

Technology trends and Scenarios for Systems beyond IMT-2020

Initial views

Agenda

- IMT evolution (1G -> 6G)
- 6G Timeline
- Vision related developments
- Future technology trends



Our presenters

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1G->6G: Each generation enriches the experience

1G (1984)
Analog Voice



2G (1996)
Digital Voice, Text, E-mail



3G (2004)
Multimedia (Video Communication)



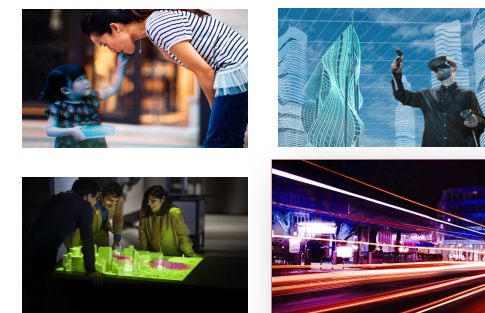
4G (2011)
True Wireless Internet (Internet Phone)



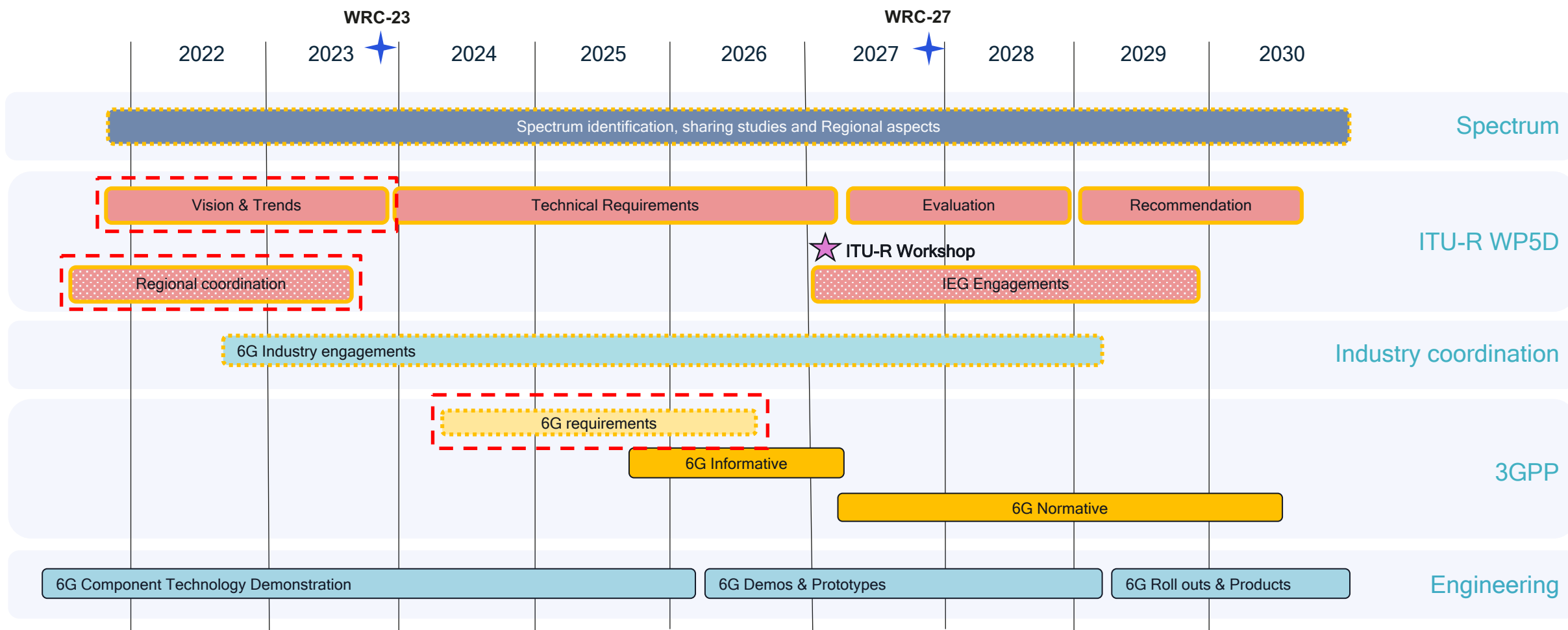
5G (2019)
High-speed eMBB & Vertical Services



