

3GPP Release 18 Overview: A World of 5G-Advanced

Wanshi Chen (Qualcomm, Chair of 3GPP RAN plenary)

Puneet Jain (Intel, Chair of 3GPP System Architecture Group-SA2)

Moderated by Iain Sharp (ATIS, Principal Technologist)

February 2nd, 2023



Agenda



Introduction



Iain Sharp
ATIS

Radio interface and RAN system aspects



Wanshi Chen
Qualcomm
3GPP RAN Chair

System capabilities and network aspects



Puneet Jain
Intel Corporation
3GPP SA2 Chair

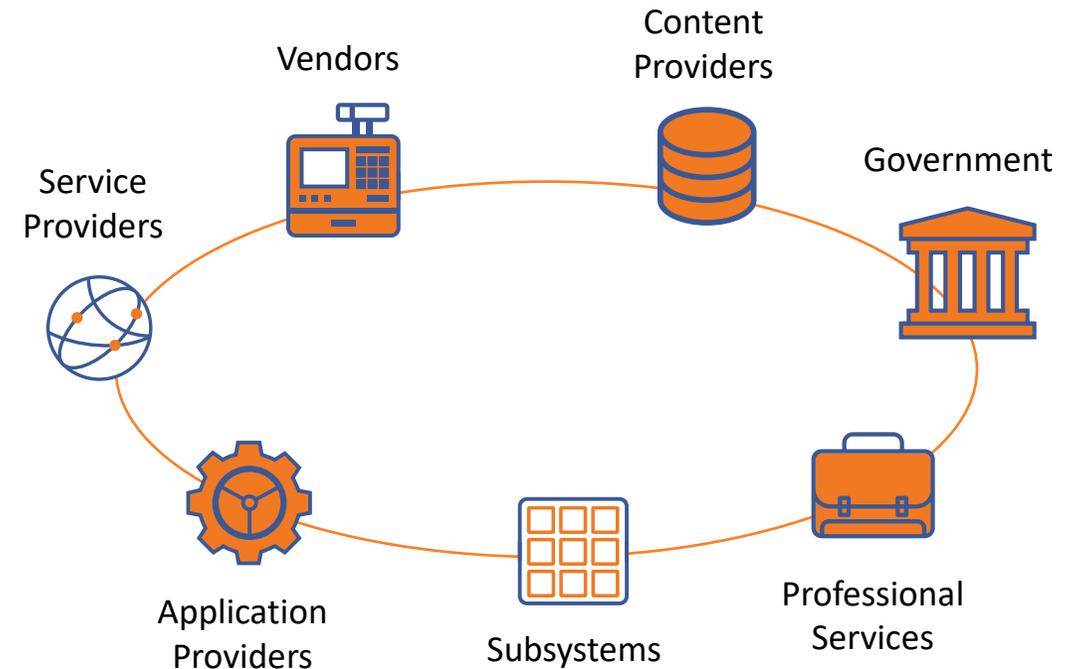
Q&A



ATIS' Value Driven Mission

ATIS strategic initiatives and solutions/standards work progresses new business opportunities, solves common industry challenges, and creates a platform for collaboration with other industries.

- > Members innovate and compete "on top of" ATIS' foundational work.
- > Collaborative efforts across industries can lead to greater scale and customer adoption.



Identifying and defining where and how to align and collaborate; sharing resources, effort and cost to develop large-scale, interoperable solutions for a "common industry good" is both critical and beneficial to the industry. ATIS is the catalyst.

Driving Leadership in 5G Standards Development

3GPP North American
Organizational Partner

5G Secure Profile for
government and enterprises

5G dense deployment
solutions using neutral host



5G Supply Chain

Alignment of North American
5G Needs Focus Group

5G as an enabler for ATIS
Innovation Agenda

Promoting collaboration on the
path towards 6G

ATIS members gain benefits through:

- > Participation in 3GPP global standards development
- > Convergence point for key North American requirements and features
- > Industry/government partnerships that promote global leadership
- > Early insight into 5G applications and use cases anticipated to impact the market

3GPP RAN Release 18: current status and beyond

Wanshi Chen

February 2nd, 2023

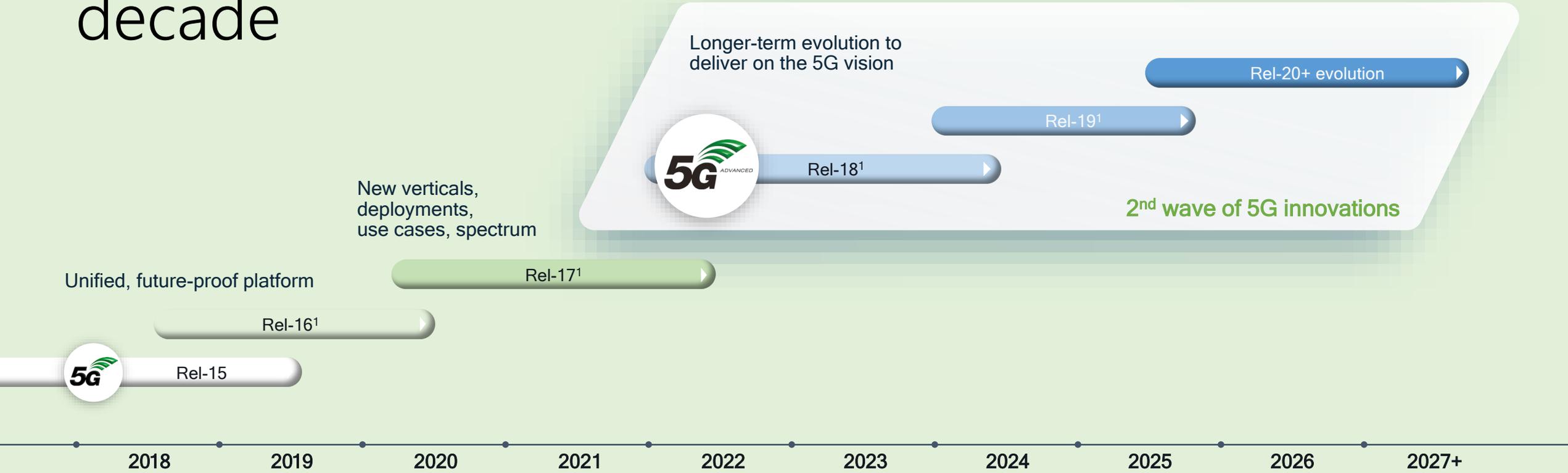




Outline

- > Rel-18 Introduction & Timeline
- > Status of the ongoing RAN Rel-18 projects
- > RAN Rel-19 preparation

Driving the 5G technology evolution in the new decade



Rel-15 eMBB focus

- 5G NR foundation
- Smartphones, FWA, PC
- Expanding to venues, enterprises

Rel-16 industry expansion

- eURLLC and TSN for IIoT
- NR in unlicensed
- 5G V2X sidelink multicast
- In-band eMTC/NB-IoT
- Positioning

Rel-17 continued expansion

- Lower complexity NR-Light
- Non-terrestrial communication (satellites)
- Unlicensed/licensed spectrum in 60 GHz
- Improved IIoT, positioning V2X, IAB, ...

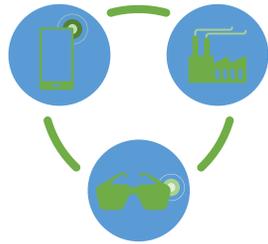
Rel-18+ 5G-Advanced

- Next set of 5G releases (i.e., 18, 19, 20, ...)
- Rel-18 study/work started in Q2-2022
- Rel-19 package is to be approved in Dec'2023, with timeline to be decided

1. 3GPP start date indicates approval of study package (study item->work item->specifications), previous release continues beyond start of next release with functional freezes and ASN.1

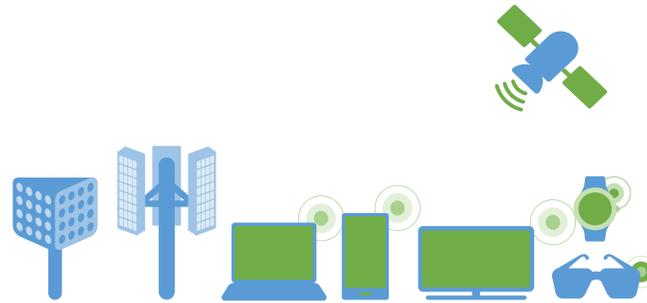
RAN Release 18: Driving a balanced 5G evolution across key technology areas

Mobile broadband evolution vs. further vertical expansion



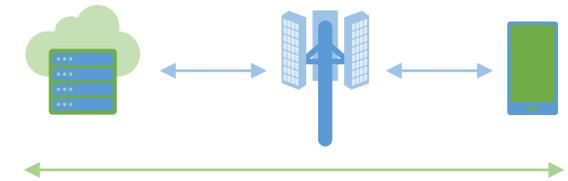
Deliver enhanced mobile broadband experiences and extend 5G's reach into new use cases

Immediate commercial needs vs. longer-term 5G vision



Drive new value in commercialization efforts and fully realize 5G's potential with future deployments

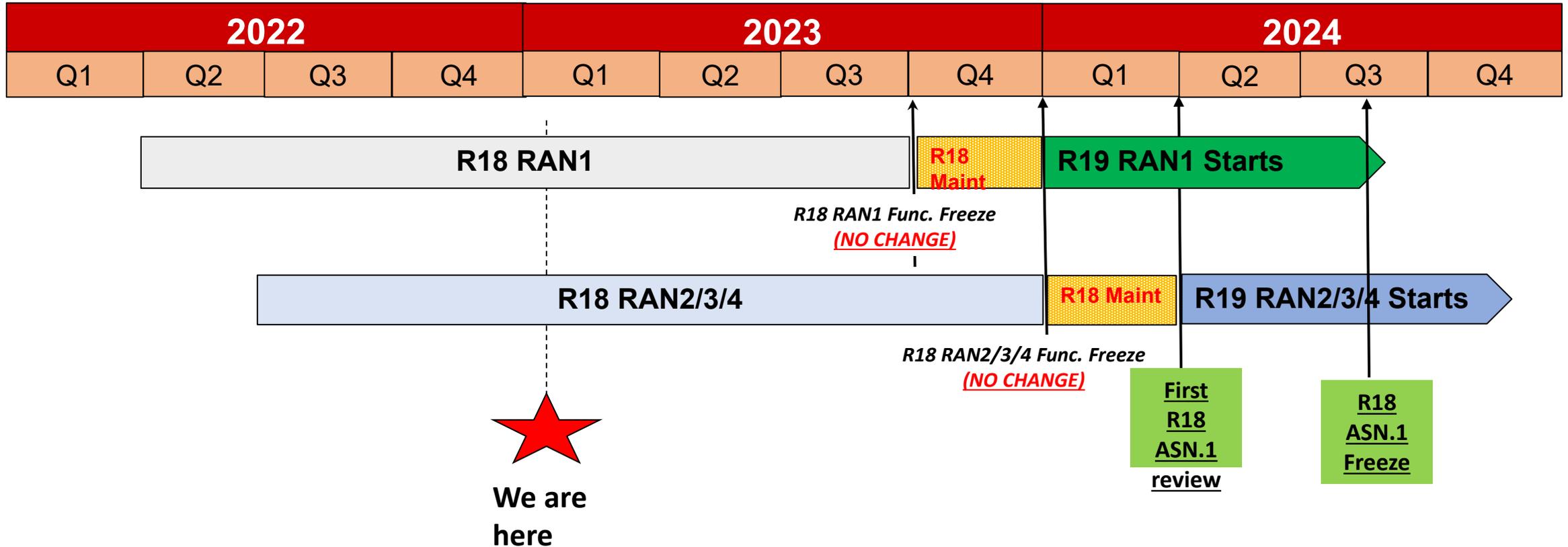
New and enhanced devices vs. network evolution



Focus on the end-to-end technology evolution of the 5G system to bring new levels of performance

Release 18 scope takes into consideration of the 5G Advanced evolution in Release 18, 19, and beyond (i.e., many Study Items defined to set up for Work Items in later releases)

Confirmed RAN Rel-18 Timeline



RAN Release 18 Status

The first 3GPP release in
5G Advanced evolution



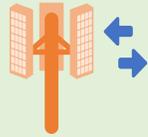


Release 18

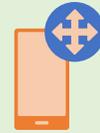
3GPP Release 18 sets off the 5G Advanced Evolution

The package has
a wide range of projects —
nominal work started in
Q2 2022

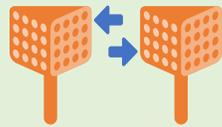
Strengthen the end-to-end 5G system foundation



Advanced
DL/UL MIMO



Enhanced
mobility



Mobile IAB,
smart repeater



Evolved
duplexing



AI/ML data-driven
designs



Green
networks

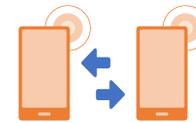
Proliferate 5G to virtually all devices and use cases



Boundless extended
reality



NR-Light (RedCap)
evolution



Expanded
sidelink



Expanded positioning



Drones & expanded
satellites comm.



