

RECOMMENDATION ITU-R M.1645

**Framework and overall objectives of the future development
of IMT-2000 and systems beyond IMT-2000**

(Question ITU-R 229/8)

(2003)

Page

1	Introduction.....	2
2	Scope.....	3
3	Related Recommendations.....	3
4	Considerations.....	4
4.1	User trends	4
4.1.1	Growing demand for mobile services	4
4.1.2	Trends in services and applications	5
4.2	Framework	6
4.2.1	Objectives.....	7
4.2.2	Perspectives on the objectives.....	8
4.2.3	Coverage objectives	10
4.2.4	Future development of IMT-2000.....	10
4.2.5	New capabilities for systems beyond IMT-2000	11
4.2.6	Relationship of IMT-2000, systems beyond IMT-2000 and other access systems	12
4.2.7	Timelines.....	16
4.3	Technology trends.....	18
4.3.1	System-related technologies	18
4.3.2	Access network and radio interface	18
4.3.3	Utilization of spectrum.....	19
4.3.4	Mobile terminals	19
4.3.5	Applications	19

4.4	Spectrum implications.....	20
4.4.1	Preferred frequency bands	21
4.4.2	Bandwidth considerations	21
5	Recommendations.....	22
5.1	Objectives.....	22
5.2	Framework of future work	23
5.3	Focus areas for further study.....	24

1 Introduction

International Mobile Telecommunications-2000 (IMT-2000) systems are third generation mobile systems, which provide access to a wide range of telecommunication services, supported by the fixed telecommunication networks (e.g. PSTN/ISDN/IP), and to other services which are specific to mobile users.

Key features of IMT-2000 are:

- high degree of commonality of design worldwide;
- compatibility of services within IMT-2000 and with the fixed networks;
- high quality;
- small terminal suitable for worldwide use;
- worldwide roaming capability;
- capability for multimedia applications within a wide range of services and terminals.

The capabilities of IMT-2000 systems are being continuously enhanced in line with user demand and expectations and technology trends.

The specifications for the initial releases of IMT-2000, which are defined in Recommendation ITU-R M.1457, have been completed, and the commercial deployment of IMT-2000 has begun. Work is already under way in various external organizations to extend the capabilities of the initial releases in line with user expectations and technology trends.

To help meet the ever increasing demands for wireless communication, and the expected higher data rates needed to meet user demands, the ITU Radiocommunication Assembly approved Question ITU-R 229/8 on the future development of IMT-2000 and systems beyond IMT-2000. That Question asks generally about the overall objectives and the technical, operational and spectrum issues related to the future development of IMT-2000 and systems beyond IMT-2000. One of the initial steps in the process of addressing this Question is producing this Recommendation on the framework of the future development of IMT-2000 and systems beyond IMT-2000. Additional Recommendations and Reports will be developed to address specific issues in more detail.

2 Scope

This Recommendation defines the framework and overall objectives of the future development of IMT-2000 and systems beyond IMT-2000 for the radio access network. This framework is based on the global user and technology trends, including the needs of developing countries. The Recommendation recommends the framework and objectives of the future development of IMT-2000 and systems beyond IMT-2000, specifically addressing:

- evolutionary development of IMT-2000, which refers to the enhancements of its technical capabilities, range of available services and breadth of applications that will be progressively introduced during its lifetime;
- systems beyond IMT-2000, for which there may be a need for a new wireless access technology to be developed around the year 2010, capable of supporting high data rates with high mobility, which could be widely deployed around the year 2015 in some countries.

The complete ITU framework for the future development of IMT-2000 and systems beyond IMT-2000 encompasses both the “radio access network” and the “core network”. However, it is recognized that, in the future, the evolution of technologies and the redistribution of traditional functions between radio access networks and core networks in real systems may blur this distinction. The scope of this ITU-R Recommendation is the radio access network, while the core network is addressed in a companion ITU-T Recommendation ITU-T Q.1702. The framework for the future development of the IMT-2000 and systems beyond IMT-2000 radio access networks includes the emerging relationships with other radio access networks (existing and future), and the capabilities required to deliver services to the users of IMT-2000 and systems beyond IMT-2000.

