

# 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 2<sup>nd</sup>, 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

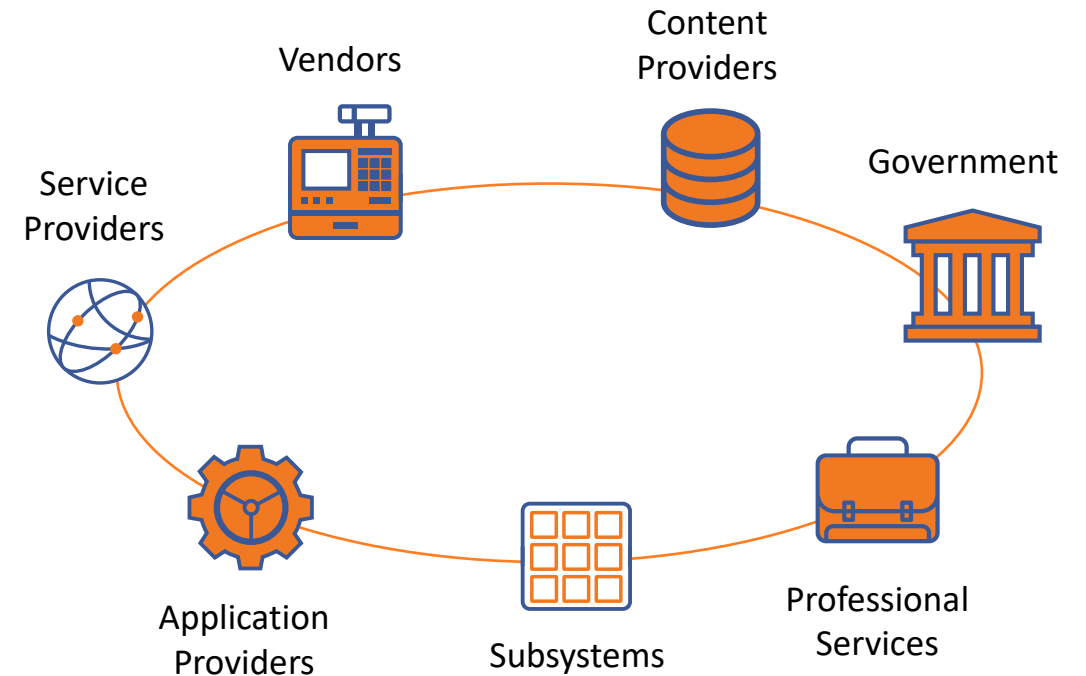
**Q&A**



# ATIS' Value Driven Mission

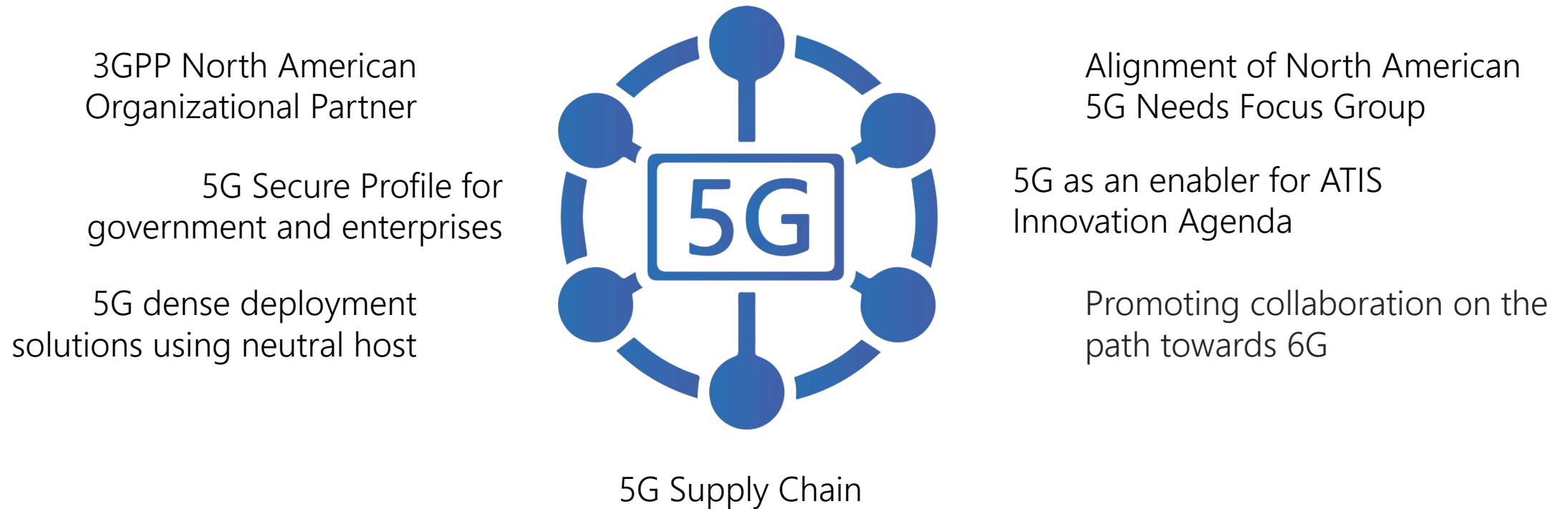
ATIS strategic initiatives and solutions/standards work progresses new business opportunities, solves common industry challenges, and creates a platform for collaboration with other industries.

- > 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



## 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 2<sup>nd</sup>, 2023

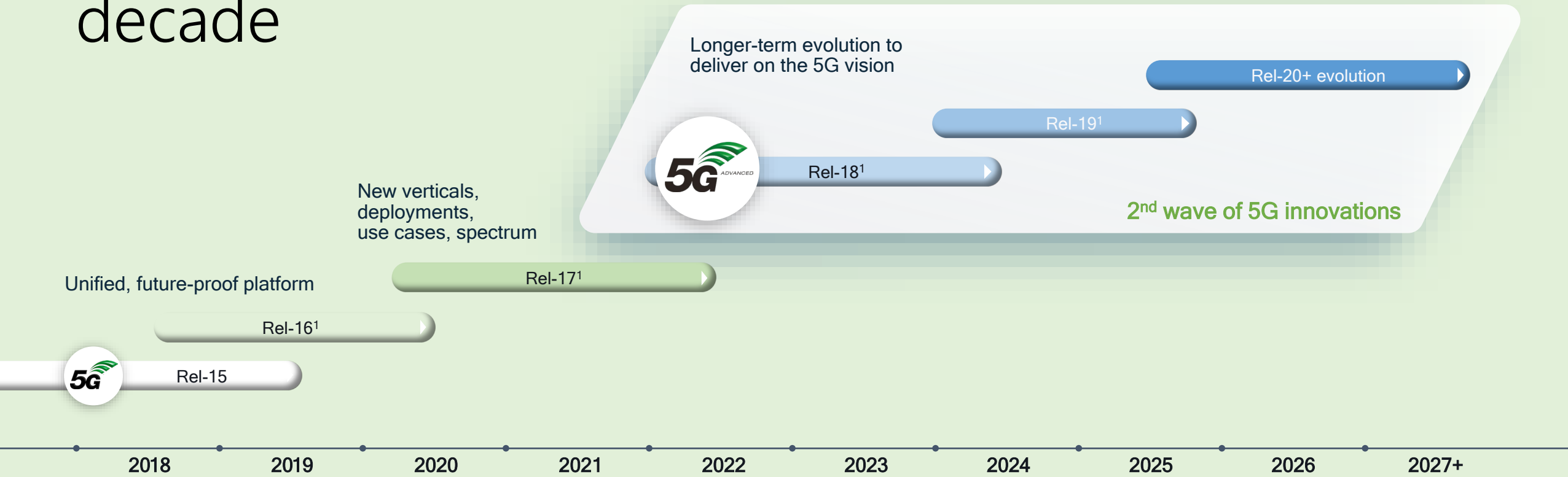




# Outline

- > 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

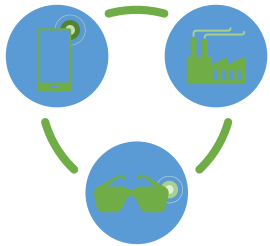
- Lower complexity NR-Light
- Non-terrestrial communication (satellites)
- Unlicensed/licensed spectrum in 60 GHz
- Improved IIoT, positioning V2X, IAB, ...

