3GPP Release 20 – An Update on 3GPP 6G Technology Studies

Webinar | April 9, 2026

Moderator
Richard Burbidge, ATIS Principal Technologist

Speakers
Puneet Jain, Senior Principal Engineer & Senior Director of Standards
Intel Corporation
SA Plenary Chair

Wanshi Chen
Head of Cellular Standards, HWT
Apple
RAN Plenary Chair 2021-2025

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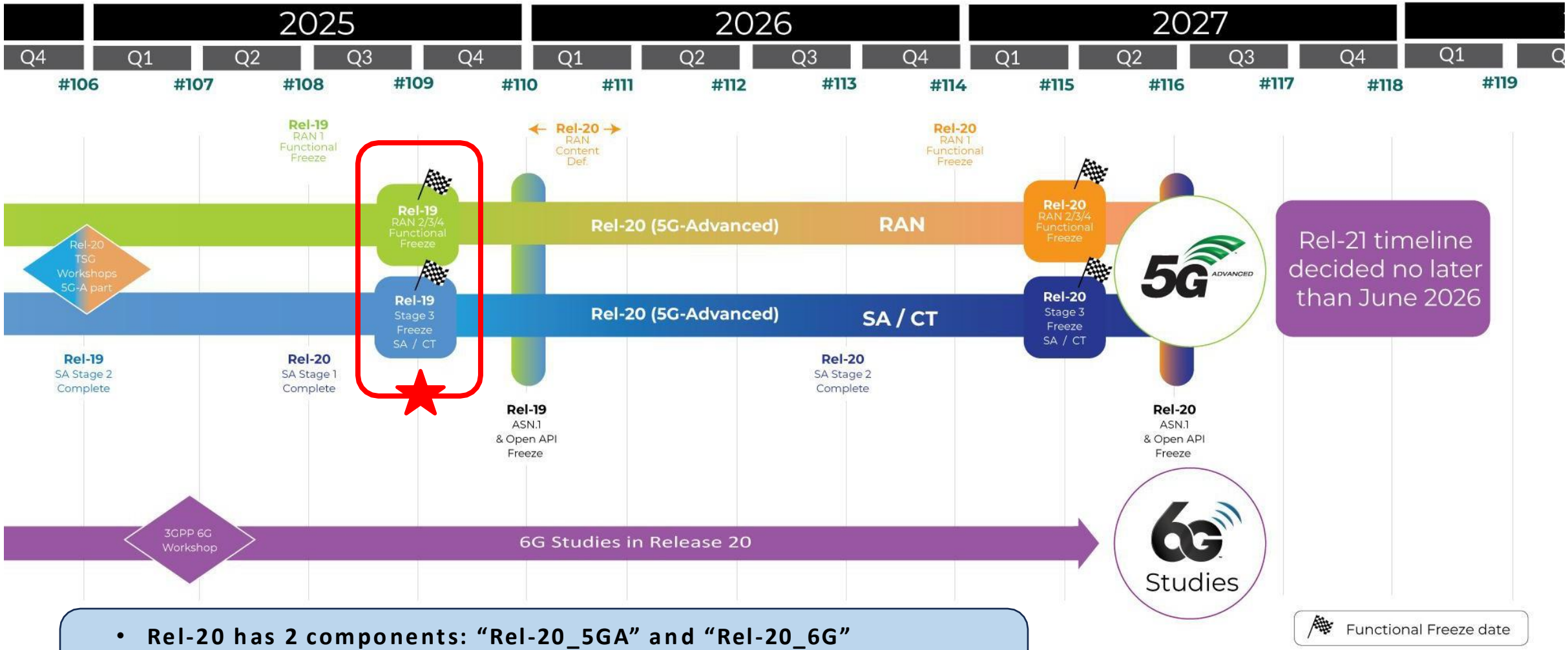
Puneet Jain
3GPP SA Chair
Sr. Principal Engineer & Sr. Director
Intel Corporation

3GPP Release 20 Introduction

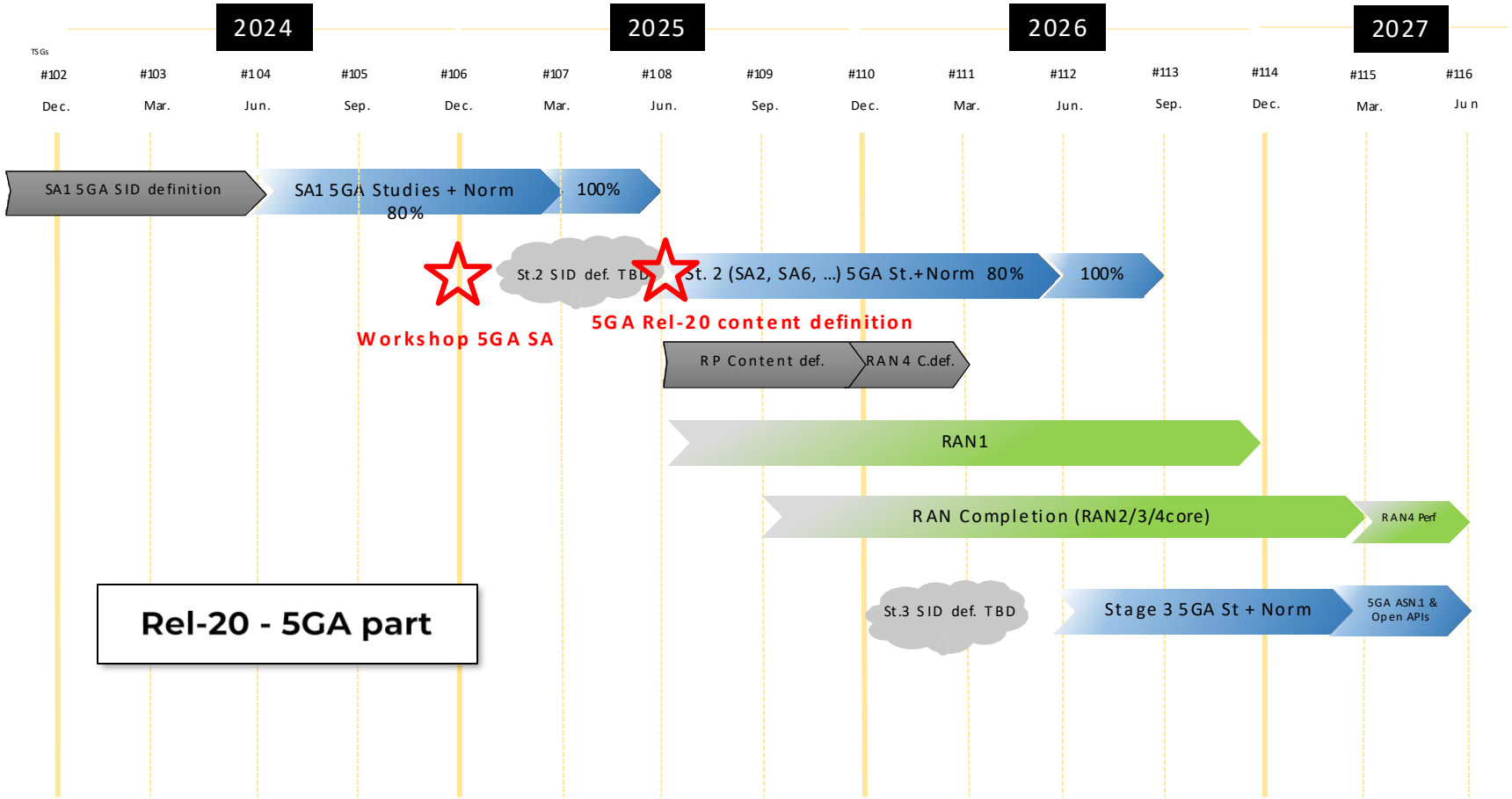


- **Rel-20 has 2 components: "Rel-20_5GA" and "Rel-20_6G"**
  - Rel-20_5GA covers 5GA studies and normative
  - Rel-20_6G covers 6G studies only

Release 20: 5G-Advanced Timeline

Rel-20 (5G-Advanced)

- **For 5G-Advanced: 18-month**
  - Stage-1 freeze : Jun 2025
  - Stage-2 freeze : Jun 2026 (>=80%); Sep 2026 (100%)
  - Stage-3 freeze : Mar 2027
  - ASN.1/OpenAPI freeze: June 2027



Release 20 (5G-Advanced) Status

SA1

(Service Requirement)

- Frozen in June 2025
  - *including now the FRMCS_Ph6-REQ (for which there was an exception in June)*

SA2, SA6

(System Architecture, APP Enablement)

- Significant number of new Normative work: 28 (normative) new WIDs
- Studies: 22 studies, OCI = 77 %
- Normative: 50 items, OCI = 37 %

SA3, SA4, SA5

(Security, Media, O&M/Charging)

- Studies: 46 studies, OCI = 50 %
- Normative: 26 items, OCI = 34 %

OCI = Overall Completion Index

Overall 3GPP 6G Workplan

2024

WG SA1

Stage-1workshop on IMT2030 use cases

Rotterdam, Netherland, May 8 – 10, 2024

To bring 3GPP closer to the ongoing initiatives of various global/regional research organizations and MRPs related to the 6G use cases

Workshop Summary: SWS-240025

Workshop Presentations: Link

TSGs#107

First 3GPP TSG-wide 6G Workshop

Incheon, S. Korea, March 10 – 11, 2025

To discuss vision & priorities for next generation RAN, system architecture, CN and protocols.

