글로벌 ICT 표준 컨퍼런스 2023

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Exploring 3GPP Standardization

3GPP RAN Status and Overview

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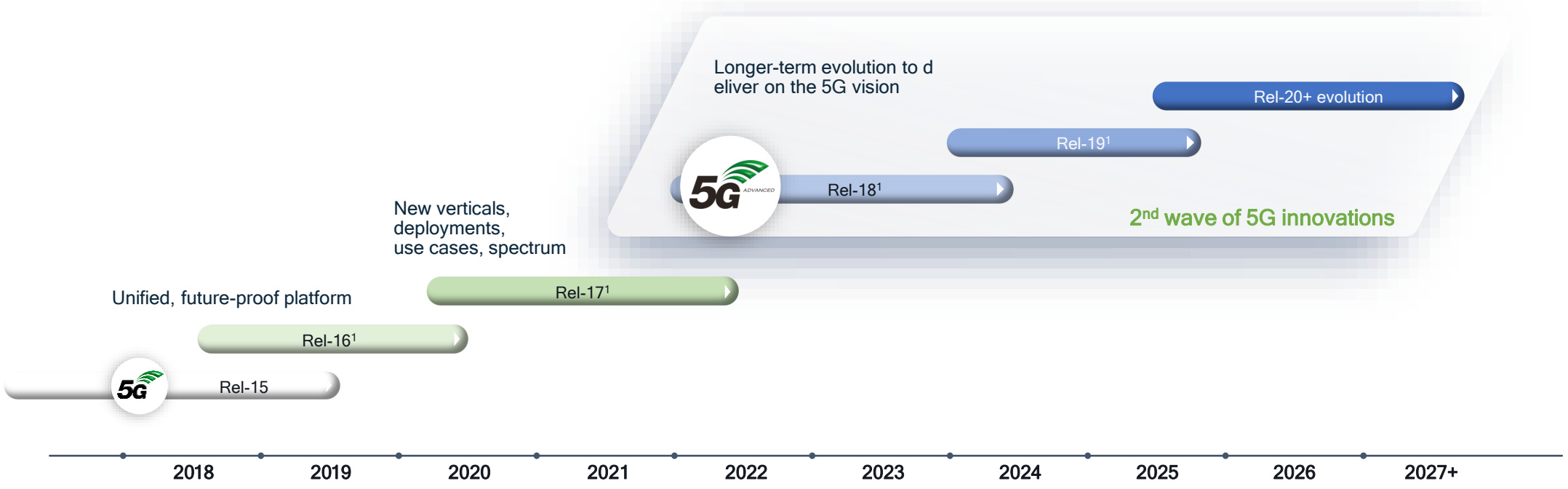
Outline

- 3GPP RAN: Current Status
- How will 5G evolve in the next decade?
  - RAN Rel-19 preparation
  - 6G in 3GPP?

5G vs. 5G-Advanced in 3GPP



Rel-15 eMBB focus

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

Rel-16 industry expansion

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

Rel-17 continued expansion

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

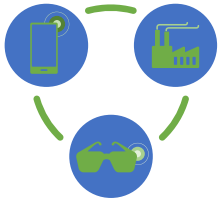
Rel-18+ 5G-Advanced

- 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

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

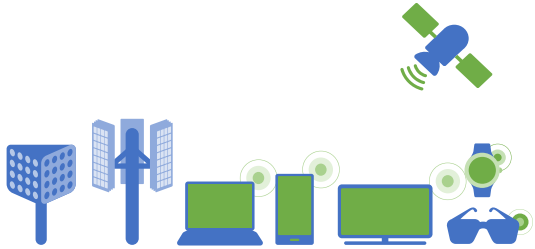
RAN Release 18: Driving a balanced 5G evolution across key technology areas

Mobile broadband evolution vs. further vertical expansion



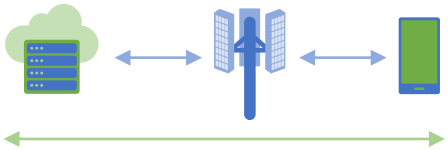
Deliver enhanced mobile broadband experiences and extend 5G's reach into new use cases

Immediate commercial needs vs. l onger-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)

