



An Introduction to 3GPP TSG RAN and the Road to 6G

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Outline of Presentation

-  An introduction on 3GPP
-  The road to 6G radio
-  The latest outcome on 6G from this week in Singapore

What is 3GPP?

- The 3rd Generation Partnership Project (3GPP) is a global consortium of seven telecommunications standards development organizations that creates technical specifications for mobile networks



Japan



North America



China



Europe



India



Korea



Japan

- Established in 1998, it is currently participated by ~800 member companies/ organizations
- It's estimated that 35~40 billion devices with 3GPP technology have been shipped globally

Why was 3GPP Created?

- 2G which debuted in the early 1990s marked the industry's monumental transition from analog to digital communications – but without a unified global standard



Europe, Asia, Africa



North America, Korea



North America



Japan

- 3GPP was established in December 1998 by major telecommunications standards organizations to create global technical specifications for 3G mobile systems.



Japan



North America



China



Europe



India

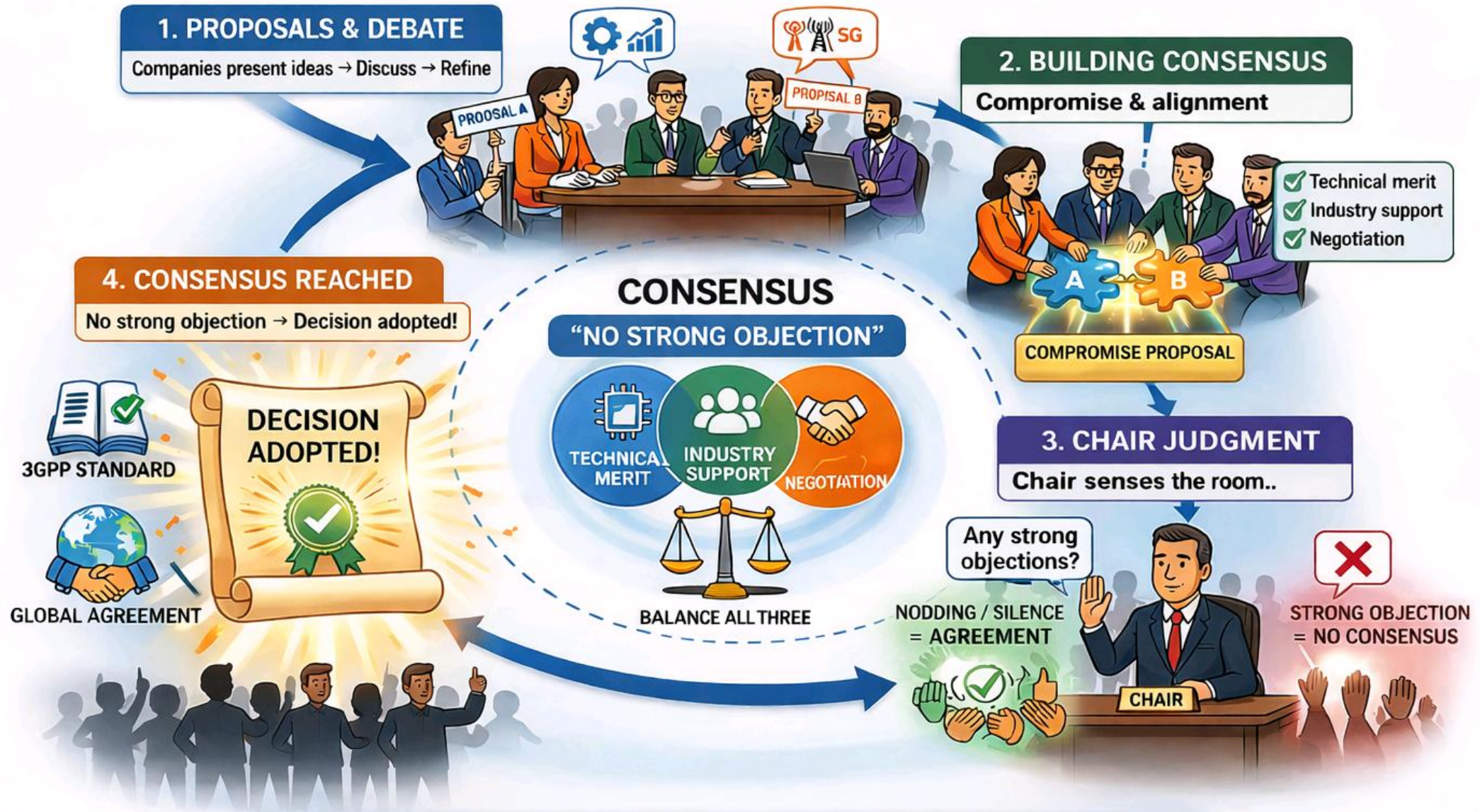


Korea



Japan

3GPP is a Consensus Driven Organization



3GPP – Outside Perception

- 3GPP is where the best talents in the industry converge to architect the future of wireless communications and push the limits of what is possible



Reality of 3GPP RAN



3GPP Organization Structure – TSGs

- 📶 The Technical Specification Groups (TSGs) prepare, approve and maintain the 3GPP Technical Specifications and Technical Reports

TSG RAN
Radio Access Network

Responsible for the air interface and the radio related protocols that allow a mobile device (UE) to communicate with a base station

TSG SA
Service & System
Aspects

Responsible for defining the end-to-end service capabilities and the overall system architecture that ensures the network functions as a cohesive unit

