differ from country to country. TCCA therefore recommends a general exemption for PPDR operators from the EU regulation.

The planned EU Critical Communication System (EUCCS)[3] for cross border operability, will require a harmonised approach to the implementation of mission critical broadband services to facilitate seamless international operations. Emergency services crossing borders or supporting colleagues in a visiting country need access to the mission critical services in the visiting network. A harmonised approach to QPP will be a key building block in the EUCCS, from both a regulatory and technical point of view.

Requirements and solutions for mission critical roaming is currently being looked at in a joint GSMA/TCCA/BroadEU.net task force. How seamless roaming with QPP and Access Class Barring can best be implemented is to be proposed by the task force.

The EUCCS could be the enabler for wider EU-level legislation on mission critical communication. Looking at the common European Emergency Number '112', it is highly regulated, also with respect to priority and not least interoperability. It is essential for the whole value chain of emergency management that both emergency communication and mission critical communication are always reliable and always available.

As EUCCS is a "system of systems"- concept interoperability will be of utmost importance. Technical and operational trials are funded by the European commission (EC) through the BroadEU.net program, while the EC-led Mission Critical Communication Expert Group (MCCG) is looking at governance and policies[4].

For cross border communication initiatives like EUCCS interoperability is needed between national systems. But interoperability is also crucial in national systems, from day one and over the lifetime. The way to go is to make sure procured products and services are following the 3GPP standard for mission critical services.

We need sustainable test and certification processes for mission critical products and services. TCCA is working together with the Global Certification Forum (GCF) to establish processes to provide certification on MCX 3GPP standard conformance and in a later stage, on interoperability. TCCA will also provide guidance to those procuring products and services through its procurement model text library. We encourage all government agencies and others procuring MCX products and services to have specific requirements for testing and certification in the contract. For early movers it may be tempting and perhaps even necessary to accept non-certified products, e.g. the test and certification process may not yet be available. In this situation TCCA recommends contract requirements where the supplier shall proactively contribute to the process and seek certification as soon as it is available.

Common requirements that drive vendors to seek certification will help establishing a global, interoperable deployment of mission critical communications systems based on 3GPP MCX standards. The European initiative may as well be an accelerator in this respect.

Nina Myren is TCCA's Board director representing DSB Norway.

https://tcca.info

[1] https://eur-lex.europa.eu/eli/reg/2015/2120/oj

[2] https://tcca.info/documents/September-23_LRWG_QPP_whitepaper.pdf/

[3] The EUCCS shall connect communication networks of all public law enforcement, civil protection and safety responders in Europe by 2030 to allow for seamless critical communication and operational mobility across the Schengen area. See European Commission, White Paper on how to master Europe's digital infrastructure needs, COM(2024) 81 final of 21.2.2024, page 17.

[4] Further information on BroadEU.net and MCCG can be found in www.broadeu.net

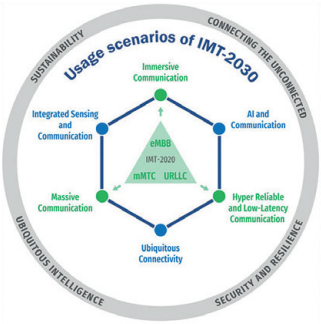
IMT-2030 Use Case Workshop: A Catalyst for 6G Planning

By Puneet Jain, TSG SA Chair

In a convergence of minds and expertise, two hundred delegates, accompanied by over three hundred and eighty online participants, convened for the '3GPP Stage 1 Workshop on IMT2030 Use Cases' from May 8th to 10th in Rotterdam, NL.

This gathering aimed to delve into the perspectives and priorities of operators, regional 6G research alliances, 3GPP partners, and other innovators regarding IMT-2030 use cases laying the groundwork for formal 6G standardization activities within 3GPP. The trigger was the finalization of the ITU-R vision framework document that enlists six overarching IMT-2023 Usage Scenarios:

- Immersive Communication
- Massive Communication
- Hyper Reliable & Low-Latency Communication
- Ubiquitous Connectivity
- AI & Communication
- Integrated Sensing & Communication



Source: SWS-240022 Workshop Update from ITU-R

The workshop primarily engaged organizations slated to participate in the initial 3GPP studies for 5G Advanced and early 6G. It provided a pivotal platform to discuss the requirements and potential use cases expected to be addressed by Release 20 6G Stage-1 Study Item(s).

Co-chaired by Jose Almodovar, the SA1 Chair, and myself, the workshop was meticulously coordinated by Alain Sultan, the WG SA1 Secretary of the MCC. On the concluding day, we delivered a comprehensive summary of the workshop's proceedings. While not yet indicative of any prioritization or ranking of 6G use cases at this nascent stage, the summary serves as a weathervane, delineating the areas under consideration.