Multicast & other
enhancements

RAN1-led Projects

Tdoc#	Title	Scope	Note
RP-223276	WI: MIMO Evolution for Downlink and Uplink	CSI and CSI-RS enhancements in high or medium velocities; Extension of unified TCI framework; Increased #orthogonal DL/UL DMRS ports; 8Tx UL operation; Simultaneous multi-panel UL tx; Async mTRP enhancements	
RP-221348	SI: Study on Artificial Intelligence (AI)/Machine Learning (ML) for NR Air Interface	Use cases (CSI, beam management, positioning), framework and model, evaluations, and specification impact	Study only in R18
RP-223041	SI: Study on Evolution of NR Duplex Operation	Subband non-overlapping full-duplex (SBFD) (gNB only). Potential enhancements to dynamic/flexible TDD	Study only in R18
RP-222806	WI: NR sidelink evolution	SL-U (focus on FR1); NR/LTE V2X co-channel coexistence; Multi-beam (licensed spectrum) FR2, study only. CA on hold until March '23.	
RP-223549	WI: Expanded and improved NR positioning	Sidelink positioning, integrity for RAT dependent positioning (error sources), accuracy enhancements (aggregation and carrier phase), Low Power High Accuracy Positioning (LPHAP), positioning for RedCap	Study completed in Dec'22
RP-223544	WI: Further NR RedCap UE complexity/cost reduction	Restricted baseband BW to 5MHz for PDSCH/PUSCH (only) [FR1]. Peak data rate reduction; Enhanced eDRX in RRC_INACTIVE (>10.24s).	Study completed in Sept'22
RP-223540	WI: Network energy savings	MIMO adaptation; PDSCH power adaptation; cell-DRX/DTX (no change to SSB; SSB-less SCell	Study completed in Dec'22
RP-221858	WI: Further NR coverage enhancements	PRACH repetitions; dynamic power aggregation in FR1 CA/DC; frequency domain spectrum shaping; dynamic waveform switching	
RP-223505	WI: NR Network-Controlled Repeaters	Single hop, stationary. Signaling & behavior for side-control info: Beamforming, UL-DL TDD op, on/off. No power control. CP signaling & procedures. NCR management (id & attachment).	Study completed in Sept'22
RP-221622	WI: Enhancement of NR Dynamic spectrum sharing (DSS)	NR PDCCH reception in symbols with LTE CRS. Support of two overlapping CRS rate matching patterns	WI completed in Sept'22
RP-222644	SI: Study on low-power Wake-up Signal and Receiver for NR	Evaluation methodology and KPIs; Wake-up Receiver architectures and signal design; specification impact; power savings	Study only in R18
RP-222251	WI: Multi-carrier enhancements for NR	Multi-cell scheduling with single DCI, UL Tx switching across 3 or 4 bands with up to 2 simultaneous Tx	Extended to 1Q'23

RAN2-led Projects

Tdoc#	Title	Scope	Note
RP-223520	WI: Further NR Mobility Enhancements	Intra-CU L1/L2 inter-cell mobility; NR-DC with selective activation of cell groups via L3 enhancements ; CHO enhancements: data forwarding optimization; FR2 SCell/SCG setup delay improvements upon connection setup	
RP-223502	WI: XR Enhancements for NR	XR traffic awareness at gNB for data handling enhancements; DRX enhancements, multiple PUSCH per CG occasion; dynamic indication of CG occasion skipping	Study completed in Dec'22 (RAN awareness study till March'23)
RP-223501	WI: NR sidelink relay enhancements	UE-UE relay (L2/L3, single-hop) for unicast; Service continuity enhancements for L2 UE-NW relay; Multi-path direct+indirect ; SL DRX for L2 UE-NW relay.	
RP-223534	WI: NR NTN (Non-Terrestrial Networks) enhancements	Coverage enhancements: repetition for PUCCH msg4, support of DMRS bundling, protocol overhead reduction; >10GHz band definition (Ka band); Network verified UE location.	
RP-223519	WI: IoT NTN enhancements	HARQ disabling; Improved GNSS operation; Neighbor cell measurements and triggers before RLF; eMTC enhancements considering R17 NR NTN; Enhancements on discontinuous coverage	
RP-223545	WI: NR Support for UAV	Measurement report enhancements;, subscription-based UE identification; UAV identification broadcasting; signaling for UAV beamforming capability	
RP-223492	WI: Dual Tx/Rx MUSIM	Simultaneous RRC_CONNECTED in two networks (NR/NR or NR/LTE); Temporary UE capability restriction/removal	
RP-221281	WI: In-Device Co-existence (IDC) enhancements for NR and MR-DC	Both TDM and FDM	
RP-222993	WI: Mobile Terminated-Small Data Transmission (MT-SDT) for NR	Paging triggered SDT (MT-SDT) for UEs in RRC_INACTIVE.	
RP-221548	WI: Enhancements of NR Multicast and Broadcast Services	Multicast reception in RRC_INACTIVE; Signaling enhancements for shared UE processing of MBS broadcast and unicast; Resource efficiency enhancements for MBS reception in RAN sharing scenarios	

RAN3-led Projects

Tdoc#	Title	Scope	Note
RP-222671	WI: Mobile IAB	Migration/topology adaptation enabling IAB-node mobility; Mobility enhancements of IAB-node; Interference mitigation of IAB-node mobility	
RP-220635	WI: Artificial Intelligence (AI)/Machine Learning (ML) for NG-RAN	Data collection enhancements and signaling to support AI/ML based Network Energy Savings, Load Balancing and Mobility Optimizations.	WI to complete in June'23, followed by study for new use cases
RP-221825	WI: Further enhancement of data collection for SON (Self-Organising Networks)/MDT (Minimization of Drive Tests) in NR and EN-DC	Data collection for MR-DC CPC/CPA and MRO successful PSCell change report, fast MCG recovery, and NR-U; MRO enhancements for inter-sys HO voice fallback; SON/MDT enhancements for RACH enhancements and NPN	
RP-223488	WI: Enhancement on NR QoE management and optimizations for diverse services	Support new service types (AR, MR, MBS, etc from SA4); QoE measurement config and collection in RRC_INACTIVE and RRC_IDLE for MBS; QoE support in NR-DC. Left-overs from R17. Continuity of legacy QoE measurement for streaming & MTSI service during intra-5GC, inter-RAT HO.	
RP-222250	SI: Study on enhancement for resiliency of gNB-CU	gNB CU-CP Resiliency Enhancements, a one-quarter study	Completed in Sept'22; no follow-up WI

RAN4-led Projects

Tdoc#	Title	Scope	Note
RP-223276	SI: Irregular Channel Bandwidths	Study to enable 6, 7, 11, 12, 13 MHz channel bandwidths	
RP-221348	WI: FR1 RF Enhancements	4Tx; 8Rx; lower MSD for EN-DC and CA combos	
RP-223041	WI: FR2 RF Enhancements	UL 256QAM; Beam correspondence for RRC_INACTIVE and idle mode	
RP-222806	WI: RRM Further Enhancements	FR2 Scell activation delay reduction; FR1-FR1 NR DC RRM requirements	
RP-223549	WI: Further enhancements for Measurement Gaps and measurements without gaps, WI	Joint operation of different concurrent MG patterns and/or network controlled small gaps (NCSG) and/or pre-configured MGs; gapless for NR and LTE inter-RAT	
RP-223544	WI: NR Demod evolution	Advanced Receiver with IC for MU-MIMO; Demodulation requirements with link adaptation for application layer throughput	
RP-223540	WI: FR2 HST enhancements	Train roof mounted CPE enhancements	
RP-221858	WI: FR2 multi-Rx chain DL reception	Requirements for multi-panel simultaneous reception with dual TCI	
RP-223505	SI: FR2 OTA testing enhancements	Test methodology for multi-panel UEs with simultaneous reception	
RP-222644	WI: 5G Terrestrial Broadcast Bands	Defining broadcast UHF (~470 - ~694/698 MHz) with 6,7,8MHz channel BW	
RP-222645	WI: NR support for dedicated spectrum less than 5MHz for FR1	Minimal spec changes to support spectrum allocations of 3-5MHz (15kHz SCS and NCP only)	
RP-222309	WI: Intra-band non-colloc. EN-DC/NR-CA	Requirements, MRTD and power imbalance	
RP-221369	WI: Air to ground (ATG) for NR	Full system requirements (BS RF, UE RF, RRM and BS/UE demod); co-channel and adjacent channel to terrestrial network (same band)	
RP-222216	SI: Simplification of Band combos	Study to simplify book keeping/spec handling process for band combinations, also study test simplifications	
RP-222554	SI: 700/800/900MHz combos enhancements	Study feasibility of implementing combinations with up to 2ULs/3DLs	
RP-222501	SI: NR BS RF requirement evolution	Study feasibility of defining requirements for BS supporting multiple FR2 bands with a single RF chain	

RAN4-led Projects – Cont'd

Tdoc#	Title	Scope	Note
RP-221806	WI: IOT NTN core/perf requirements	Core and performance requirements for Rel-17 IOT NTN	
RP-220916	SI: EMC enhancements	Study by March '23 the need and motivation for additional UE features for EMC enhancements for CA/DC, SUL, UL MIMO, V2X (NR FR1), CA/DC (LTE).	
RP-223041	WI: NR MIMO OTA enhancements	Continuation of Rel.17 MIMO OTA WI to finalize the performance requirements for FR2	
RP-222806	WI: NR TRP/TRS enhancements	Continuation of Rel.17 TRP/TRS WI to introduce requirements for 2Tx(TxD and 1L UL MIMO), RedCap (focus on wearables) and CA	
RP-223549	WI: 3Tx for FWA and 4Rx study for handheld in <1GHz	Study feasibility to introduce 4Rx for handheld UEs in <1GHz, introduce requirement if feasible; Requirements for 3Tx with 2 band UL CA and different power classes	
RP-223544	WI: 4Rx for FWA in <1GHz	Introduce requirements for 4Rx for FWA devices in bands <1GHz frequency range	

Others: Ambient IOT

- > A RAN plenary study
- > **Target:** New 3GPP IOT Technology suitable for deployment in a 3GPP system relying on **ultra-low complexity** devices with **ultra-low power consumption** orders of magnitude lower than existing 3GPP LPWA technologies (NB-IoT, eMTC) addressing use cases that cannot otherwise be fulfilled based on existing 3GPP LPWA IoT technologies (e.g., NB-IoT including with reduced peak Tx power)
- > Identify deployment scenarios; formulate RAN design targets; Compare and assess feasibility of meeting design targets for relevant use cases on the basis of appropriate deployment scenario

How will 5G
evolve in the new
decade?