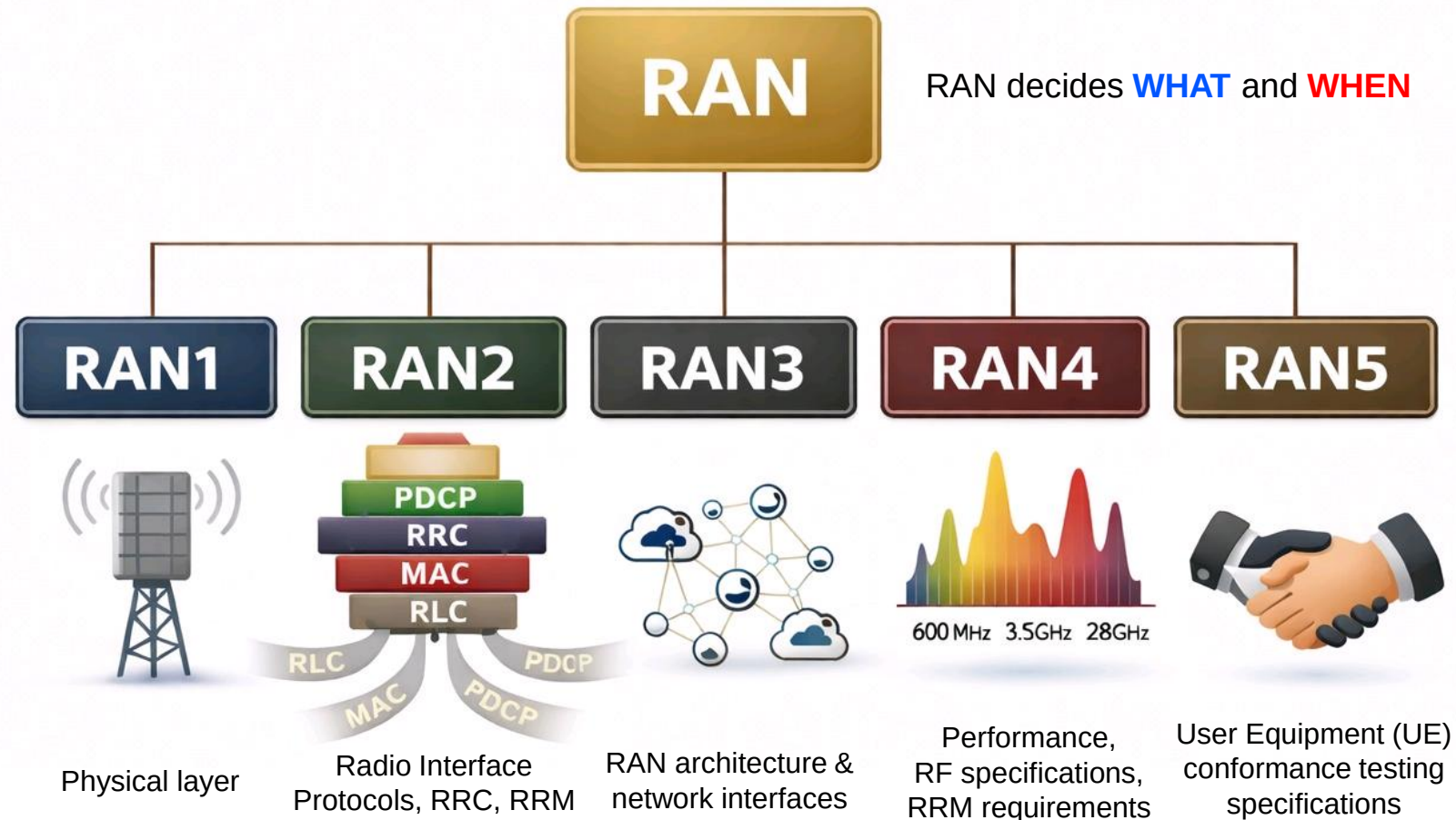
TSG CT
Core Network &
Terminals

Responsible for the actual protocols, signaling, and data formats that allow the mobile device to talk to the core network

TSG RAN Working Groups

- Each TSG is parent to a set of WGs (total of 16 WGs across 3 TSGs)
 - Each WG has its field of expertise and submit their technical work to parent TSG for official approval

WGs decide **HOW** according to the scope and schedule defined by RAN



Evolution of 3GPP Radio Technologies

Dawn of mobile data

- Web browsing, video calls
- Circuit+Packet switched
- Turbo/convolutional codes, CDMA

The smartphone app engine

- High speed broadband
- All-IP (packet)
- OFDMA, MIMO, ...

Beyond the smartphone

- IoT, industrial, AR/VR, ...
- Network slicing
- Massive MIMO, LDPC/Polar codes

6G Radio (under study)

- ISAC, digital twin, ...
- AI-native design
- Sustainability by design



6G Radio – RAN Timeline



6G Radio in RAN is developed in 3 steps:

- RAN-level study on 6G Scenarios and Requirements (**Work completed this week!**)
- WG-level study on 6G Radio – Kicked off in June 2025 and to be completed in June 2027
- Normative work (work item phase) – From March 2027 until Dec 2028 (**Schedule agreed this week!**)

2024				2025				2026				2027				2028				2029			
103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120	121	122	123	124	125	126

Decision on
timeline for 6G study



6G Workshop



Decision on timeline
for 6G normative work



Approval of
6G work item



6G specs ready!



6G RAN-level Study

6G RAN Working Group Study

6G Work Item

6G Radio – Performance



Peak data rate

Downlink: 36 Gbps
Uplink: 18 Gbps
(for 600MHz aggregated BW)

Wider BW:
Downlink Max 400 MHz
Uplink Max 200 MHz



Spectral efficiency

Downlink: 23.4 bps/Hz
Uplink: 16.2 bps/Hz
(for dense urban scenario)



Coverage

Aim to reuse 5G site grid
for 6G (5G @3.5GHz, 6G @7GHz)



Mobility

High speed vehicular
(120km/h~500km/h)