## 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

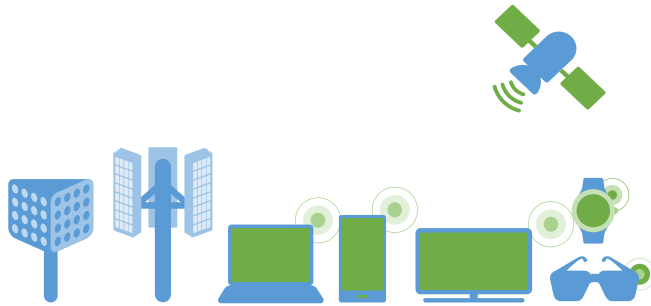
# RAN Release 18: Driving a balanced 5G evolution across key technology areas

Mobile broadband evolution vs. further vertical expansion



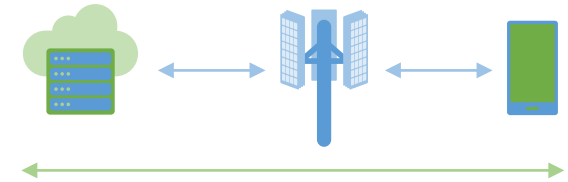
Deliver enhanced mobile broadband experiences and extend 5G's reach into new use cases

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

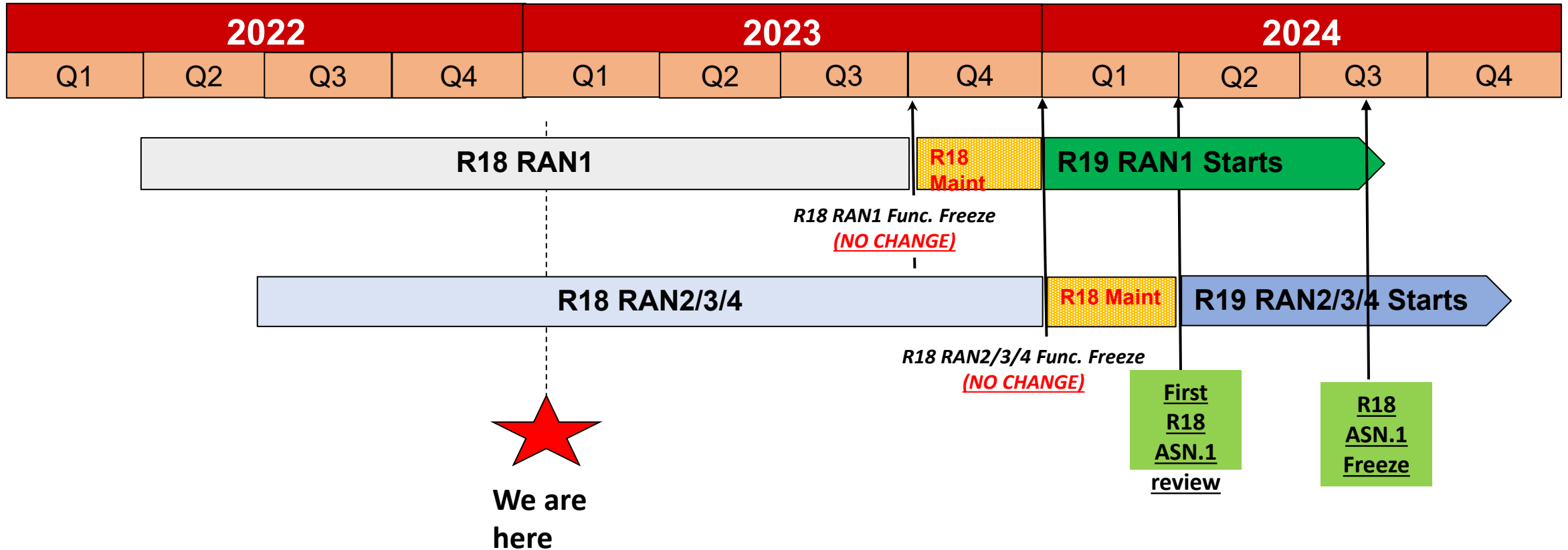


Focus on the end-to-end technology evolution of the 5G system to bring new levels of performance

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



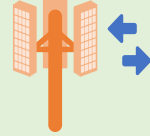


Release 18

# 3GPP Release 18 sets off the 5G Advanced Evolution

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

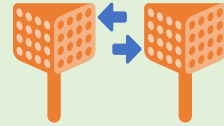
## Strengthen the end-to-end 5G system foundation



Advanced  
DL/UL MIMO



Enhanced  
mobility



Mobile IAB,  
smart repeater



Evolved  
duplexing



AI/ML data-driven  
designs



Green  
networks

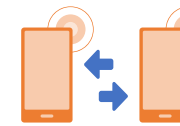
## Proliferate 5G to virtually all devices and use cases



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	<b>WI: MIMO Evolution for Downlink and Uplink</b>	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	<b>SI: Study on Artificial Intelligence (AI)/Machine Learning (ML) for NR Air Interface</b>	Use cases (CSI, beam management, positioning), framework and model, evaluations, and specification impact	Study only in R18
RP-223041	<b>SI: Study on Evolution of NR Duplex Operation</b>	Subband non-overlapping full-duplex (SBFD) (gNB only). Potential enhancements to dynamic/flexible TDD	Study only in R18
RP-222806	<b>WI: NR sidelink evolution</b>	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	<b>WI: Expanded and improved NR positioning</b>	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	<b>WI: Further NR RedCap UE complexity/cost reduction</b>	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	<b>WI: Network energy savings</b>	MIMO adaptation; PDSCH power adaptation; cell-DRX/DTX (no change to SSB; SSB-less SCell	Study completed in Dec'22
RP-221858	<b>WI: Further NR coverage enhancements</b>	PRACH repetitions; dynamic power aggregation in FR1 CA/DC; frequency domain spectrum shaping; dynamic waveform switching	
RP-223505	<b>WI: NR Network-Controlled Repeaters</b>	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	<b>WI: Enhancement of NR Dynamic spectrum sharing (DSS)</b>	NR PDCCH reception in symbols with LTE CRS. Support of two overlapping CRS rate matching patterns	<b>WI completed in Sept'22</b>
RP-222644	<b>SI: Study on low-power Wake-up Signal and Receiver for NR</b>	Evaluation methodology and KPIs; Wake-up Receiver architectures and signal design; specification impact; power savings	Study only in R18
RP-222251	<b>WI: Multi-carrier enhancements for NR</b>	Multi-cell scheduling with single DCI, UL Tx switching across 3 or 4 bands with up to 2 simultaneous Tx	<b>Extended to 1Q'23</b>

# 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 patters 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



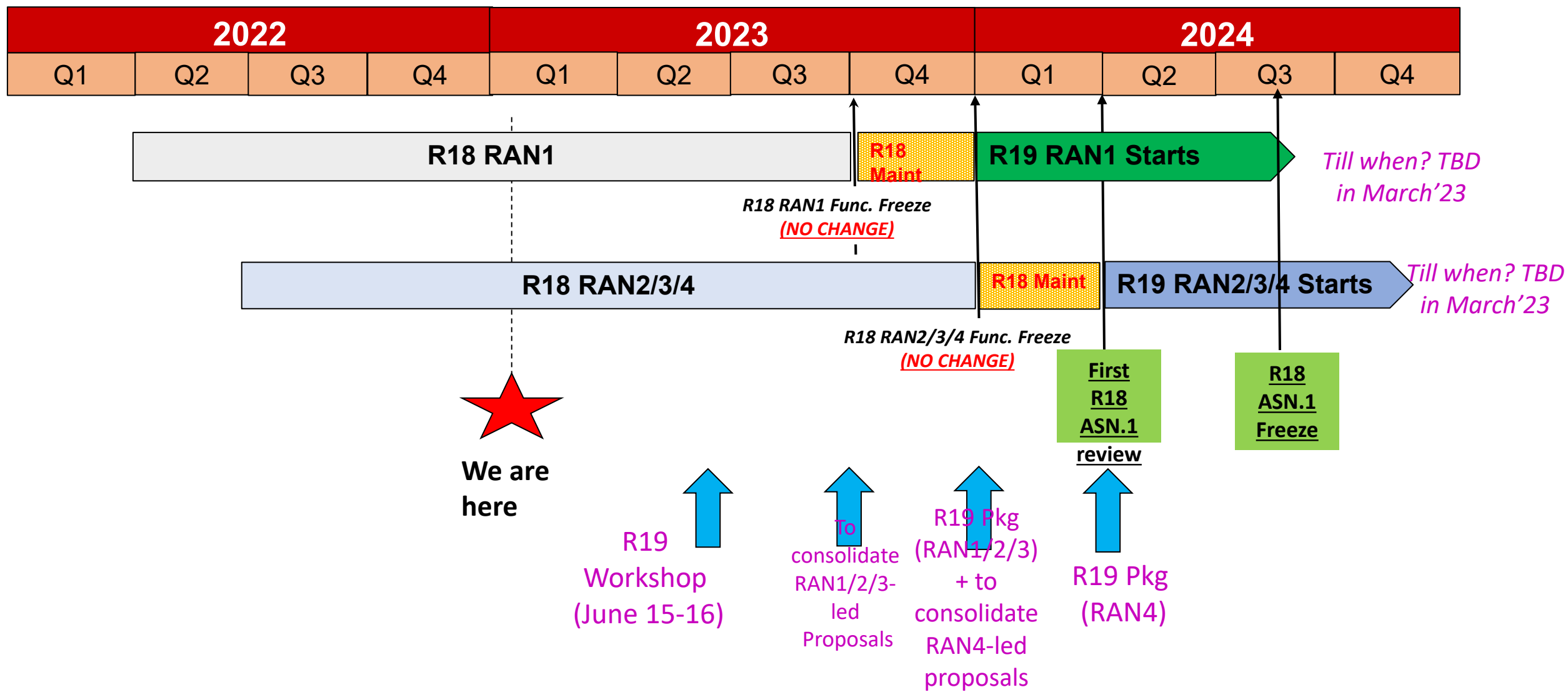
# Advancing 5G to fulfill its full promise

