RECOMMENDATION ITU-R M.816-1*

FRAMEWORK FOR SERVICES SUPPORTED ON INTERNATIONAL MOBILE TELECOMMUNICATIONS-2000 (IMT-2000)

(Question ITU-R 39/8)

(1992-1997)

1 Introduction

International Mobile Telecommunications-2000 (IMT-2000) are third generation mobile systems which are scheduled to start service around the year 2000 subject to market considerations. They will provide access, by means of one or more radio links, to a wide range of telecommunication services supported by the fixed telecommunication networks (e.g. public switched telephone network/integrated services digital network (PSTN/ISDN)), and to other services which are specific to mobile users.

A range of mobile terminal types is encompassed, linking to terrestrial or satellite based networks, and the terminals may be designed for mobile or fixed use.

Key features of IMT-2000 are:

– incorporation of a variety of systems;

– high degree of commonality of design worldwide;

– compatibility of services within IMT-2000 and with the fixed networks;

– high service quality;

– use of a small pocket terminal worldwide.

IMT-2000 are defined by a set of interdependent ITU-R Recommendations of which this one on services is a member. This Recommendation forms a framework for continued development towards detailed IMT-2000 service descriptions such as ITU-T Recommendation F.115.

A goal for third generation mobile systems is to provide universal coverage and to enable terminals to be capable of seamless roaming between multiple networks. The user's application will need to negotiate to establish a communication path having the required characteristics of bandwidth, delay and quality, recognising that many multimedia communications will be highly asymmetric. The need to provide for future non-standardized services, which can be created independently in a competitive, multi-operator environment places radically new requirements on the radio interface concept. No longer will the various elements of the radio interface (e.g. channel coder, modulator, transcoder, etc.) have fixed parameters, rather, they would be in the form of a "toolbox" whereby the key parameters of bandwidth, transmission quality and delay can be selected, negotiated, mixed and matched by the requirements of the teleservice, according to the instantaneous capability of the radio channel.

2 Scope

A phased approach is adopted for the definition of IMT-2000. In this Recommendation the services required for Phase 1 are described, and an outline of the services for Phase 2 is also given. Phase 1 includes those services supported by user bit rates up to approximately 2 Mbit/s. Phase 2 is envisaged as augmenting Phase 1 with new services, some of which may require higher bit rates.

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* This Recommendation should be brought to the attention of the Telecommunication Standardization Sector.

3   Considerations

The ITU-R considers that IMT-2000 will operate in a complex environment which requires recognition of the following factors:

–   the involvement of a number of commercial interests (such as service providers, re-sellers, network operators, value-added service suppliers, etc.);

–   the possible involvement of, or the cascading of, networks which may be of different types;

–   increasing technical developments and opportunities;

–   the changing regulatory framework for those involved in supplying services (e.g. competition for users and customers, and deregulation in various forms by administrations);

–   the needs of many users for services which are not bounded by constraints of geography or operator;

–   that the mobile user of the services may be a person/persons or a machine. That these users could have different service requirements by virtue of either the desires of the user or the economics of providing for that service to the users' mode of mobility;

–   that service availability will be dependant on a number of factors which could include: mobile terminal type, speed of motion, and geographic factors; for example hand portable sized/vehicle mounted terminals, indoor/outdoor, residential or business areas, urban/suburban/rural areas etc.;

–   that it is to be expected that the number and content of the service offerings will change with time, and will not be the same in every location;

–   the increasing importance of the various types of non-voice telecommunication services;

–   that mobile terminals of IMT-2000 may be used to access mobile satellite systems for use on land, ships and aircraft;

–   that there is a need for mobile terminals to roam between public land mobile telecommunication networks in different countries and between networks in the same country;

–   that a standardized radio interface would facilitate the roaming of mobile terminals between networks;

–   that users may want to be able to use the same terminal equipment and procedures as in the fixed networks to access similar telecommunications services in IMT-2000;

–   that there is a need to provide for fixed wireless access services particularly in developing countries.