Workshop Summary: 6GWS-250243

Workshop Presentations: Link

3GPP & O-RAN ALLIANCE Joint Workshop on 6G Coordination

Sophia Antipolis, France, April 24 – 15, 2025

To share high-level information and establish high-level understanding of work split between 3GPP and O-RAN.

Workshop Summary: 3ORW-250035

Workshop Presentations: Link

Studies for 6G from Release 20

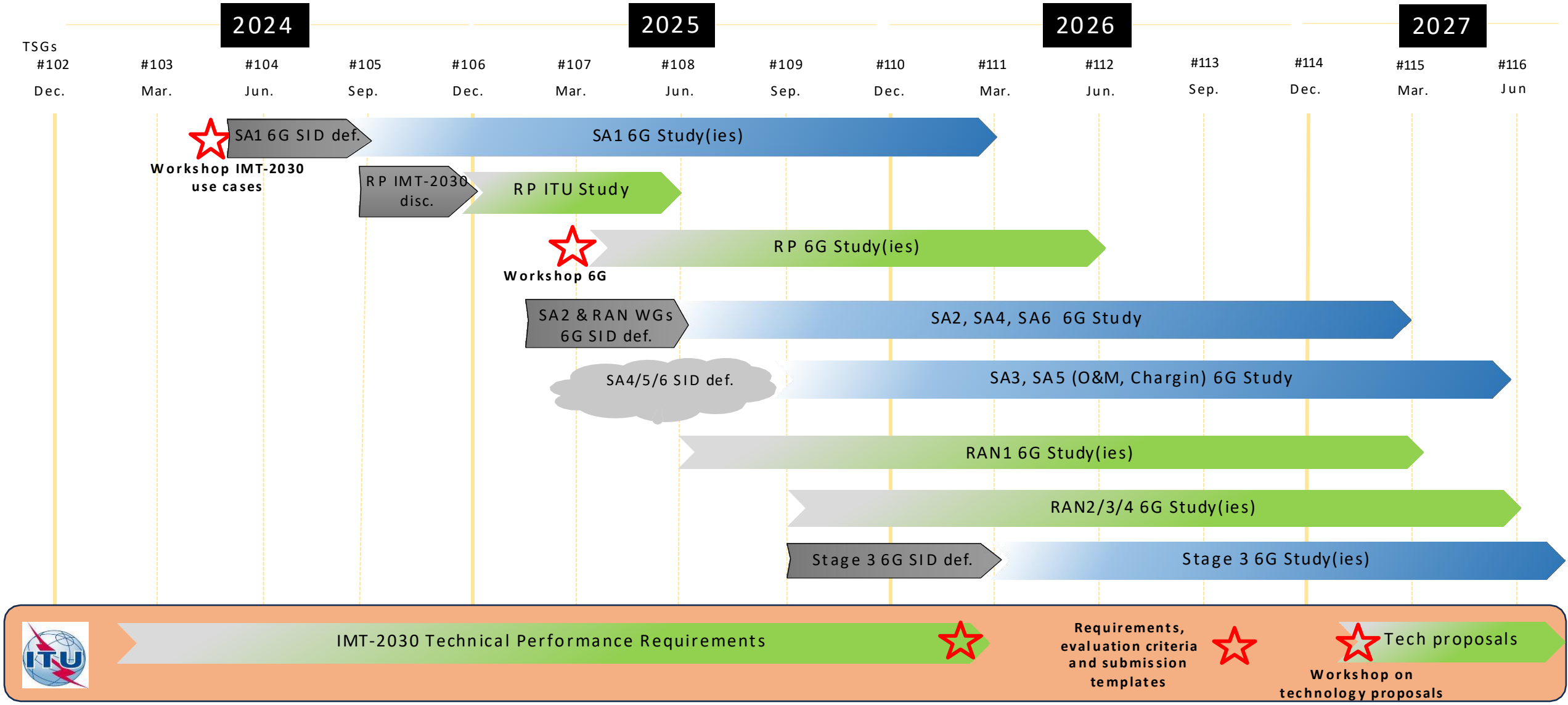
SA/RAN 6G studies are well underway, targeting completion by Mar 2027 – June 2027

Normative work for 6G from Release 21

Rel-21 timeline will be finalized in June 2026

2030

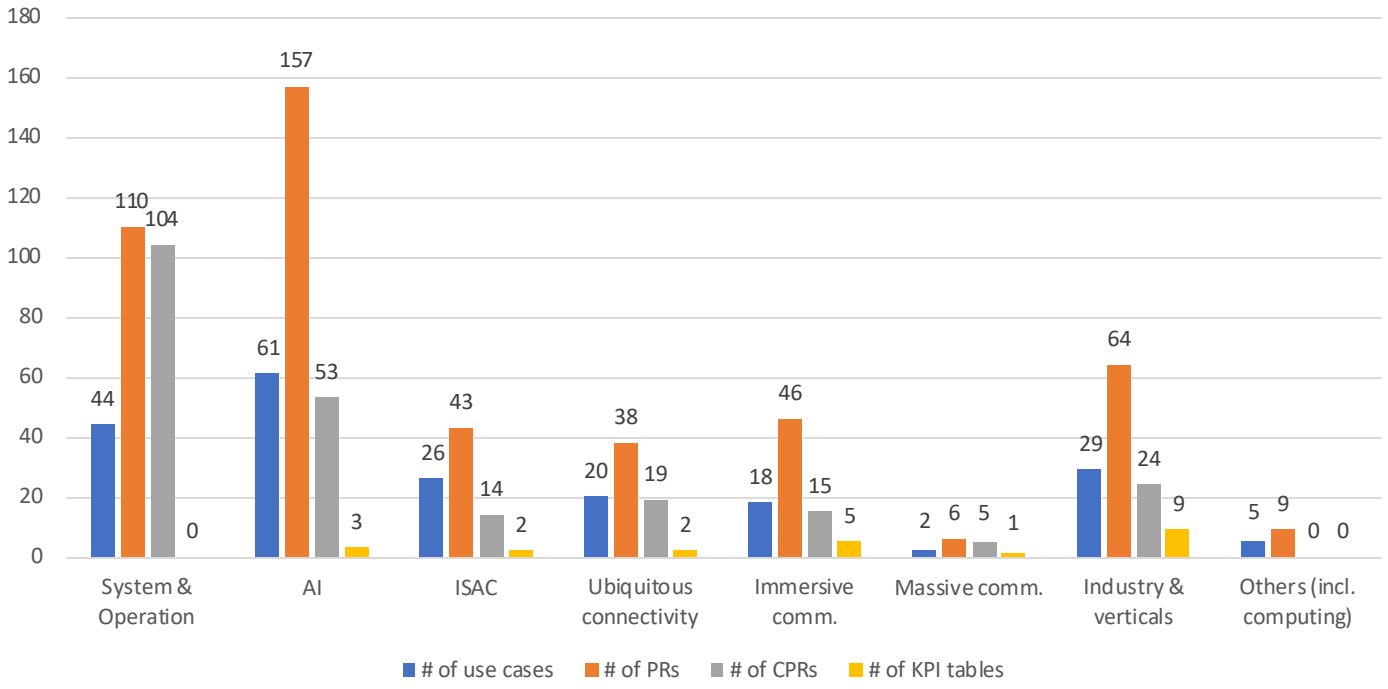
Release 20: 6G Study Item (SI) Timeline



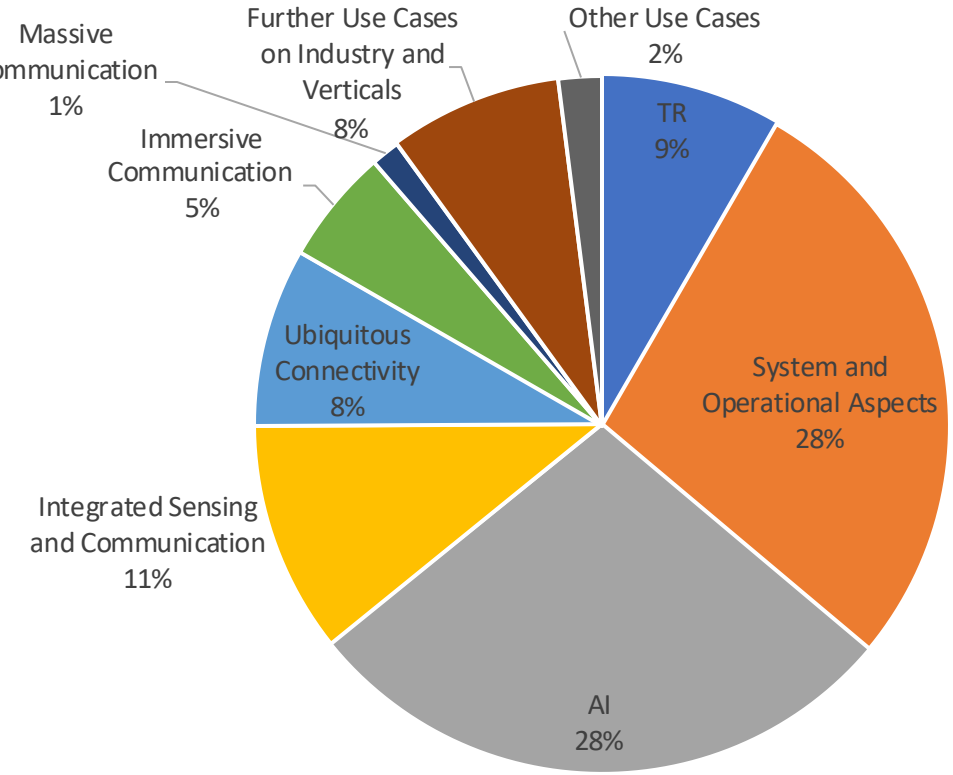
6G REQ Study (**FS_6G_REQ**) Status

3GPP SA1 6G study (FS_6G_REQ) is complete, TR 22.870 was approved at TSG#111 (Mar 2026)

AI and system and operation aspects are the most heated topics.



