1. Question: What does IMT stand for?

IMT stands for "International Mobile Telecommunications'.

Since 1990, the ITU's **"International Mobile Telecommunications" (IMT)** standards (or 'ITU-R Recommendations on IMT') have shaped the way mobile communication services develop worldwide. This is a generic term to designate broadband mobile systems worldwide. ITU membership lead the studies to identify the spectrum allocations and verify the possibility of its harmonization to produce standards for the implementation of IMT technologies (3G, 4G and now 5G).

2. Question: What is ITU's role in IMT?

Since 1990, ITU has developed the IMT framework of standards — or International Mobile Telecommunications system — for mobile telephony, and continues to lead international efforts involving governments and industry players to produce the standards (or 'ITU-R Recommendations on IMT') for global mobile communications (3G, 4G and now 5G).

3. Question: What is IMT-2000, IMT-Advanced, IMT-2020?

The initial set of IMT standards which the ITU approved were called **IMT-2000**. Recently ITU's Radiocommunication Sector (ITU-R) has approved **IMT-Advanced** standards and will keep progressing the upgrade for the next generation of these technologies e.g. IMT-2020. All 3G and 4G mobile broadband systems are based on the ITU's IMT standards.

ITU established the detailed specifications for **IMT-2000** and the first 3G deployments commenced around the year 2000.

In January 2012, ITU defined the next big leap forward with 4G wireless cellular technology, **IMT-Advanced** and this is now being progressively deployed worldwide.

The detailed investigation of the key elements of **IMT-2020** is already well underway with trials of 5G technologies starting its initial implementation in 2018.

IMT provides the global platform on which to build the next generations of mobile broadband connectivity.

4. Question: What technology is IMT-2000, IMT-Advanced, IMT-2020?

IMT-Advanced isn't a specific technology but rather, it's a specification and list of requirements for high-speed mobile broadband service. ITU defined the process of evaluation and the subsequent selection of

mobile technologies that fulfill a number of established technical parameters (peak data rate, latency, spectrum efficiency, etc.).

The process to develop the IMT standards for 5G is in place and it has been agreed in close collaboration with the mobile broadband industry and the wide range of stakeholders in the 5G community.

In this regard, IMT-2020 systems are mobile systems that include the new capabilities of IMT that go beyond those of IMT-Advanced which would make IMT-2020 more efficient, fast, flexible, and reliable when providing diverse services in the intended usage scenarios.

The procedure, the methodology and the criteria (technical, spectrum and service) to be used in evaluating the candidate IMT-2020 radio interface technologies (RITs) or Set of RITs (SRITs) will be applied to a number of test environments. These test environments are chosen to simulate closely the more stringent radio operating environments. The evaluation procedure is designed in such a way that the overall performance of the candidate RITs/SRITs may be fairly and equally assessed on a technical basis. It ensures that the overall IMT 2020 objectives are met.

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5. Question: Which technologies meet the IMT criteria and specification?

The technologies that meet **IMT-2000** criteria and specifications are:

1- IMT-2000 CDMA Direct Spread
2- IMT-2000 CDMA Multi-Carrier
3- IMT-2000 CDMA TDD
4- IMT-2000 TDMA Single-Carrier
5- IMT-2000 FDMA/TDMA
6- IMT-2000 OFDMA TDD WMAN

Right now, two technologies have been found to meet the **IMT-Advanced** criteria and specifications:

1- LTE-Advanced
2- WirelessMAN-Advanced

ITU has determined that "LTE-Advanced" and "WirelessMAN-Advanced" should be accorded the official designation of IMT-Advanced. These are extensions of the 3G LTE and WiMax technologies.

The technologies to meet IMT-2020 specifications are under preparation.

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6. Question: What are the key features of IMT systems?