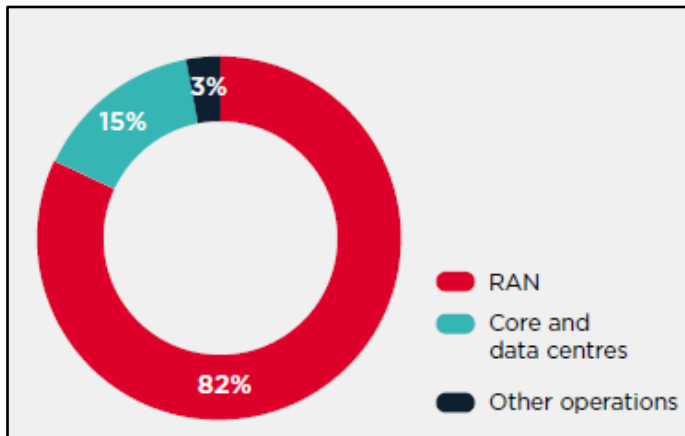
Some sample KPIs from TR38.914 (RP-261565)

6G Radio – Energy Efficiency

- 📶 According to GSMA Intelligence, RAN accounts for 82% of an operator's energy use [1]
- Remaining 18% comes from data centers and other operations such as offices, retail activities

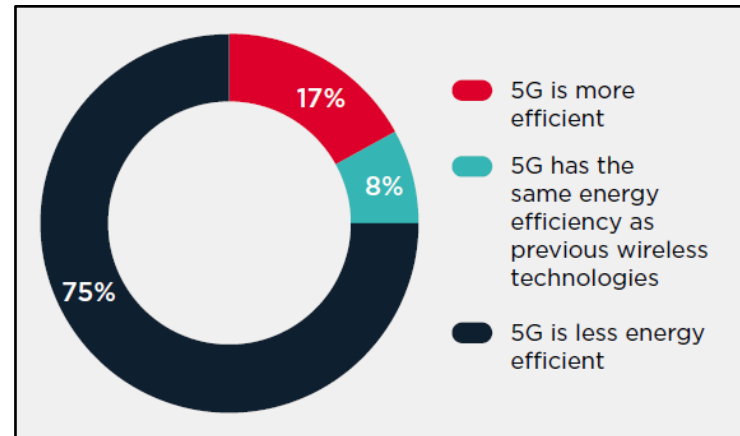
[1] GSMA Intelligence, Going green: Measuring the energy efficiency of mobile networks

Mobile operator energy use

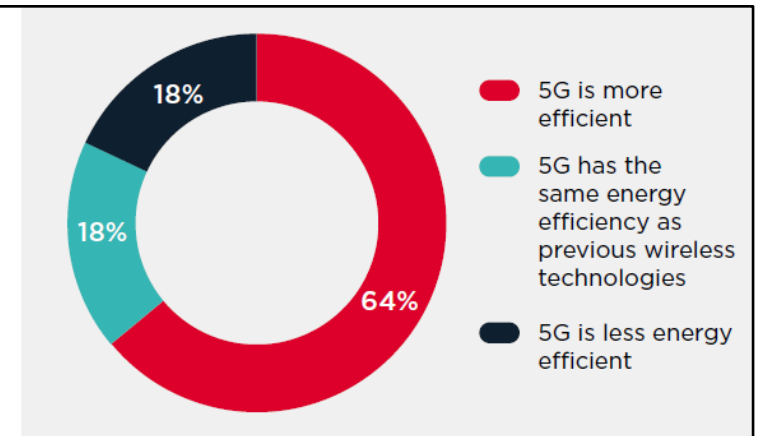


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5G's energy efficiency in the **short** run