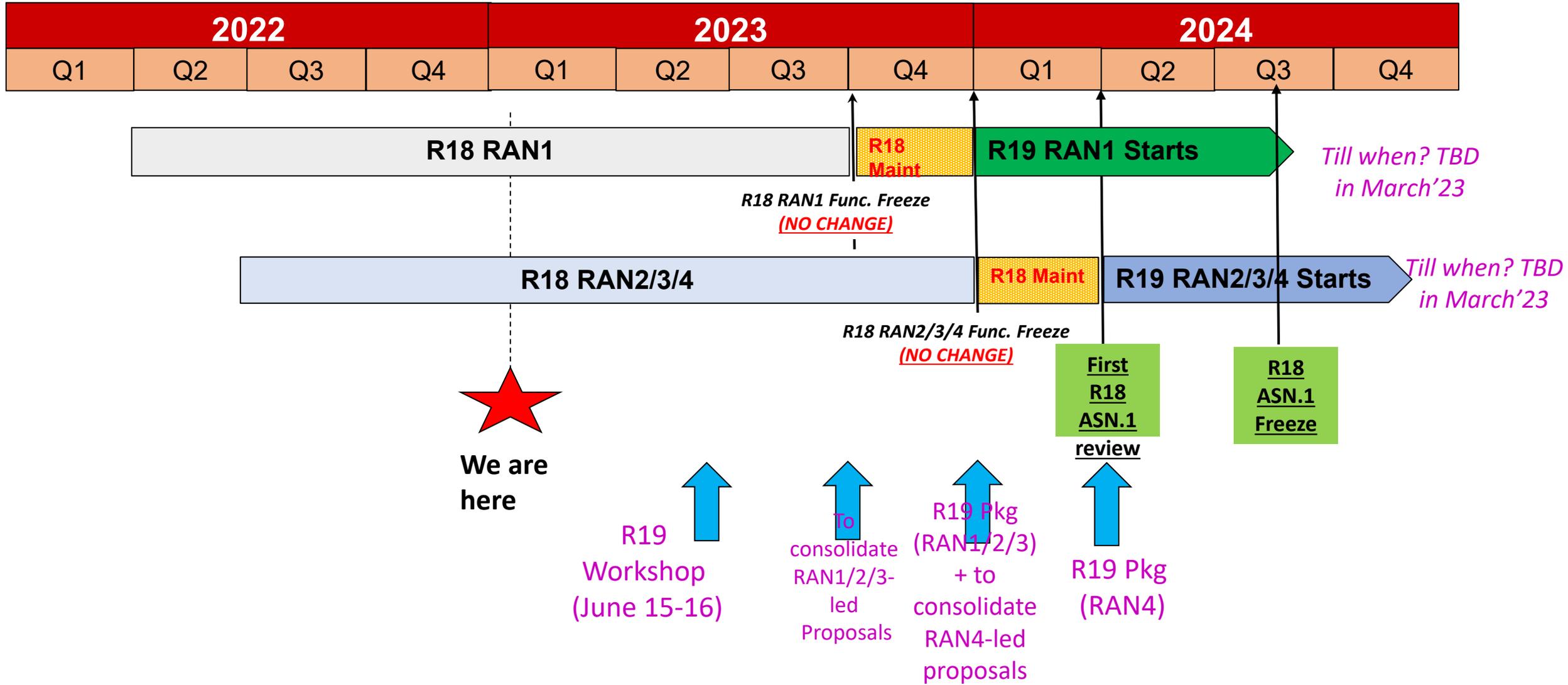
Continued evolution towards 6G

Advancing 5G to fulfill its full promise

Enhanced mobile experiences, new capabilities,
and expansion to diverse verticals



Rel-19 Preparation



Questions/Comments?

3GPP 5G-ADV: SA2 REL-18 STATUS AND BEYOND

Puneet Jain

3GPP SA2 Chair

Sr. Principal Engineer & Sr. Director, Intel Corporation

Feb 02, 2023

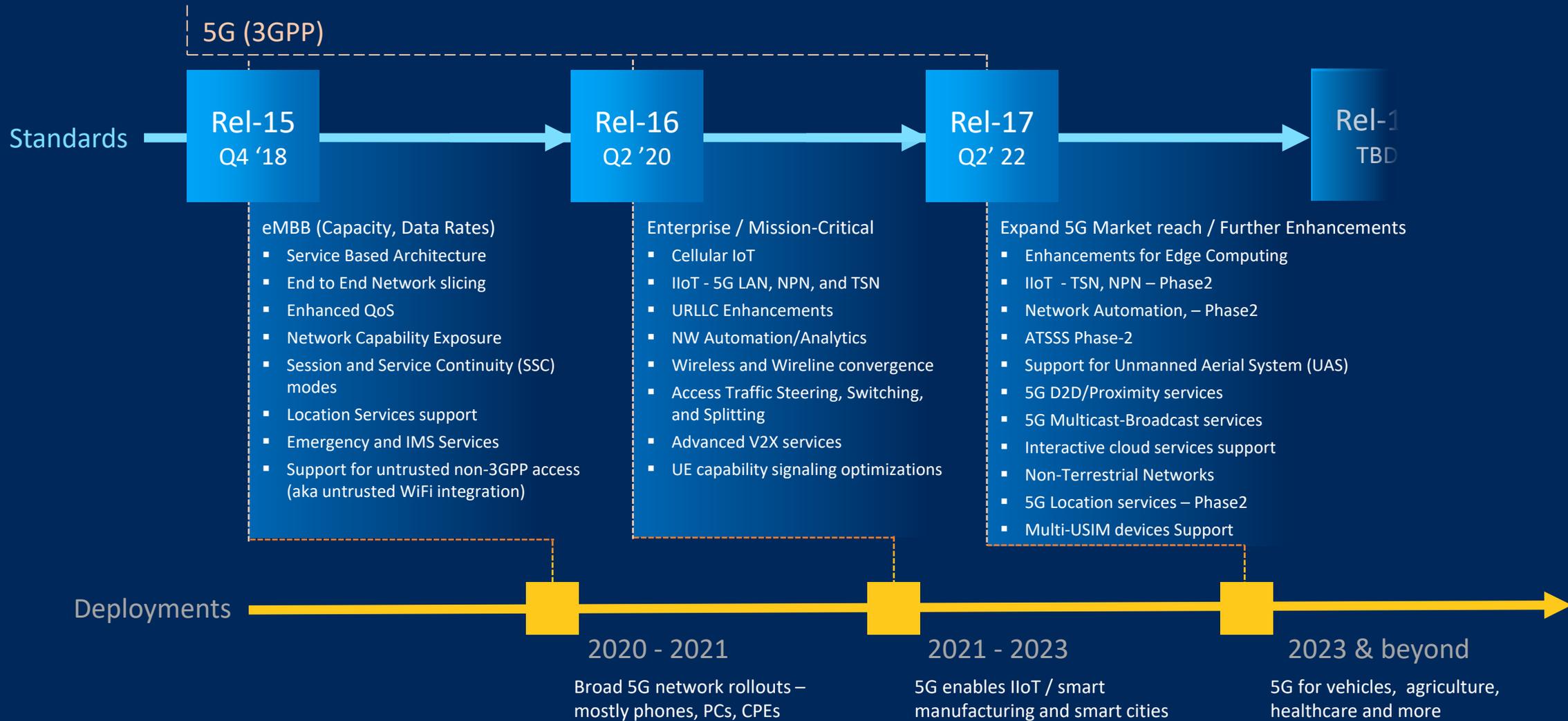




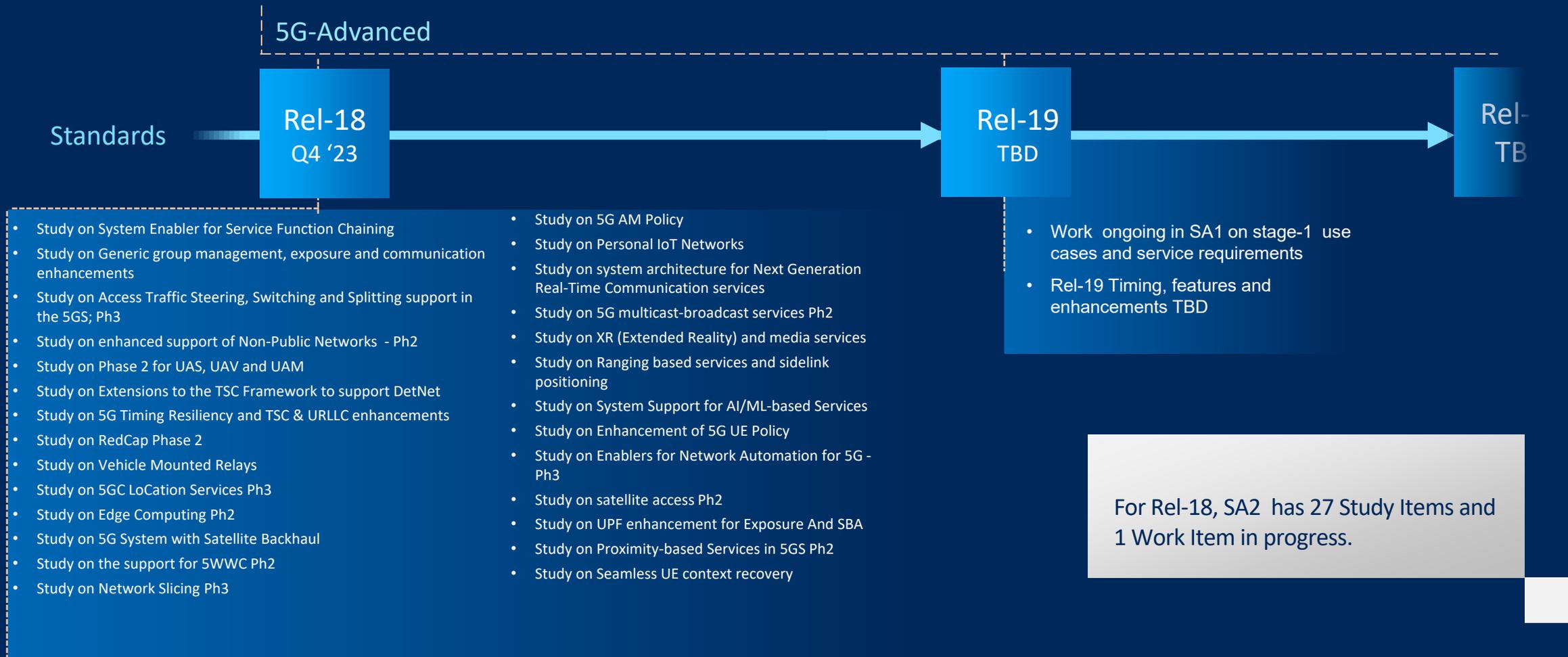
Outline

- Rel-18 introduction and timelines
- Overview of Rel-18 stage-2 work
- Rel-19 introduction and timelines
- Overview of Rel-19 stage-1 service requirements