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

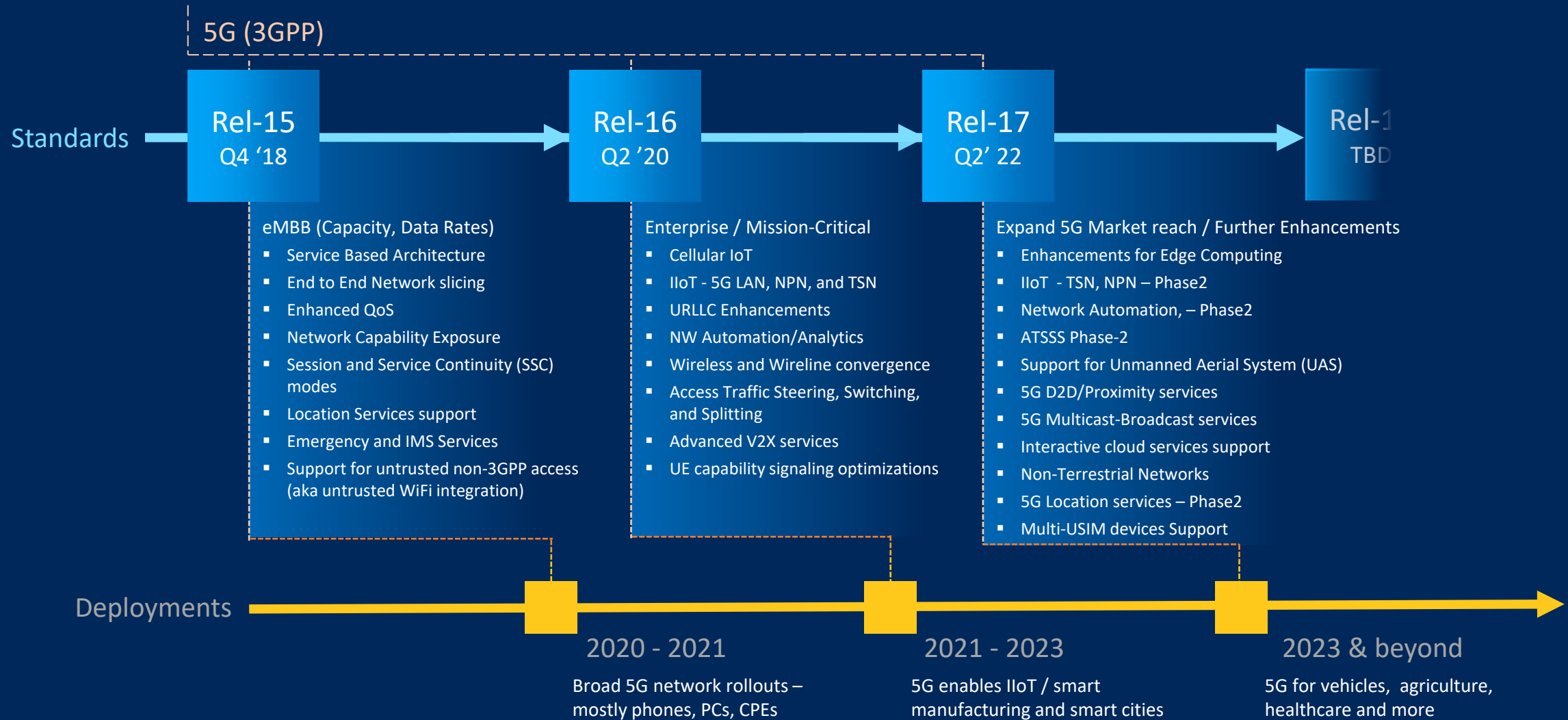




## Outline

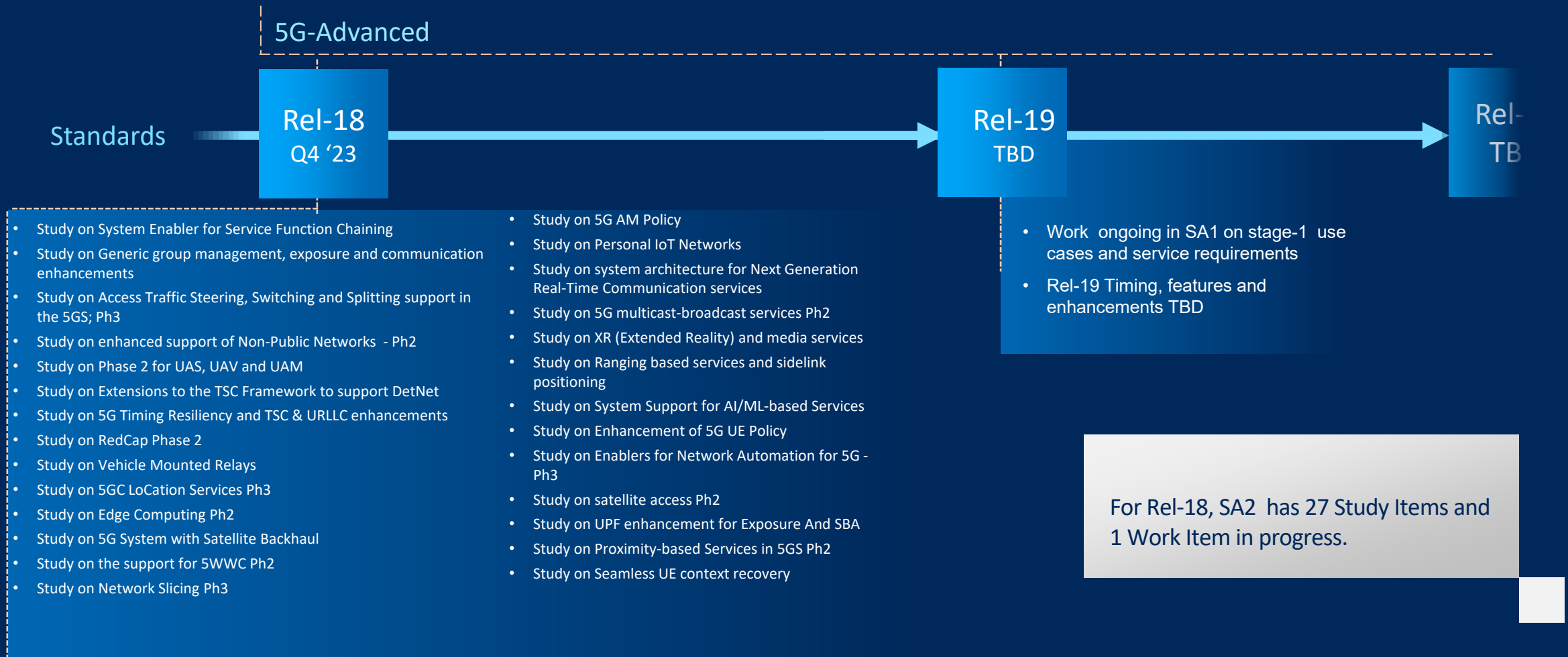
- Rel-18 introduction and timelines
- Overview of Rel-18 stage-2 work
- Rel-19 introduction and timelines
- Overview of Rel-19 stage-1 service requirements