Potential Drivers for 6G:

- Security and Trust: Spanning network security, user data confidentiality, service continuity, mitigation of emerging threats, and integration of quantum-safe security mechanisms.
- Support of AI/ML: Enabling intelligent network automation, performance optimization, AI-assisted enhancements in air interface and positioning, and facilitating AI at the application level such as AI as a Service (AIaaS) and media personalization.
- Immersive Communications: Facilitating extended reality, holographic, telepresence, multi-sensorial communication, digital twins, and the hyper-realistic metaverse.
- Sustainability: Addressing the environmental footprint of telecom operators through energy-efficient designs, reduced energy consumption, streamlined processes, and fostering circular economy practices.
- Ubiquitous and Resilient Coverage: Ensuring seamless coverage in remote and underserved areas for applications like smart agriculture and education, with enhancements including non-terrestrial, aerial, and maritime communications.
- Network Resiliency: Minimizing network outages and bolstering resilience against unexpected events such as natural disasters.
- Sensing: Leveraging communication infrastructure for human activity recognition, localization, environmental monitoring, and fostering intelligent sensing and communication coexistence.

Source: SWS-240025 Summary of the Workshop

Throughout the workshop, certain recurrent themes emerged, serving as catalysts for early ideas for 6G, including "Smart" everything, Voice over 6G, Fixed Wireless Access, Low Area Wide Area (LPWA)/massive IoT, Industrial IoT, Open Network Northbound APIs, Healthcare, Autonomous Driving, and Enhanced Positioning. These themes will fuel discussions as we embark on crafting the initial service requirements and KPIs for 6G features.

Next Steps in 3GPP:

Looking ahead, SA1#106 (May 27-31, Jeju - KR) will witness presentations from 3GPP Members outlining their perspectives on 6G Use Cases and study item aspects. This session will culminate in a decision regarding the initiation of one or several studies for 6G. Approval for SA1 6G SID(s) is targeted for the September 2024 plenary (TSG SA#105).

Furthermore, during TSG#107 in Korea in March 2025 (10-11), TSG-wide workshops will be convened, focusing on kickstarting the Release 20 study on the 6G radio interface and 6G core network architecture within the RAN and SA Working Groups, respectively.

Get the workshop presentations:
www.3gpp.org/Stage1_IMT2030_UC_WS

An interview with...

Diana Pani, RAN2 Chair, InterDigital Inc.

As VP and Head of Wireless Standards at InterDigital, overseeing the research and contributions to 3GPP 5G/NR RAN and Core Network (TSGs SA/CT) standards, Diana Pani is deeply entwined within the 3GPP ecosystem and standards process. Her broad expertise includes Technical Specification Group RAN, specifically Working Group RAN 2 - where she was elected Vice-Chair in 2013 and now serves as Chair, following her election in August 2023.

We met in Maastricht in March 2024, during the 103rd Technical Specification Group (TSG) plenaries.

Highlights: Having attended TSG RAN#103, could you give us a flavour of what is happening this week in the group?

Diana Pani: The primary focus of this week's meetings was to define and finalize the Rel-19 work plan for topics led by WG RAN4. In December 2023 we defined the Rel-19 work plan for RAN1, RAN2, and RAN3-led topics, so at the conclusion of these meetings we will have a complete view of the scope of Rel-19 across all WGs and the work ahead of us for the next 18 months.

The 6G timeline was another major discussion topic across the TSGs.

Highlights: You have the Rel-18 freeze, work on Rel-19 planning and then you are looking forward to 6G. How difficult is to do all of this at once?

Diana Pani: It's quite difficult to handle everything at the same time, so the TSG and WG chairs must carefully plan how to allocate time for their WGs throughout the release, to balance the completion of one release with the start of a new release. Until now, RAN2 has concentrated 100% on finishing the Rel-18 work to ensure stability of the specifications. However, April and May will be much more challenging because we have to begin the Rel-19 work while also prioritizing completion of Rel-18 and a successful ASN.1 Rel-18 freeze.

The 6G timeline is very important and informative, but 6G doesn't yet impact the RAN2 work. As decided in December, RAN working groups will start work for 6G in Rel-20.

Highlights: Can we get an insight into your standards journey? What brought you to the standards field and to a career at InterDigital, in Canada?

Diana Pani: I started working at InterDigital right out of college, I had just completed my engineering degree and was really happy in Montreal. Prior to working there, I had actually interned at InterDigital as well, looking at smart access point Wi-Fi algorithm design and implementations. I found the environment welcoming and the work extremely interesting, so I was very happy to return after my graduation, and soon after joined InterDigital's Standards group. After two years of work in the back office, I was asked to go to 3GPP to represent our company as a replacement for a co-worker for just two meetings. Those two meetings quickly turned into 15 years of participation. I realized that I had fallen into the "new delegate trap". After you've been to two meetings, you are hooked!