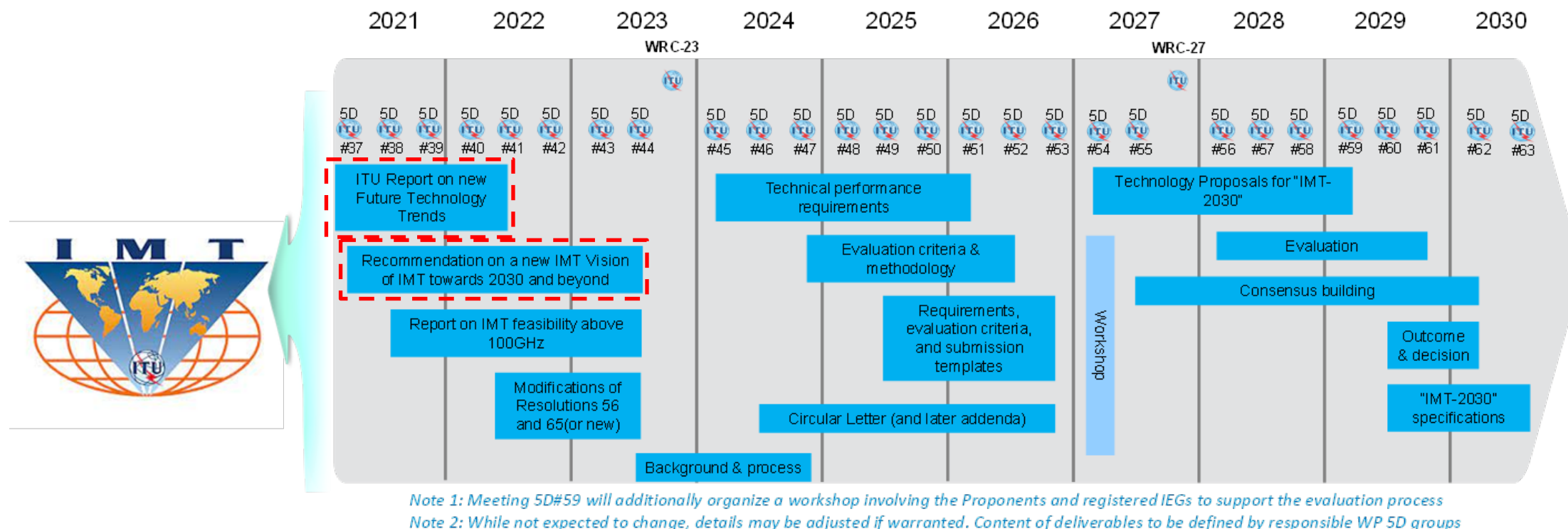
6G (from around 2030 onwards)
Extreme connectivity & immersive augmented experience



6G Activities / Tasks (indicative)



WP 5D timeline for IMT towards 2030 and beyond



There will be closer collaboration between ITU-R and external organizations for the development of IMT towards 2030 and beyond



Standard artefacts from ITU-R WP5D

- **ITU Reports from IMT-2020**

- M.2320: Future technology trends of terrestrial IMT systems
- M.2083 - Framework and overall objectives of the future development of IMT for 2020 and beyond
- M.2376 - Technical feasibility of IMT in bands above 6 GHz
- M.2410: Minimum requirements related to technical performance
- M.2411 and M.2412: Evaluation aspects

- **ITU Reports for IMT towards 2030 and beyond**

- FTT: Future technology trends of terrestrial IMT systems (DNR)
- Vision: Framework and overall objectives of the future development of IMT for 2020 and beyond
- >100GHz: Technical feasibility of IMT in bands above 100 GHz
- TPR: Minimum requirements related to technical performance (Phase 2)
- Eval: Evaluation aspects

Vision

Start	Mar '21 (37e)
PDNR	Feb '23 (43)
DNR	Jun '23 (44)

Framework and overall objectives of the future development of IMT for 2030 and beyond [Recommendation]

- Describes the framework of the development of IMT for 2030 and beyond, including a broad variety of capabilities associated with envisaged usage scenarios
- Addresses the objectives for the development of IMT for 2030 and beyond, which includes further enhancement and evolution of existing IMT and the development of IMT-[2030]

Covers,

- Trends of IMT for 2030 and beyond
- Evolution and role of IMT
- Usage scenarios of IMT for 2030 and beyond
- Capabilities of IMT for 2030 and beyond

WP5D Discussions on Vision

- Working document of Vision Rec. remains work in progress.
 - User and application trends
 - 11 User and application trends currently identified
 - Usage scenario
 - 6 usage scenarios under consideration
 - Capability
 - 16 capabilities identified
 - Few more in consideration.