# 5G: Evolutionary and Revolutionary



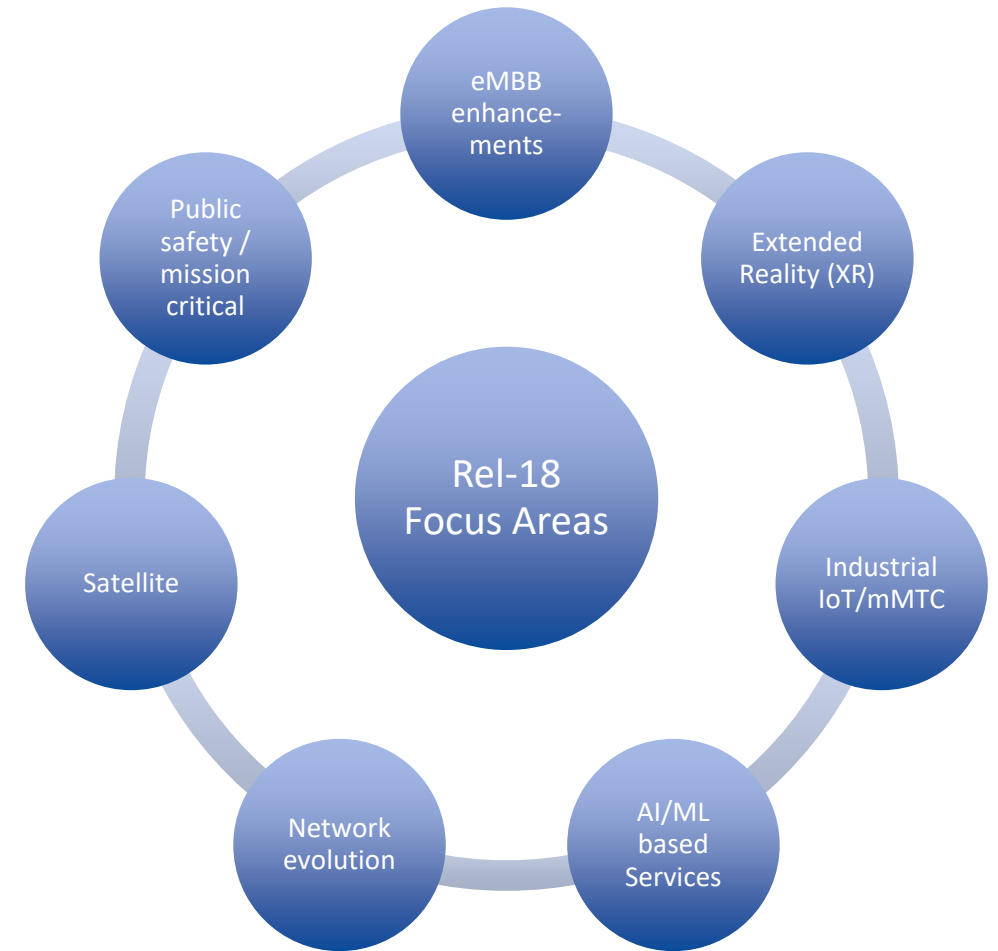


# 5G-Advanced – Rel-18/Rel-19 progress

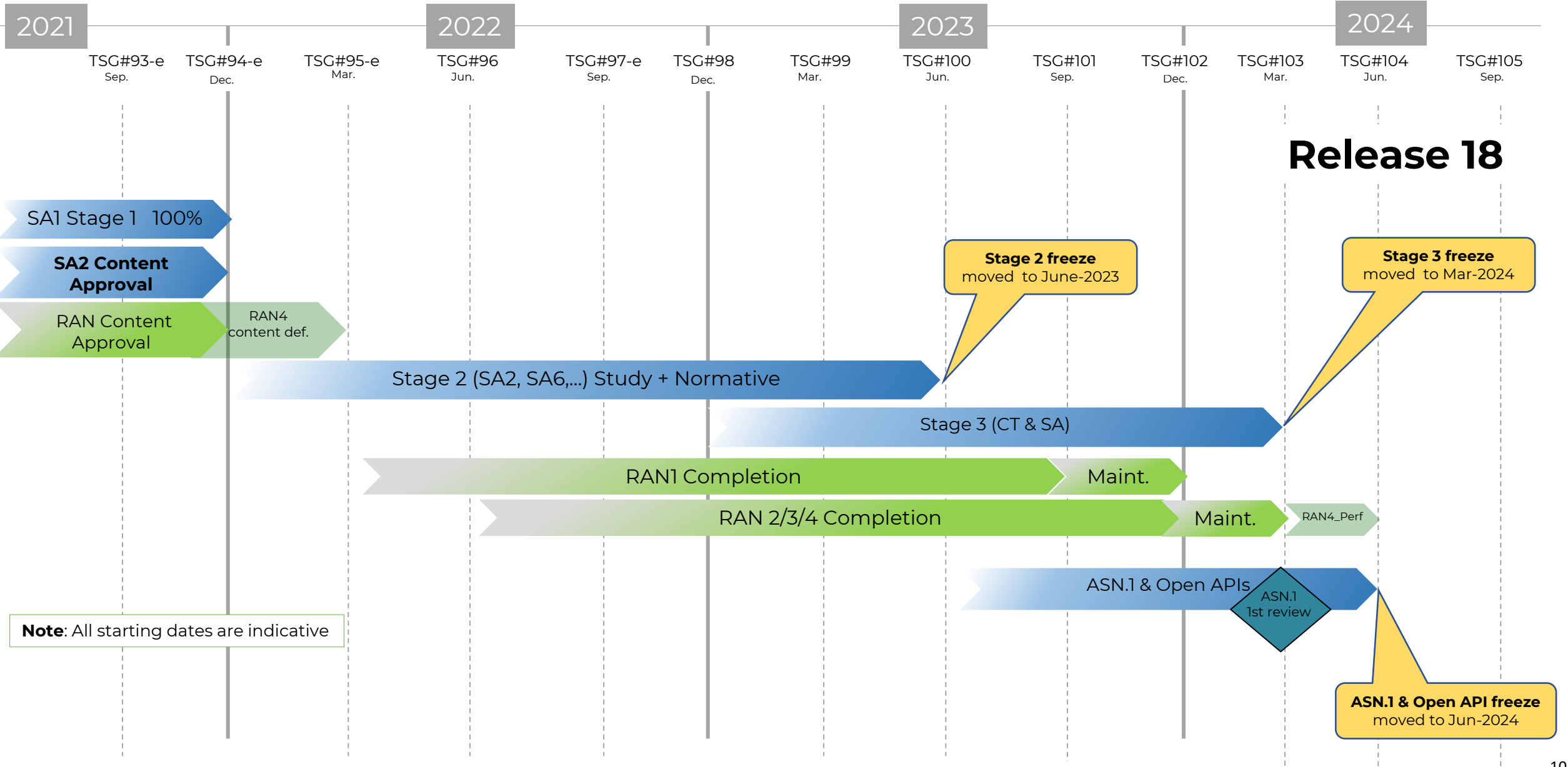


# Release 18 – Focus Areas

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

# Support for eXtended Reality and Media Services (XRM)

## ■ Support for PDU set based QoS handling

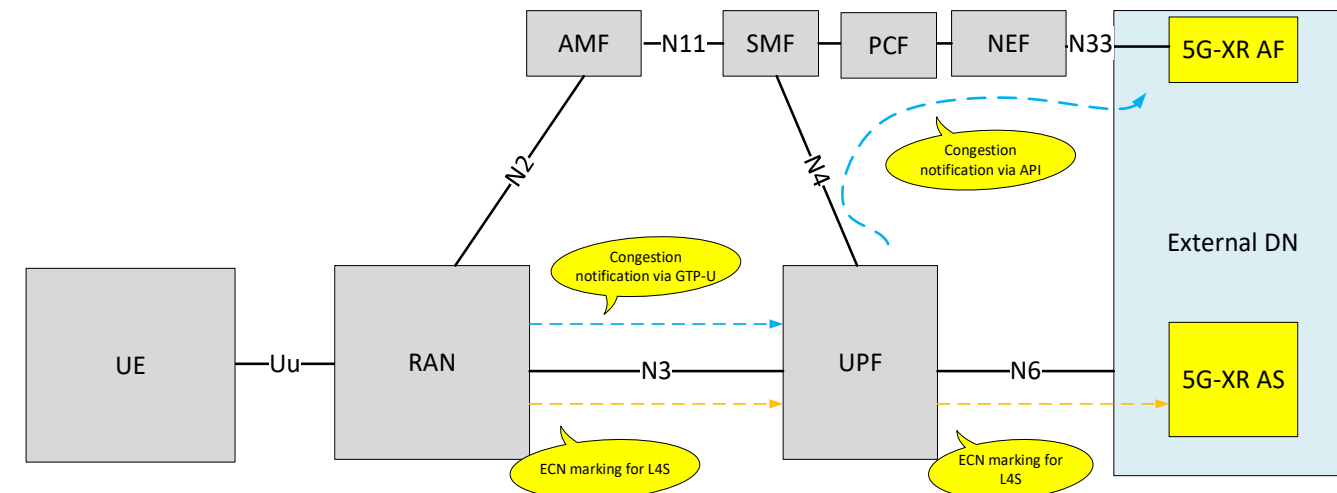
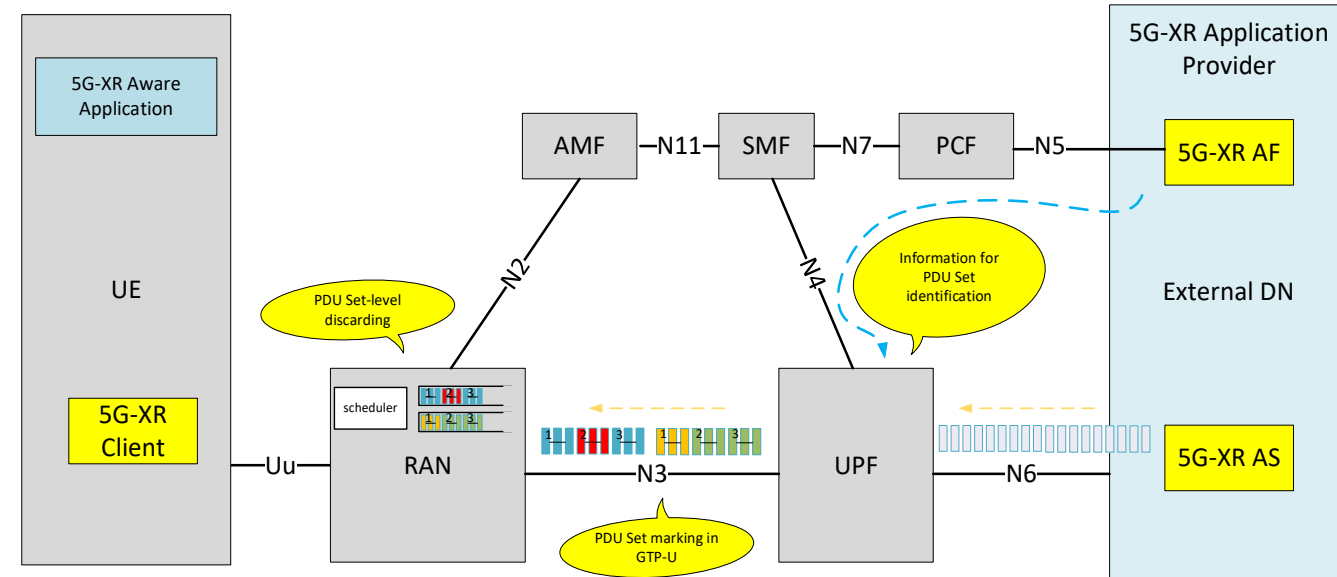
- PDU set based QoS Parameters with PCF determination and provisioning, based on AF provisioned information
