

RECOMMENDATION ITU-R M.1168

FRAMEWORK OF INTERNATIONAL MOBILE
TELECOMMUNICATIONS-2000 (IMT-2000)

(Question ITU-R 39/8)

(1995)

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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. PSTN/ISDN), and to other services which are specific to mobile users.

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

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;
- use of a small pocket-terminal with worldwide roaming capability.

IMT-2000 are defined by a set of interdependent ITU Recommendations of which this one is a member.

This Recommendation forms part of the requirements for specifying the radio interfaces of IMT-2000. IMT-2000 will operate in the worldwide bands identified by Radio Regulations Provision No. 746A (1 885-2 025 MHz and 2 110-2 200 MHz, with the satellite component limited to 1 980-2 010 MHz and 2 170-2 200 MHz).

The subject matter of IMT-2000 is complex and its representation in the form of a Recommendation is evolving. To maintain the pace of progress on the subject it is necessary to produce a sequence of Recommendations on a variety of aspects. The Recommendations strive to avoid apparent conflicts between themselves. Nevertheless, future Recommendations, or revisions, will be used to resolve any discrepancies.

IMT-2000 management is considered as providing the various functions necessary for planning, provisioning, installation, operation, maintenance, administration and customer services. To provide such functions, a service-specific network which permits the exchange and processing of management information between IMT-2000 equipment and/or operations systems is needed. This network could be established based on the TMN concept. TMN has been studied in the ITU Telecommunication Standardization Sector (ITU-T) which has developed the philosophy and concept of TMN and made some TMN relevant Recommendations [1]. The basic concept behind TMN is to provide an organized architecture to achieve the interconnection between various types of operation systems and telecommunications equipment for the exchange of management information using an agreed architecture with standardized interfaces.

2 Scope

The purpose of this Recommendation is to present the conceptual and methodological framework for the definition of the management of IMT-2000.

The methodology described in ITU-T Recommendation M.3020 [2] is used to define management requirements, management services, management functions, information models, and management protocols related to the management of IMT-2000.

This framework is the initial Recommendation on IMT-2000 management and identifies objectives for IMT-2000 management, and provides guidelines for the specification of Recommendations on IMT-2000 management, particularly a TMN management service on IMT-2000. Other Recommendations on IMT-2000 management will be produced by ITU in the near future.

3 Structure of the Recommendation

Section 4 of this Recommendation, provides a list of related documents. In § 5, a list of definitions commonly used throughout this Recommendation is given. Section 6 states the considerations that have been taken into account in the creation of this Recommendation. Section 7 identifies objectives for IMT-2000 management standardization, general requirements for IMT-2000 management, and provides principles for the specification of IMT-2000 management Recommendations, particularly the TMN management service on IMT-2000. Annex 1 discusses the application of TMN concept to IMT-2000 management. Annex 2 records details which should be used to produce the future Recommendations on IMT-2000 management.

4 Related documents

The following ITU-R and ITU-T Recommendations are related to this Recommendation:

- [1] ITU-T Recommendation M.3010 – Principle for a Telecommunications Management Network (TMN)
- [2] ITU-T Recommendation M.3020 – TMN Interface Specification Methodology
- [3] Recommendation ITU-R M.817 – International Mobile Telecommunications-2000 (IMT-2000). *Network Architectures*
- [4] Recommendation ITU-R M.818 – Satellite Operation within International Mobile Telecommunications-2000 (IMT-2000)
- [5] ITU-T Recommendation M.3200 – TMN Management Services: Overview
- [6] ITU-T Recommendation M.3100 – Generic Network Information Model
- [7] ITU-T Recommendation M.3400 – TMN Application Functions
- [8] Recommendation ITU-R M.687 – International Mobile Telecommunications-2000 (IMT-2000)
- [9] Recommendation ITU-R M.816 – Framework for Services Supported on International Mobile Telecommunications-2000 (IMT-2000)
- [10] Recommendation ITU-R M.1078 – security Principles for International Mobile Telecommunications-2000 (IMT-2000)
- [11] Recommendation ITU-R M.1034 – Requirements for the Radio Interface(s) for International Mobile Telecommunications-2000 (IMT-2000)
- [12] Recommendation ITU-R M.1035 – Framework for the Radio Interface(s) and Radio Subsystem Functionality for International Mobile Telecommunications-2000 (IMT-2000)
- [13] Recommendation ITU-R M.1079 – Speech and Voiceband Data Performance Requirements for International Mobile Telecommunications-2000 (IMT-2000).