5G: Evolutionary and Revolutionary

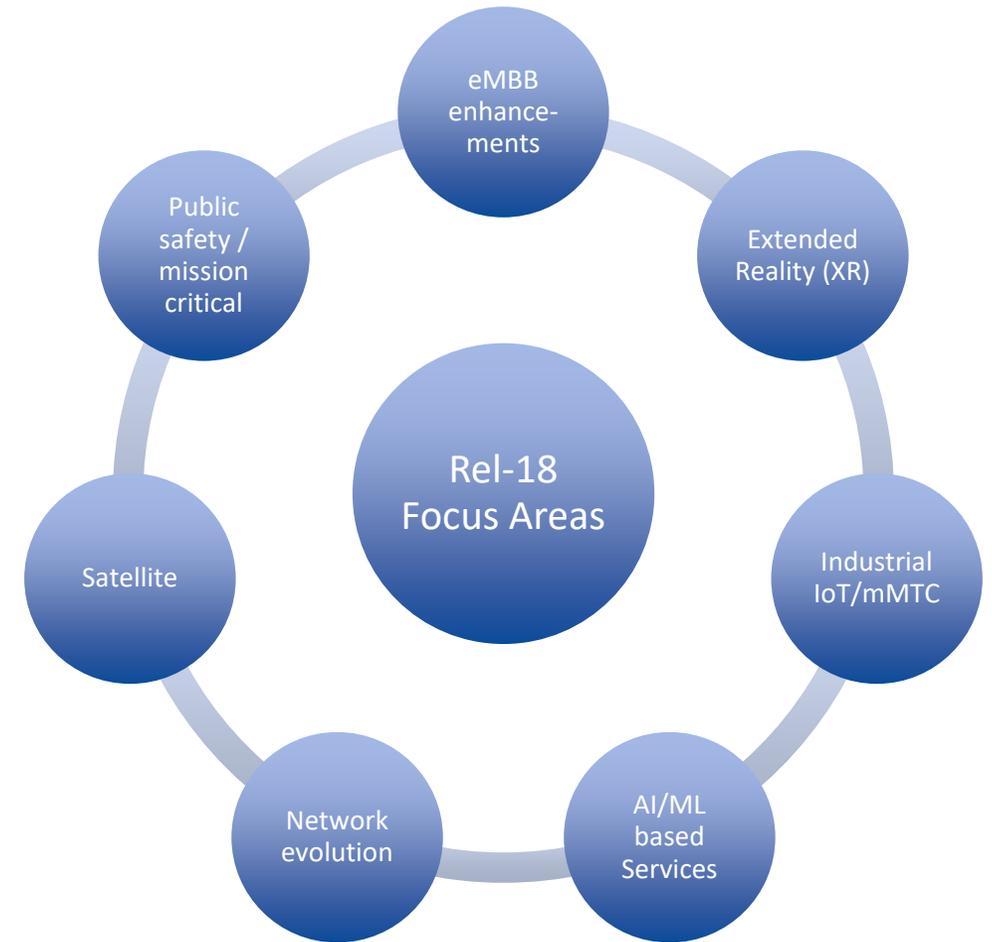


5G-Advanced – Rel-18/Rel-19 progress

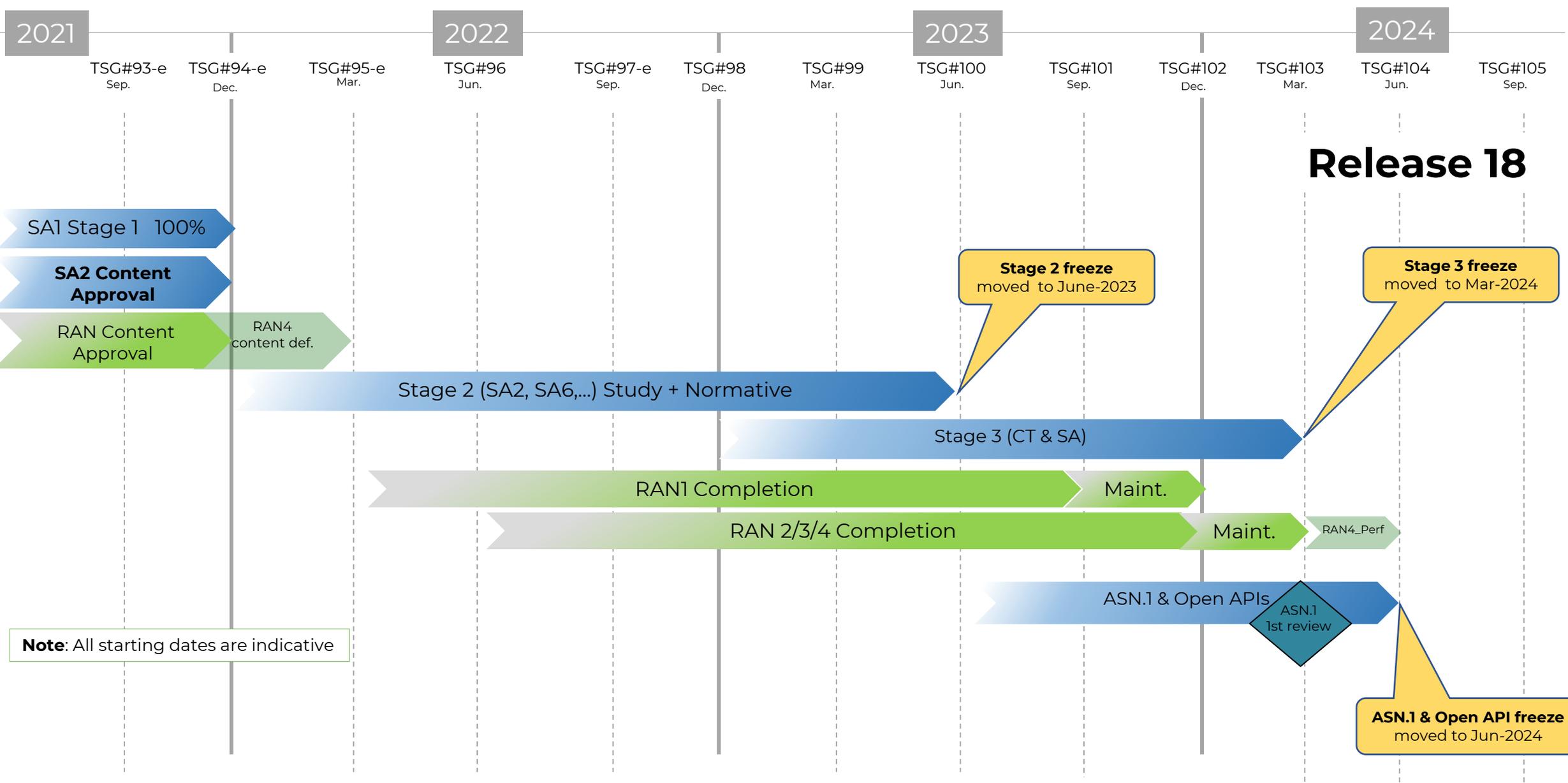


Release 18 – Focus Areas

- **Rel-18** is the first Release for 5G-Advanced
 - Expand the market reach of 5G technology by adding new big features such as XRM, AIMLsys, etc.
 - Address additional requirements from mobile operators and verticals such as eMBB & URLLC enhancements, public safety/mission critical enhancements, Satellite enhancements, IIoT/MMTC enhancements, etc.



5G-Advanced Rel-18 timelines



SA2 Rel-18 Status

UID	Name	Acronym	SID	TR#	Target	Study % Completion	Work % Completion
940060	Study on Support of Satellite Backhauling in 5GS	FS_5GSATB	SP-211639	23.700-27	9/12/2022	100%	65%
940074	Study on 5GC enhancement for satellite access Phase 2	FS_5GSAT_Ph2	SP-211651	23.700-28	9/12/2022	100%	20%
940065	Study on Personal IoT Networks	FS_PIN	SP-211643	23.700-88	9/12/2022	100%	20%
940051	Study on Phase 2 of UAS, UAV and UAM	FS_UAS_Ph2	SP-211632	23.700-58	9/12/2022	100%	25%
940069	Study on Ranging based services and sidelink positioning	FS_Ranging_SL	SP-211647	23.700-86	12/12/2022	100%	10%
940058	Study on Enhancement to the 5GC LoCation Services-Phase 3	FS_eLCS_Ph3	SP-220069	23.700-71	12/12/2022	100%	45%
940077	Study on Stage 2 for Proximity based Services Phase 2	FS_5G_ProSe_Ph2	SP-211653	23.700-33	12/12/2022	100%	60%
940061	Study on generic group management, exposure and communication enhancements	FS_GMEC	SP-211603	23.700-74	9/12/2022	100%	70%
940071	Study on 5G System Support for AI/ML-based Services	FS_AIMLsys	SP-220071	23.700-80	12/12/2022	100%	20%
940067	Study on architectural enhancements for 5G multicast-broadcast services Phase 2	FS_5MBS_Ph2	SP-220072	23.700-47	12/12/2022	100%	60%
940063	Study on Enhancement of Network Slicing Phase 3	FS_eNS_Ph3	SP-220073	23.700-41	12/12/2022	100%	20%
940068	Study on architecture enhancement for XR and media services	FS_XRM	SP-220705	23.700-60	12/12/2022	100%	20%
940056	Study on RedCap Phase 2	FS_REDCAP_Ph2	SP-220074	23.700-68	9/12/2022	100%	95%
940066	Study on system architecture for next generation real time communication services	FS_NG_RTC	SP-220288	23.700-87	9/12/2022	100%	10%
940070	Study on Access Traffic Steering, Switching and Splitting support in the 5GS; Phase 3	FS_ATSSS_Ph3	SP-211612	23.700-53	12/12/2022	100%	85%
940076	Study on UPF enhancement for Exposure And SBA	FS_UPEAS	SP-220417	23.700-62	12/12/2022	100%	75%
940059	Study on Stage 2 of Edge Computing phase 2	FS_EDGE_Ph2	SP-220352	23.700-48	12/12/2022	100%	50%
940055	Study on 5G Timing Resiliency and TSC&URLLC enhancements	FS_5TRS_URLLC	SP-211634	23.700-25	9/12/2022	100%	70%
940057	Study on Architecture Enhancements for Vehicle Mounted Relays	FS_VMR	SP-211636	23.700-05	9/12/2022	100%	40%
840085	Study on enhancement of support for 5WWC	FS_5WWC_Ph2	SP-220419	23.700-17	12/12/2022	100%	45%
940053	Stage 2 of MPS_WLAN	MPS_WLAN	SP-211595	NA	3/12/2023	NA	50%
940064	Study on 5G AM Policy	FS_AMP	SP-220647	23.700-89	9/12/2022	100%	100%
940073	Study on Enablers for Network Automation for 5G - phase 3	FS_eNA_Ph3	SP-220678	23.700-81	9/12/2022	100%	45%
940075	Study on enhanced support of Non-Public Networks phase 2	FS_eNPN_Ph2	SP-220418	23.700-08	12/12/2022	100%	70%
840020	Study on enhancement of 5G UE Policy	FS_eUEPO	SP-211649	23.700-85	12/12/2022	100%	40%
940052	Study on System Enabler for Service Function Chaining	FS_SFC	SP-220415	23.700-18	9/12/2022	100%	60%
940054	Study on Extensions to the TSC Framework to support DetNet	FS_DetNet	SP-211633	23.700-46	9/12/2022	100%	50%
940079	Study on Seamless UE context recovery	FS_SUECR	SP-211654	23.700-61	9/12/2022	100%	100%