- PDU set information identification (e.g., PDU Set boundaries, PDU Set Importance, etc.) and marking by PSA UPF in GTP-U header over N3

## ■ 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

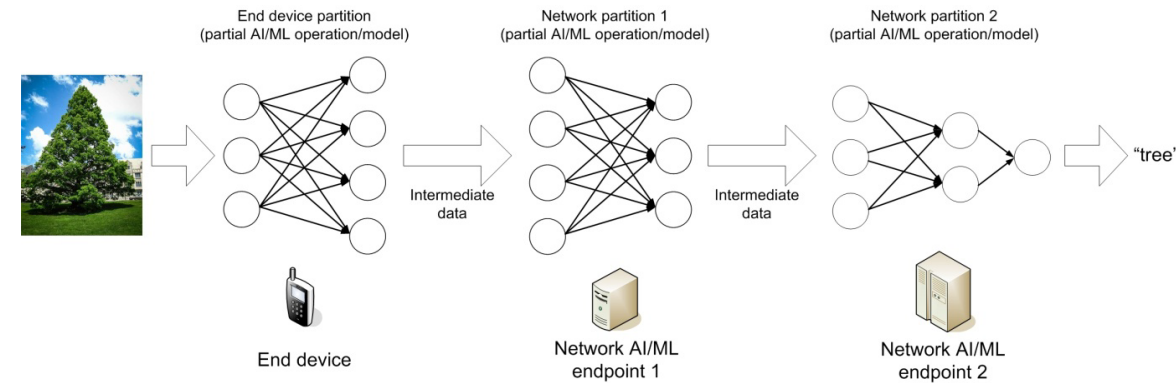
## ■ Other XRM related Enhancements

- 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.

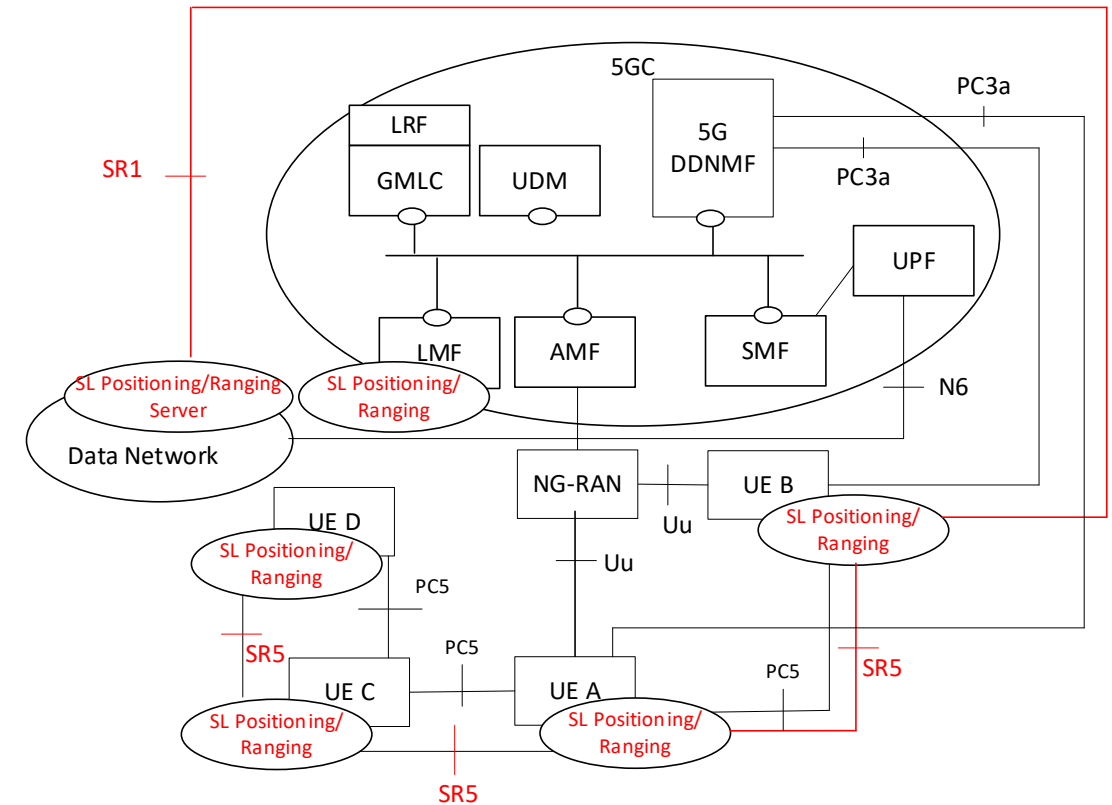


**Example of Split AI/ML inference**

- 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.