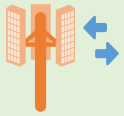
Release 18

3GPP Release 18 sets off the 5G Advanced Evolution

The package has a wide range of projects —

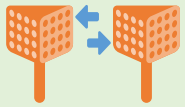
nominal work started in Q2 2022

Strengthen the end-to-end 5G system foundation



Advanced DL/UL MIMO

Enhanced mobility



Mobile IAB, smart repeater

Evolved duplexing

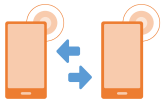
AI/ML data-driven designs

Green networks

Proliferate 5G to virtually all devices and use cases

Boundless extended reality

NR-Light (RedCap) evolution



Expanded sidelink

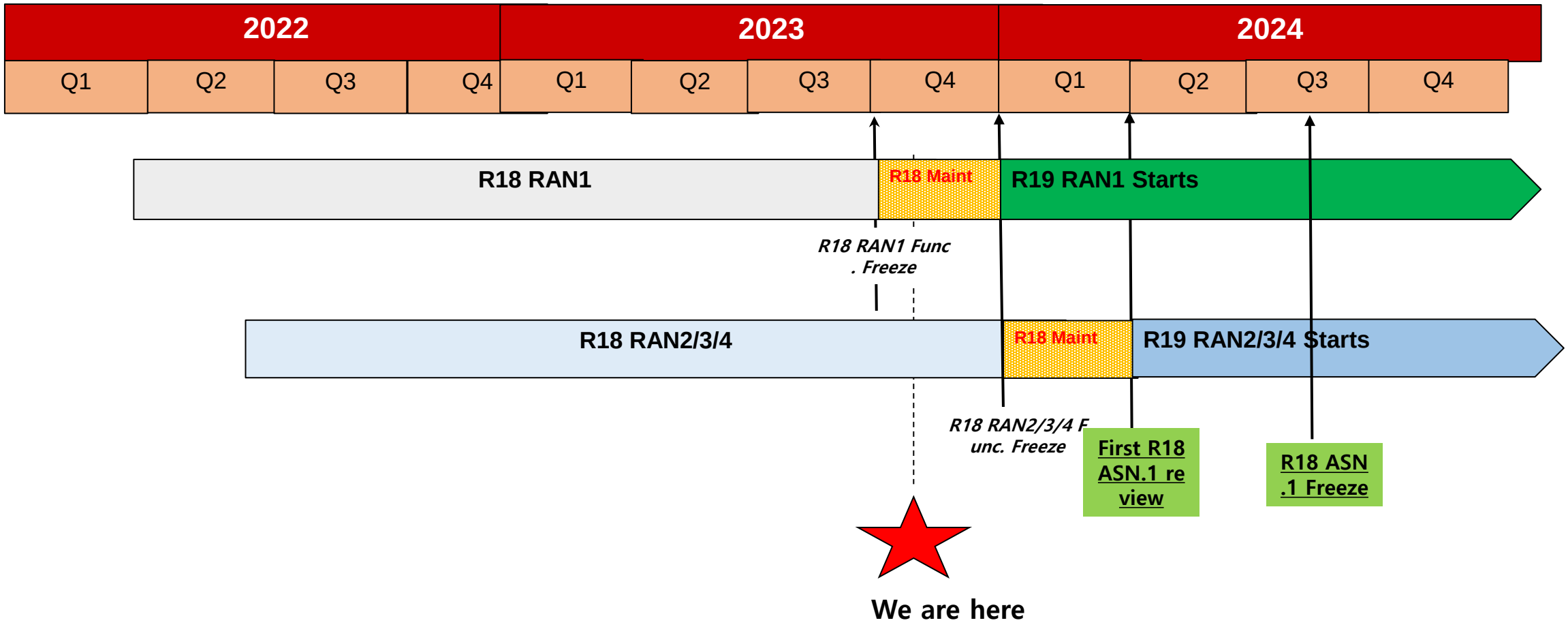
Expanded positioning

Drones & expanded satellites comm.

Multicast & other enhancements

5

3GPP RAN Rel-18 Timeline



How will 5G evolve in the next decade?

Rel-19: Continue Driving 5G Commercialization and a Bridge to 6G

(refer to RWS-230488)

- The **package of Release 19 projects** is to be approved in **December'2023,** targeting an **18-month** duration for the release
- As a continuation of 5G-Advanced, Release 19 will primarily focus on continuing investing in **5G-Advanced commercial deployments** to further improve performance and address critical needs
  - Continuing balanced evolutions between
    - Mobile broadband evolution vs. further vertical domain expansion, immediate vs. longer term commercial needs, and device evolution vs. network evolution
  - Increasingly more critical to address for real and urgent commercial deployment needs
- Release 19 can also serve as **a bridge to 6G**
  - Strong interest to initiate some studies, e.g., channel modeling for new spectrum such as 7-24GHz, integrated communications and sensing (ISAC), etc.