Support for eXtended Reality and Media Services (XRM)

Support for PDU set based QoS handling

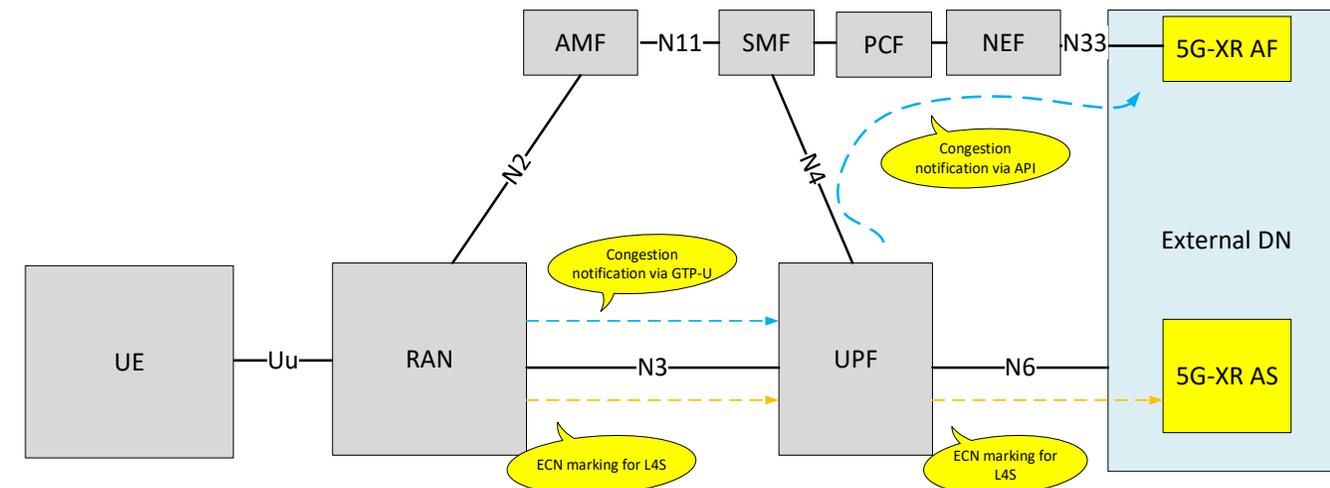
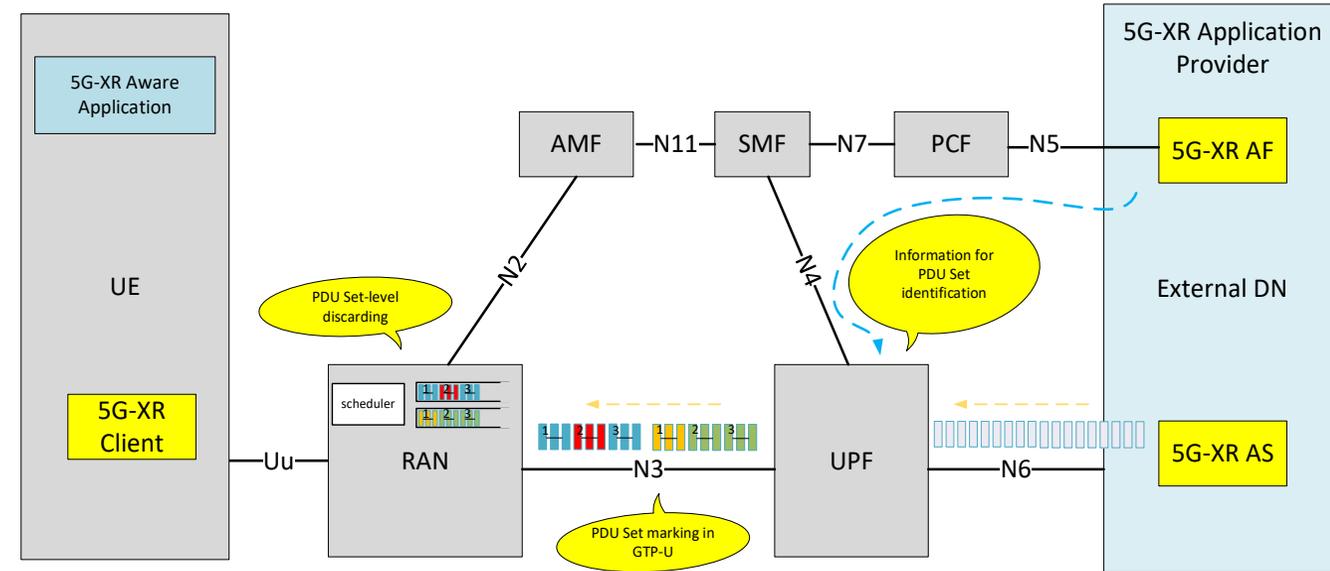
- PDU set based QoS Parameters with PCF determination and provisioning, based on AF provisioned information
- PDU set information identification (e.g., PDU Set boundaries, PDU Set Importance, etc.) and marking by PSA UPF in GTP-U header over N3

5GS information exposure for XR/media enhancements

- Support for ECN marking for the purpose of L4S (Low Latency Low Loss Scalable throughput) by NG-RAN or by PSA UPF
- API based information exposure to AF e.g., radio congestion information

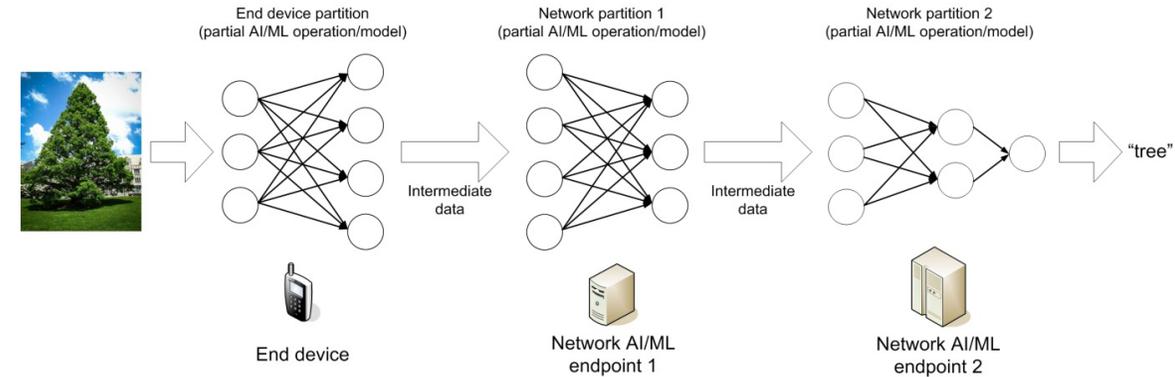
Other XRM related Enhancements

- Policy control enhancements to support multi-modality flows for single UE and multiple UEs, based on AF provisioned information.
- Uplink-downlink transmission coordination to meet round-trip latency requirements
- Policy enhancements for jitter minimization
- Enhancements to UE power savings for XR services
- Trade-off of QoE and power saving requirements



5G system support for AI/ML-based Services

- Support of network resource utilization monitoring for AI/ML application operations
 - AF uses NWDAF based data analytics for Application AI/ML operation.
- 5GC Information Exposure to authorized 3rd party for Application Layer AI/ML Operation
- Enhancing External Parameter Provisioning
- 5GC Enhancements to enable Application AI/ML Traffic Transport
- QoS and Policy enhancements
 - Existing QoS monitoring mechanisms for URLLC services are re-used.
 - SMF send the info to UPF to binds the AI/ML traffic to distinct QoS flow.
- 5GS Assistance to Federated Learning Operation
 - New member selection functionality was added that can provide a list of recommended UEs based on the parameters contained in the request from the AF.

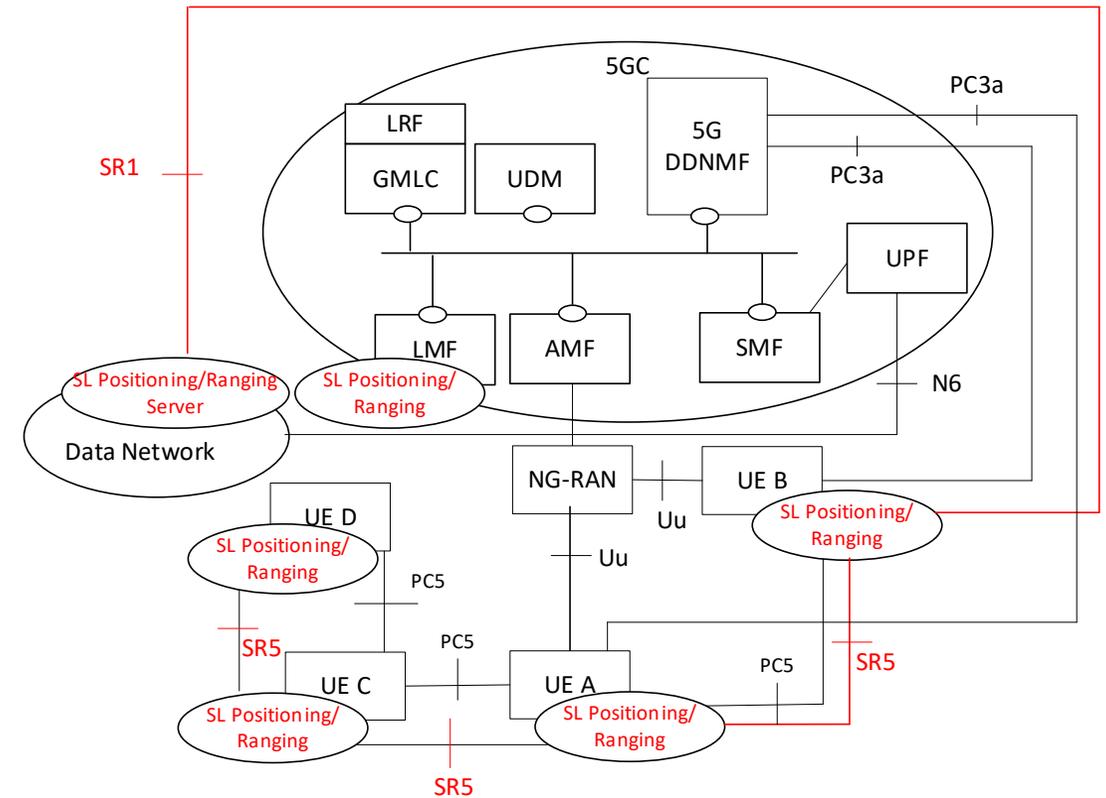


Example of Split AI/ML inference

- UE triggers split inference. UE and an AI/ML server negotiate over application layer for the split inference operations.
- The AF subscribes to one or more NWDAF analytics to generate the AI/ML Assistance information. AI/ML Assistance information from 5GC is needed to assist the AI/ML server to make corresponding decisions for the split inference.
- Based on the assistance information and the current system environmental factors such as communications data rate, resource at UE, the AI/ML server AF makes decisions on split inference.