Number of use cases and potential requirements per clause



Contribution of SA1#111

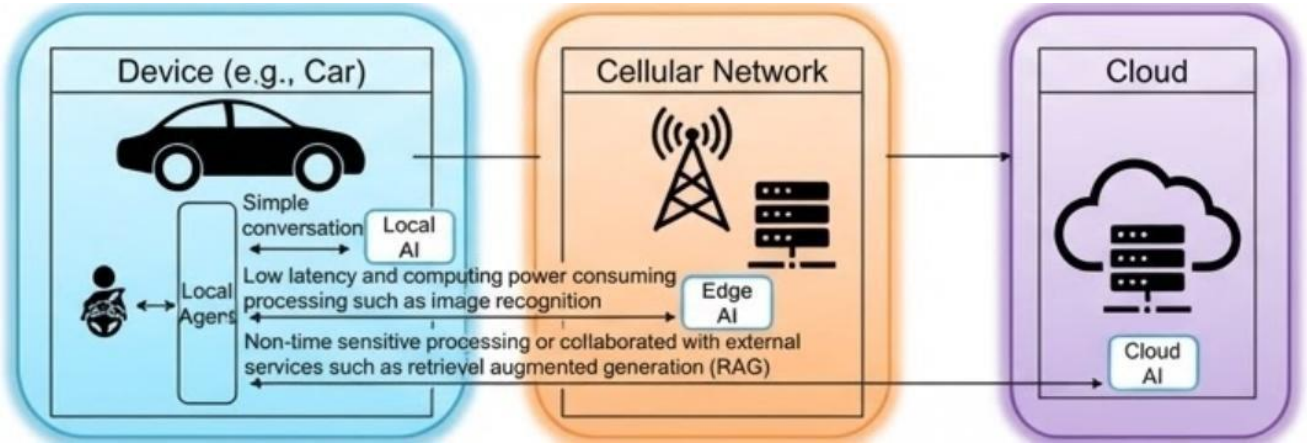
FS_6G_REQ: 6G AI Use Cases

AI native 6G system

- UE behaviour prediction, network-UE collaboration, AI service resilience in disasters, adaptive service provisioning;
- Network AI Agent (e.g., to handle user service Intent, service provisioning, providing combination of multiple 3GPP services to fulfil Intent, interaction with UE/user/3rd party Agent and dynamic optimization of 3GPP services);
- IMS related: Intelligent Communication Assistant services.

Enhanced support for AI applications

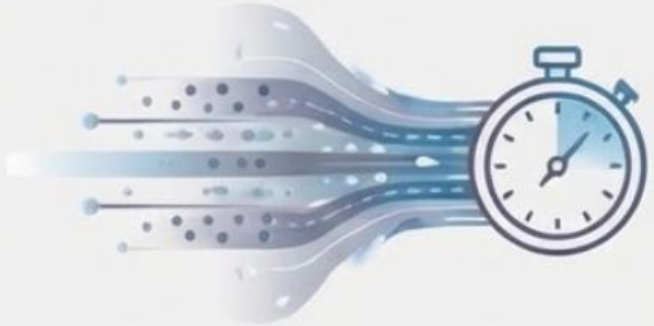
- 3rd Party AI Agent registration, discovery and identification, hosting and access, collaboration features, resource allocation;
- AI model training and inferencing: service requests and guarantees, reliability and exposure, coordination and distribution.



FS_6G_REQ: 6G AI KPIs Highlights

Burst Latency

- **50 ms** latency for a 400 KB burst (Image GenAI);



- **400 ms** latency for a 20 MB burst (Video GenAI);

Uplink Throughput

64 Mbps to **400 Mbps** UL

for GenAI applications.

Service Latency Breakdown

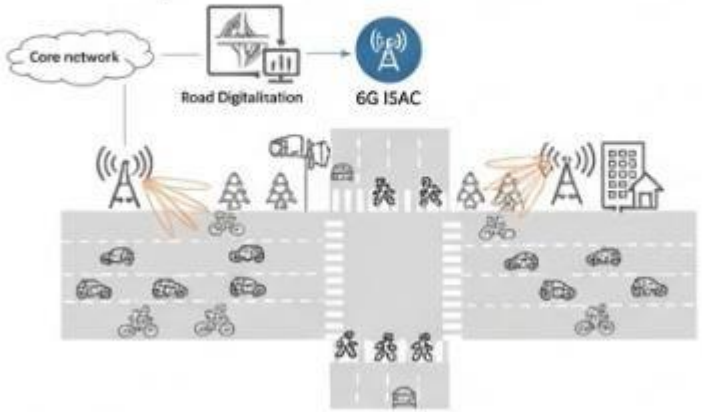
Total service latency

90-140 ms

for enhanced service robots, split between network transport and processing.

FS_6G_REQ: 6G ISAC & KPIs

More complexity in relation to 5GA Rel19 & Network Optimization



- **Detection & Analysis:** Detect, classify (e.g., UAVs vs. birds), count targets, predict characteristics (vehicle shape/size).
- **Service Integration:** Link sensing to communication, density-based services, exposure within time windows (alongside audio/video).
- **Security & Efficiency:** Monitoring, validation against 3rd party info, prioritization of combined communication/sensing/positioning.
- **Infrastructure Flexibility:** Operators provide services via shared RAN (e.g., 5G/6G wireless sensing).
- **Network Optimization:** ISAC improves mobile network performance by detecting line-of-sight blockages.

6G ISAC KPIs highlights

- **Sensing Resolution:**
  - **Range Resolution:** 0.2m (road digitalisation) / 0.01m (gestures)
  - **Velocity Resolution:** 0.2m/s (road digitalisation)
- **Accuracy of Positioning estimate (Sensing-based):**
  - **Horizontal/Vertical:** 0.1m (structural monitoring, high-topology mapping)

Performance requirements for combined communication, sensing and positioning services

	Communication KPIs			Positioning KPIs		Sensing KPI
Scenario	User experienced data rate (Mb/s)	E2E latency (ms)	Communication Service availability	Connection density	Location accuracy	Sensing accuracy
Combined communication, sensing and positioning services (UC 7.x Network assisted smart transportation)	[1-10]	[20]	98 99 % (NOTE 1)	10^4 devices / km^2	[1m] * [1m] * [1m] with 90% probability (NOTE 2)	category 2 or 3 (NOTES 2, 3)

NOTE 1: within service volume
NOTE 2: within 99% of the service volume
NOTE 3: Category 2 or 3 in Table 6.2-1 in TS 22.137 [6]

FS_6G_REQ : 6G Ubiquitous Connectivity and KPIs

Connectivity, Positioning & Resilience

Connectivity scenarios

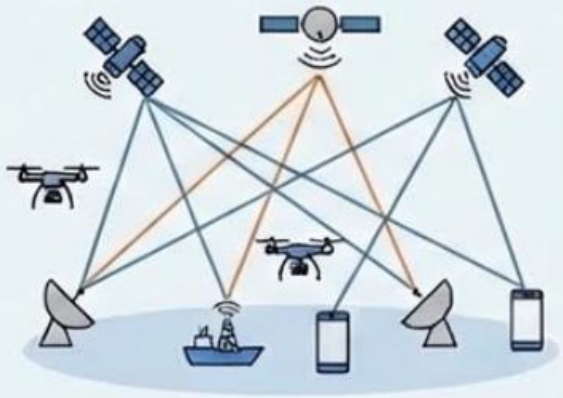
- Always on broadband/IoT for massive devices in sparse/dense satellite setups, with service continuity during handovers;
- Drones, vessels gain resilient backhaul and broadband services, minimizing interruptions via link switching.

Positioning and timing

- 3GPP satellite-based positioning (standalone or hybrid with non-3GPP positioning) for UEs;
- Independent satellite-based time synchronization, decoupling from GNSS.

Resilience features

- PLMN coordination for disasters/traffic spikes; HAPS-ground mobility; direct UE-UE comms on HAPS without ground routing.