5G's energy efficiency in the **long** run



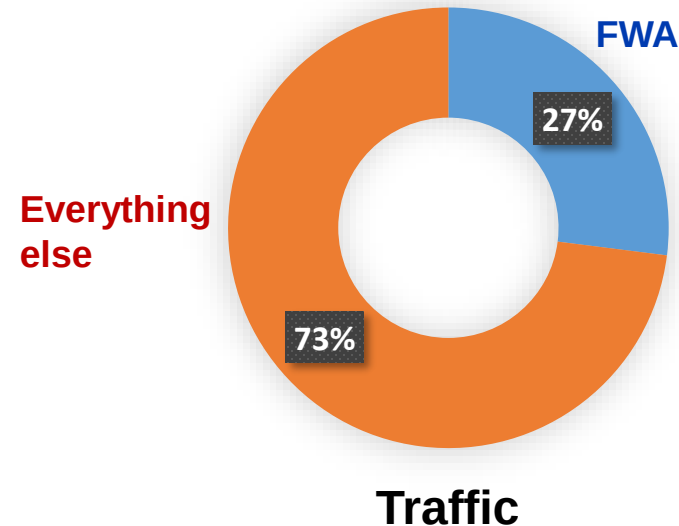
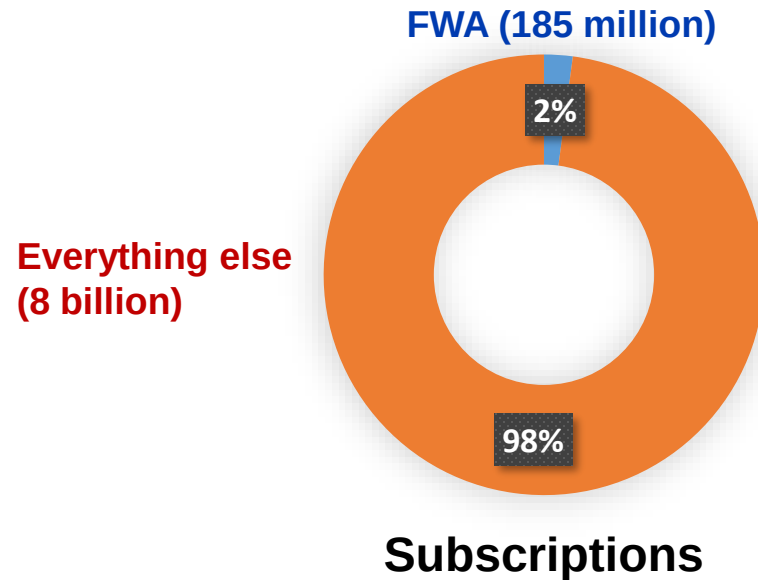
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6G Radio – Fixed Wireless Access (FWA)

- 🌿 As of late 2024, 494 operators in 176 countries/territories had launched FWA services using LTE or 5G technologies [1]
- 🌿 By end of 2025, FWA data traffic is set to represent 27% of global mobile data traffic [2]
- 🌿 A single FWA CPE consumes 10~20 times more traffic than a smartphone