Categorization of topics based on Rel-19 Workshop contributions

(source: RWS-230488 slide 7)

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

Additional RAN1-led Candidate Topics

- LP-WUS/WUR
- Multi-carrier Enhancements
- Coverage Enhancements
- Positioning Enhancements
- SL Evolution

Additional RAN2-led Candidate Topics

- NCR
- SL Relay Enhancements
- UAV/UAM
- MU-SIM
- Broadcast/multicast
- UE aggregation, collaboration, and backup

Additional RAN3-led Candidate Topics

- Topological enhancements
  - IAB/WAB/Femto
  - E.g.., for public safety/emergency services
- QoE

Others

- Lean protocol stack/High speed packetization/Layer 2 UP enhancements
- RAN architectural enhancements/AS Security Enhancements
- Network/Outer coding
- RedCap Enh./High reliability and low complexity IoT
  - Combination w/ SL or NTN can be discussed in the SL/NTN topics, respectively)
- TaaS (Timing as a service)/High Accuracy Timing Service
- SDT enhancements
- LTE enhancements
- Dynamic UE capability update
- Others (e.g.,, Idle/Inactive enhancements, RAN slicing enhancements, etc.)

List of Potential RAN1-led Items for Subsequent Discussion till RAN#102

(Source RP-231540)

Index	Title	First-order TU Estimate (# TUs)
1	AI (Artificial Intelligence)/ML (Machine Learning) for Air interface	[4]
2	MIMO Evolution	[1-2]
3	Duplex Evolution	[2-3]
4	Ambient IoT*	[3-4]
5	Network energy savings	[2]
6	LP-WUS/WUR	[1-2]
7	ISAC & Exploring study in new spectrum (7-24 GHz) **	[2]

* Further discussion SI only or SI → WI

** May start as a RAN-level study item first. For the new spectrum, focusing on channel modeling only. For ISAC, further discuss channel modeling only or additionally techniques

- ~10% RAN1 capacity (~27TUs) is planned to be reserved
- ~1TU (in the 2nd half Rel-19) is planned to be reserved for TEI purpose
- With [2-3] TUs left, RAN1 may have room up to 2 RAN1-led **small** projects

Total: [17]

Cross-WG/TSG impact: 3-4 TUs

~4 TUs reserved

[2-3] TUs left

List of Potential RAN2-led Items for Subsequent Discussion till RAN#102

(Source RP-231540)

Index	Title	First-order TU Estimate (# TUs)
1	Mobility Enhancements	[2]
2	Enhancements for XR	[2]
3	NTN (Non-Terrestrial Networks) evolution for NR	[2]
4	NTN (Non-Terrestrial Networks) evolution for IoT	[1]
5	AI/ML for Air interface SI (Mobility)	[2]
	[RAN1-led] Ambient IoT	*[2]*
	[RAN1-led] AI/ML for Air interface	*[2]*

- ~10% RAN2 capacity (~40TUs) is planned to be reserved
- Additionally, 13 TUs are reserved in RAN2 for maintenance, LSs, overflows, etc.
- ~1TU (in the 2nd half Rel-19) is planned to be reserved for TEI purpose
- With [3] TUs left, RAN2 may have room up to 3 RAN2-led **small** projects

Total: [13]

Cross-WG/TSG impact: [7] TUs

** Besides A-IoT & RAN1-led AI/ML*

~17 TUs reserved

[3] TUs left

List of Potential RAN3-led Items for Subsequent Discussion till RAN#102

(Source RP-231540)

Index	Title	First-order TU Estimate (# TUs)
1	AI/ML for NG-RAN	[2]
2	SON/MDT Enhancements	[1-2]
3	Additional Topological Enhancements	[1-2]
	[RAN1-led] Ambient IoT	*[2]*

- ~10% RAN3 capacity (12 TUs) is planned to be reserved
- With [0-1] TU left, RAN3 may not have room for additional RAN3-led projects

Total: [7]

Cross-WG/TSG impact: [3-4] TUs

* *Besides A-IoT*

~[1] TU reserved

~[0-1] TU left

6G in 3GPP?

- 3GPP is expected to develop an input to the IMT-2030 process
- The timeline for 6G in 3GPP is to be decided through the usual contribution-driven and consensus-based process, e.g.,
  - When should be the 1st 6G workshop?
  - Should 6G workshop be ahead of any RAN-level study (requirements/channel modeling)?
  - When should the first 6G release be completed?
  - Should we target one or two releases for ITU submission in 2030?
- First (very brief) 6G timeline discussion in 3GPP occurred in RAN#101 (September '2023). More discussion including possible decisions is expected in RAN#102 (December'2023) and thereafter

Thank you

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