5 Definitions

The following abbreviations are used in this Recommendation:

B-ISDN: broadband aspects of ISDN

BS: base station

CCCH: common control channel

GDMO: guidelines to define managed objects

GOS: grade of service

IN: intelligent network

ISDN: integrated services digital network

MF: mediation function (see [1])

MS: mobile station

MSC: mobile service switching centre

NEF: network element function (see [1])

O&M: operation and maintenance

OS: operation system (see [1])

OSF: operation system function (see [1])

OSI: open system interconnection (see ITU-T Recommendation X.200)

PLMN: public land mobile network

PSTN: public switched telephone network

QAF: Q adapter function (see [1])
 QoS: quality of service
 RBC: radio bearer control
 RFTR: radio frequency transmission and receiving
 RRC: radio resource control
 SCEF: service creation environment function
 TMN: telecommunications management network (see [1])
 UPT: universal personal telecommunication
 WSF: work station function (see [1])

Definitions will be developed in the future Recommendation on IMT-2000 terminology. (See also ITU-T Recommendation Q.1001.)

6 Considerations

The ITU Radiocommunication Assembly,

considering

- a) that system management is related to activities which control, monitor and record the use of telecommunication resources, and which enable the evaluation of the performance of these resources;
- b) the importance to ensure the integrity, the configuration flexibility and the resource status monitoring of IMT-2000, in order to provide telecommunication services to users with a certain level of quality;
- c) the importance to provide an open architecture for IMT-2000 which will permit the easy introduction of technology advancements, as well as different applications;
- d) that the mobility will be unrestricted in terms of location within the radio coverage area;
- e) that IMT-2000 will support UPT;
- f) that management capabilities can vary in complexity from a very simple connection between an OS and a single piece of telecommunications equipment to a complex network interconnecting many different types of OSs and telecommunications equipment;
- g) that IMT-2000 management may extend beyond the traditional operations and maintenance activities of a stand-alone network;
- h) that there is a need to support global terminal mobility among public mobile telecommunication networks in different countries or the same country;
- j) that exchange of appropriate management information among IMT-2000 operators is necessary;
- k) that an effective and accurate exchange of management information among operators implies the needs to satisfy organizational, security, functional, naming, and communications requirements;
- l) that the inter-operation between IMT-2000 and a wide range of existing or future partner networks and services (e.g. other mobile networks, ISDN/B-ISDN, PSTN, UPT) must be addressed;
- m) the need to allow the cost effective introduction and implementation of IMT-2000;
- n) the existing work and results from other standards organizations on system management;
- o) the need for IMT-2000 management Recommendations;
- p) the importance of using management techniques for IMT-2000 which are consistent with those used in other systems;
- q) the importance of an evolutionary approach towards IMT-2000,

recommends

- 1 to specify IMT-2000 management according to the framework given in § 7.

7 Recommendations

7.1 Recommendations for IMT-2000 management standardization

7.1.1 Objectives

IMT-2000 management should be defined in compliance with the following objectives:

