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| **Radiocommunication Study Groups** |  |
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| Working Party 5D |
| IMT-2030 BACKGROUND |

# 1 Evolution of IMT

Following the adoption by International Radio Consultative Committee (CCIR) of the Study Question on the Future Public Land Mobile Telecommunication Systems (FPLMTS) in 1985, and the identification of the radio spectrum in 1992, it took eight years for the development of International Mobile Telecommunications-2000 (IMT-2000) specifications (Recommendation [ITU‑R M.1457](https://www.itu.int/rec/R-REC-M.1457/en)).

In 2000 the ITU started developing the Vision Recommendation for IMT-Advanced, and published it as Recommendation [ITU-R M.1645](https://www.itu.int/rec/R-REC-M.1645/en) in June 2003. Thereafter, it took nine years for the development of the IMT-Advanced specifications (Recommendation ITU-R M.2012, January 2012).

From July 2012, the ITU started the development of the Vision Recommendation for IMT-2020 and published it as Recommendation [ITU‑R M.2083](https://www.itu.int/rec/R-REC-M.2083/en) in September 2015 containing the framework and overall objectives of the future development of IMT for 2020 and beyond. Based on this Recommendation, the ITU released the Recommendation [ITU-R M.2150](https://www.itu.int/rec/R-REC-M.2150/en) of the terrestrial radio interface of IMT-2020 in 2021, which took six years after the completion of the Vision Recommendation.

To meet the ever-increasing demand for wireless communications, IMT has been, and continues to be, enhanced. Towards this, from February 2021, the ITU started the development of ITU-R Framework Recommendation for IMT-2030 which was approved by the Radio Assembly 2023 and published as Recommendation [ITU‑R M.2160](https://www.itu.int/rec/R-REC-M.2160/en) - Framework and overall objectives of the future development of IMT for 2030 and beyond. Based on this Recommendation, the ITU has started the process of the development of IMT-2030. The IMT-2030 terrestrial radio interface specification is expected to be completed in 2030.

# 2 User demands

The motivation for the development of IMT-2030 is to continue to build an inclusive information society towards contributing to support the UN’s sustainable development goals (SDGs). Applications and services enabled by IMT-2030 are expected to connect humans, machines and various other things together. In addition, technological advancement and the corresponding user needs would promote innovation and accelerate the delivery of advanced communication applications to consumers. Recommendation [ITU-R M.2160](https://www.itu.int/rec/R-REC-M.2160/en) “Framework and overall objectives of the future development of IMT for 2030 and beyond” describes these motivation and societal considerations, potential user and application trends, technology trends, spectrum harmonisation and envisaged frequency bands. Also Report [ITU-R M.2516](https://www.itu.int/pub/R-REP-M.2516) “Future technology trends of terrestrial IMT systems towards 2030 and beyond” and Report [ITU-R M.2541](https://www.itu.int/pub/R-REP-M.2541) “Technical feasibility of IMT in bands above 100 GHz” details these expected trends and phenomena for IMT-2030.

In order to fulfil these varied demands, Usage scenarios of IMT-2030 are envisaged to expand on those of IMT-2020 (i.e., eMBB, URLLC, and mMTC introduced in Recommendation [ITU-R M.2083](https://www.itu.int/rec/R-REC-M.2083/en)) into broader use requiring evolved and new capabilities. In addition to expanded IMT‑2020 usage scenarios, IMT-2030 is envisaged to enable new usage scenarios arising from capabilities, such as artificial intelligence and sensing, which previous generations of IMT were not designed to support. Figure 1 illustrates the usage scenarios for IMT-2030.

Figure 1

Usage scenarios and overarching aspects of IMT-2030



# 3 Capabilities of IMT-2030

IMT-2030 is expected to provide enhanced capabilities compared to those described for IMT-2020 in Recommendation [ITU-R M.2083](https://www.itu.int/rec/R-REC-M.2083/en), as well as new capabilities to support the expanded usage scenarios of IMT-2030. In addition, each capability could have different relevance and applicability in the different usage scenarios.

The range of values given for capabilities are estimated targets for research and investigation of IMT-2030. All values in the range have equal priority in research and investigation. For each usage scenario, a single or multiple values within the range would be developed in future in other ITU-R Recommendations/Reports. These values may further depend on certain parameters and assumptions including, but not limited to, frequency range, bandwidth, and deployment scenario. Further these values for the capabilities apply only to some of the usage scenarios and may not be reached simultaneously in a specific usage scenario.

The capabilities of IMT-2030 include:

1) Peak data rate

Maximum achievable data rate under ideal conditions per device.

The research target of peak data rate would be greater than that of IMT-2020. Values of 50, 100, 200 Gbit/s are given as possible examples applicable for specific scenarios, while other values may also be considered.

2) User experienced data rate

Achievable data rate that is available ubiquitously[[1]](#footnote-1) across the coverage area to a mobile device.

The research target of user experienced data rate would be greater than that of IMT-2020. Values of 300 Mbit/s and 500 Mbit/s are given as possible examples, while other values greater than these examples may also be explored and considered accordingly.