Highlights: Can you tell us a little about how the standards work is organized within the company?

Diana Pani: At InterDigital, we have a dedicated wireless standards team that mainly focuses on 3GPP, Wi-Fi, ITU, and IETF standards. Our team is comprised of both researchers and experienced standards delegates that work very well together across all the different areas of the wireless systems. We also have an experienced team in our Video Lab that contributes research and holds leadership roles in various video standards.

I am extremely proud and grateful to work with such a committed, collaborative, and overall world class team of standards engineers.

Highlights: Looking at the work of TSG RAN, could you help us demystify how the stages of a release come together? On the TSG/CT side of the house, the stage 1 requirements followed by the stage 2 architecture split is quite clearly divided between SA1 and SA2, while CT covers most of the stage 3 work. RAN work seems to be a little different; do you have all three stages in your groups?

Diana Pani: We do have similar stages of work in RAN, but the working groups splits are not determined by the stages of work but instead on areas of expertise and protocol layers within the RAN. Typically, the work happens in parallel across the RAN working groups. For many features there are dependencies between the groups, which require cooperation and coordination between them and for some topics coordination with the TSG SA and TSG CT groups.

In my role as RAN2 Chair, I work with the other WG Chairs to identify areas of overlap and determine which group should begin the work. Coordination is sometimes difficult because the separation is not always very clear and both groups are busy, but by working closely with the WG and Session Chairs, we ensure that we make good progress on the features.

Highlights: As Rel-19 gets fully underway, what are the major RAN2 projects for the release?

Diana Pani: Projects for Rel-19 primarily focus on continuing the balanced evolution of eMBB and verticals to address new commercial needs and build the bridge toward 6G.

For RAN2, some of the major projects include the evolution of Rel-18 5G-Advanced projects like, eXtended Reality, Non-Terrestrial Networks, Network Energy Saving, Mobility and SideLink Relays. RAN2 is also working on several new important 5G-Advanced projects like Ambient IoT and AI/ML for Mobility and Air Interface.

Highlights: Once the focus on who does what is agreed, what is the dynamic in the RAN2 group? How do decisions get made?

Diana Pani: Reaching consensus and agreement takes a lot of time and discussions both during and between the meetings. In RAN2 we have roughly 350 delegates looking at 2000 documents per meeting.

While in RAN2 there are many offline discussions, most of the agreements are made online. For this reason, it is important to have our 3GPP experts participate in physical meetings to resolve disagreements face to face. The discussions are detailed and difficult, often because there are diverging views on what is important and how a problem should be solved. Achieving consensus requires a lot of cooperation from companies and a willingness to compromise to reach a common goal and complete the work on time so the industry can benefit.

RAN2 maintains a strong track record on compromise in the pursuit of solutions and deadlines.

Highlights: How is it possible to deal with 2000 documents in the Working Group week?

Diana Pani: Indeed, 2000 documents are a lot to process and the chairs and delegates have a responsibility to review them before the meeting. Because of the very high workload and work being done in parallel for different projects, companies often send a large number of delegates. Delegates can then focus on their specific topics and read all the contributions related to them, but that is still a high volume of documents.

We have limited time at the meetings, so we can only address and present some of the documents. The chairs select a very limited number of contributions to present for each agenda item and these contributions sometimes provide different perspectives on how to address a problem. Sometimes, we receive 50 documents for one agenda item but only have time to present 2 or 3 to ensure the remaining time can be dedicated to technical discussions.

Highlights: Can this create stress around which contributions are chosen for discussion?

Diana Pani: Even if only 2 or 3 documents are treated it doesn't mean the remaining contributions are not important. Companies typically review all contributions before the meeting and are aware of the technical contents of the contributions. Companies bring their views directly to the discussion without needing to present their document. In these technical discussions, all ideas are considered equally, regardless of whether they come from a presented contribution.

Highlights: Do the large-scale co-located 'mega' meetings help or hinder things, with the WGs gathering in the same place and the same time? I guess you can't easily be in two WGs at the same time. Could we improve coordination efforts?

Diana Pani: Theoretically, co-hosted meetings can help, but in practice everyone is busy – So, coordination during the meeting itself is limited. We haven't held joint sessions between WGs for some time, so meeting in a common place is useful, but it isn't always necessary. For companies with small delegations, like some vertical companies, co-located meetings can be useful because it supports attendance at different WGs for the same features (considering there are no collisions, which are often difficult to avoid).

On coordination, the WG chairs don't have much time to do that during the week, because they are consistently chairing meetings. Overall, the [TSG] plenaries are the place where the WG Chairs have time to talk to each other.

Highlights: Looking towards future efforts on 6G, how much is that being shaped by the current focus on 5G-Advanced?