- 7.1.1.1 To provide a management architecture, in order to support a multi-vendor IMT-2000 environment.
 - 7.1.1.2 To define management information to be exchanged across standardized interfaces in terms of OSI model.
 - 7.1.1.3 To support the capability of controlling IMT-2000 itself as far as possible.
 - 7.1.1.4 To address the management and assessment of system performance and operation through the use of measurements, etc.
- NOTE 1 – This would enable an IMT-2000 operator to make comparisons with its service quality criteria and objectives.
- 7.1.1.5 To improve service assistance and interaction with customers.
 - 7.1.1.6 To address a flexible billing and accounting administration, so as to support charging across IMT-2000 and non-IMT-2000 systems.
 - 7.1.1.7 To support the capability of geographical dispersion of control functions.
 - 7.1.1.8 To provide common methods for the provisioning of IMT-2000 services by IMT-2000 management.
 - 7.1.1.9 To provide the capability to report events and reaction in a common way, in order to enable remote control and to simplify maintenance interventions.
 - 7.1.1.10 To minimize the complexity of IMT-2000 management.
 - 7.1.1.11 To minimize the load caused by management traffic when the telecommunications network is used to carry it.
 - 7.1.1.12 To define methods and control to be employed to effect as quick as possible set up and changes to the system.
- NOTE 2 – This would enable a safe, continuing extension and enhancement of offered IMT-2000 services.
- 7.1.1.13 To enable the support and control of a growing number of resources. This would allow the system to start from a small and simple configuration and to grow as needed both in size and complexity.
 - 7.1.1.14 To support the system to be configured for the condition of not only a high traffic area but also a low traffic area, e.g. rural remote area.
 - 7.1.1.15 To allow for enough flexibility in the configuration of the system such that particular IMT-2000 operator requirements concerning the availability of IMT-2000 services may be met.
 - 7.1.1.16 To address the convergence of IMT-2000 management for the operation of terrestrial and satellite components of IMT-2000.
 - 7.1.1.17 To allow also the management of IMT-2000 radio-connected “infrastructure” (e.g. mobile base stations).
 - 7.1.1.18 To address interworking between IMT-2000 operators, whether public or private, covering overlapping or adjacent areas.

NOTE 3 – This will allow IMT-2000 services provision by more than one operator in any area of coverage, and a continuity of service between IMT-2000 environments.

7.1.1.19 To specify standards to support the exchange of necessary and/or desirable management information between IMT-2000 operators, whether public or private.

NOTE 4 – This would support inter-operators roaming from mobile users.

7.1.1.20 To reuse the existing relevant standardization work on management of PLMN, IN, ISDN/B-ISDN, etc. already carried out by other standardization bodies.

7.1.1.21 To address IMT-2000 interworking with a wide range of existing or future partner networks and services such as other mobile networks, ISDN, B-ISDN, PSTN, UPT.

7.1.1.22 To support and control the management of the security aspects in IMT-2000 such as cryptographic key administration and access control management.

7.1.1.23 To take account of existing and developing mobile telecommunication networks and systems that may wish to evolve towards IMT-2000.

7.1.2 General requirements for IMT-2000 management

The objectives for IMT-2000 management must now be analysed from different viewpoints (e.g. service quality aspects, management functional areas) to identify general requirements for IMT-2000 management.

NOTE 1 – IMT-2000 operator refers to an IMT-2000 network operator or an IMT-2000 service provider or to both of them, according to how the responsibility is shared between the network operator and the service provider.

NOTE 2 – A direct assignment of O&M functions and activities to functional blocks is not possible before the definition of network architecture. This statement is at the moment valid for all network components of IMT-2000.

7.1.2.1 Service quality

IMT-2000 operators should be able to select criteria for the evaluation of the IMT-2000 service quality. The following requirements, from an operator's perspective, have been identified:

- to recognize the kind of service and related service quality;
- to monitor the service quality;
- to be able to recognize the different kinds of terminal;
- to support handover between networks while maintaining the appropriate quality;
- to support the demand of users to communicate in every network with the appropriate service quality;
- to support the functionality to indicate degraded service quality to the user/terminal;
- to cooperate on service quality issues with other network management systems.

7.1.2.2 Service and business areas

This section provides the general IMT-2000 management requirements, from an IMT-2000 operator point of view, for the following aspects:

- subscriber and user administration;
- charging and billing (e.g. collection of charges from subscribers);
- inter-operator accounting (e.g. collection of charges from other operators);
- service management.

7.1.2.2.1 Subscriber and user administration

IMT-2000 management should include the management functions associated with the administration of data (possibly distributed over several databases), related to the provision of IMT-2000 services to subscribers and users. The use of a unique user identification and of a unique equipment identification needs to be foreseen.

Every user is associated with a subscription. Every subscription is associated with a service provider.

7.1.2.2.2 Charging and billing

In IMT-2000 there will exist different possibilities to charge for calls:

a) *Normal case*

In this case usage records are created by the network operators. These usage records will be collected by the appropriate service providers for billing.

b) *Hot billing after the call* (credit card callings)

In this case the network operator bills the credit card agency for the call after collection of all relevant usage records.

c) *Hot billing during the call* (prepaid cards or cash)

In this case the network operator deducts units from the prepayment while the call is in progress.