Key features of IMT-2000 and IMT-Advanced systems:

- a high degree of commonality of functionality worldwide while retaining the flexibility to support a wide range of services and applications in a cost-efficient manner;

- compatibility of services within IMT and with fixed networks;
- capability of interworking with other radio access systems;
- high quality mobile services;
- user equipment suitable for worldwide use;
- user-friendly applications, services and equipment;
- worldwide roaming capability; and,
- enhanced peak data rates to support advanced services and applications:

Initially 100 Mbit/s for high and 1 Gbit/s for low mobility were established as targets.

These features enable IMT-2000 and IMT-Advanced to address evolving user needs and the capabilities of are being continuously enhanced in line with user trends and technology developments.

Key features of IMT-2020 can be found within the questions about IMT-2020.

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7. Question: What is the Vocabulary of terms for IMT?

This is available in Recommendation ITU-R M.1224.

IMT-Advanced systems, the next step in global wireless broadband communications, include new capabilities that go beyond IMT-2000, widely deployed since 2000 and referred to as 3G mobile technology.

With the completion of an intensive programme developed by ITU's Radiocommunication Sector (ITU-R) to stimulate global development of the future IMT technologies and following a detailed evaluation against stringent technical and operational criteria, ITU has determined that "LTE-Advanced" and "WirelessMAN-Advanced" should be accorded the official designation of IMT-Advanced.

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8. Question: Where can I find the list of ITU-R Reports on IMT?

These are available here.

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9. Question: Where can I find the full list of ITU-R Recommendations (standards or specifications) on IMT?

These are available here.

10. Question: What Specifications for IMT are available in ITU-R Recommendations?

Terrestrial Component:

Rec. ITU-R M.1457 for IMT-2000 (widely referred to as 3 G mobile technology) - 'Detailed specifications of the terrestrial radio interfaces of International Mobile Telecommunications-2000 (IMT-2000)'.

Rec. ITU-R M.2012 for IMT-Advanced – 'Detailed specifications of the terrestrial radio interfaces of International Mobile Telecommunications Advanced (IMT-Advanced)'.

Satellite Component:

Rec. ITU-R M.1850 for IMT-2000 (widely referred to as 3 G mobile technology) - 'Detailed specifications of the radio interfaces for the satellite component of International Mobile Telecommunications-2000 (IMT-2000)'.

11. Question: Is there a satellite component to IMT?

A series of ITU-R Recommendations (standards) for the satellite component to IMT have been developed including integration of the terrestrial and satellite mobile communication systems, these are:

Rec. ITU-R M.818 - Satellite operation within International Mobile Telecommunications-2000 (IMT-2000)
Rec. ITU-R M.1167 - Framework for the satellite component of International Mobile Telecommunications-2000 (IMT-2000)
Rec. ITU-R M.1182 - Integration of terrestrial and satellite mobile communication systems
Rec. ITU-R M.1850 - Detailed specifications of the radio interfaces for the satellite component of International Mobile Telecommunications-2000 (IMT-2000)
Rec. ITU-R M.2014 - Global circulation of IMT-2000 satellite terminals

12. Question: Is IMT-2000 and IMT-Advanced - 3G or 4G?

ITU does not have a definition for "4G" and ITU cannot hold a position on whether or not a given technology is labelled with that term for marketing purposes.

IMT-2000, in use for over a decade since 2000, has been widely deployed and is commonly referred to as "3G".

The term "4G" remains undefined, but it is being applied by some operators to the forerunners of **IMT-Advanced** technologies — LTE, HSPA+, WiMax and to other evolved 3G technologies, which provide a

substantial level of improvement in performance and capabilities with respect to the initial third generation systems now deployed.

Specifications for the next phase of development in mobile broadband wireless technology – **IMT-Advanced** – were agreed by the ITU Radiocommunication Assembly (RA-12) in January 2012. See **Press Release** of 18 January 2012: *"IMT-Advanced standards announced for next-generation mobile technology"*.

