INTERNATIONAL TELECOMMUNICATION UNION

CCITT

E.202

THE INTERNATIONAL
TELEGRAPH AND TELEPHONE
CONSULTATIVE COMMITTEE

(10/92)

TELEPHONE NETWORK AND ISDN

OPERATION, NUMBERING, ROUTING AND MOBILE SERVICE

NETWORK OPERATIONAL PRINCIPLES FOR FUTURE PUBLIC MOBILE SYSTEMS AND SERVICES

Recommendation E.202

FOREWORD

The CCITT (the International Telegraph and Telephone Consultative Committee) is a permanent organ of the International Telecommunication Union (ITU). CCITT is responsible for studying technical, operating and tariff questions and issuing Recommendations on them with a view to standardizing telecommunications on a worldwide basis.

The Plenary Assembly of CCITT which meets every four years, establishes the topics for study and approves Recommendations prepared by its Study Groups. The approval of Recommendations by the members of CCITT between Plenary Assemblies is covered by the procedure laid down in CCITT Resolution No. 2 (Melbourne, 1988).

Recommendation E.202 was prepared by Study Group II and was approved under the Resolution No. 2 procedure on the 30th of October 1992.

CCITT NOTES

1) In this Recommendation, the expression "Administration" is used for conciseness to indicate both a telecommunication administration and a recognized private operating agency.

2) A list of abbreviations used in this Recommendation can be found in Annex A.

© ITU 1993

All rights reserved. No part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from the ITU.

Recommendation E.202

NETWORK OPERATIONAL PRINCIPLES FOR FUTURE PUBLIC MOBILE SYSTEMS AND SERVICES

(1992)

1 Introduction

1.1 The active research and interest in future public mobile radio systems and personal communications has meant that mobile systems will have a significant role in the provision of telecommunication services. The anticipated demand for personal mobility has caused the need for guidelines for interconnecting and integrating future public mobile systems with the current and future fixed networks (including PSTN, ISDN and B-ISDN).

1.2 This Recommendation sets out principles, from the network operational point of view, which should be taken into account during the design of new public mobile systems and networks. The objective is to ensure that such future systems can be interconnected to the fixed network with minimal adverse effect on overall Quality of Service and without the need for enhanced functionality in the fixed network.

2 Scope

2.1 Future public mobile systems may result in the convergence of cellular and cordless functionalities, and combination/amalgamation with satellite based systems. This Recommendation focuses on terrestrial based future mobile systems. Satellite based systems are not specifically addressed, and are for further study.

3 Related Recommendations

3.1 Recommendation E.201, reference Recommendation for mobile systems and services, provides a comprehensive guide to related Recommendations in CCITT and CCIR. Of particular relevance to the present Recommendation are

- Recommendation E.220, Interconnection of public land mobile networks (PLMN).
- Recommendation E.750-Series Recommendations dealing with traffic engineering aspects of mobile systems.
- Recommendation G.173, Transmission planning aspects of the speech service in digital public land mobile networks.

4 General principles

4.1 In general, the interconnection of future public mobile systems to the PSTN/ISDN, should not impose any requirement for additional functionality in the current fixed network, nor any restriction in the normal operation of the fixed network (Recommendation E.220). Operational principles for grade of service should conform to the E.750-Series Recommendations. In general, Quality of Service and end-to-end network performance should conform to appropriate CCITT Recommendations.

4.2 The interconnection and integration of future public mobile systems should not result in any impairment to the Quality of Service provided on calls routed across the interconnection or within the integrated network.

5 Network operation

5.1 *General*

5.1.1 In principle networks used to support future mobile systems should be digital and compatible with the ISDN.

5.1.2 Where appropriate, Intelligent Network (IN) technology should be employed, and this should be compatible with the IN principles and standards produced by CCITT.

5.2 *Roaming*

5.2.1 Mobile units in a future public mobile system may either travel within the home public network, across or within other public networks, or private customer premises networks. Roaming requires the updating of a location data base for a mobile unit to provide service to the mobile unit when it is in the coverage area of a location data base beyond its home network. This location management may be handled by a distributed data base function.

5.2.2 From the location data base point of view, at least three roaming scenarios are possible for future public mobile systems:

- inter-operator roaming (roaming between public networks);
- intra-environment roaming (roaming within one public network);
- inter-environment roaming (roaming from a public network to a private customer premises network).