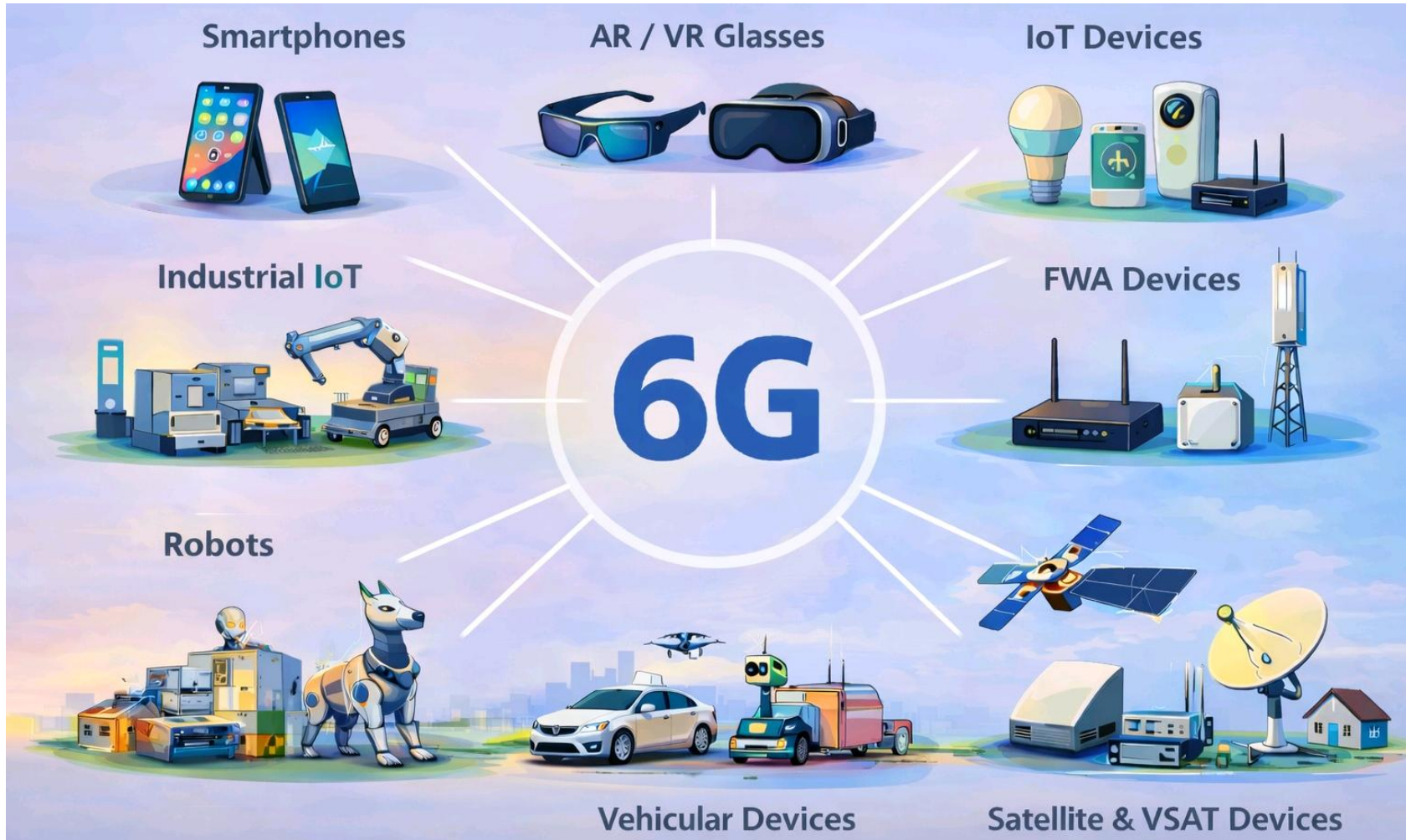
[1] Trends in FWA, GSA 4G-5G FWA Forum

[2] Ericsson Mobility Report November 2025

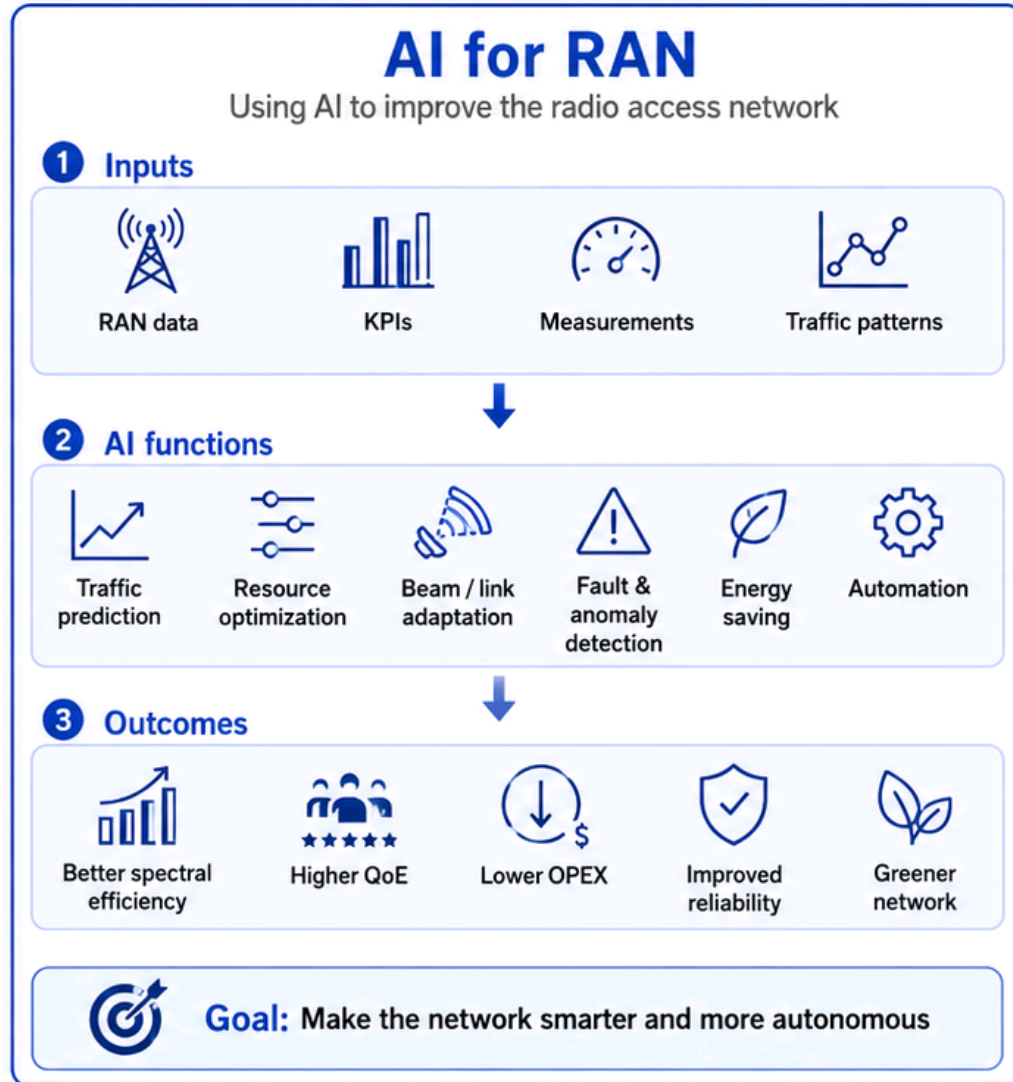


6G Radio – Device Types

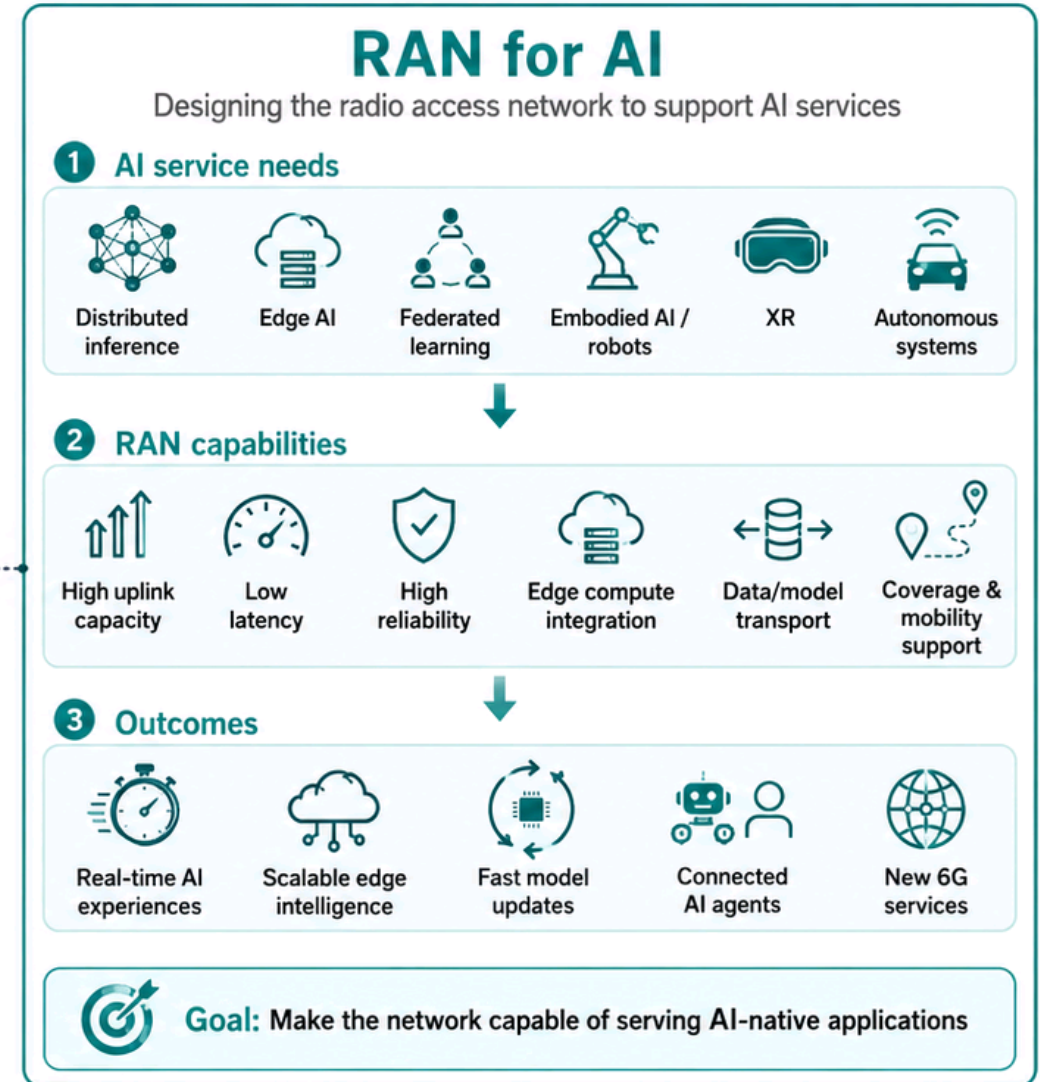
🌿 It's no longer just about smartphones – diverse device types with unique requirements



6G Radio – Artificial Intelligence



Complementary perspectives



What Happened in This Week in RAN (1/2)

Two critical aspects of 6G were handled in RAN#112

- Rel-21 timeline (schedule first set of 6G specifications) – Endorsed in RAN#103 (Mar 2024)

Rel-21 timeline is to be decided no later than June 2026

- Rel-20 6G study check point – Approved as part of 6G study item document (June 2025)

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.**

What Happened in This Week in RAN (2/2)

- 📶 For channel coding, RAN agreed on the support of LDPC BG3 (base graph 3) along with the applicability conditions
- 📶 For modulation, RAN agreed to continue the study on geometric and probabilistic shaping for another quarter to finalize the support of constellation shaping for 6G
- 📶 For higher layer split, RAN agreed the following
 - 6G RAN Architecture shall support HLS Architecture to enable smooth migration from 5G to 6G Split Architecture
 - 6G HLS shall support both CU-DU, CU-CP & CU-UP separation and standardized open interfaces to support inter-operability
 - RAN tasks RAN3 to make decision on 6G HLS by Q3/26: Whether to support 5G HLS for 6G or introduce optimizations for HLS

Thank You!