The term "4G" remains undefined. ITU has specified that **IMT-Advanced** is the next step in mobile broadband wireless technology building on IMT-2000, widely referred to as 3G.

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13. Question: What is the step represented by IMT-Advanced in global mobile broadband ?

Specifications for the next step in mobile broadband wireless technology – IMT-Advanced – were approved by the ITU Radiocommunication Assembly (RA-12) in January 2012.

With the completion of an intensive programme developed by ITU's Radiocommunication Sector (ITU-R) to stimulate global development of the future IMT technologies and following a detailed evaluation against stringent technical and operational criteria, ITU has determined that "LTE-Advanced" and "WirelessMAN-Advanced" should be accorded the official designation of IMT-Advanced.

IMT-Advanced systems include new capabilities that go beyond IMT-2000, widely deployed since 2000 and referred to as 3G mobile technology. ITU has now specified the standards for IMT-Advanced, the next step in global wireless broadband communications.

IMT-Advanced provides comprehensive support for broadband wireless data and brings major improvements. These include increased spectrum efficiency to handle more users at higher data rates per radio channel; a fully packet-based architecture for reduced costs; lower latency leading to more responsive Internet and multimedia applications; improved radio resource management and control to enhance quality of service, and, new capabilities for the radio interface such as wideband radio channels and multiple-input and multiple-output (MIMO) for the use of multiple antennas at both the transmitter and receiver end to improve communication performance.

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14. Question: What is the step represented by IMT-2020 in global mobile broadband ?

The socio-technical evolution in the last few decades has been significantly driven by the evolution of mobile communications and has contributed to the economic and social development of both developed and developing countries. Mobile communications has become closely integrated in the daily life of the whole society. It is expected that the socio-technical trends and the evolution of mobile communications systems will remain tightly coupled together and will form a foundation for society in 2020 and beyond.

In the future, however, it is foreseen that new demands, such as more traffic volume, many more devices with diverse service requirements, better quality of user experience (QoE) and better affordability by further reducing costs, will require an increasing number of innovative solutions.

The scope of 5G is much broader than the previous generations of mobile broadband communication systems. We are speaking here about not just an enhancement to the traditional mobile broadband scenarios, but extending the application of this technology to use cases involving ultra-reliable and low latency communications, and massive machine-type communications.

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15. Question: IMT bands – how many IMT bands are there around the world?

In terms of spectrum, the **ITU Radio Regulations (RR)** establish the allocation of specific frequency bands for each radio service (41 services in total), including the mobile terrestrial service (the service involved, in this case). At the national or regional level, such allocated bands are then further allocated or assigned for specific types of systems or applications using specific channel arrangements. These channel arrangements may differ from region to region or from country to country, resulting in a large diversity of such "bands".

As the channeling arrangements do not necessarily use the whole allocated spectrum, and sometimes channeling plans might overlap each other, the sum of bandwidths of the various bands does not match with the total bandwidth of allocated spectrum.

While spectrum allocations are defined in the RR, which has the authority of being an international treaty, the various channeling options and their resulting "bands" are considered mainly by the ITU-R Study Groups, (in this case ITU-R Study Group 5), and the results are issued as ITU Recommendations.

Such Recommendations or standards are not compulsory, however, as they are developed with the participation of all sectors of the industry and approved by ITU Member States, they play a key role in determining which channel arrangements are adopted in a given region or country. ITU strives to achieve worldwide harmonization of these channel arrangements, to the universal benefit of industry and users, but in some cases this goal is not able to be fully realized.

There are specific ITU-R Recommendations which describe the detailed technical specifications for the IMT terrestrial radio interfaces, including IMT-2000 and IMT-Advanced; they specify which technologies fully meet the technical criteria for the respective IMT radio interfaces (see table below).