5.2.3 In principle, all mobile units should be able to initiate access to public networks operated by different operators as well as private customer premises networks. However, users should be able to make a choice between the networks based on parameters such as tariff structure, service quality, and coverage whenever possible. This choice is intended to be made at connection setup. The possibility of a choice during an established connection, e.g. on the basis of data available on line, is for further study.

5.2.4 The design of future systems should take account of the possibility of occasional loss of roaming functionality, and provide for customer notification and recovery procedures.

5.2.5 In principle, efficient network routing should be provided to roaming mobile units. Consideration has to be given to the trade-off between the amount of location registration/paging signalling traffic and the time to locate a mobile unit.

5.3 *Handover*

5.3.1 Assuming that future public mobile systems will be optimized to achieve spectrum efficiency, consideration has to be given to the amount of signalling to be carried by the fixed network especially in an integrated fixed network and mobile system. The optimum proportion of signalling traffic to the user traffic is a complex issue related to cell size, location registration and paging area, user density, and at the system level at which the control is performed, i.e. locally or centrally.

5.3.2 In future public mobile systems, microcells may be implemented, wherever service demand justifies their deployment. Mixed cell architecture may be introduced, with microcells co-located with macrocells in order to achieve both strategic and wide-area radio coverage. In general, backward handover (i.e. handover signalling effected via the current channel) should normally be employed to ensure network control and spectral efficiency. However, when a mobile unit turns a corner, or moves into a shadowed area (e.g. an underground car park), the signal level may be significantly degraded and rapid handover may have to be effected to ensure the continuity of the connection. In this situation the option of a “forward” handover (i.e. handover signalling effected via the new channel) may need to be executed as the quality of the current channel may not be sufficient to support the required handover signalling.

5.3.3 Consideration should be given to the possibility of network blocking, leading to the possibility that a handover will be unsuccessful due to non-availability of network circuits. This topic is covered by Recommendation E.771 on GOS parameters and target values for circuit switched land mobile networks. Consideration should also be given to the handover of high bit rate services and simultaneous multiple handover in mobile customer premises networks (e.g. in buses, trains).

5.3.4 In some existing cellular radio systems the handover between mobile switching centres requires an anchor mobile switching centre (i.e. one which retains control of the call). In future systems, if the cell size is decreased, the number of handovers per call is likely to increase. In addition, future local exchanges (LEs) might be equipped with the functionality associated with mobile switching centres. The chance of multiple inter-LE handover during a call will increase accordingly. To avoid multiple LEs being held-up by one call it is desirable that future public mobile systems should be required to transfer both connection control and call control to the new LE under the control of the transit exchange. The routing in the fixed network should also be optimized.

5.3.5 In principle, the Quality of Service of a call should not be degraded during inter-environment handover. This issue is for further study.

5.3.6 With the roaming facilities that will be offered by future mobile systems the echo path of a connection may vary during the duration of a call because of inter-environment handover. Echo control devices should be able to converge on new echo paths without injecting subjective impairments on calls.

5.3.7 In principle, priority should be given to the handover of calls-in-progress over new call attempts.

5.4 *Grade of service*

Grade of service should conform to the appropriate E.750-Series Recommendations.

5.5 *Security*

5.5.1 In principle, data security and voice privacy should be maintained in roaming and handover and should conform to CCITT Recommendations.

6 Signalling

6.1 In principle, the signalling systems used or developed for future mobile systems should be compatible with those utilized in the fixed network. The objective should be to maximize service and feature transparency, thereby reducing the need for complex interworking relationships between, and easing the integration of, fixed and mobile networks.

7. Transmission

7.1 General

7.1.1 In principle, the design of future mobile systems should take into account, the overall end-to-end transmission performance on all realistic connections. In particular, the cumulative effects of speech processing devices, both in the mobile network and the fixed network should be considered. Recommendations G.173, G.721, G.763 and P.94 refer.

7.2 *Transmission delay*

The overall one way transmission time between any two mobile terminals or between a mobile and a fixed terminal, should be kept to a minimum. It is recognized that not all possible user applications and network configurations can be predicted, such that some user applications and network arrangements may combine processing and propagation delays such that the transmission time exceeds what would be considered the recommended value for the fixed network. See Recommendation G.114.

7.3 *Speech quality*

7.3.1 Speech quality should be as good as or better than Recommendation G.721 (32 kbit/s ADPCM standard) with approximately 3.5 qdu between analogue interfaces.

7.3.2 Echo protection should conform with CCITT Recommendations in particular with Recommendation E.220. Due consideration should be given to acoustic echoes in hands-free operating environment.