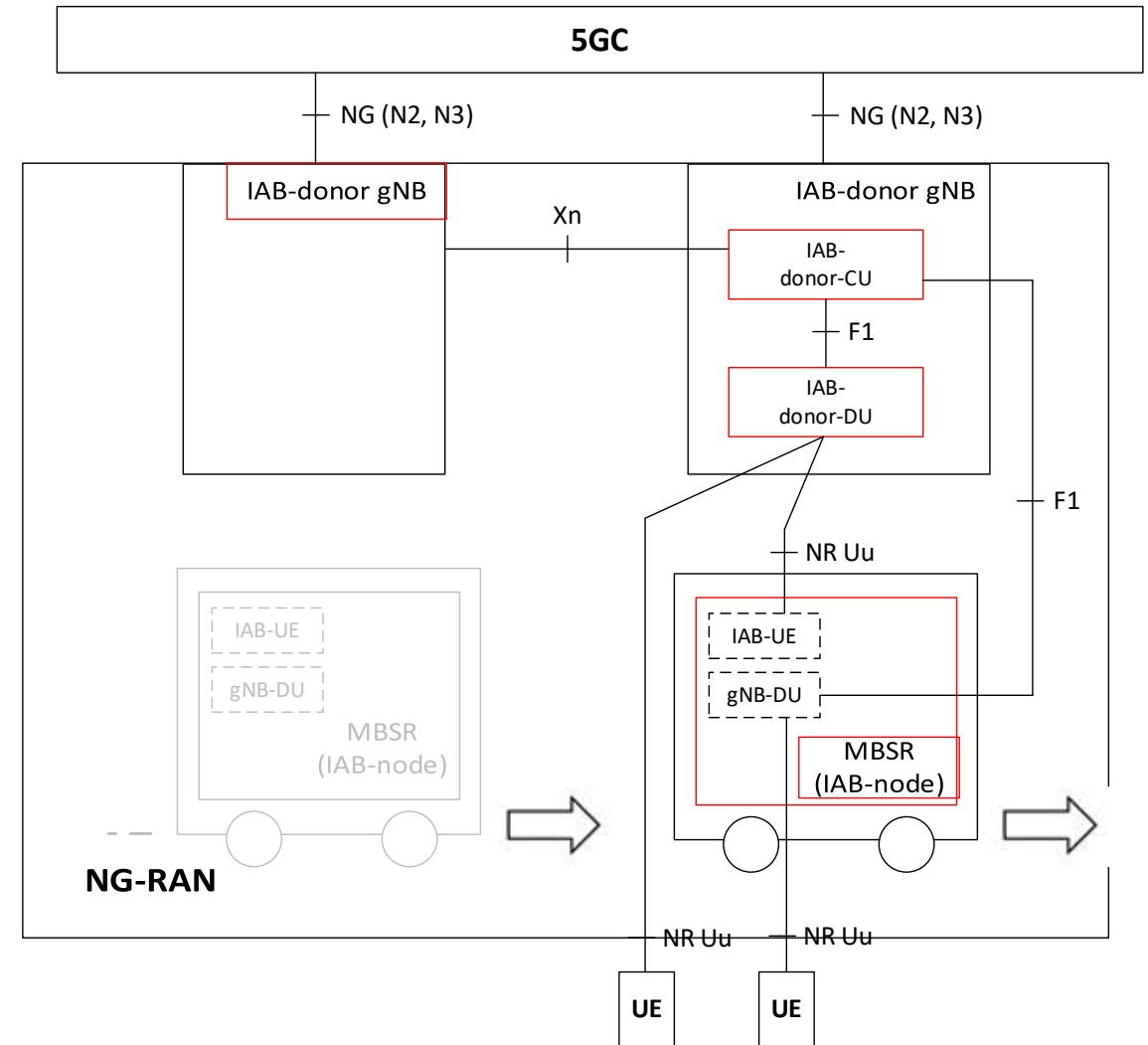
# Ranging based Services and Sidelink Positioning

- 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

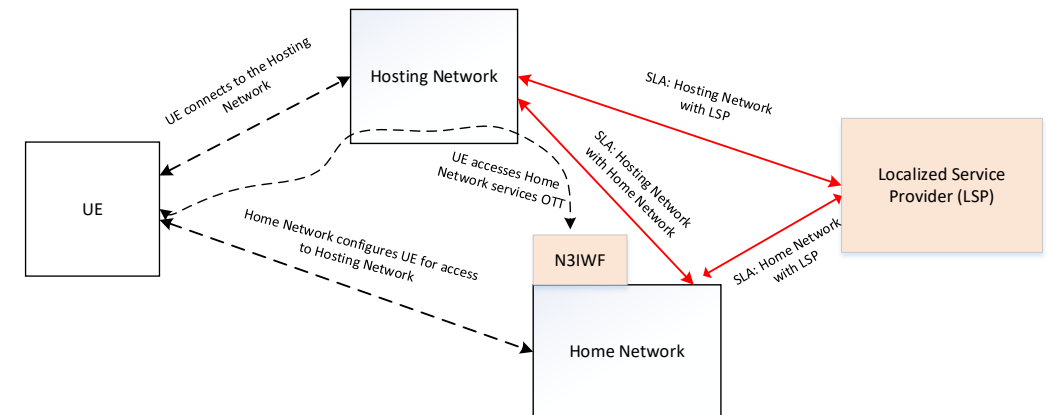
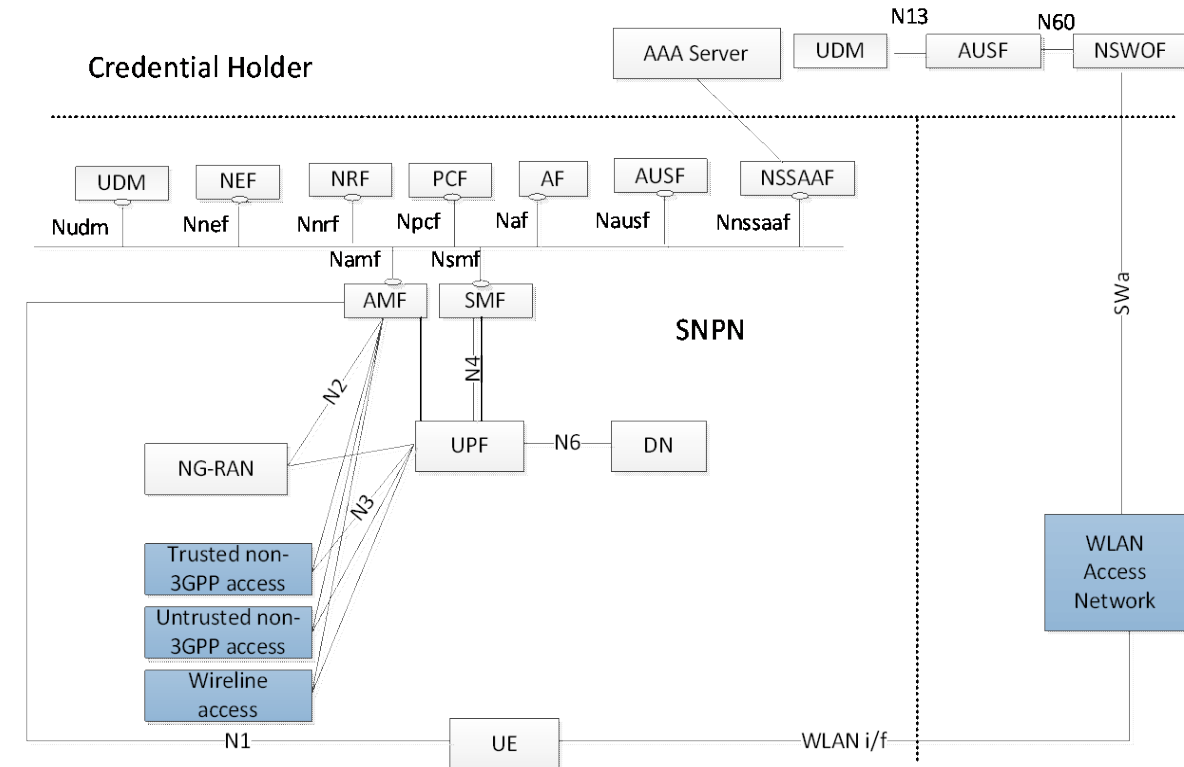
- Mobile base station relay (MBSR) configuration.
- Efficient mobility and service continuity
  - Moving UE
  - Moving MBSR
- Roaming of mobile base station relays
- Location services for UEs accessing via a mobile base station relay
- Control of UE's access to 5GS via a mobile base station relay