Diana Pani: Rel-19 and it's 5G-Advanced features are building the bridge towards 6G, and in RAN2 we are doing work now that will prepare us and eventually become fundamental building blocks of 6G. Some of the work reflects '6G' topics, for example RAN1's channel modelling work for sensing and new spectrum, while other areas like AI/ML, Network Energy Savings, XR, etc represent 5G topics that will become important in 6G.

Each of these will evolve and I believe the lessons we learn in 5G will prove to be critically important for the design and implementation of 6G. Being ready for the transition of the G's is a major purpose we share across the groups.

This is by design; each wireless generation evolves and builds upon itself. Looking historically, we saw that the later features of 4G LTE became fundamental building blocks of 5G. I think we can expect 5G-Advanced to contribute to the foundations of 6G in a similar way.

For more on WG RAN2: www.3gpp.org/3gpp-groups

3GPP RAN2#126, Fukuoka City, May 2024

CALENDAR OF MEETINGS (2H24)

Here is a snapshot of the TSG (bold) and WG meetings for June to September, with only the TSG meetings shown for Q424:

Meetings	Start Date	City
CT#104	**17/06/2024**	**Shanghai**
RAN#104	**17/06/2024**	**Shanghai**
SA#104	**18/06/2024**	**Shanghai**
SA3#94-LI	09/07/2024	Amsterdam
CT1#150	19/08/2024	Maastricht
CT3#136	19/08/2024	Maastricht
CT4#124	19/08/2024	Maastricht
RAN1#118	19/08/2024	Maastricht
RAN2#127	19/08/2024	Maastricht
RAN3#125	19/08/2024	Maastricht
RAN4#112	19/08/2024	Maastricht
RAN5#104	19/08/2024	Maastricht
SA1#107	19/08/2024	Maastricht
SA2#164	19/08/2024	Maastricht
SA3#117	19/08/2024	Maastricht
SA4#129-e	19/08/2024	Online

Meetings	Start Date	City
SA5#156	19/08/2024	Maastricht
SA6#62	19/08/2024	Maastricht
CT6#119-bis	20/08/2024	Maastricht
CT#105	**09/09/2024**	**Melbourne**
RAN#105	**09/09/2024**	**Melbourne**
SA#105	**10/09/2024**	**Melbourne**
CT#106	**09/12/2024**	**Madrid, TBC**
RAN#106	**09/12/2024**	**Madrid, TBC**
SA#106	**10/12/2024**	**Madrid, TBC**
CT#107	**12/03/2025**	**Korea**
RAN#107	**12/03/2025**	**Korea**
SA#107	**12/03/2025**	**Korea**

The full calendar is online at: https://portal.3gpp.org

Hans on for 100!

In March, one of 3GPP's most experienced delegates celebrated attending 100 consecutive Plenary meetings at the 103rd TSG meetings in Maastricht in the Netherlands. Hans van der Veen of NEC has attended uninterrupted TSG RAN meetings since June 1999 and TSG SA since October of that year.

For a time, Hans also served in the 3GPP Mobile Competence Centre in ETSI, as a seconded expert supporting (as Technical Officer) TSG RAN and RAN WG2.

6G planning

The Project Coordination Group (PCG) of 3GPP has approved a new logo for use on specifications for 6G, during their 52nd PCG meeting, hosted by ATIS in Reston, April 23, 2024.

The creation of this graphical mark is another step in 3GPP's preparations for the next generation of mobile systems. In December 2023, the Organizational Partners: ARIB (Japan), ATIS (North America), CCSA (China), ETSI (Europe), TSDSI (India), TTA (Korea) and TTC (Japan) announced their joint commitment to make 6G happen in 3GPP. Now there is a graphical badge that can accompany the 3GPP work on the topic, on study cover sheets (TRs) and on future specifications (TSs).

Awards for 2023 Excellence

The annual Excellence Awards for delegates in 3GPP have been presented by the Working Group Chairs during the 1Q24 Working Group meetings in Seville and Athens.

Congratulations to Håkan Palm (RAN2), Yizhi Yao (SA5), Qi Caixia (CT4) and Jinguo Zhu (SA2).

See full details and the Awards roll of honour at **www.3gpp.org/about-us/achievement-awards**

5G-MAG in Maastricht

During the March Plenaries, held in Maastricht, a demonstration of 5G-MAG Reference Tools provided tangible examples of how 5G-MAG facilitates the translation of 3GPP's specifications into products. The 5G-MAG Reference Tools development programme effectively bridges the gap between technical specifications and practical applications.

5G-MAG plays a key role in consensus-building efforts prior to standardization, it develops comprehensive profiles and guidelines, creates reference implementations and provides valuable feedback to Standards Development Organizations such as 3GPP.