3 Related Recommendations

ITU-R F.1399	Vocabulary of terms for wireless access
ITU-R M.687	International Mobile Telecommunications-2000 (IMT-2000)
ITU-R M.816	Framework for services supported on International Mobile Telecommunications-2000 (IMT-2000)
ITU-R M.818	Satellite operation within International Mobile Telecommunications-2000 (IMT-2000)
ITU-R M.819	International Mobile Telecommunications-2000 (IMT-2000) for developing countries

ITU-R M.1034	Requirements for the radio interface(s) for International Mobile Telecommunications-2000 (IMT-2000)
ITU-R M.1035	Framework for the radio interface(s) and radio sub-system functionality for International Mobile Telecommunications-2000 (IMT-2000)
ITU-R M.1182	Integration of terrestrial and satellite mobile communication systems
ITU-R M.1224	Vocabulary of terms for International Mobile Telecommunications-2000 (IMT-2000)
ITU-R M.1311	Framework for modularity and radio commonality within IMT-2000
ITU-R M.1450	Characteristics of broadband radio local area networks
ITU-R M.1457	Detailed specification of the radio interfaces of International Mobile Telecommunications-2000 (IMT-2000)
ITU-T Q.1702	Long-term Vision of Network Aspects for Systems Beyond IMT-2000

4 Considerations

The ITU Radiocommunication Assembly,

considering

4.1 User trends

In defining the framework for the future development of IMT-2000 and systems beyond IMT-2000, it is important to understand the user trends that will affect the development of such systems. In particular, the framework should be based on increasing user expectations and the growing demand for mobile services, as well as the evolving nature of the services and applications that may become available. The trends discussed below are thus an important underpinning of the framework.

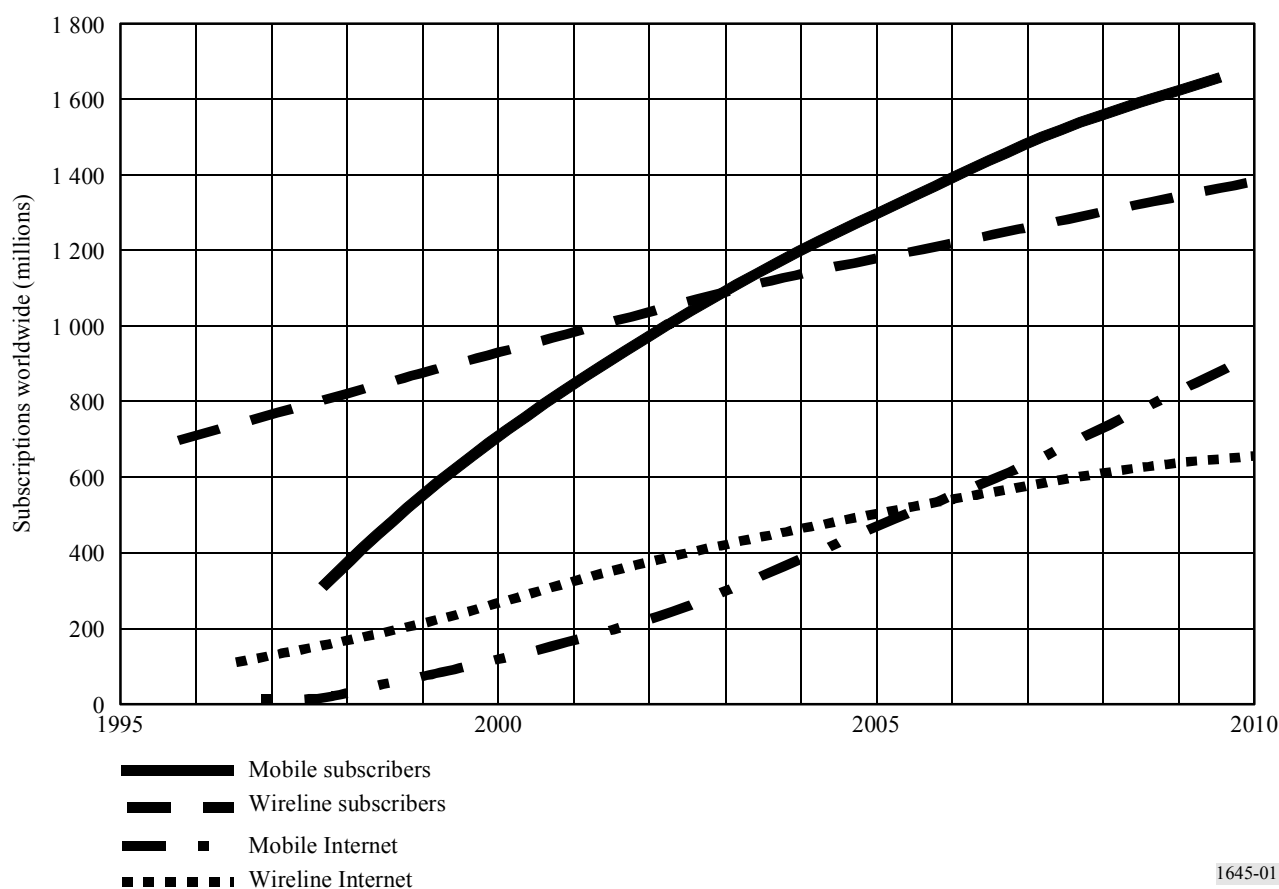
4.1.1 Growing demand for mobile services

The number of mobile subscribers worldwide has increased from 215 million in 1997 to 946 million (15.5% of global population) in 2001 as shown in Fig. 1¹. It is predicted that by the year 2010 there will be 1 700 million terrestrial mobile subscribers worldwide. A substantial portion of these additional subscribers are expected to be from outside the countries that already had substantial numbers of mobile users by the year 2001.