All current IMT frequency bands

Frequency band (MHz)	Bandwidth (MHz)
450-470	20
470-608	138
614-698	84
698-960	262
1427-1452	25
1452-1492	40
1492-1518	26
1710-2025	315
2110-2200	90
2300-2400	100
2500-2690	190
3300-3400	100
3400-3600	200
3600-3700	100
4800-4990	190
	1,880 (not equally spread over the 3 Regions)

The ITU World Radiocommunication Conference 2019 (WRC-19) to be held in Sharm el-Sheikh from 28 October to 22 November 2019 is expected to further allocate and identify spectrum for IMT. Further details are available in Question 19.

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16. Question: What are the spectrum bands identified for IMT systems?

The term International Mobile Telecommunications (IMT) encompasses both IMT-2000 and IMT-Advanced collectively. Successive World Radiocommunication Conferences (WRCs) have identified specific frequency bands for the deployment of IMT systems in general. This identification does not preclude the use of this band by any application of the services to which it is allocated and does not establish priority in the Radio Regulations (RR). In effect, it is up to each country to determine which bands will be made available for IMT in each country/region depending on national/regional requirements.

The Radio Regulations (RR) identify 7 frequency bands, with a total bandwidth of: 1,177 MHz, that may be used for IMT systems (see table below).

For further information, please find below the following items:

- List of bands identified on the Radio Regulations (RR) for deploying IMT systems;
- Table with the Recommendations containing the IMT-Advanced and IMT-2000 technical specifications and the related radio interface standards that have been recognized as meeting such specifications.

All these documents are publically available, free of charge (download version) from the following web sites:

- http://www.itu.int/rec/R-REC-M/en (for ITU-R M-Series Recommendations)
- https://www.itu.int/pub/R-REG-RR/en (for ITU Radio Regulations (RR))

The World Radiocommunication Conference 2019 (WRC-19) to be held in Sharm el-Sheikh from 28 October to 22 November 2019 is expected to further allocate and identify spectrum for IMT. Please see further details in Question 19.

Band (MHz)	Radio Regulations Footnotes identifying the band for IMT
450-470 (20 MHz)	5.286AA
698-960 (262 MHz)	5.313A, 5.317A
1710-2025 (315 MHz)	5.384A, 5.388
2110-2200 (90 MHz)	5.388
2300-2400 (100 MHz)	5.384A
2500-2690 (190 MHz)	5.384A
3400-3600 (200 MHz)	5.430A, 5.432A, 5.432B, 5.433A

	IMT-2000	IMT-Advanced
ITU-R Recommendation	ITU-R M.1457-10 (06/2011): Detailed specifications of the terrestrial radio interfaces of International Mobile Telecommunications-2000 (IMT-2000)	ITU-R M.2012 (01/2012): Detailed specifications of the terrestrial radio interfaces of International Mobile Telecommunications Advanced (IMT-Advanced)
Main Technical Criteria	1- high degree of commonality of design worldwide; 2- compatibility of services within IMT-2000 and with the fixed networks; 3- high quality; 4- small terminal for worldwide use; 5- worldwide roaming capability; 6- capability for multimedia applications, and a wide range of services and terminals.	1- a high degree of commonality of functionality worldwide while retaining the flexibility to support a wide range of services and applications in a cost-efficient manner; 2- compatibility of services within IMT and with fixed networks; 3- capability of interworking with other radio access systems; 4- high-quality mobile services; 5- user equipment suitable for worldwide use; 6- user-friendly applications, services and equipment; 7- worldwide roaming capability; 8- enhanced peak data rates to support advanced services and applications (100 Mbit/s for high and 1 Gbit/s for low mobility were established as targets for research; (rates surced from ITU-R M.1645)

Recognized Radio Interfaces	1- IMT-2000 CDMA Direct Spread 2– IMT-2000 CDMA Multi-Carrier 3– IMT-2000 CDMA TDD 4– IMT-2000 TDMA Single-Carrier 5– IMT-2000 FDMA/TDMA 6– IMT-2000 OFDMA TDD WMAN	1- LTE-Advanced 2- WirelessMAN-Advanced

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17. Question: Where are the 'key technical performance parameters for IMT-2020 (5G)'?

