

RECOMMENDATION ITU-R M.1311

**FRAMEWORK FOR MODULARITY AND RADIO
COMMONALITY WITHIN IMT-2000**

(1997)

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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. 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, linked 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 service quality,
- worldwide roaming, and
- use of a small pocket terminal worldwide.

This Recommendation forms part of the process of specifying the radio interface(s) of IMT-2000. IMT-2000 is defined by a set of interdependent ITU Recommendations of which this Recommendation is a member.

1.1 Emerging trends

One of the most challenging aspects of designing future wireless telecommunications systems is accurately anticipating what the future market and technological drivers will be. This is made even more difficult by the rapid advances in technology over the last few years and the increasingly sophisticated demands of the end-user. For example, in the next few years wireless networks will likely need to support high-speed data, image, and/or multimedia in addition to pure voice traffic in order to meet customer demands. Even voice will be coded differently and at different rates for various services and applications. This will create the need for an infrastructure that can support end-user connections with differing technical systems requirements. As a result of all the factors, the design of any future wireless network must be as flexible as possible. Clearly, a common, flexible infrastructure is needed that can interface with multiple radio interface technologies on the one hand and multiple fixed network technologies on the other.

At the time IMT-2000 are introduced, narrow-band voice networks will still predominate in the fixed network, but advanced broadband networks will be a critical component as well. In these broadband networks, asynchronous transfer mode (ATM) technology will likely be the switching and transmission technology of choice due to the provision of a common, flexible platform from which many different types of communications (voice, data, image, video, high-quality sound and multimedia) can be served.

In addition, there is a worldwide move towards standards which are substantially technology-independent, to maximize their potential application to a number of different environments.

A number of emerging trends are having a significant impact upon the design of telecommunications networks and current indications are that this process will accelerate in the future. Work in other standards bodies, particularly regarding broadband technologies, and other major advances in technology, are contributing to this situation. Of particular consequence to network design are:

- the separation of applications from networks,
- the convergence of telecommunications and information technology,
- the convergence of fixed, mobile and private network capabilities,
- the emerging importance of personal communications,
- new advanced distributed processing concepts available for service control,
- the increasing use of ATM and transmission control protocol/Internet protocol (TCP/IP) for the transport of all types of information,
- the need for substantially “seamless” evolution from one telecommunications technology/standard to a later one, or for evolution within the standard.

1.2 Objectives of IMT-2000 that impact on modularity

Important design objectives for IMT-2000 are to minimize the number of radio interfaces, to maximize the commonality between them and to be able to flexibly adapt different services onto these radio interface(s). These design objectives should be met in order to minimize costs and to ease service and network deployment.

A number of objectives have been established which place requirements upon IMT-2000 system design and the design of networks implementing IMT-2000. The key aspects for the purpose of this Recommendation are:

- to facilitate evolution to IMT-2000 from existing fixed and mobile systems;
- to provide a common platform/framework for the support of various categories of services;
- to be adaptable to the service providers' and network operators' need to differentiate their service offerings;
- to facilitate the deployment of the system in a manner consistent with the individual needs of service providers and network operators.

Each of these objectives could have a significant impact upon IMT-2000 system, network and protocol design.

In short, two major goals to be achieved for the transport mechanisms are: independence from the transmission technology and support of a wide and changing range of services.

A modularized functional and physical architecture needs to satisfy the following requirements:

- future evolution,
- interworking between a variety of access technologies/standards, core transport and core control standards/networks,
- technology-independence of telecommunications standards,
- service differentiation options for operators and/or service providers,
- standards which provide scope, within a generic framework, for proprietary enhancements to meet specific needs,
- support for a variety of radio environments,
- backwards compatibility.

1.3 Rationale

IMT-2000 will serve different radio environments leading potentially to different radio interface technology choices. In order to minimize the investments in the core network (CN), it is thought that the ability to connect different radio transmission modules to the same CN equipment, e.g. a switch, should be investigated. Moreover, it has been recognized that IMT-2000 shall be "future proof", that is IMT-2000 shall have the ability to evolve by replacing modules and keeping others. Such a design will also facilitate the evolution of mobile systems that are currently in service or will be introduced prior to IMT-2000 (referred to as "pre-IMT-2000" systems) to third generation ones. One way to achieve such a goal is, again, to have radio transmission modules clearly separated from the CN.

Such similar goals have been pursued in the field of the fixed network and led to the development of ATM standards. Therefore it is proposed to adopt a similar approach for the radio interface of IMT-2000. Taking a similar approach means using a layered approach leading to a clear independence of the transport mechanism from the services on one side and from the transmission technology on the other side.

2 Scope

This Recommendation is primarily based on the principles, requirements and framework of the IMT-2000 radio interface(s), as outlined in IMT-2000 Recommendations ITU-R M.687, ITU-R M.819, ITU-R M.1034 and ITU-R M.1035. This Recommendation identifies and describes the modularity and radio commonality principles which should be adopted in the development of the radio-related aspects of IMT-2000.

This includes:

- the modularity concept and its rationale,
- the functional modules in the radio access network (RAN),
- the groupings of functions in the RAN.

The purpose of the Recommendation is to facilitate the development of a modular framework which can be used as a basis for specific architectures, enabling these to be combined in various ways to meet operators' needs.

3 Related documents

- Recommendation ITU-R M.687: International Mobile Telecommunications-2000 (IMT-2000).
- Recommendation ITU-R M.816: Framework for services supported on IMT-2000.
- Recommendation ITU-R M.817: International Mobile Telecommunications-2000 (IMT-2000) Network Architectures.
- Recommendation ITU-R M.818: Satellite operations within IMT-2000.
- Recommendation ITU-R M.819: IMT-2000 for Developing Countries.
- Recommendation ITU-R M.1034: Requirements for the Radio Interface(s) for IMT-2000.
- Recommendation ITU-R M.1035: Framework for the Radio Interface(s) and Radio Subsystem Functionality for IMT-2000.
- Recommendation ITU-R M.1036: Spectrum Considerations for Implementation of IMT-2000 in the Bands 1 885-2 025 MHz and 2 110-2 200 MHz.
- Recommendation ITU-R M.1167: Framework for the Satellite Component of IMT-2000.
- Recommendation ITU-R M.1224: Vocabulary of Terms for IMT-2000.
- Recommendation ITU-R M.1225: Guidelines for Evaluation of Radio Transmission Technologies for IMT-2000.
- ITU-T Recommendation Q.931: Digital subscriber signalling system No. 1 (DSS 1) – ISDN user-network interface layer 3 specification for basic call control.
- ITU-T Recommendation Q.2931: Broadband integrated services digital network (B-ISDN) – Digital Subscriber Signalling System No. 2 (DSS 2) – User-Network Interface (UNI) layer 3 specification for basic call/connection control.

4 Terminology

This paragraph defines terminology relevant to this Recommendation which is not included in Recommendation ITU-R M.1224.

4.1 Terms and definitions

Adaptation functionality (AF)

A set of functions which allows the provision of CN services transparently through the RAN between the mobile terminal and the corresponding CN.

Interworking function (IWF)

Mechanism which masks the differences in physical, link and network technologies by converting or mapping states and protocols into consistent network and user services (see Recommendation ITU-R M.1224).