3) Spectrum efficiency

Spectrum efficiency refers to average data throughput per unit of spectrum resource and per cell[[2]](#footnote-2).

The research target of spectrum efficiency would be greater than that of IMT-2020. Values of 1.5 and 3 times greater than that of IMT-2020 could be a possible example, while other values greater than these examples may also be explored and considered accordingly.

4) Area traffic capacity

Total traffic throughput served per geographic area.

The research target of area traffic capacity would be greater than that of IMT-2020. Values of 30 Mbit/s/m2 and 50 Mbit/s/m2 are given as possible examples, while other values greater than these examples may also be explored and considered accordingly.

5) Connection Density

Total number of connected and/or accessible devices per unit area.

The research target of connection density could be 106 – 108 devices/km2.

6) Mobility

Maximum speed, at which a defined QoS and seamless transfer between radio nodes which may belong to different layers and/or radio access technologies (multi-layer/multi-RAT) can be achieved.

The research target of mobility could be 500 – 1 000 km/h.

7) Latency

Latency over the air interface refers to the contribution by the radio network to the time from when the source sends a packet of a certain size to when the destination receives it.

The research target of latency (over the air interface) could be 0.1 – 1 ms.

8) Reliability

Reliability over the air interface relates to the capability of transmitting successfully a predefined amount of data within a predetermined time duration with a given probability.

The research target of reliability (over the air interface) could range from 1-10−5 to 1-10−7.

9) Coverage

Coverage refers to the ability to provide access to communication services for users in a desired service area. In the context of this capability, coverage is defined as the cell edge distance of a single cell through link budget analysis.

10) Positioning

Positioning is the ability to calculate the approximate position of connected devices. Positioning accuracy is defined as the difference between the calculated horizontal/vertical position and the actual horizontal/vertical position of a device.

The research target of the positioning accuracy could be 1 – 10 cm.

11)  Sensing-related capabilities

Sensing-related capabilities refer to the ability to provide functionalities in the radio interface including range/velocity/angle estimation, object detection, localization, imaging, mapping, etc. These capabilities could be measured in terms of accuracy, resolution, detection rate, false alarm rate, etc.

12) Applicable AI-related capabilities

Applicable AI-related capabilities refer to the ability to provide certain functionalities throughout IMT-2030 to support AI enabled applications. These functionalities include, distributed data processing, distributed learning, AI computing, AI model execution, and AI model inference, etc.

13) Security and resilience

In the context of IMT-2030:

− Security refers to preservation of confidentiality, integrity, and availability of information, such as user data and signalling, and protection of networks, devices and systems against cyberattacks such as hacking, distributed denial of service, man in the middle attacks, etc.

− Resilience refers to capabilities of the networks and systems to continue operating correctly during and after a natural or man-made disturbance, such as the loss of primary source of power, etc.

14) Sustainability

Sustainability, or more specifically environmental sustainability, refers to the ability of both the network and devices to minimize greenhouse gas emissions and other environmental impacts throughout their life cycle. Important factors include improving energy efficiency, minimizing energy consumption and the use of resources, for example by optimizing for equipment longevity, repair, reuse and recycling.

Energy efficiency is a quantifiable metric of sustainability. It refers to the quantity of information bits transmitted or received, per unit of energy consumption (in bit/Joule). Energy efficiency is expected to be improved appropriately with the capacity increase in order to minimize overall power consumption.

15) Interoperability

Interoperability refers to the radio interface being based on member-inclusivity and transparency, so as to enable functionality(ies) between different entities of the system.

The capabilities of IMT-2030 are shown in Figure 2.

FIGURE 2

Capabilities of IMT-2030



# 4 Relationship between existing IMT and IMT-2030

In order to support emerging usage scenarios and applications for 2030 and beyond, it is foreseen that development of IMT-2030 would be required to offer enhanced capabilities as described in § 3. The values of these capabilities go beyond those described in Recommendation [ITU-R M.2083](https://www.itu.int/rec/R-REC-M.2083/en). The minimum technical requirements (and corresponding evaluation criteria) are to be defined by ITU‑R based on these capabilities for IMT-2030. They could potentially be met by adding enhancements to existing IMT, incorporating new technology components and functionalities, and/or the development of new radio interface technologies. Furthermore, IMT-2030 is envisaged to interwork with existing IMT.

# 5 Framework of IMT-2030

The framework and objectives including overall timeframes for the future development of IMT for 2030 and beyond are described in some detail in Recommendation [ITU-R M.2160](https://www.itu.int/rec/R-REC-M.2160/en).

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1. The term “ubiquitous” is related to the considered target coverage area and is not intended to relate to an entire region or country. [↑](#footnote-ref-1)
2. The coverage area over which a mobile terminal can maintain a connection with one or more units of radio equipment located within that area. For an individual base station, this is the coverage area of the base station or of a subsystem (e.g., sector antenna). [↑](#footnote-ref-2)