KPIs Highlights

Satellite based positioning accuracy

- Target: 1-5 m horizontal and 1-5 m vertical accuracy (for UAV positioning) using hybrid based positioning and non-3GPP positioning which is not under control of the 6G System;
- Target: 0,1s positioning service latency (for airplane taxiway).

Satellite based communication

- DL target: 6 Gbit/s per plane with speed up to 1500 km/h;
- UL target: 3 Gbit/s per plane with speed up to 1500 km/h.

FS_6G_REQ : 6G Immersive Communication and KPIs

Features & Support

QoS Exposure and Predictive Insights

- Inform authorized 3rd parties about current or predicted throughput.

Application–Network Collaboration

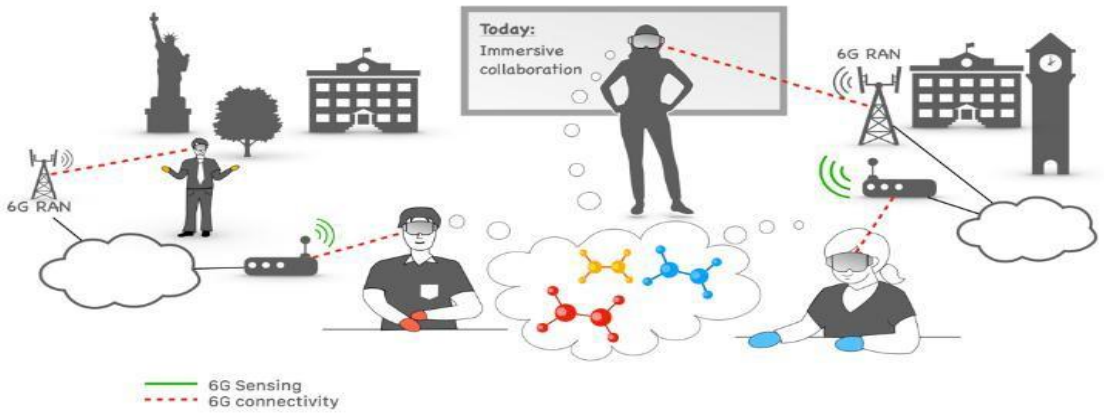
- Application-level information (e.g., traffic patterns, expected service quality) or user experience feedback from UEs or third parties can be received by the network to optimize communication performance.

Multimodal and XR Communication Support:

- Synchronization of heterogeneous data flows (possibly across multiple UEs) for multimodal or multi-user experiences.
- Spatial association of XR content (e.g., holograms with positioning info) to ensure safe and context-accurate interactions for users.

KPI Highlights

- **Immersive communication service**
  - Target: up to **1 Gbps** user experienced DL for holographic telepresence in healthcare with **99.999 % reliability.**
  - Target: **< 10 ms** end-to-end latency for split rendering in education/gaming scenarios.
- **Synchronisation (New KPI):** The maximum time offset between different media streams (e.g., audio, video, haptics) or between different devices in a group.
  - Target: **1 - 10 µs** for immersive audio production in live events.



FS_6G_REQ : 6G Massive Communication and Industry Verticals

Massive Communication

- **Coverage and Emergency Support:**
  - Wide-area scenarios (rural, deep indoor)
  - Emergency services (calls) available
  - Low-throughput basic services (MO/MT, SMS, small data) reliable
- **Device and Third-Party Capabilities:**
  - Low-complexity devices in massive deployments (low power, limited antennas)
  - Authorised 3rd parties configure parameters (MO/MT traffic, data volume)
- **KPI highlights:**
  - UL/DL Target: 5-7 Mbit/s, latency: 100ms, payload: up to 20 MB

Further Use Cases on Industry and Verticals

- **Localised network (factories, hospitals, disaster zones):**
  - Maintain full local functionality (auth, routing, voice/data) during backhaul severance
  - Minimize service interruption during network changes
  - UE-to-UE communication within localised network
- **MCX services:**
  - Service continuity across networks/modes, interworking with non-3GPP

Robotics: Dynamic grouping, data sharing, info exposure

Others - Reliable time sync, slice info exposure, long battery life IoT

- **KPIs highlights:**
  - Digital Twin support (sensing): 10cm location accuracy, 1-10 ms latency
  - High reliability services: 99.999%, 1ms latency (decentr. PowerGr)
  - Horizontal positioning: 2cm, Vertical: 10cm (outdoor machine control)
  - Time sync accuracy: 1 µs, service area: 20 km x 30 km (critical comms for smart grids)

FS_6G_REQ: 6G System and Operation Aspects

Legacy, Enhancements, and Device Support

Support for legacy services and requirements:
Inherit 5G functional/performance;
Mobility with 6G/5G CN or EPC;
Exclude E-UTRAN/UTRAN/GERAN requirements.

Enhancements to legacy services:
Event-triggered network sharing, FWA optimization, SMS verification, intra-PLMN routing, network slicing improvements, UAC for new services.

Device support: Support for UEs with different characteristics and service needs.

Non-AI or Immersive IMS enhancements:
Minimise transition perception, MMTEL over IP-CAN in 6GS, multi-service resilience.

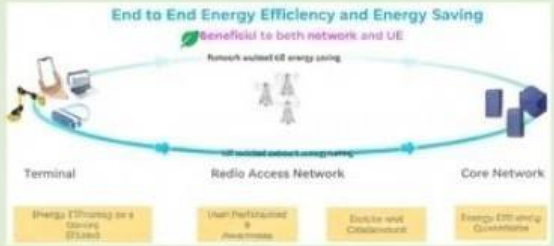
Security, Operational, and Energy Aspects

Security and privacy: Quantum-resistant authentication; Threat management and resilience; Privacy and identity protection; Additional assurances.

Lawful interception and access: LI support, security/privacy balance, data retention.

Resilience: Service continuity, degradation mitigation, on-demand provisioning, disaster coordination.

Energy related aspects: Network and UE energy optimization with carbon-aware operation.



Data, Charging, & OAM: Data collection framework, flexible charging, other operational support (NDT, validation, OAM).

6G System Architecture Study

- Twenty-four specific Key Issues have been identified for investigation, ranging from core network enhancements like QoS and policy, to new capabilities such as AI integration, integrated sensing, and computing support.
- The study uses the 5G Service Based Architecture as a baseline and assumes the 6G system will natively support both terrestrial and non-terrestrial networks.
- Various solution variants are currently being documented and evaluated, including detailed drafts for handling voice services, emergency fallback, location services, and AI agent coordination.
- Work is ongoing to reach interim agreements on these solutions, though many topics remains FFS and require coordination with other groups like the RAN working groups.
- SA2 6G architecture study (FS_6G_ARC) is expected to be complete by Mar 2027.

Key Issue #	Key Issue Title
#1	Study the support for control signalling for 6G System
#2	SBA framework
#3	Support of Network Slicing in the 6G system
#4	User Plane Architecture
#5	QoS Framework for 6G
#6	Policy and charging control framework
#6	Network Exposure
#8	Network Sharing in the 6G system
#9	Localized Service Access
#10	FWA / Fixed Wireless Access
#11	Support of non-3GPP access
#12	Voice Services for 6G
#13	Emergency Voice Services for 6G
#14	Location Services for 6G
#15	Messaging Services for 6G
#16	Other Essential/Regulatory Services for 6G
#17	Migration and Interworking
#18	AI for 6G architecture
#19	6G Network for AI
#20	Integrated Sensing and Communication
#21	6G data framework in SA2
#22	6G Computing Support
#23	Support of 6G NTN
#24	Analyse SGS IoT features and solutions

Study on 6G Security Aspects

- The study is structured around seven primary security areas: Security Architecture, RAN (Radio Access Network) Security, UE to Core Network Security, Core Network/Interconnect/Roaming Security, Subscription Authentication and Authorization, Network Exposure Security, and Data Collection for Security Monitoring.
- Begun detailing specific key issues. Current investigations include defining 6G security domains and trust anchors, structuring the 6G key hierarchy, and handling security contexts during mobility within 6G and between 5G and 6G networks.
- Actively developing a preliminary 6G attacker model to identify capabilities and threat locations based on the high-level 6G architecture.
- Detailed risk analyses are being conducted on specific network layers, such as evaluating potential vulnerabilities MAC CEs to determine if they pose novel risks compared to standard attacks like RF jamming.