4   General service objectives and requirements

4.1   Structure

The service recommendations for IMT-2000 are achieved in three stages. The first gives general objectives and requirements. This provides an outline description of the services offered and can be used to provide a framework within which the services are defined. These objectives are given in this section.

The second stage lists, in descriptive form, the detailed services offered on IMT-2000. These are given in § 7, 8 and 9 of this Recommendation.

Third stage descriptions involve more quantitative definitions and also involve definitions produced by non-ITU-R bodies (ITU-T, etc.).

The ITU-R recommends that the services supported by IMT-2000 be in compliance with the following general objectives and requirements:

4.2 General service objectives

– To provide a capability that enables existing as well as new audio, video, data and multimedia services, which are significantly more advanced than pre-IMT-2000 technologies. Both packet and circuit switched and connection oriented and connectionless services are envisaged;

– To provide flexible radio bearer services;

– To provide capability for bandwidth-on-demand supporting a wide range of data rates, from simple low-rate paging messages, voice, to significantly higher rates associated with video or file transfer;

– To support asymmetrical data capabilities, which require high rates in one direction but much lower rates in the other;

– To provide a wide range of telecommunications services to mobile or fixed users by means of one or more radio links;

– To ensure that the services provided by IMT-2000 should, as far as possible, be identical to those offered to users of fixed telecommunications terminals (connected to fixed telecommunication networks) and with a comparable quality of service;

– To provide a robust signalling interface that is required to support those services not dependent upon a bearer capability;

– To make these services available for mobile terminals located anywhere subject only to constraints of economic provision, and to limitations of implementation timing;

– To provide for flexibility of service provision, for example, between mobile terminal categories and on a geographical or user density basis;

– To ensure that the user of the personal station, when roaming between networks, should have available (provided the personal station has the necessary capabilities):

  – an indication of the service availability;

  – access to voice telephony;

  – Universal Personal Telecommunication (UPT), and

  – access to a selection of data services;

– To provide for services subject to mobile terminal type, location, and availability from the network operator;

– To provide for worldwide roaming.

4.3 Requirements on Service Creation

IMT-2000 services are provided for the mass market but should be offered in a flexible way so that individual requirements can be met. This requires flexible service creation instead of rigidly specified individual services. Support for intersystem roaming will require access to, and invocation of, the user's personalized services where these services are supported by the concerned radio operating environment and access system.

4.4 General service requirements

– To provide validation and authentication procedures to facilitate billing and accounting (see ITU-T Recommendation X.509);

– to provide for additional levels of security for telecommunication services;

– to provide privacy of location of a roaming user when desired by the called or calling party.

4.5 General access requirements

– *For access to the fixed networks:* IMT-2000 may be either an adjunct to or an integral part of the PSTN/ISDN. Services offered in the PSTN/ISDN should, as far as possible, be offered to IMT-2000 users;

– *for international operation:* IMT-2000 should allow international operation and automatic roaming of mobile users and stations to the extent practical or permitted;

–   *for maritime and aeronautical:* IMT-2000 should allow operation in the maritime and aeronautical environment to the extent permitted by national and international regulatory authorities;

–   *for satellite systems:* IMT-2000 should allow operation either directly or indirectly via satellite.

4.6   Quality of service requirements

Quality of service is the subject of separate Recommendations, ITU-R M.1079 related to speech and voiceband data performance requirements and ITU-T G.174 (Transmission Performance Objectives for Terrestrial Digital Wireless Systems Using Portable Terminals to Access the PSTN) which give the detailed requirements.

The quality of services offered over IMT-2000 should be closely comparable to the quality of the same services achieved when using the contemporary fixed networks (e.g. PSTN/ISDN) alone.

4.7   Support of User Identity Module (UIM) functionality

Originating and terminating calls should require a UIM as a physical device or as a functionality to be present in the mobile terminal, subject to legal constraints concerning the requirement for UIM functionality in order to place an emergency call.