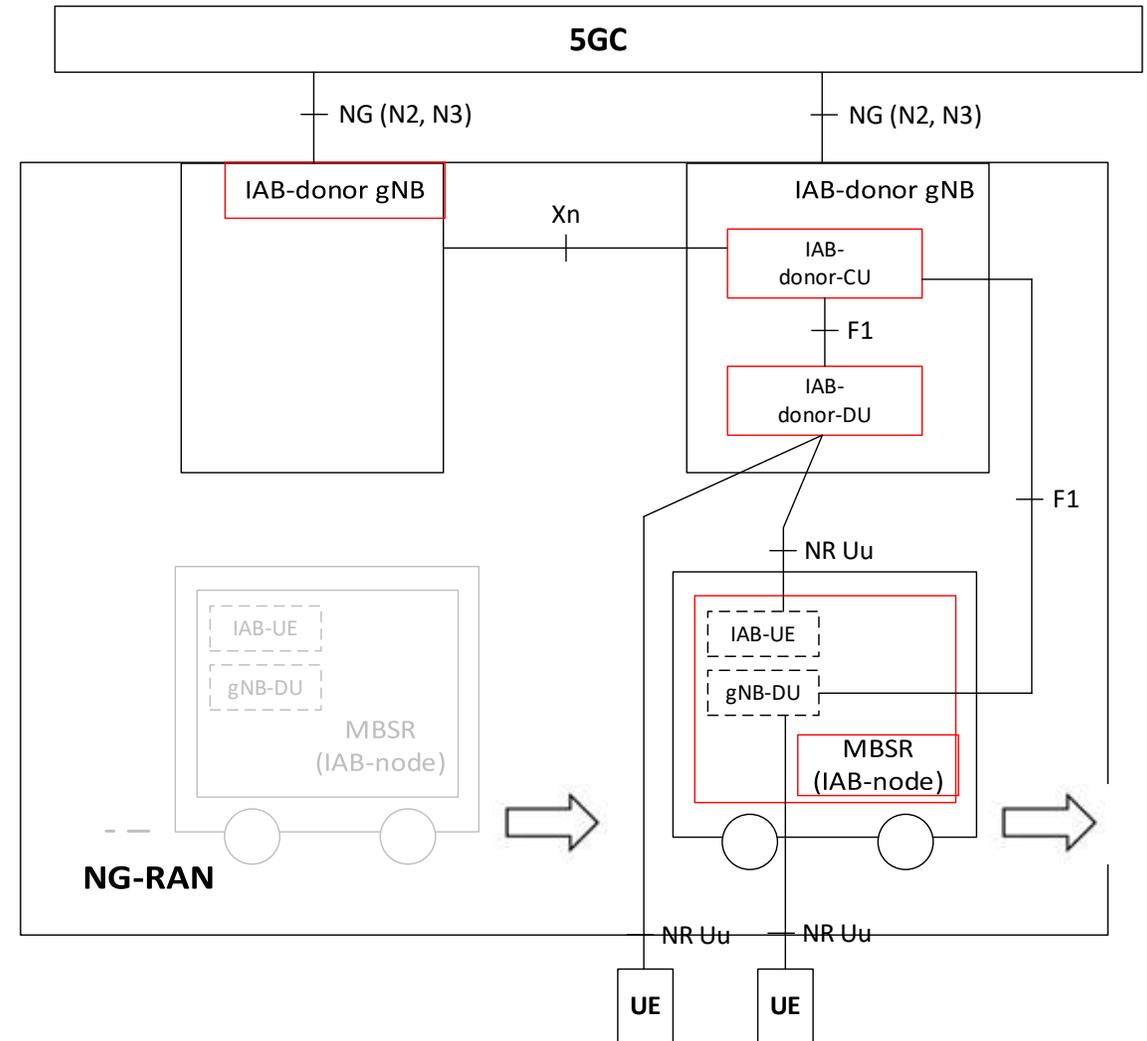
Ranging based Services and Sidelink Positioning

- Authorization and policy/parameter provisioning to UE.
- Ranging/Sidelink Positioning device discovery
- Operations for Ranging/Sidelink positioning
- Network assisted Sidelink Positioning
- Ranging service with the assistant UE
- Ranging and sidelink positioning service exposure to a UE or Application server



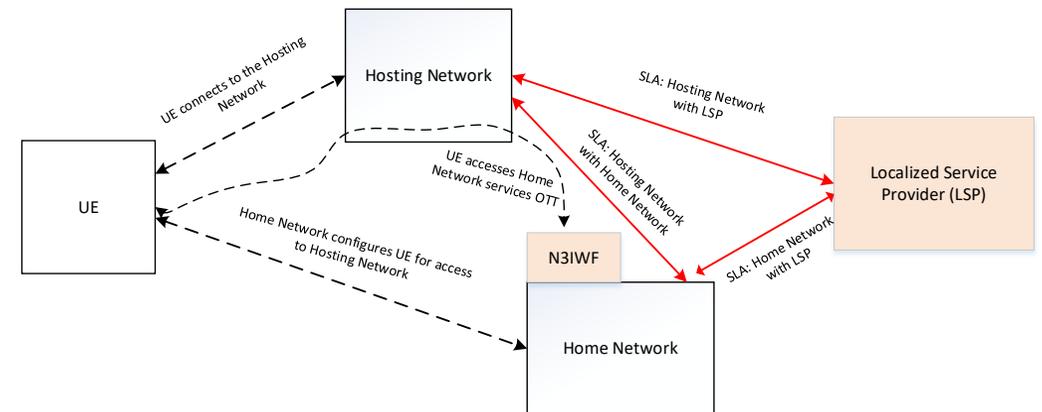
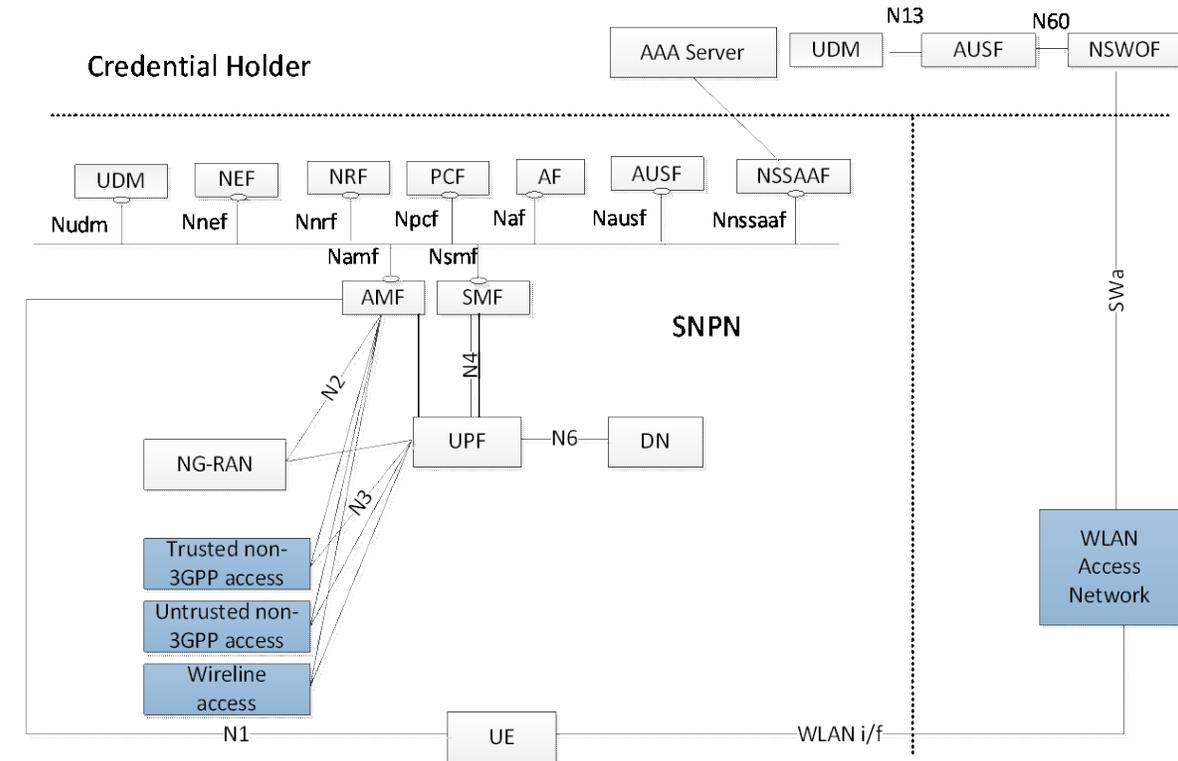
Vehicle-Mounted Relays

- Mobile base station relay (MBSR) configuration.
- Efficient mobility and service continuity
 - Moving UE
 - Moving MBSR
- Roaming of mobile base station relays
- Location services for UEs accessing via a mobile base station relay
- Control of UE's access to 5GS via a mobile base station relay