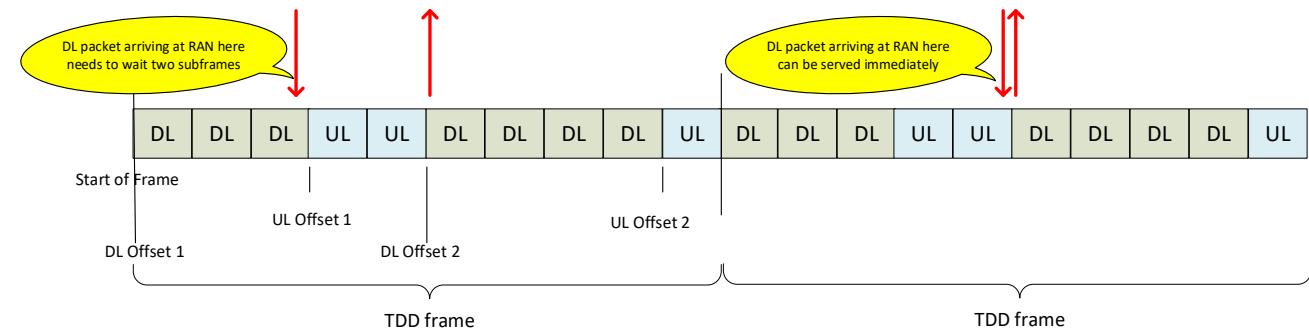
# Enhanced support of Non-Public Networks

- 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

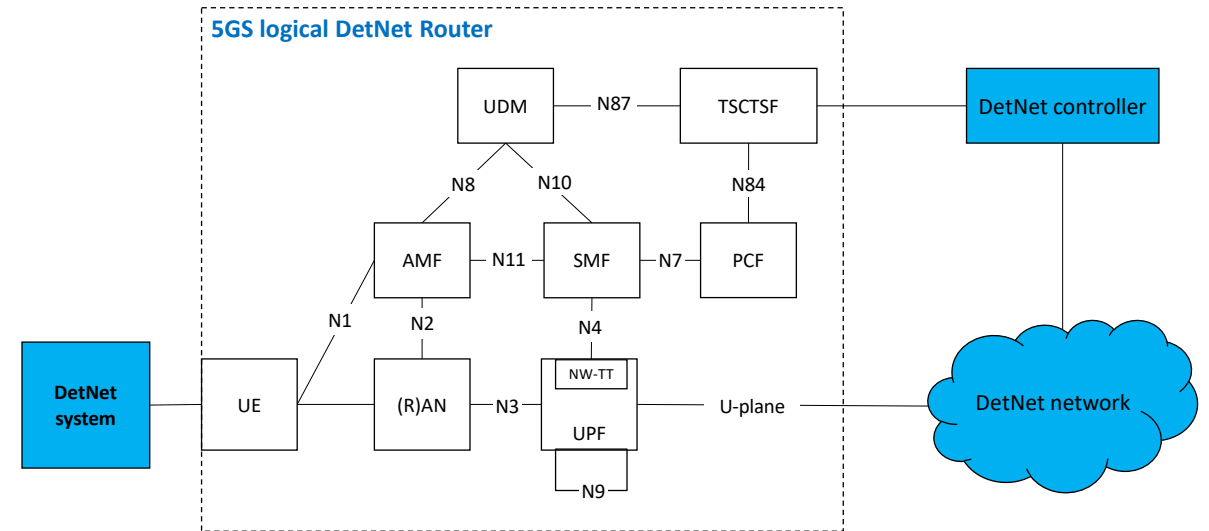
- Support for low latency communication and efficient N3 transmission
- Support for 5G Timing Resiliency requirements defined by SA1
- Enable AFs to request time synchronization service in a specific coverage area and enforce the coverage area
- Control 5G time synchronization service based on subscription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



# Support for Deterministic Networking

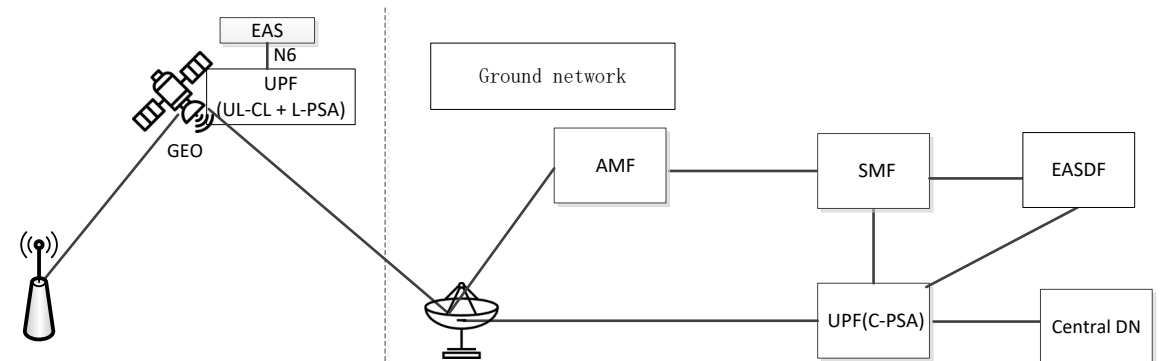
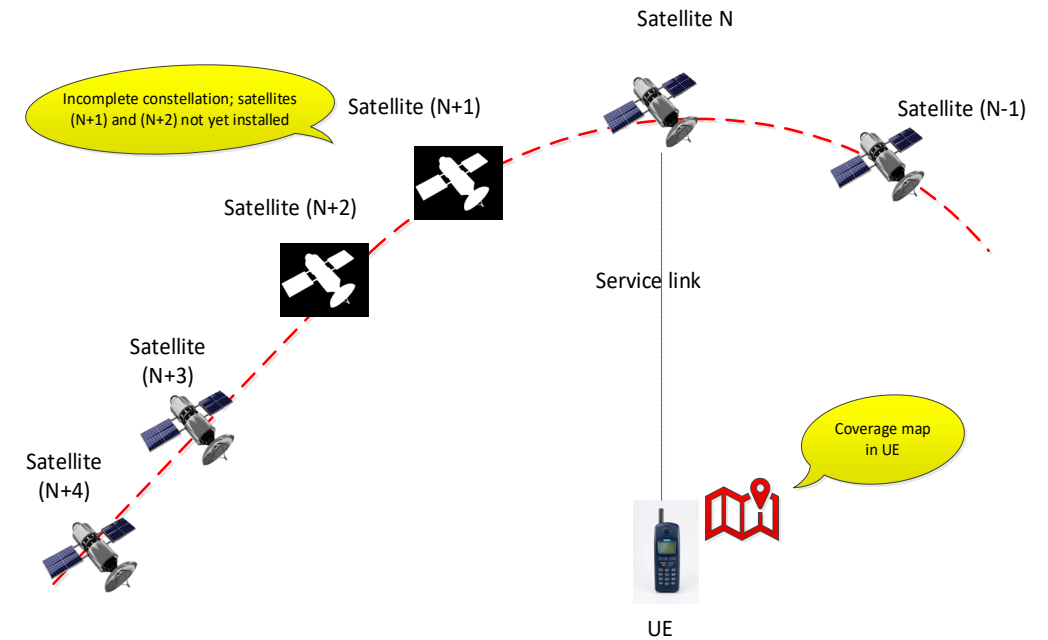
## Support for Deterministic Networking (DetNet), as standardized in the IETF