The capability to record user and terminal identities should be provided. Whether such recording capability is actually used and the information provided to emergency service authorities is subject to national regulations.

5   UPT

UPT is a service which allows a user to access any suitably equipped terminal and obtain from it a range of telecommunications services which are specific to the user requirements. UPT provides personal mobility as opposed to terminal mobility provided by IMT-2000. UPT is defined in ITU-T Recommendation F.851.

The ITU-R recommends that IMT-2000 have the objective of supporting UPT and maintaining UPT's common presentation to users. It should be noted that the details of UPT, and the implications for IMT-2000, are dependant on the work currently being performed by the ITU-T on the subject.

6   Support of fixed network services

IMT-2000 will interwork or be integrated with fixed networks such as PSTN, ISDN, B-ISDN and others.

6.1   PSTN

IMT-2000 should support PSTN services.

6.2   ISDN

The ISDN is a fixed network which provides digital highways, digital signalling channel(s), and associated services to users' terminals. ISDN is defined in the ITU-T I-Series of Recommendations.

IMT-2000 will operate in an era when ISDN will be widely available; ISDN will provide users with high quality speech and data connections and services. Since IMT-2000 has the objective of matching the quality of the then contemporary fixed network, then the quality reference will be that of the ISDN. In addition, commonality of the technical elements of IMT-2000, for example, speech codecs, RF components, etc., enables cost benefits to be passed on to network operators and users.

The ITU-R recommends that the design of IMT-2000 be conducted such that the maximum compatibility possible is achieved with the ISDN (see Recommendation ITU-R M.687). However, considering spectrum limitations and efficient spectrum usage, it is recognized that the IMT-2000 user may not in all cases have available the full extent and quality of ISDN services.

7 IMT-2000 service categories

Three main service categories have been identified from a user's perspective which form a part of or are supported by IMT-2000:

– mobility services,

– interactive services,

– distribution services.

An example overview of service categories and their application is given in Annex 1.

7.1 Mobility services

Mobility services are those services which are directly related to mobility of the user including terminal mobility (see also UPT in § 5). A particular mobility service is the location service.

Location information can be provided to authorized users by IMT-2000 or to relevant authorities in cases of emergency calls or for vehicular traffic management. In order to protect the privacy of the user, the access to location information must be restricted to specific applications authorized by the customer and the administration concerned. The location information accuracy is subject to system limitation and user requirement.

7.2 Interactive services

Interactive services for IMT-2000 are closely aligned to those defined by the ITU-T for fixed networks. These are separated into three categories, conversational services, messaging services, and retrieval and storage services:

– conversational services are to provide the means for bidirectional dialogue communication with real-time end-to-end information transfer from user to user or between user and host (e.g. for data processing);

– messaging services offer user-to-user communication between individual users via storage units with store-and-forward, mailbox and/or message handling (e.g. information editing, processing and conversion) functions;

– the retrieval and storage services can retrieve and/or store information in information centres.

7.3 Distribution services

Distribution services provide a continuous flow of information which is distributed from a central source to an unlimited number of authorized receivers connected to the network. They include broadcast services. The user may or may not be able to control the presentation and the information may be broadcast to all receivers or addressed to one or more specific receivers.

8 Recommendations on IMT-2000 telecommunication services

The ITU-R recommends that the set of bearer services supported by IMT-2000 should be selected from the services listed below, which require a specific bearer capability to meet the requirements of the ITU-T defined services. In addition, the ITU-R recommends that a high quality, reliable, robust signalling interface within IMT-2000 and between IMT-2000 and fixed networks such as PSTN, ISDN, B-ISDN and others be incorporated into the overall IMT-2000 design. This will ensure that the large majority of services which do not require a unique bearer capability, but rely on signalling, can be provided.

8.1 Network services

The following matrix identifies the telecommunication services to be provided by IMT-2000, the type of service and the bearer bit rate required.