Report ITU-R M.2410 - *"Minimum requirements related to technical performance for IMT-2020 radio interface(s)"* describes key requirements related to the minimum technical performance of IMT-2020 candidate radio interface technologies. It also provides the necessary background information about the individual requirements and the justification for the items and values chosen. Provision of such background information is needed for a broader understanding of the requirements:

- **Peak data rate:** Maximum achievable data rate under ideal conditions per user/device (in Gbit/s). Downlink peak data rate of 20 Gbit/s, Uplink peak data rate of 10 Gbit/s
- **User experienced data rate:** Achievable data rate that is available ubiquitously across the coverage area to a mobile user/device (in Mbit/s or Gbit/s). Downlink user experienced data rate of 100 Mbit/s, Uplink user experienced data rate of 50 Mbit/s
- **Latency:** The contribution by the radio network to the time from when the source sends a packet to when the destination receives it (in ms). 4 ms for eMBB and 1 ms for uRLLC
- **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/-RAT) can be achieved (in km/h). Stationary: 0 km/h, Pedestrian: 0 km/h to 10 km/h, Vehicular: 10 km/h to 120 km/h, High speed vehicular: 120 km/h to 500 km/h
- **Connection density:** Total number of connected and/or accessible devices per unit area (per km^2). 1 million devices per km^2
- **Spectrum efficiency:** Average data throughput per unit of spectrum resource and per cell (bit/s/Hz). Downlink peak spectral efficiency of 30 bit/s/Hz, Uplink peak spectral efficiency of 15 bit/s/Hz
- **Area traffic capacity:** Total traffic throughput served per geographic area (in $Mbit/s/m^2$). 10 $Mbit/s/m^2$
- Other parameters: **Energy efficiency, reliability, control plane latency, mobility interruption time,** etc. with their applicable scenarios are provided in **Report ITU-R M.2410.**

See also: ITU Press Release of 23 February 2017.

18. Question: Where can I find further information from ITU regarding IMT-2020?

The **"ITU towards 'IMT for 2020 and beyond"** webpage is updated regularly with information about this futuristic mobile 5G technology e.g. the list of ITU-R Recommendations, Reports and Resolutions on IMT and the Working Party 5D activities in this area: The webpage is visible here:

19. Question: What frequency bands are under study for the implementation of IMT-2020 (5G)?

The following bands, which are already allocated to mobile, will be studied with a view to an IMT-2020 (5G) identification:

- **24.25 – 27.5 GHz**
- **37 – 40.5 GHz**
- **42.5 – 43.5 GHz**
- **45.5 – 47 GHz**
- **47.2 – 50.2 GHz**
- **50.4 – 52.6 GHz**
- **66 – 76 GHz**
- **81 – 86 GHz**

The following bands will also be studied, although they do not currently have global mobile allocations:

- **31.8 – 33.4 GHz**
- **40.5 – 42.5 GHz**
- **47 - 47.2 GHz**

The results of the studies will be submitted for decision to the next **ITU World Radio Conference (WRC-19),** to be held from 28 October to 22 November 2019 in Sharm el-Sheikh, Egypt.