3GPP 6G Studies

6G SIDs – TSG SA

6G Use Cases and Service Requirements	S1	**Completed**
Architecture for 6G System	S2	**March 2027**
Security for the 6G System	S3	**June 2027**
Supporting AEAD algorithms	S3	**Sept. 2026**
Transitioning to Post Quantum Cryptography in 3GPP	S3	**June 2026**
Lawful Interception for 6G	S3LI	**Dec. 2027**
Media Aspects for 6G System	S4	**March 2027**
Charging Aspects of 6G System	S5	**June 2027**
6G Management and Orchestration	S5	**June 2027**
6G Application Enablement	S6	**June 2027**
Mission Critical Services for 6G	S6	**June 2027**

6G SIDs – TSG RAN

By June 2026:

- TR 38.914 6G Scenarios and Requirements

By March 2027:

- TR 38.760-1Study on 6G Radio RAN1 aspects
- TR 38.760-2 Study on 6G Radio RAN2 aspects
- TR 38.760-3 Study on 6G Radio RAN3 aspects
- TR 38.760-4 Study on 6G Radio RAN4 aspects

6G SIDs – TSG CT

- **CT4 SI:** Control Plane Protocols in Core Network of the 6G System
- **CT4 SI:** Protocol aspects for User Plane in Core Network of 6G System
- **CT4 SI:** Resilience and Reliability in Core Network of the 6G System
- **CT1 SI:** NAS Protocol for 6G System

By September 2027

3GPP 6G Work Plan

UID	Name	Acronym	Rel	WG	Target	Prog.	WID	Impacted_TSs_and_TRs
1110085	6G Service Requirements	6G-REQ	Rel-21	S1	March 27	0%	SP-260323	22.228; 22.137; 22.101; 22.156; 22.173
1050110	Study on 6G Use Cases and Service Requirements	FS_6G_REQ	Rel-20	S1	March 26	100%	SP-241391	22.870
1060079	Study on 6G Scenarios and Requirements	FS_6G_RAN_Scen_Req	Rel-20	RP	June 26	90%	RP-251395	38.914
1080057	Study on Architecture for 6G System	FS_6G_ARC	Rel-20	S2	March 27	30%	SP-251633	23.801-01
1080072	Study on 6G Radio	FS_6G_Radio	Rel-20	R1	June 27	19%	RP-260282	RANP: 38.960; RAN1: 38.760-1; RAN2: 38.760-2; RAN-3: 38.760-3; RAN-4: 38.760-4
1100019	Study on 6G Application Enablement	FS_6G_APP	Rel-20	S6	June 27	10%	SP-251688	23.801-02
1090044	Study on Security for the 6G System	FS_6G_SEC	Rel-20	S3	June 27	10%	SP-251233	33.801-01
1100010	Study on Media Aspects for 6G System	FS_6G_MED	Rel-20	S4	March 27	9%	SP-251652	26.870
1090013	Study on Charging Aspects of 6G System	FS_6G_CH	Rel-20	S5	June 27	25%	SP-251708	32.801-02
1100014	Study on 6G Management and Orchestration	FS_6G_OAM	Rel-20	S5	June 27	5%	SP-251653	32.801-01
1100011	Study on Lawful Interception for 6G	FS_6G_LI	Rel-20	S3LI	Dec. 27	0%	SP-251651	33.801-06
1110045	Study on MC architecture evolution and 6G capabilities for MC service	FS_MCX_MC	Rel-20	S6	June 27	0%	SP-260342	23.801-03
1090028	Study on supporting AEAD algorithms	FS_AEAD	Rel-20	S3	Sep. 26	40%	SP-251247	33.771
1080045	Study on Transitioning to Post Quantum Cryptography in 3GPP	FS_CryptoPQC	Rel-20	S3	June 26	70%	SP-250858	33.703
1110004	Study on Control Plane Protocols in Core Network of the 6G System	FS_6G_CPCN_CT	Rel-20	C4	Sep. 27	0%	CP-260165	29.840
1110005	Study on Protocol aspects for User Plane in Core Network of 6G System	FS_6G_UPCN_CT	Rel-20	C4	Sep. 27	0%	CP-260166	29.841
1110006	Study on Resilience and Reliability in Core Network of the 6G System	FS_6G_ResRel_CT	Rel-20	C4	Sep. 27	0%	CP-260167	29.842
1110088	Study on NAS protocol for 6G System	FS_6G_NAS_CT	Rel-20	C1	Sep. 27	0%	CP-260171	24.860

Next version of 3GPP Work Plan (post TSG#111) to be available by April 5th latest

Latest Draft of TR/Ts is available here: https://www.3gpp.org/ftp/Specs/latest-drafts

Release 21: 6G Normative Work Timeline

6G Normative work

IMT-2030 submission and normative work for 6G in 3GPP are expected to start from Release 21

- Release 21 is expected to produce the 1st set of 3GPP 6G technical specifications, and will be the release for IMT-2030 submission before 2030
- Release 21 is expected to be delivered with a single drop (i.e., a single code freeze)

Release 21 timeline

Rel-21 (5G-Adv and 6G)*

- 5G-A/6G Package Approval: Mar 2027
- Stage-1 freeze : Mar 2027
- Stage-2 freeze : Mar 2028 (>=80%); June 2028 (100%)
- Stage-3 freeze : Dec 2028
- ASN.1/OpenAPI freeze: Mar 2029

* Based on TSG Chairs input at TSG#111 (Mar 2026). Rel-21 dates to be finalized in June 2026

Summary of Next Steps Towards 6G

> Rel-20 adopts a dual-track approach, advancing 5G-Advanced normative work while launching 6G studies under Rel-20_6G.

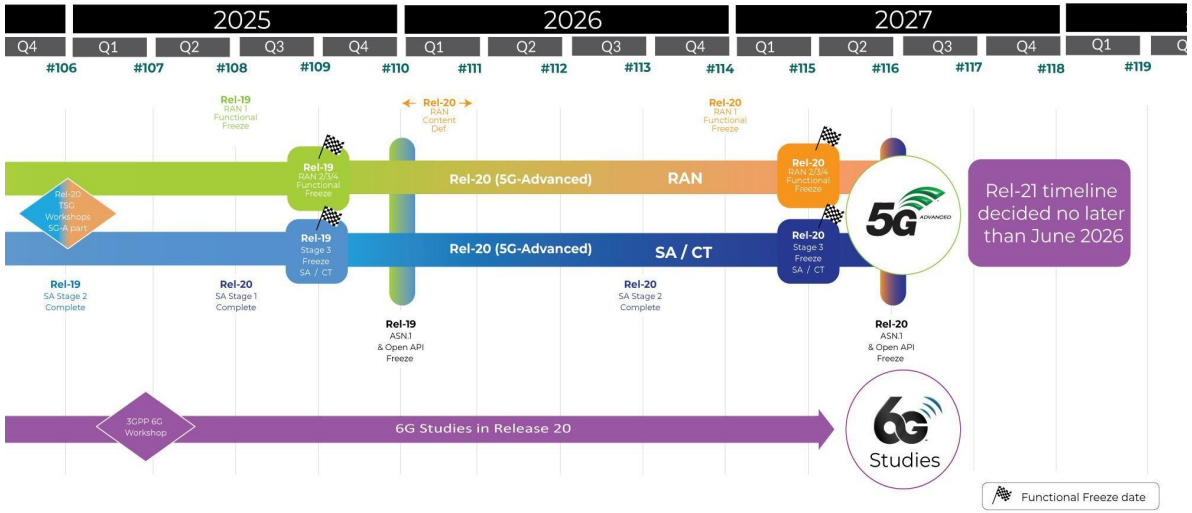
> The SA1 6G service requirements study (TR 22.870) is 100% complete and Rel-21 normative work was approved with target completion of Mar 2027.

> RAN studies are well underway, targeting completion in Mar 2027.

> SA2's architecture study (FS_6G_ARC) is progressing through eight work tasks covering control and user plane, AI integration, computing, sensing, data framework, NTN, and migration aspects. SA3 has initiated studies on 6G security, AEAD algorithms, and transition to post-quantum cryptography (PQC).