TABLE 1

Telecommunication services versus required bearer services in IMT-2000

ITU-T Recommendation	Title of the User Service Recommendation	Support IMT-2000 initial	Service support RNIS associé	B-ISDN bearer service category	Bit rate required
F.182	Operational provisions for the international public facsimile service between subscribers with Group 3 facsimile terminals (Telefax 3)	Yes	Speech	A	14 400 bit/s
F.184	Operational provisions for the international public facsimile service between subscriber stations with group 4 facsimile machines	Yes	Unrestricted digital data	A	64 kbit/s
F.300	Videotex service	Yes	Unrestricted digital data	A + C	< 64 kbit/s
F.600	Service and operational principles for public data transmission services	Yes	Unrestricted digital data	Same as X.25, X.21 and X.75	For further study
F.700	Framework Recommendation for audiovisual/multimedia services	Yes	Speech + unre-stricted digital data	A + B + C + D	For further study
F.702	Multimedia conference services	Yes	Speech + unre-stricted digital data	A + B	For further study
F.711	Audio graphic conference tele-service for ISDN	Yes	Unrestricted digital data	A or B	64 kbit/s[1] 128 kbit/s
F.721	Video telephony service for ISDN	Yes	Unrestricted digital data	A	64 kbit/s[1] 128 kbit/s
F.811	Broadband connection-oriented bearer services	Yes	None	A + B + C	Basic bearer service specification
F.812	Broadband connectionless data bearer service	Yes	None	D	Basic bearer service specification
F.Pag	International paging service	Yes			Very low per user
E.105	International telephone service	Yes	Speech	A[1]	64 kbit/s[1]
I.231 series	Circuit-mode bearer service categories	Yes	All	A	≤ 2 Mbit/s[2]
I.232 series	Packet mode bearer service categories	Yes	All	B + C + D	≤ 2 Mbit/s
I.240 series	Tele-Services supported by ISDN	Yes	–	A + B	[3]
I.241.7	Telephony 7 kHz tele-service	Yes	–	A	64 kbit/s[2]

[1]   Unless other voice coding is used.

[2]   No broadband specific specification of bearer service introduced yet.

[3]   Throughput is system dependent.

All bearer service classes (A-D) should be supported in IMT-2000.

The bearer service classes are based on ITU-T Recommendation I.362. The following Table 2 explains the bearer service classes.

TABLE 2

Class	A	B	C	D
Timing relation source to destination	Required		Not required	
Bit rate	Constant	Variable		
Connection mode	Connection oriented			Connectionless

Bearer class A is a circuit mode service, classes C and D imply a packet mode service.

Higher bit rate data applications will require ISDN and B-ISDN bearer services (e.g. ITU-T Recommendations I.231 and I.232).

IMT-2000 should be designed so that provision of voice, video and data simultaneously to a user (i.e. including multimedia services) will be supported, from Phase 1, in appropriate environments.

8.2 Mobile specific services

Mobile specific services are those specific to the radio environment and are not normally provided in the fixed network.

8.2.1 Short message service

This connectionless service allows the exchange of messages of limited length between a storage system and a mobile station, or between mobile stations in real time. It can be a point-to-point or point-to-multipoint service.

8.2.2 Location

The provision of information to the calling or called party as to the location of the corresponding IMT-2000 user. In order to protect the privacy of the IMT-2000 user, access to location information must be restricted to specific applications authorized by the IMT-2000 user and the administration concerned.

8.3 Supplementary services

The following supplementary services, amongst others, may be supported by IMT-2000:

8.3.1 Separation of answering from alerting

In current public telecommunication systems, the alerting function resides in the same terminal used to answer the call. However, in IMT-2000, it is envisaged that the device on which the alert is received, e.g. pager or personal station, is not necessarily the one used to answer the call. The called IMT-2000 user will be able to use any terminal of their choice (e.g. telephone or personal station) to answer the incoming call. This implies that the delivery of a signal to an alerting device is not a completed activity, rather, just a part of the total activity associated with establishing a call.