It is envisaged that, by the year 2020, potentially the whole population of the world could have access to advanced mobile communications devices, subject to, amongst other considerations, favourable cost structures being achieved. There are already more portable handsets than either fixed line telephones or fixed line equipment such as PCs that can access the Internet, and the number of mobile devices is expected to continue to grow more rapidly than fixed line devices. Mobile terminals will be the most commonly used devices for accessing and exchanging information.

¹ www.itu.int/ITU-D/ict/statistics.

FIGURE 1
Global growth of mobile and wireline subscribers



4.1.2 Trends in services and applications

User expectations are continually increasing with regard to the variety of services and applications. In particular, users will expect a dynamic, continuing stream of new applications, capabilities and services that are ubiquitous and available across a range of devices using a single subscription and a single identity (number or address). Versatile communication systems offering customized and ubiquitous services based on diverse individual needs will require flexibility in the technology in order to satisfy multiple demands simultaneously.

Multimedia traffic is increasing far more rapidly than speech, and will increasingly dominate traffic flows. There will be a corresponding change from predominantly circuit-switched to packet-based delivery. This change will provide the user with the ability to more efficiently receive multimedia services, including e-mail, file transfers, messaging and distribution services. These services can be either symmetrical or asymmetrical, and real-time or non real-time. They can consume high bandwidths, resulting in higher data rate requirements in the future.

External market studies have predicted that in Europe in the year 2010 more than 90 million mobile subscribers will use mobile multimedia services, generating about 60% of the traffic in terms of transmitted bits.

In Japan, mobile web browsing, which is one type of mobile multimedia service, started to become popular around the year 2000; the number of users was 48.5 million (72% of mobile subscribers) at the end of the year 2001 and is still growing.

Work has already begun on the convergence of telecommunication services such as digital broadcasting and commercial wireless services. The trend toward integration and convergence can be characterized by:

- connectivity (provision of a pipe, including intelligence in the network and the terminal);
- content (information, including push and pull services);
- commerce (transactions).

These trends may be viewed as the integration and convergence of information technology, telecommunications, and content. This will result in new service delivery dynamics and a new paradigm in telecommunications where value added services, such as those which are location dependent, will provide enormous benefits to both the end users and the service providers.

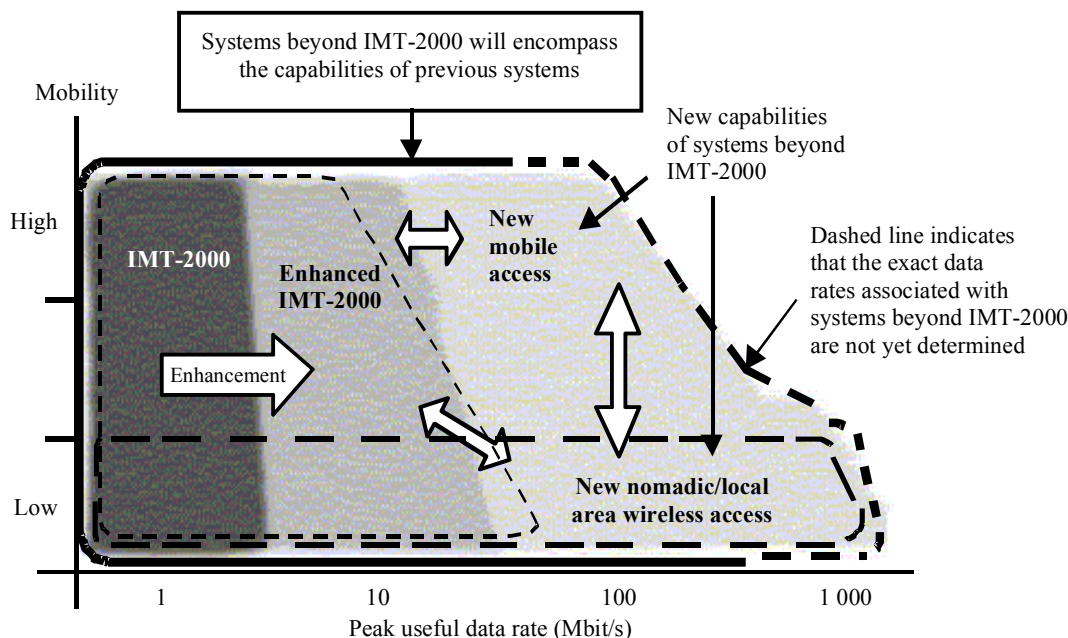
In addition, these trends are supported by “digitalization”, which is already well advanced. The majority of electronic and communications devices and delivery mechanisms (i.e. cellular, broadcast, fixed wireless access (FWA), radio local area networks (RLANs), xDSL (digital subscriber line delivery mechanisms), satellite, etc.) are either already digital or in the process of migrating to digital technologies.