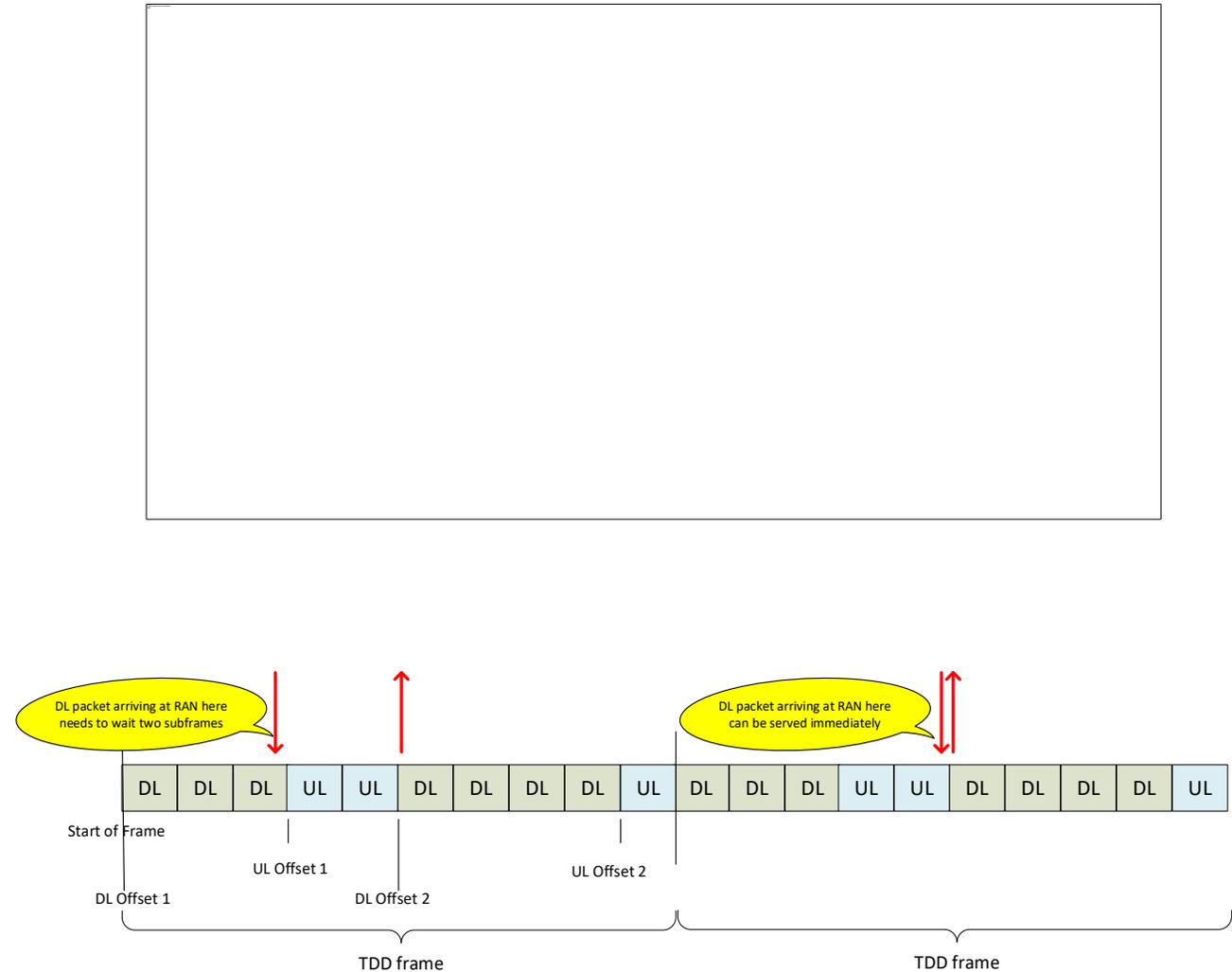
Enhanced support of Non-Public Networks

- Support for enhanced mobility by enabling support for idle and connected mode mobility between SNPNs (standalone private networks) without new network selection
 - Porting the concept of Equivalent PLMNs to SNPNs
- Support for non-3GPP access to SNPN services
 - Access to SNPN services using SNPN or Credentials Holder (CH) credentials for **Untrusted** non-3GPP access, **Trusted** non-3GPP access, **Wireline** access, Non-5G Capable WLAN (**N5CW**) devices
 - Non-Seamless WLAN Offload (**NSWO**) for UEs using SNPN or CH credentials
- Support for providing access to Localized Services



Timing Resiliency and URLLC enhancements

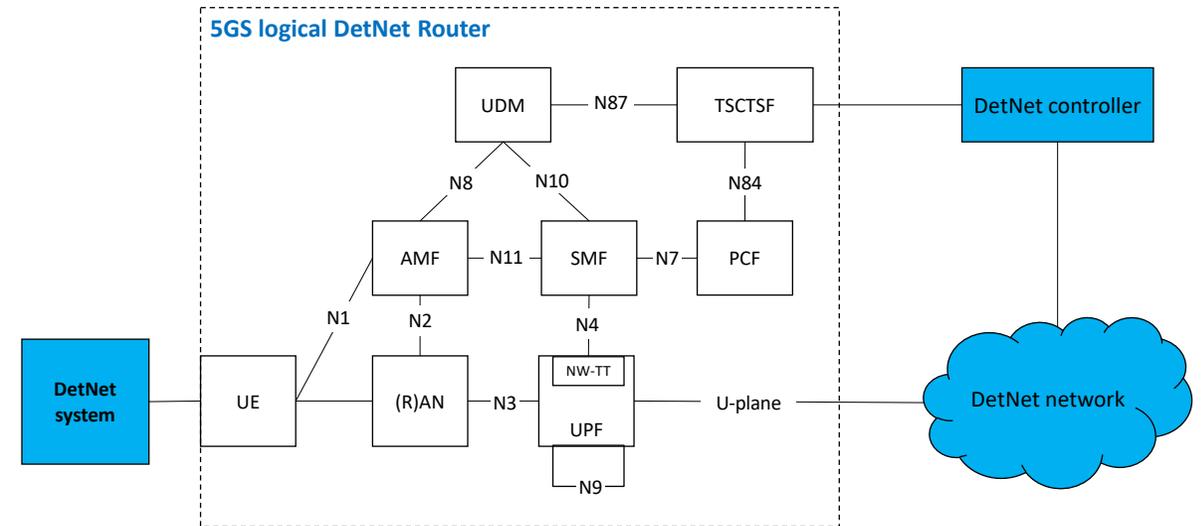
- Support for low latency communication and efficient N3 transmission
- Support for 5G Timing Resiliency requirements defined by SA1
- Enable AFs to request time synchronization service in a specific coverage area and enforce the coverage area
- Control 5G time synchronization service based on subscription
- Enable an AF to explicitly provide Packet Error Rate (PER) to NEF/PCF



Support for Deterministic Networking

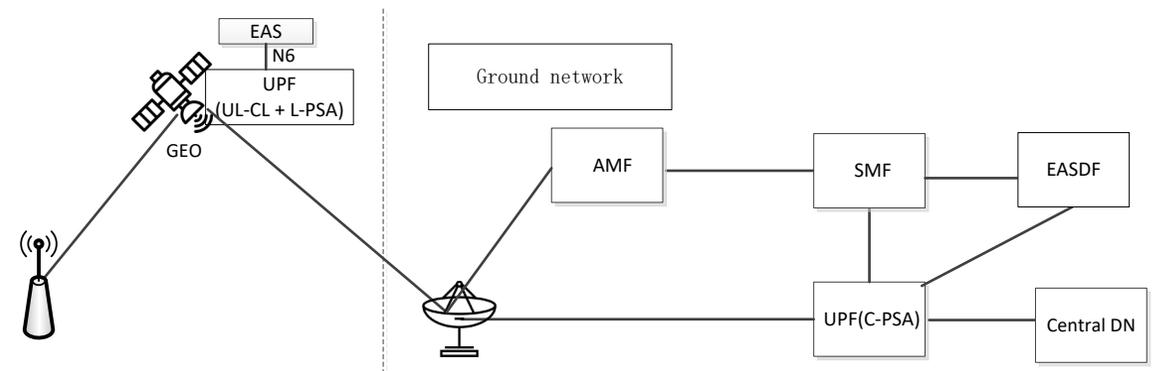
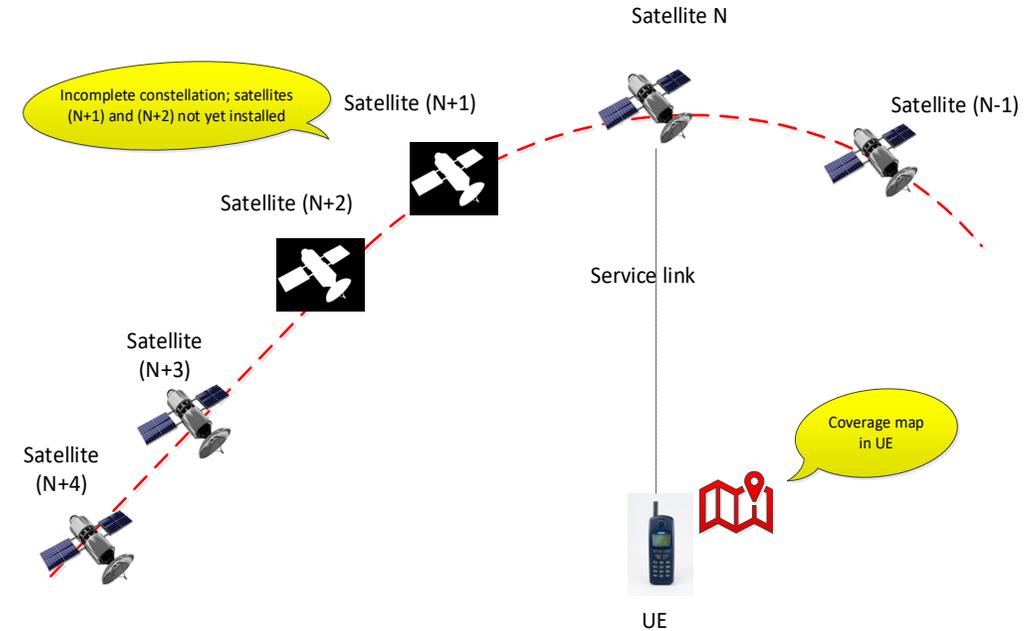
Support for Deterministic Networking (DetNet), as standardized in the IETF

- Reuses the Time Sensitive Communications (TSC) framework for deterministic QoS and time synchronization services defined in Rel-17
- 5GS acts as logical DetNet node/router
- Adds support for 5GS DetNet node reporting to the DetNet controller
- Adds support for provisioning of DetNet configuration from the DetNet controller to 5GS



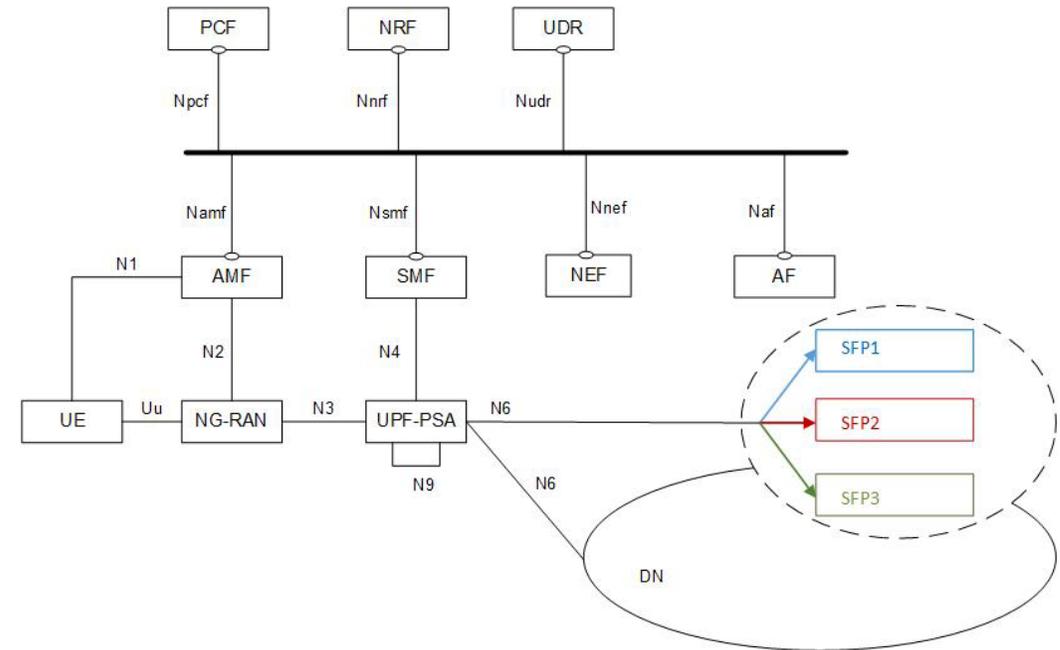
Satellite-related enhancements

- 5GC/EPC enhancements for satellite access (Phase 2)
 - Mobility management and power saving enhancements in presence of discontinuous coverage
 - Relies on provisioning satellite coverage maps:
 - to the UE from an external server, and/or
 - to the AMF via OAM or via AF
 - Reuses existing Power Saving Mode (PSM) and Mobile Initiated Connection Only (MICO) features, considering the coverage maps
- Support for 5G System with Satellite Backhaul
 - Support of PCC/QoS control enhancement considering dynamic satellite backhaul and satellite backhaul information exposure
 - Support of satellite Edge Computing via UPF on-board (applies to GEO satellite backhaul only)
 - Support of local data switching via UPF on-board (applies to GEO satellite backhaul only)