- 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



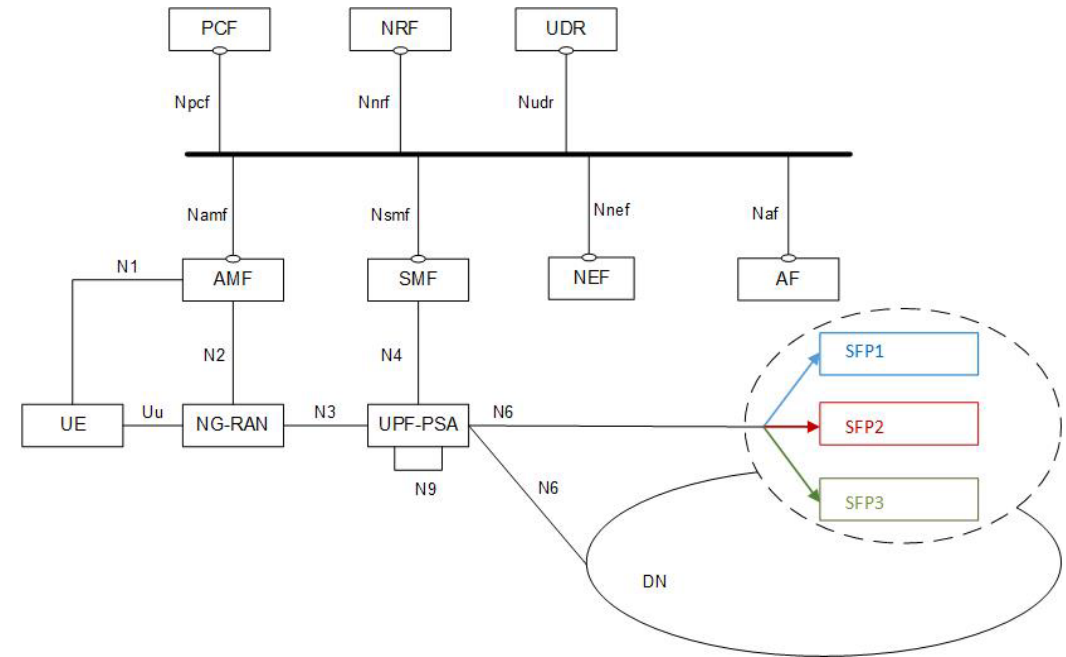
# Satellite-related enhancements

- 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

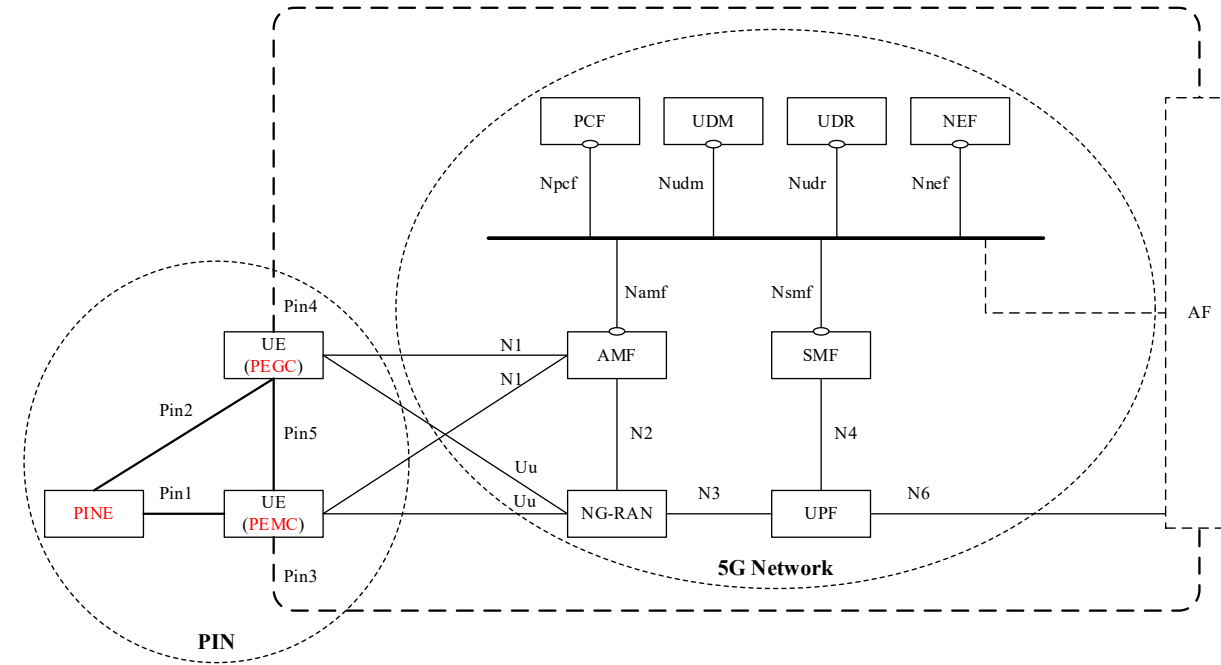
- Traffic Steering Policy and SFC Enhancements
  - Support for SFC in 5GS applies to non-roaming and Home-Routed roaming scenarios where the Application Function (AF) has an agreement with the HPLMN.
  - An AF may request steering of user-plane traffic to a pre-configured chain of service functions on 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.

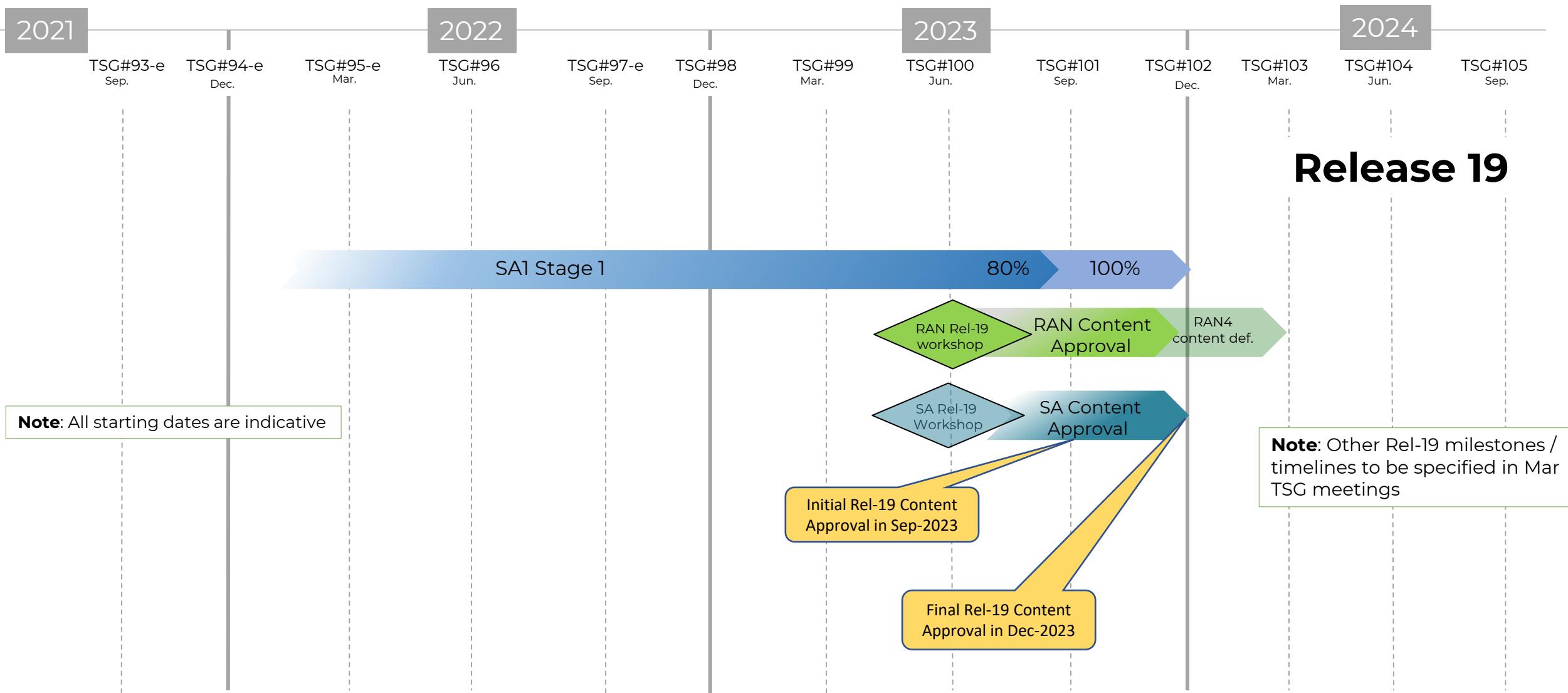


- **PIN**: Personal IoT Network
- **PEGC**: PIN Element with Gateway Capability
- **PEMC**: PIN Element with Management Capability
- **PINE**: PIN Element

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