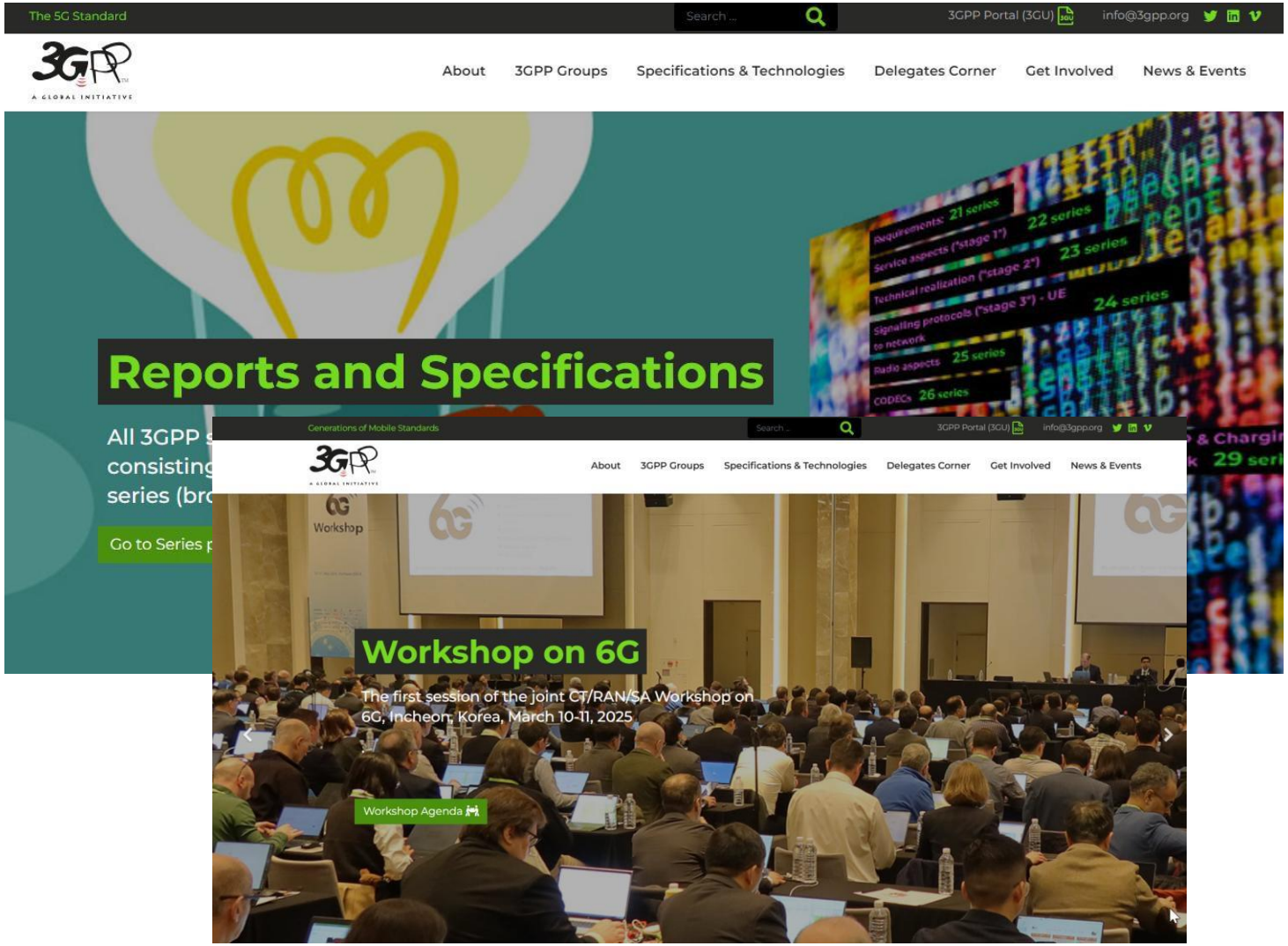
> SA4, SA5 and SA6 are defining scope for 6G study on Media, OAM, and application enablement frameworks for Dec plenary approval.

> Release 21 will mark the start of normative 6G work and IMT-2030 submission preparation, with its timeline to be finalized by June 2026 and ASN.1/OpenAPI freezes targeted for March 2029.



Thank you!

Puneet Jain
Chair of 3GPP TSG SA
puneet.jain@intel.com
www.3gpp.org



3GPP Release 20 – An Update on 3GPP 6G Technology Studies: RAN

Webinar | April 9, 2026

Wanshi Chen
3GPP RAN Chair 2021-2025
Head of Cellular Standards - HWT
Apple

Agenda

- 3GPP 6G Timeline
- 3GPP RAN Rel-19 Feature Summary
- 3GPP RAN Rel-20 Feature Summary
- 3GPP RAN 6G Study Update: Some Highlights

6G Timeline

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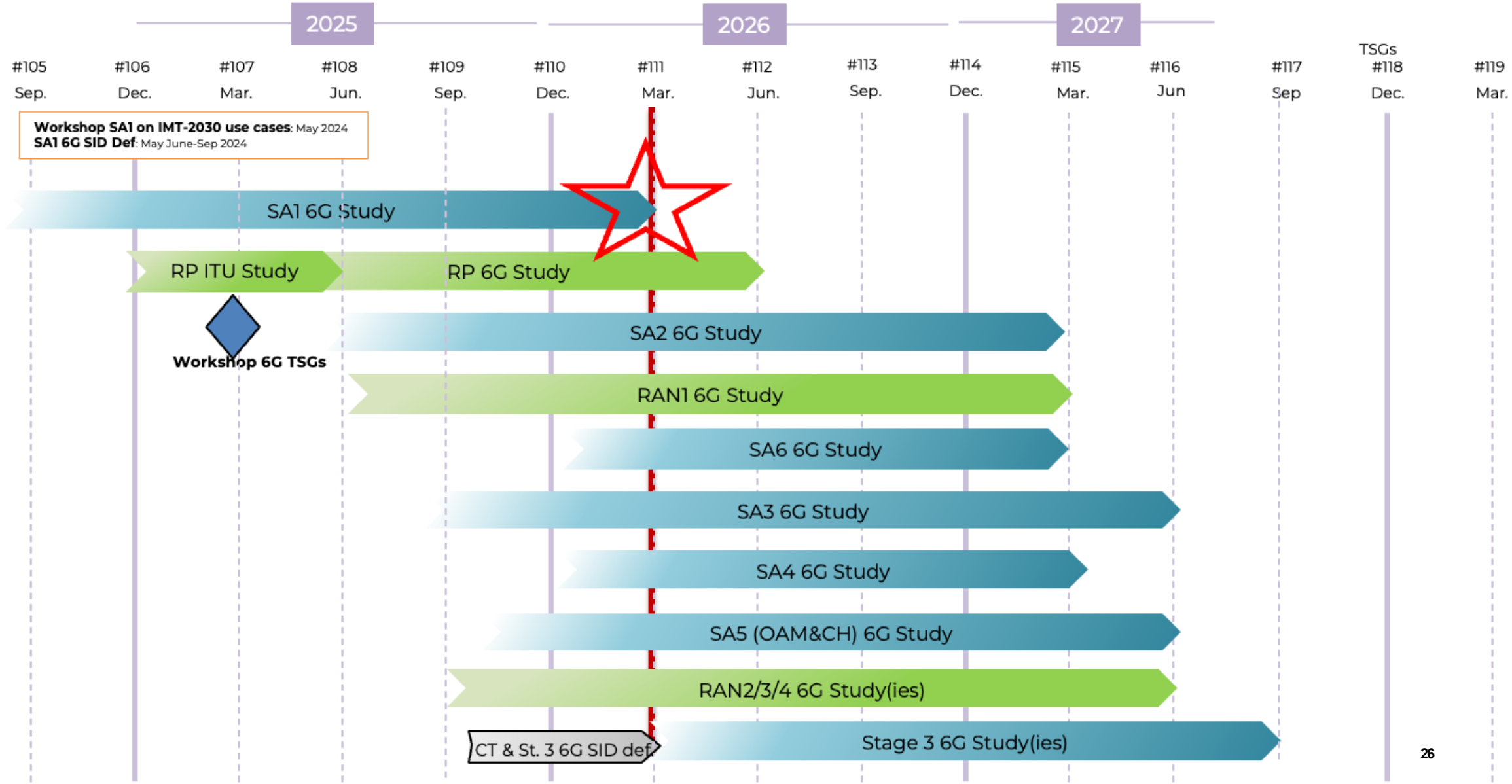
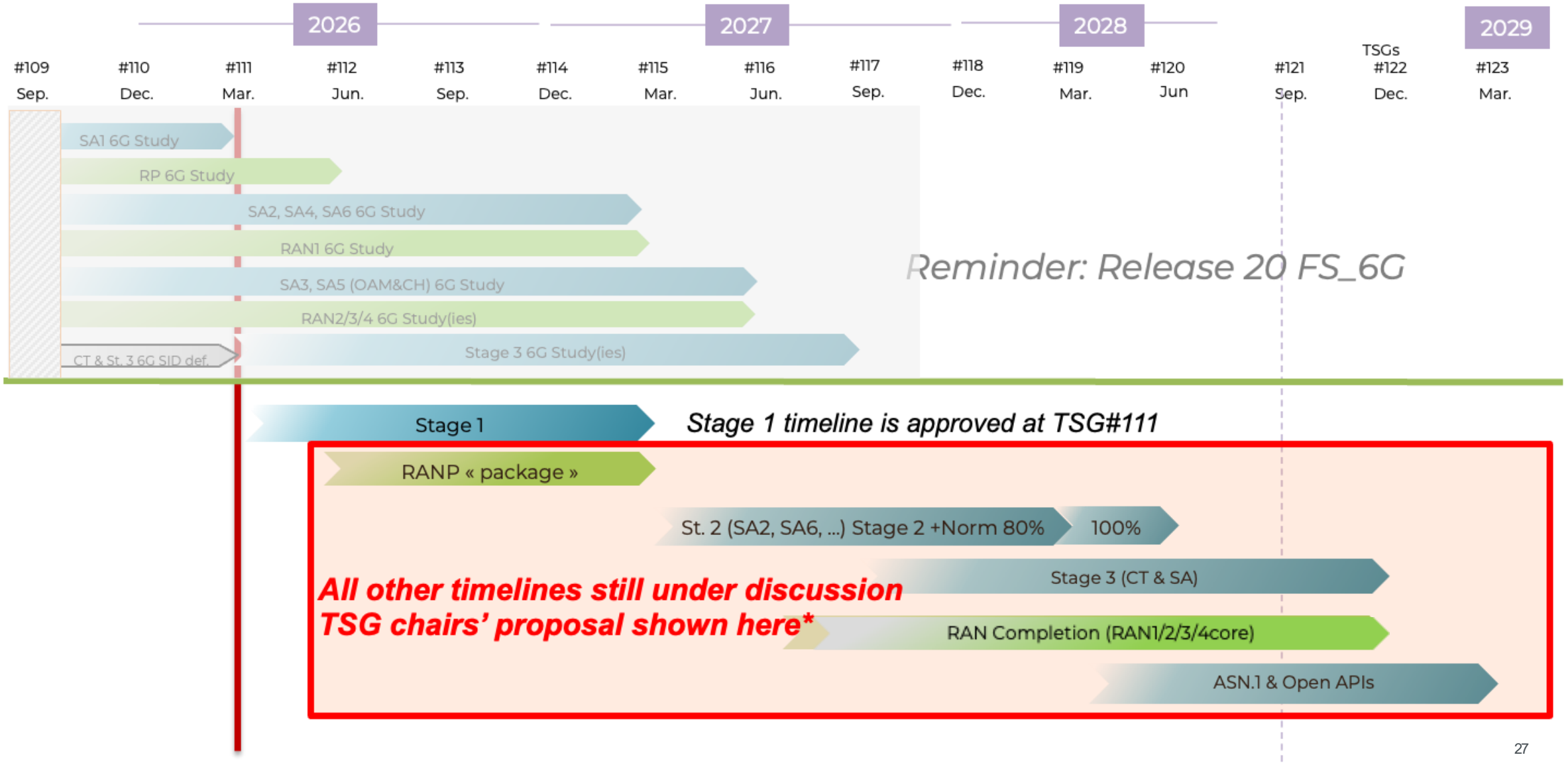
Rel-20 6G Study Timeline | Re-cap