20. Question: What is the estimated timeline for the IMT-2020 standardization process?

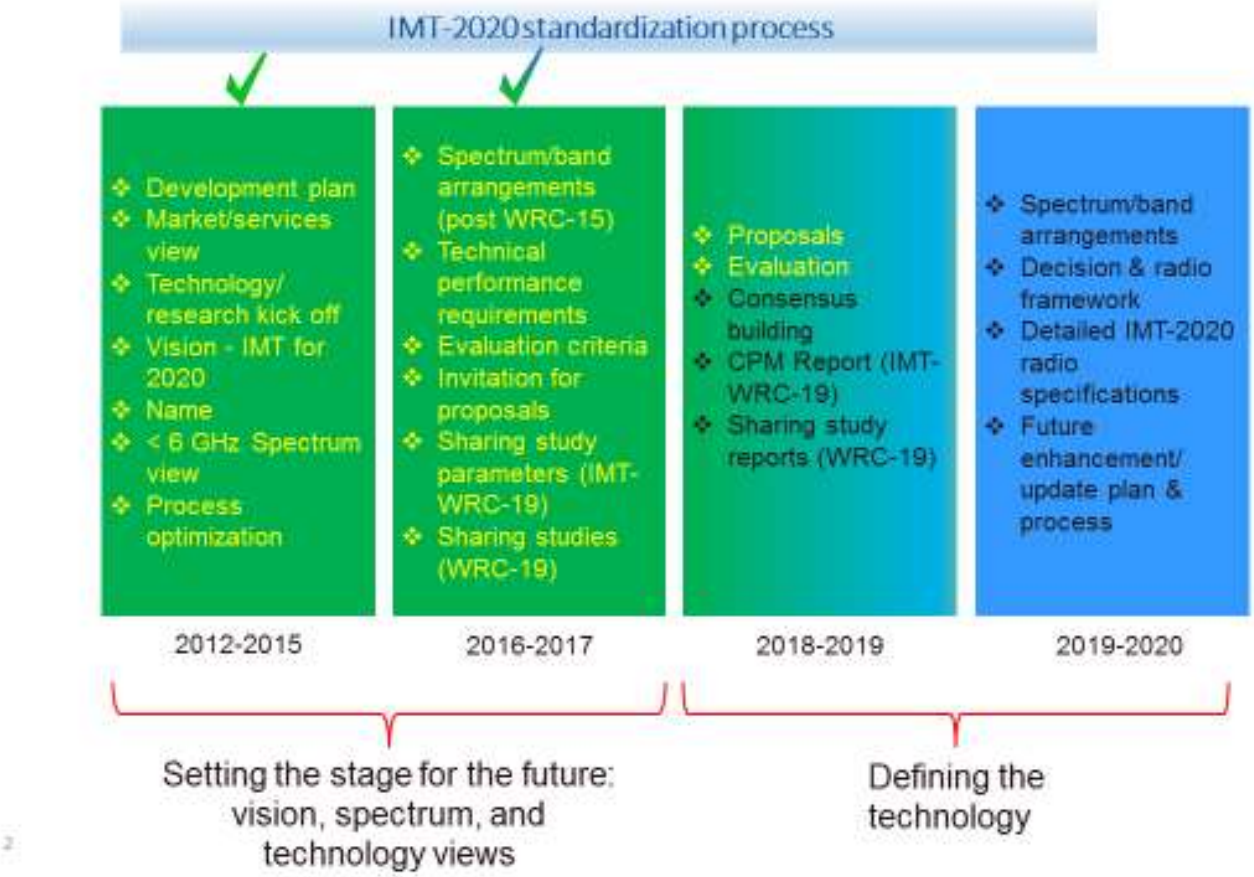

Figure: Updated February 2018.

21. Question: What are some usage scenarios of IMT for 2020 and beyond?

Three main usage scenarios for IMT-2020 have been identified in Recommendation ITU-R M.2083 - *"IMT Vision – Framework and overall objectives of the future development of IMT for 2020 and beyond,"* which are enhanced mobile broadband, ultra-reliable and low latency communications, and massive machine-type communications. Additional use cases are expected to emerge, which are currently not foreseen. For future IMT, flexibility will be necessary to adapt to new use cases that come with a widely varying range of requirements.

IMT-2020 will encompass a large number of different features. Depending on the circumstances and the different needs in different countries, future IMT systems should be designed in a highly modular manner so that not all features have to be implemented in all networks.

This following figure illustrates some examples of envisioned usage scenarios for IMT-2020.