IMT-2000 management should provide the means to apply proper charging according to cases a) to c).

Usage records are transferred to the service provider of the involved users.

Originating, transit and terminating IMT-2000 operators should be able to do usage metering.

Usage metering of network resources for the purpose of billing shall be the responsibility of the network operator.

IMT-2000 management should enable IMT-2000 operators to register certain kinds of handovers, in order to be able to charge differently depending on handover cases (e.g. terrestrial/satellite).

IMT-2000 management should enable IMT-2000 operators to charge for the usage of location management procedures.

In order to enable different charging techniques during the call (e.g. directly to the user), IMT-2000 management should provide mechanisms to manage the exchange of charging information, e.g. when a handover is invoked.

7.1.2.2.3 Inter-operator accounting

Inter-operator accounting should be verifiable. This implies that when traffic over a given connection or link between two IMT-2000 operators is to be charged, usage metering needs to be done on both sides: outgoing (Operator A) and incoming traffic (Operator B).

The service provider will be able to collect usage records relating to use of resources from all involved network operators.

Inter-operator accounting should result in an exchange of usage metering information based on the actual route.

Usage metering of signalling traffic (out of call procedures: e.g. interrogation, location updates) for the purpose of inter-operator accounting might be needed.

7.1.2.2.4 Service management

IMT-2000 management should allow the use of IMT-2000 for the purpose of providing its services to fixed users.

IMT-2000 management should support the use of IMT-2000 for the purpose of providing its services to fixed users, as well as to mobile users.

IMT-2000 management should allow service management even in the case of shared infrastructure.

IMT-2000 management should support IMT-2000 operation (interworking) with a wide range of existing or future partner networks and services (e.g. other mobile networks, ISDN/B-ISDN, PSTN, UPT). This should allow the desired services to be offered in a cost-effective way.

7.1.2.3 Security management area

This section provides the general IMT-2000 management requirements for the following aspects:

- management of IMT-2000 specific security mechanisms and algorithms,
- key management,
- encryption management,
- authentication management,
- access control management,
- service barring list management,
- security audit management,
- management of subscriber related credential information,
- information exchange regarding security management.

NOTE 1 – Security management standardization is concerned with the management functions allowing IMT-2000 operators to perform administration of the security features of the network (e.g. handling of security alarms).

NOTE 2 – Security management standardization is not concerned with the definition of security features (e.g. cryptographic key generation and distribution).

7.1.2.4 Performance monitoring area

This section provides the general IMT-2000 management requirements for the following aspects:

- performance data generation and collection (e.g. for QoS/GOS analysis),
- traffic measurements,
- subscriber activity tracing.

IMT-2000 management should support the use of measurements from, e.g. handover, user registration, location updating and paging, for performance and planning purposes.

The measurement data produced by the network could be used for:

- traffic measurements (e.g. successful/unsuccessful handovers per a group of base stations per hour);
- evaluation of current network configuration (e.g. ratio of handover attempts and successful handovers per cell). The measurement results can be further processed in the network planning and reconfiguration part of TMN;
- evaluation of possible fault situations around the IMT-2000 network (e.g. number of successful and failed handovers per source/target cell).

7.1.2.5 System configuration area

This section provides the general IMT-2000 management requirements for the following aspects:

- spectrum management,
- system extension (e.g. introduction of a new network element or function),
- system reduction (e.g. removal of a network element or function),
- system modification (e.g. change of an existing network element or function),
- interworking with other systems.

IMT-2000 management should support:

- the flexibility to manage a wide range of cell types;
- reconfiguration of assigned frequency blocks (spectrum management) in response to changing traffic, service requirements or spectrum allocation, allowing efficient and economical use of the radio spectrum;
- provision of access to IMT-2000 dependent on the mobile terminal type or location;
- provision of access to IMT-2000 for fixed users;
- reconfiguration of the system without disrupting the normal provision of services;
- the management of the relevant configuration information used by IMT-2000 specific radio interface protocols, e.g. cell identities;