Rel-21 6G Specification Timeline | TSG Chairs' Proposal

Final Decisions Expected to in June 2026



RAN Rel-19 Feature Summary

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RAN Rel-19 Feature Summary (1/2)

Item	High Level Features	WID/SID	Leading
AI/ML for NR Air	General framework for one-sided model, and BM prediction/Positioning/CSI prediction use cases	RP-252930	RAN1
MIMO Phase 5	UE-initiated BM, CSI for up to 128 ports, CSI for CJT, UL only TRP	RP-242394	RAN1
NES	SCell on-demand SSB, IDLE/INACTIVE on-demand SIB1, adaptation of SSB/paging/RO	RP-252332	RAN1
LP WUS/WUR	Support LP-WUS including LP-SS for both RRC_IDLE/INACTIVE and RRC_CONNECTED	RP-251200	RAN1
SBFD	Support non-overlapping SBFD operation at gNB side and CLI enhancement	RP-251874	RAN1
Ambient IoT	Support Device 1 with D1T1 (BS and device both indoor with direct link)	RP-252105	RAN1
Multi-carrier Phase 3	Different SCS/carrier type and multiple PUSCHs/PDSCHs per scheduled cell by the single DCI	RP-252564	RAN1
IoT-NTN TDD	Support new NB-IoT TDD NTN mode , i.e., a pattern with a period of 9 radio frame	RP-252935	RAN1
LTE-based 5G	Support time-interleaving and frequency-interleaving	RP-250794	RAN1
ISAC	Channel modelling	RP-234018	RAN1
7-24 GHz	Channel modelling	RP-242348	RAN1
Mobility Phase 4	Inter-CU LTM and conditional Intra-CU LTM, and Measurements enhancements for LTM	RP-252111	RAN2
NR NTN Phase 3	DL coverage enhancement, UL capacity enhancement (OCC), regenerative payload, RedCap/	RP-251954	RAN2
IoT NTN Phase 3	UL capacity enhancement, broadcast of PWS messages, and regenerative payload with	RP-252504	RAN2
E-UTRAN TN to NR	IDLE mode mobility from E-UTRATN to NR NTN	RP-240924	RAN2
XR Phase 3	Multi-modality awareness, RRM enhancement, User plane enhancements, uplink congestion	RP-250107	RAN2
BDS	A-GNSS for BDS	RP-252083	RAN2
NavIC	A-GNSS for NavIC	RP-251552	RAN2
Sidelink relay	Up to two additional hops relays, intra-gNB service continuity	RP-250188	RAN2

RAN Rel-19 Feature Summary (2/2)

Item	High Level Features	WID/SID	Leading WG
AI/ML for NG-RAN	Data collection/Signalling AI/ML-based Slicing and AI/ML based CCO, leftovers in Rel-18 AI/ML for NG-RAN	RP-251245	RAN3
NR topological Enh.	Wireless Access Backhaul (WAB) and 5G Femto	RP-252479	RAN3
SON/MDT Phase 4	MRO enhancement for R19 mobility mechanisms, including inter-CU LTM and intra-CU conditional LTM	RP-252557	RAN3
RRM Phase 5	FR2-1 SSB based L3 measurement delay reduction, Fast SCell activation	RP-252494	RAN4
UE RF	HPUE for CA in TN, Power boosting, 6Rx	RP-251816	RAN4
BS RF	EIRP mask for upper 6GHz, OTA test enhancement, Transmitter co-existence spurious emission requirements	RP-253517	RAN4
LBCA via Switching	Semi-static switching between DL in SDL and DL/UL in FDD	RP-252694	RAN4
UE Demod Phase 5	8Rx, FR1 PUSCH performance requirements with inter-cell interference	RP-252538	RAN4
<5MHz FR1 Phase 2	UE RF and RRM requirements with 3MHz CBW in the one band and 5MHz or 10MHz CBW in the other band	RP-251670	RAN4

RAN Rel-20 Feature Summary

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RAN Rel-20 Feature Summary

Item	High Level Features	WID/SID	Leading
AI/ML Phase 2	Framework for two-sided model, CSI spatial/frequency compression, Inter-vendor training	RP-260511	RAN1
MIMO Phase 5	SRS enhancement (Enh. FH for RPFS, cross slot SRS), Early CSI/SRS/CSI-RS and Lower Freq. density CSI-RS	RP-252936	RAN1
Coverage Phase 3	PRACH repetition with different beams, Msg 5 PUSCH repetition, pi/2-BPSK with more MCS entries	RP-252824	RAN1
Ambient IoT Phase 2	Active Device C and Device 2b, D2T2 (indoor-to-outdoor with intermediate node), device (un)availability, etc	RP-260826	RAN1
Mobility Phase 5	LTM SCell activation improvements, Dynamic L1 measurement and reporting configuration change	RP-260232	RAN2
AI/ML Mobility	RRM measurement prediction and measurement event prediction for UE sided models	RP-252899	RAN2
IoT NTN Phase 4	Voice over NB-IoT NTN, semi-persistent scheduling for DL and UL, UE transmit power higher than	RP-253813	RAN2
XR Phase 4	Characteristics of mobile AI traffic and specify (if justified) potential enhancements, etc.	RP-252755	RAN2
E-UTRAN TN to NR	Inter-RAT measurements and RRM requirement	RP-252890	RAN2
AI/ML NG-RAN Phase 3	AI/ML-based mobility use case including Multi-hop UE trajectory across gNBs, Intra-CU LTM, and	RP-260773	RAN3
SON/MDT Phase 5	MRO enhancement for R19 mobility mechanisms	RP-252560	RAN3
RRM Phase 6	RRM enhancement for (e)RedCap UEs, early data scheduling on SCell prior to UE transmitting valid	RP-253279	RAN4
UE RF	HPUE for NR single carrier operation, 6MHz channel bandwidth	RP-252899	RAN4
BS RF	Enhancement of co-location requirements, SBFD BS to SBFD BS adjacent channel co-existence	RP-260514	RAN4
LBCA via Switching	Semi-static switching between (DL and UL on FDD) and (DL on both FDD and SDL)	RP-260702	RAN4
UE Demod Phase 5	Performance requirements under a single spatial channel model for SU-MIMO in FR1, and 6Rx UE	RP-253458	RAN4
NR//IOT NTN	HPUE for NTN, HD-FDD for NTN, DL intra-band intra-SAN CA for NTN	RP-260790	RAN4
OTA	FR1 TRP and TRS requirements, and FR1 MIMO OTA requirement for new bands	RP-253851	RAN4
UAV	Enhancement of NR RF and RRM requirements for UAV	RP-260569	RAN4

RAN 6G Study Update: Some Highlights

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High-Level 3GPP Guidance: No "Easy" Objections & Streamlined 6G

- **Decision PCG54/10**: PCG approved to incorporate the following text to the agendas of each and every TSG and Working Group on "**Consensus principles** reminder"

> The attention of the delegates to the meeting is drawn to the fact that 3GPP endeavours to reach consensus on all decisions and therefore depends on a cooperative spirit of the Individual Members. In particular, Individual Members are encouraged to seek a **consensus-based solution** and **only to sustain objections as a very last resort, and where absolutely necessary and well justified**. The leadership will conduct the present meeting in a manner whereby informal methods of reaching consensus are encouraged, whilst ensuring that well justified concerns are taken into account.

- **Endorsement RAN#107**: RAN endorsed the following working principle for 6G (in RP-250766)

> 3GPP to create **lean and streamlined standards for 6G**, e.g., by dimensioning an **appropriate set of functionalities**, **minimizing the adoption of multiple options for the same functionality**, **avoiding excessive configurations**, etc. Any exception to the above shall be well justified.