8 Reference configurations

8.1 Figure 1a)/E.202 shows the case of a future mobile system operating as a stand-alone network connected to the fixed network. In the figure, the following network elements are defined:

MS: Mobile unit, i.e. the user terminal. This is connected to the public network or a customer premises network through a radio path.

BSS: The base station sub-system is composed of more than one physical network element. It may contain a base station controller and a number of base transceiver stations.

MCN: The mobile control node is responsible for all mobile specific control functions such as mobile call establishment, handover, and security.

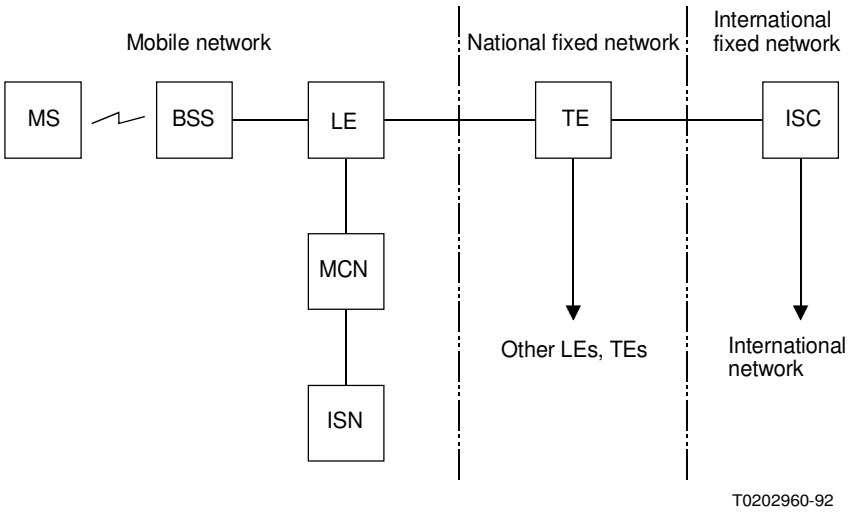
LE: The local exchange has the capability associated with a mobile switching centre.

ISN: The information storage node stores the information on location, terminal, subscriber, and services.

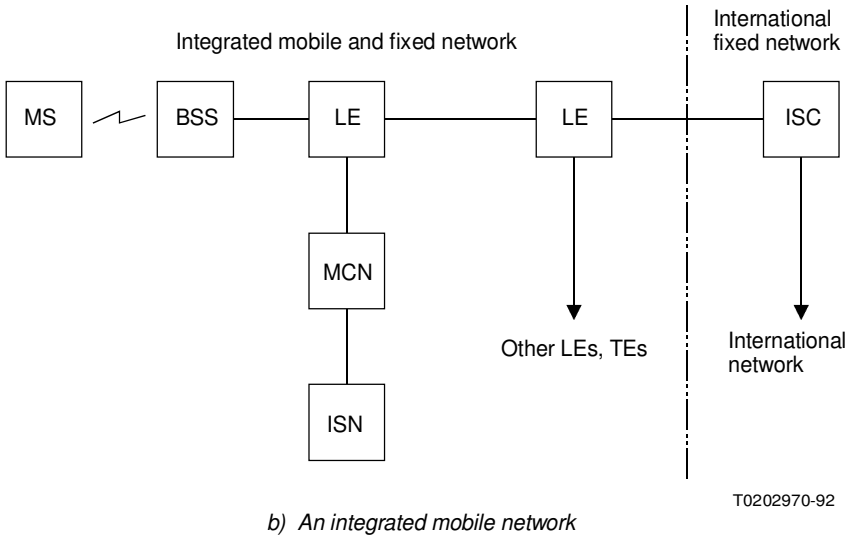
8.2 Figure 1b)/E.202 shows the case of future mobile systems operating as sub-networks of the fixed network. In this case, the local exchange has the capability of connecting base station sub-systems with MCNs.

9 History

First published in 1993.



a) A stand-alone mobile network



b) An integrated mobile network

FIGURE 1/E.202

ANNEX A

(to Recommendation E.202)

Alphabetical list of abbreviations used in this Recommendation

ADPCM	Adaptive differential pulse code modulation
B-ISDN	Broadband integrated services digital network
BSS	Base station sub-system
IN	Intelligent network
ISC	International switching centre
ISDN	Integrated services digital network
ISN	Information storage node
LE	Local exchange
MCN	Mobile control node
MS	Mobile unit
PSTN	Public switched telephone network
TE	Transit exchange