4.2 Framework

Present mobile communication systems have evolved by adding more and more system capabilities and enhancements, and the user will see a significant increase in capability through the future development of IMT-2000. Systems beyond IMT-2000 will be realized by functional fusion of existing, enhanced and newly developed elements of IMT-2000, nomadic wireless access systems and other wireless systems with high commonality and seamless interworking.

The framework for the future development of IMT-2000 and systems beyond IMT-2000 is depicted in Fig. 2, which illustrates the various components described in § 4.2.1 and their relationships to each other. Systems beyond IMT-2000 will encompass the capabilities of previous systems. Other communication relationships will also emerge, in addition to person to person, such as machine-to-machine, machine-to-person and person-to-machine.

FIGURE 2
Illustration of capabilities of IMT-2000 and systems beyond IMT-2000



↔ Denotes interconnection between systems via networks, which allows flexible use in any environment without making users aware of constituent systems

○ Nomadic/local area access systems

○ Digital broadcast systems

Dark shading indicates existing capabilities, medium shading indicates enhancements to IMT-2000, and the lighter shading indicates new capabilities of systems beyond IMT-2000.

The degree of mobility as used in this Figure is described as follows: low mobility covers pedestrian speed, and high mobility covers high speed on highways or fast trains (60 km/h to ~250 km/h, or more).

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4.2.1 Objectives

The objectives of the future development of IMT-2000 and systems beyond IMT-2000 is considered to be as follows:

– *Future development of IMT-2000:*

There will be a steady and continuous evolution of IMT-2000 to support new applications, products and services. For example, the capabilities of some of the IMT-2000 terrestrial radio interfaces are already being extended up to 10 Mbit/s and it is anticipated that these will be extended even further up to approximately 30 Mbit/s by around the year 2005, under optimum signal and traffic conditions. This is discussed in more detail in § 4.2.4.

– *New capabilities of systems beyond IMT-2000:*

For systems beyond IMT-2000, there may be a requirement for a new wireless access technology for the terrestrial component, around the year 2010. This will complement the enhanced IMT-2000 systems and the other radio systems. It is predicted that potential new radio interface(s) will need to support data rates of up to approximately 100 Mbit/s for high mobility such as mobile access and up to approximately 1 Gbit/s for low mobility such as nomadic/local wireless access, by around the year 2010. This is discussed in more detail in § 4.2.5.

These data rate figures and the relationship to the degree of mobility (Fig. 2) should be seen as targets for research and investigation of the basic technologies necessary to implement the framework. Future system specifications and designs will be based on the results of the research and investigations. Due to the predicted data rate requirements, additional spectrum will be needed in order to deliver the new capabilities of systems beyond IMT-2000. The data rate figures anticipate the advances in technology, and these values are expected to be technologically feasible in the time-frame noted above. It is possible that upstream and downstream may have different maximum transmission speeds.

– *Relationship of IMT-2000, systems beyond IMT-2000, and other access systems:*

In conjunction with the future development of IMT-2000 and systems beyond IMT-2000, relationships will continue to develop between different radio access and communications systems, for example wireless personal area networks (WPANs), LANs (WLANs), digital broadcast, and FWA. This is discussed in more detail in § 4.2.6.

4.2.2 Perspectives on the objectives

The framework for the future development of IMT-2000 and systems beyond IMT-2000 can be considered from multiple perspectives, including the users, manufacturers, application developers, network operators, and service and content providers. From the user's perspective, there will be a demand for a variety of services, content and applications whose capabilities will increase over time. Similarly, users will expect services to be ubiquitously available through a variety of delivery mechanisms and service providers, using a wide variety of devices that will be developed to meet their differing requirements. These may resemble today's devices such as desktop and laptop PCs, mobile phones, digital televisions, and other computing and communication devices. User demands will be addressed by a large community including content providers, service providers, network operators, manufacturers, application and hardware developers.