6G Study Check Points in June 2026

Interim results shall be delivered as per the milestones below, in coordination with the Rel-20 RAN Plenary 6G Study (FS_6G_RAN_Scen_Req) (RP-251881)

TSG#112 (June/2026):

RAN1 to provide interim assessment on the following areas:

- **Waveform**, **modulation**, **channel coding**: scope of enhancements beyond NR baseline ((2) a, c)
- **Channel bandwidth (min and max)**, **frame structure**, **numerology** ((2) b, d)
- **Basic sync signal structure** and associated **periodicity(ies)** ((2) h)

For objectives where RAN4 may be impacted, RAN1 shall coordinate with RAN4 early to enable the above assessment by June 2026.

RAN3 to provide interim study results to allow TSGs to make a decision on:

- **RAN-CN interface**: P2P vs SBI
- **RAN internal interfaces**: CU-DU split, CP-UP split

NOTE: It is planned to decide on Release-21 timeline in June/2026.

TSG#113 (September/2026):

RAN plenary to make a decision on **additional migration option(s)** (other than standalone, MRSS, and inter-RAT mobility between NR-6G). This includes decision on additional **6G-6G aggregation beyond 6G CA**: 6G-6G DC. RAN plenary will task relevant RAN WGs for any specific technical analysis, as needed.

RAN 6G KPIs: Moderate Updates from IMT-2020

- Highlights of RAN agreed **6G air interface KPIs**
  - *Peak data rate (***1.8x** of IMT-2020): **36/18 Gbps** for **DL/UL**, respectively
    - Calculated based on 600MHz aggregated bandwidth
  - *Peak Spectrum Efficiency* (**2x** of IMT-2020): **60/30 bps/Hz** for **DL/UL**, respectively
    - Can be achieved by 5G already
  - The following is the **same** as IMT-2020
    - *Aggregated Bandwidth*: **400MHz**; *Reliability*: **10^{-5}**; *User PlaneLatency for IC (Immersive Communication)*: **4ms**; *User PlaneLatency for HRLLC (Hyper Reliable and Low-latency Communication)*: **1ms**; *Control Plane Latency*: **20ms**; *Connection Density for Massive Communication*: **10^6 (devices/km^2)**; *Mobility interruption*: **0ms**
  - **Improvements** over IMT-2020
    - 5^{th} *percentile user Data Rate*: **3x** of IMT-2020 for **DL** and the same for UL but without bandwidth scaling
    - 5^{th} *percentile user Spectral Efficiency*: **3x** of IMT-2020 for **DL and UL**
    - **For co-site 5G mid-band (~3.5GHz) and ~7GHz deployment**, targeting
      - Same coverage for initial access
      - Comparable to same data rate for data channels

6G Diverse Device Types: Preliminary & Controversial Discussion

- **6G Diverse Device Types**
  - Discussion will be largely contained in RAN plenary only
  - Both RAN and RAN WGs will continue the study on both the **minimum spectrum allocation** and the **smallest maximum UE bandwidth**

- **Areas for investigation**
  - Motivations/justifications behind the proposed diverse device types, which should be a limited set
  - Whether/how to have one or more device types for eMBB or 6G IoT
  - Whether/how to have other device types for, e.g., XR/ immersive experiences, CPE/FWA, VUE, wearables/ RedCap, sensing, NTN-specific, AI agents, collaborative robots, etc.
  - Whether/how to explicitly standardize device
  - types Ensuring forward compatibility
  - Minimizing/avoiding potential market fragmentation

- More Progress in RAN#110 (December 2025)
  - **Key takeaways**
    - 6G supports minimum spectrum allocation of 3MHz with 15kHz SCS, but not required to be optimized for performance
    - For design of the common signals/channels (at least for SSB) for initial access, RAN1 can down-select between Opt1 (assuming at least 5MHz with 15kHz SCS) and Opt2 (assuming 3MHz)
    - For UE smallest maximum BW, 3MHz is precluded
    - Divers device types support at least **MBB (as high priority)**, **CPE/FWA** and **Massive IoT** services
- Not much progress in RAN#111 (March 2026)

6G Architecture and Migration: Prioritize (for now) Standalone/MRSS/CA

- Key takeaways
  - **Prioritize standalone 6GR with 5G-6G MRSS** with **inter-RAT mobility between 6GR and 5G**
  - **Additional migration options** (to MRSS + 6G/6G CA) are being studied
    - Examples: 5G-6G DC, 6G-5G DC, Dual-stack
    - Decision is planned in RAN by **September 2026** including the need of **6G-6G DC**
  - Support **standalone RAN architecture**
  - 6G shall be designed considering both **TN and NTN**
  - Support connectivity through **multiple TRPs, either collocated or non-collocated**
  - Support **spectrum aggregation** (e.g., carrier aggregation) for **both DL and UL**, and for **both co-located and non-co-located TRPs**
    - *RAN plenary tasked RAN WGs to study 6G-6G spectrum aggregation for non-colocated deployment scenarios for FR1-FR2 combination, assuming backhaul latency up to 10ms*
    - *DC or CA?*
  - 6G shall enable **lower CAPEX/OPEX** with respect to current networks
  - Support at least idle mode inter-RAT mobility between 6GR and E-UTRAN
  - Support co-existence with NB-IoT (all deployment modes) and eMTC via semi-static configuration

6G Services

- 6G New and Existing services
  - **Prioritize 6GR design for eMBB**
  - For 6G Massive Communication (IoT), **the minimum number of UE receive/transmit antenna is 1** for lowest-tier device with PHY minimum peak data rate is **10Mbps DL and 10Mbps UL**, **not overlapping with Ambient IoT nor NB-IoT**
  - Agreed high-level principle of **service awareness in RAN**
  - 6GR should study the all **sensing** modes, including **TRP monostatic, TRP-TRP bistatic, TRP-UE DL, UE-TRP UL, UE-UE bistatic and UE monostatic,** one or more types of sensing targets including at least **UAV**, **human**, **vehicle**, **AGV** can be dropped, with the detailed sensing related assumptions, e.g. distribution, mobility of the sensing targets referring to TR 38.901

Update on Some Key Physical Layer Features

- **Max UE Channel Bandwidth**
  - DL 400MHz and UL 200MHz, aiming for a common solution for single RF and two RF implementation
- **Waveform**
  - Reuse 5G NR Waveforms for both DL & UL
  - DFT-s-OFDM in UL most likely to be extended from rank 1 only in 5G to at least rank 2 in 6G
  - Low PAPR waveform (important for coverage enhancements) receives a lot of interest, but details need to be converged —> ***important piece for UL coverage enhancement***
- **Modulation**
  - Reuse 5G NR QAMs (up to 1k QAM in DL and 256 QAM in UL)
    - 4k QAM in DL and 1k QAM in UL are under study
  - Study on probabilistic shaping, and geometric shaping ongoing, but hopefully conclude by June
- **Coding**
  - Reuse 5G NR Polar Coding for control and LDPC coding for data as much/appropriate as possible
  - Possible extension/enhancements for control coding, and data coding (especially higher peak data rates)
- **Numerology & Frame structure**
  - Avoid “mixed SCS” to simplify from 5G NR: 6GR study assumes same SCS between 6GR Sync signals and other channels/signals (except PRACH) for a given band
  - 6GR shall at least be capable of configuring the same TDD slot configurations as deployed in 5G NR

Coverage and Energy Efficiency

- **Coverage**
  - RAN plenary needs to decide how much additional coverage 6G should target compared with 5G
    - 10dB more?
  - Unclear whether ~7GHz can reach the same coverage as C-band (~3.5GHz), especially for UL
    - In particular, massive MIMO is crucial

- **Energy Efficiency**
  - A lot of emphasis on base station energy efficiency (green networks, sustainability)
    - Whether "always-on" signals should be further extended/sparser
      - E.g., from 20ms periodicity to 40/80/160ms for SSB (sync-signal block) transmissions
  - Care needs to be taken to ensure UE energy efficiency needs, and simplified operation

AI/ML Study in 6G

- **AI for RAN**
  - (Way too) Many use cases have been identified by different working groups,
  - Unclear how to downselect/prioritize to a reasonable short list, particularly in RAN1
  - In any case, *6GR and RAN design shall ensure that the 6G System can also operate without AI/ML*
- **RAN for AI**
  - Increasing interest in how 6G can better serve AI related services (interactive AI, token based communications, etc.)
  - Unclear how it will impact the actual 6G design
  - Generally related to “service awareness”

Sensing Study in 6G

- **WG study not started yet**
- Generally, two tracks
  - Sensing-assisted communications
  - Sensing specific use cases
- Unclear how sensing will be specified and bring values to operators/vendors

Other Areas

- Initial discussion on many “non-major-hardware” features (e.g., initial access, control, MIMO, reference signals, beam management, 6G NTN, etc.)
  - RAN1 in 2H’2025 primarily focused on major HW impact features
- Initial study on enhancing user plane, control plane, etc. with a long list of possible areas
- RRM simplification and more systematic management draw quite some attention
  - Including measurement gap design
  - Along with many other aspects such as system parameters (e.g., channel raster, irregular channel bandwidths, etc.), demodulation, RF, etc.
- Multi-TRP (Transmission and Reception Point) and “Gothia Cell” draws quite some attention

Q&A

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