Support for Service Function Chaining (SFC) in 5GS

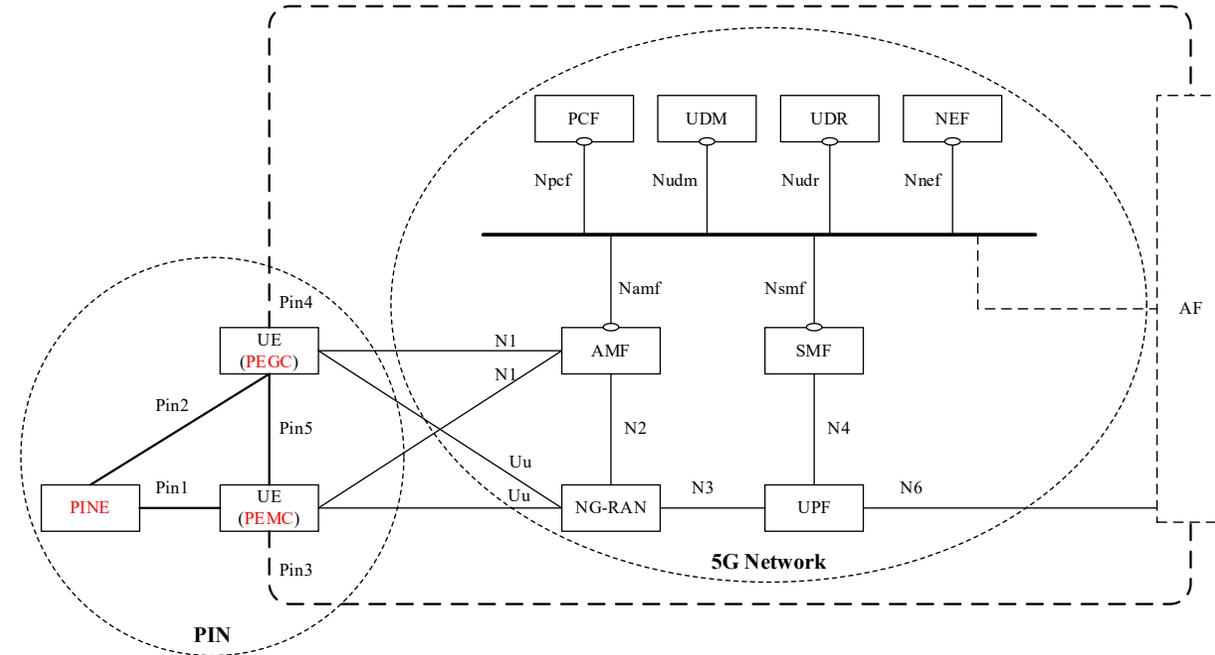
- Traffic Steering Policy and SFC Enhancements
 - Support for SFC in 5GS applies to non-roaming and Home-Routed roaming scenarios where the Application Function (AF) has an agreement with the HPLMN.
 - An AF may request steering of user-plane traffic to a pre-configured chain of service functions on N6-LAN.
- Exposure to enable AF to request predefined SFC for traffic flow(s) related with target UE(s)
 - A Service Function Chain is identified by the SFC ID which is included in the AF request sent to the 5GC.
 - The AF request may optionally include the Metadata information that is transparently passed to the UPF and provided by the UPF to the N6-LAN.



5G system architecture for SFC support

Personal IoT Network (PIN)

- Personal IoT Network (PIN) provides local connectivity between PIN elements i.e., UEs and/or non-3GPP devices.
- A UE in a PIN Element with Gateway Capability (PEGC) can register with 5G network and act as 5G gateway for PIN elements to access 5G network.
- PIN and PIN elements are managed by specific PIN element with Management Capability (PEMC) and the support from an Application Function (AF), if AF is deployed.
- The AF for PIN may communicate with PEMC and PEGC via application layer for management of the PIN.
- PEGC will map the PIN or PIN packets to an existing PDU session or establish a new PDU session based on the QoS markings.

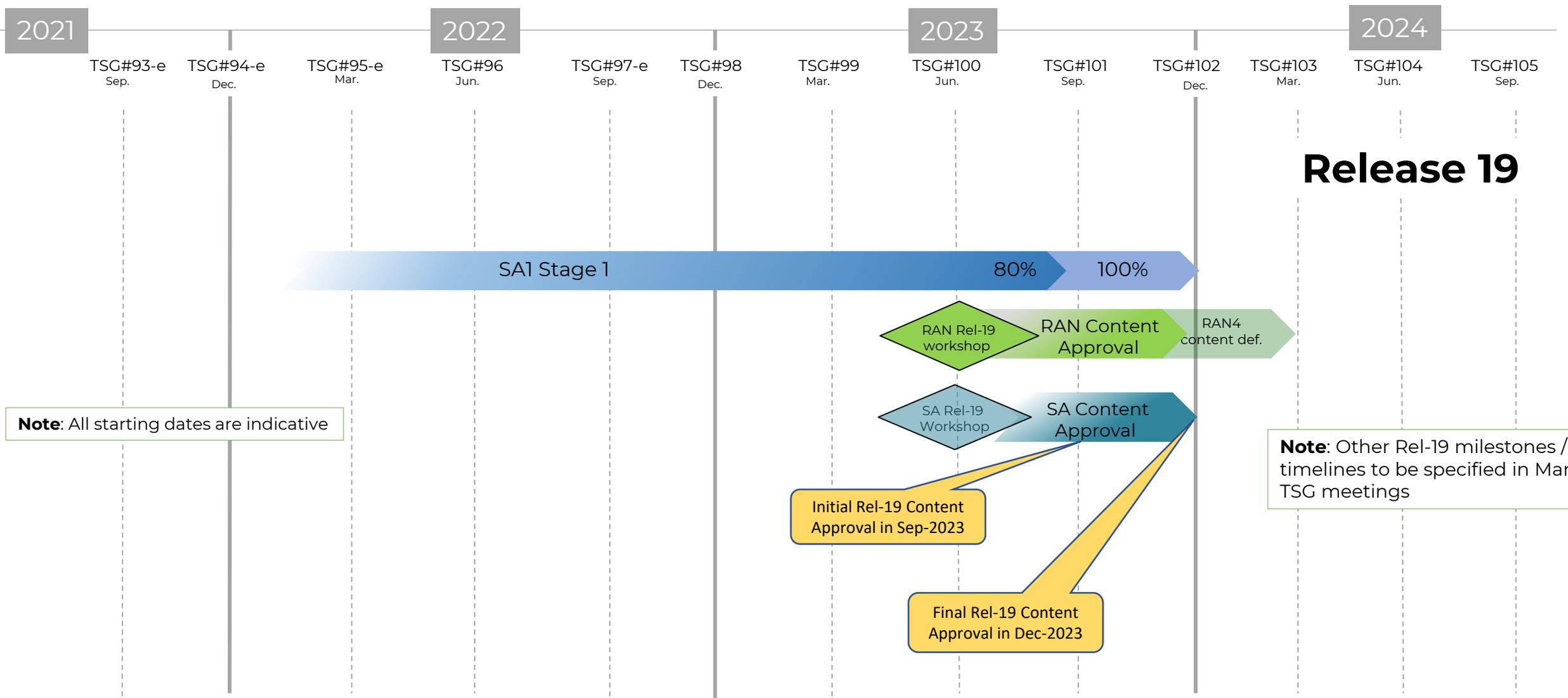


- **PIN**: Personal IoT Network
- **PEGC**: PIN Element with Gateway Capability
- **PEMC**: PIN Element with Management Capability
- **PINE**: PIN Element

Other Rel-18 enhancements

- Study on Access Traffic Steering, Switching and Splitting support in the 5GS - Ph3
- Study on UAS, UAV and UAM - Ph2
- Study on RedCap - Ph2
- Study on 5GC LoCation Services - Ph3
- Study on the support for 5WWC – Ph2
- Study on Network Slicing - Ph3
- Study on Edge Computing - Ph2
- Study on Enablers for Network Automation for 5G - Ph3
- Study on 5G Proximity based Services - Ph2
- Study on 5G multicast-broadcast services - Ph2
- Study on Generic group management, exposure and communication enhancements
- Study on UPF enhancement for Exposure And SBA
- Study on 5G AM Policy
- Study on system architecture for Next Generation Real-Time Communication services
- Study on Enhancement of 5G UE Policy
- Study on Seamless UE context recovery
- Stage 2 of MPS_WLAN (Work Item)

5G-Advanced Rel-19 timelines



SA1 Rel-19 Studies

New Features

- Study on Integrated Sensing and Communication (**FS_Sensing**)
- Study on Ambient power-enabled Internet of Things (**FS_Ambient IoT**)
- Study on Localized Mobile Metaverse Services (**FS_Metaverse**)
- Study on roaming value added services (**FS_RVAS**)

Enhancements

- Study on Energy Efficiency as service criteria (**FS_EnergyServ**)
- Study on Upper layer traffic steering, switching and split over dual 3GPP access (**FS_DualSteer**)
- Study on AI/ML Model Transfer_Phase2 (**FS_AIML_MT_Ph2**)
- Study on Network Sharing Aspects (**FS_NetShare**)

Verticals + NTN focused

- Study on Network of Service Robots with Ambient Intelligence (**FS_SOBOT**)
- Study on satellite access - Phase 3 (**FS_5GSAT_Ph3**)
- Study on UAV Phase 3 (**FS_UAV_Ph3**)
- Study on FRMCS - Phase 5 (**FS_FRMCS_Ph5**)

Cont. Rel-18: Study on Supporting of Railway Smart Station Services (**FS_RAILSS**)

Rel-19 SA1 Study Items Progress

Acronym	Study Item Name	Rapporteur	SID	Technical Report	Target	% Completion (Dec 2022)
FS_RAILSS	Study on Supporting of Railway Smart Station Services	Hansung University	SP-190838	TR 22.890	Dec-2022	100%
FS_Sensing	Study on Integrated Sensing and Communication	Deutsche Telekom	SP-220717	TR 22.837	Jun-2023	65%
FS_AmbientIoT	Study on Ambient power-enabled Internet of Things	OPPO	SP-220085	TR 22.840	Dec-2022	65%
FS_Metaverse	Study on Localized Mobile Metaverse Services	Samsung	SP-220353	TR 22.856	Mar-2023	55%
FS_NetShare	Study on Network Sharing Aspects	China Unicom	SP-220087	TR 22.851	Dec-2022	75%
FS_FRMCS_Ph3	Study on FRMCS Phase 5	UIC	SP-220437	TR 22.989	Sep-2023	50%
FS_AIML_Ph2	Study on AI/ML Model Transfer_Phase2	OPPO	SP-220439	TR 22.875	Dec-2022	50%
FS_RVAS	Study on roaming value added services	Ericsson	SP-220442	TR 22.877	Mar-2023	100%
FS_5GSAT_Ph3	Study on satellite access - Phase 3	Novamint	SP-220679	TR 22.865	Mar-2023	55%
FS_UAV_Ph3	Study on UAV Phase 3	China Mobile	SP-220680	TR 22.843	Jun-2023	45%
FS_DualSteer	Study on Upper layer traffic steering, switching and split over dual 3GPP access	Qualcomm	SP-220445	TR 22.841	Jun-2023	60%
FS_EnergyServ	Study on Energy Efficiency as service criteria	China Mobile	SP-220446	TR 22.882	Mar-2023	40%
FS_SOBOT	Study on Network of Service Robots with Ambient Intelligence	LG Electronics	SP-220447	TR 22.916	Mar-2023	40%



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Questions and Answers

Moderator



Iain Sharp
ATIS

Radio interface and RAN system aspects



Wanshi Chen
Qualcomm
3GPP RAN Chair

System capabilities and network aspects



Puneet Jain
Intel Corporation
3GPP SA2 Chair

Slides and recording will be provided after the event.

Thanks to the speakers and participants





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