Usage Scenarios

- A. Immersive / MBB Communication
- B. Extreme [Critical] Communications
- C. Massive / Ubiquitous MTC
- D. Global mobile connectivity
- E. [Network for AI or AI for communication]
- F. Integrated Communication & Sensing

2.2. User and application trends

- 2.2.1 AI Everywhere
- 2.2.2 Smart industry
- 2.2.3 Immersive multimedia and multi-sensory communication
- 2.2.4 Digital twin and extended world
- 2.2.5 Seamless and ubiquitous coverage
- 2.2.6 E-health and well being
- 2.2.7 Sensing
- 2.2.8 Pervasive IoT [Editor's note: may be merged with other trends.]
- 2.2.9 Communication and computing convergence
[Editor's note: agreed to be merged with Section 2.1.1.]
- 2.2.10 Native trustworthiness
[Editor's note: The term "critical" needs to be revised and explained.]
- 2.2.11 Sustainability
[Editor's note: The description should be developed to cover UN's SDGs. Further consideration to "digital divide" is needed.]
- [2.2.x Autonomous and trustworthy service
[Editor's note: will be merged with Section 2.1.1]]

11 capabilities with tentatively agreed descriptions

- 1) Peak data rate
- 2) User experienced data rate
- 3) Spectrum efficiency
- 4) Area traffic capacity
- 5) Connection Density
- 6) Mobility
- 7) Latency
- 8) Reliability
- 9) [Coverage] - Divergent views
- 10) Positioning
- 11) Sensing[related] capabilities

5 capabilities with not agreed descriptions

- 12) AI[-related] capabilities
- 13) [Availability/scalability] - considered to be merged with trustworthiness
- 14) Trustworthiness
- 15) Sustainability (including energy efficiency)
- 16) [Device lifetime/power related] – Div. views

Others which need to be considered in #42

- Mobility - proposed to handle Others in TPR
- Jitter - may go beyond radio network
- Spectrum and Bandwidth
- Sidelink

Technology Trends

Start Feb '20 (34)
PDNR Feb '22 (40)
DNR Jun '22 (41)

Future Technology Trends of Terrestrial IMT Systems towards 2030 and Beyond [Report]

- This Report provides a broad view of future technical aspects of terrestrial IMT systems considering the time frame up to 2030 and beyond, characterized with respect to key emerging services, applications trends, and relevant driving factors. Technologies described in this Report are collections of potential technology enablers which may be applied in the future.
- It comprises a toolbox of technological enablers for terrestrial IMT systems, including the evolution of IMT through advances in technology and their deployment. This Report does not preclude the adoption of any other existing technologies and emerging technologies expected in the future.

Covers,

- Overview of emerging services and applications
- Emerging technology trends and enablers
- Technologies to enhance the radio interface
- Technology enablers to enhance the radio network

Future Technology Trends of Terrestrial IMT Systems towards 2030 and Beyond

Emerging technology trends and enablers

- Technologies for AI-native communications
- Technologies for integrated sensing and communication
- Technologies to support convergence of communication and computing architecture
- Technologies for device-to-device communications
- Technologies to efficiently utilize spectrum
- Technologies to enhance energy efficiency and low power consumption
- Technologies to natively support real-time services/communications
- Technologies to enhance trustworthiness

Technologies to enhance the radio interface

- Advanced modulation, coding and multiple access schemes
- Advanced antenna technologies
- In-band full duplex communications
- Multiple physical dimension transmission
- THz communications
- Technologies to support ultra-high accuracy positioning

- RAN privacy
- Quantum technology with respect to the RAN
- Physical-layer security technologies

Technology enablers to enhance the radio network

- RAN slicing
- Technologies to support resilient and soft networks for guaranteed QoS
- New RAN architecture
- Technologies to support digital twin network
- Technologies for interconnection with non-terrestrial networks
- Support for ultra-dense radio network deployments
- Technologies to enhance RAN infrastructure sharing

Thank you!