This service concept could have implications on the sequence of call-establishment signals as well as call-completion time delays.

8.3.2 Advice of charging

The paying party (or parties) should be able to receive the respective charge information before, during, or after each call.

8.3.3   End-to-end encryption

The IMT-2000 should support the use of end-to-end encryption associated with any service that uses an unrestricted circuit-mode or packet-mode bearer service. As a supplementary service, IMT-2000 should also support end-to-end encryption of speech by the use of an unrestricted circuit-mode bearer via the ISDN.

8.3.4   Automatic message box status indication

Automatic message box status indication (e.g. new message, urgent message, empty) reduces loss of communication whilst a user is moving.

9   Services to be considered for later phases of IMT-2000

The ITU-R recognizes that it is important to consider emerging and new requirements of services to be included within IMT-2000. However, to enable Phase 1 of IMT-2000 to be implemented in the near future, its scope is limited to those services requiring user bit rates up to approximately 2 Mbit/s.

Phase 2 is envisaged as augmenting Phase 1 with new services some of which may require user bit rates higher than 2 Mbit/s.

The following are new service objectives identified for inclusion in Phase 2:

– support of the high data rate needs of portable computing users, and

– support of enhanced multimedia communications requirements (e.g. providing voice, video and data simultaneously to a user).

Other service objectives may be identified in the future work of the ITU-R and ITU-T.

ANNEX 1

IMT-2000 service categories
(User perspective)

Service category[1]	Type of information[1]	Service examples	IMT-2000 application example
1 Mobility services 1.1 Locating	Voice	Voice announcement indicating location of user	[2]
	Audio	[2]	[2]
	Text	Text information indicating location of user	Location information to dispatcher
	Image	Image data indicating location of user	Mobile navigation to vehicle or dispatch
	Video	[2]	[2]
	Signalling	Signalling information based on user location	Presentation of location specifics to enable user to reconfigure equipment or service profile

ANNEX 1 (*continued*)

Service category[1]	Type of information[1]	Service examples	IMT-2000 application example
2 Interactive services 2.1 Conversational[3]	Voice	End-to-end 2-way voice connection	2-person telephone call Conference call
	Audio	End-to-end 2-way audio connection	Audio conference Interactive data using modems or dual tone multifrequency (DTMF) tones Control and monitoring or medical data instruments with A/D and D/A conversion
	Text	End-to-end data connection for 2-way presentation of text/data	2-person data call for screen sharing Data conference calls Connectionless short message conversation
	Image	End-to-end 2-way image connection	2-way fax
	Video	End-to-end 2-way video connection	2-way compressed video
	Signalling	End-to-end 2-way signalling connection	Remote control and status acquisition
2.2 Messaging (store and forward)	Voice	Store and forward voice	Voice mail box
	Audio	Store and forward voice	[2]
	Text	Store and forward data/text	Email Text-paging
	Image	Store and forward images	Fax mailbox
	Video	Store and forward video	Video mail
	Signalling	Store and forward signalling	Call alert Calling No. identification
2.3 Retrieval and storage services	Text	Text-based data storage/retrieval	Document sharing
	Binary data	Exchange of computer data	Database, software exchange
	Image	Exchange of stored images	Computer image storage and retrieval
	Audio	Exchange of stored audio	Audio document annotation, and shared audio libraries
	Video	Exchange of stored moving pictures	Video database Shared video libraries
3 Distribution services	Audio	[2]	
	Voice	Voice message	Voice paging individual or group call
	Text	Text message	Radio paging with text display individual or group calls
	Image	Addressed image	Telefax, point-to-point or point-to-multipoint
	Video	[2]	
	Signalling	Signalling message	Radio paging alerting only

[1] There may also be combinations of services and types of information in a given use of telecommunications services (e.g. multimedia).

[2] For further study to determine potential new IMT-2000 user service.

[3] There may be various combinations of services which are not symmetric in both directions but which together constitute a conversational service.