INTERNATIONAL TELECOMMUNICATION UNION

CCITT

THE INTERNATIONAL
TELEGRAPH AND TELEPHONE
CONSULTATIVE COMMITTEE

BLUE BOOK

VOLUME III – FASCICLE III.7

INTEGRATED SERVICES DIGITAL NETWORK (ISDN)
GENERAL STRUCTURE AND SERVICE CAPABILITIES

RECOMMENDATIONS I.110-I.257

IXTH PLENARY ASSEMBLY
MELBOURNE, 14-25 NOVEMBER 1988

Geneva 1989

INTERNATIONAL TELECOMMUNICATION UNION

CCITT

THE INTERNATIONAL
TELEGRAPH AND TELEPHONE
CONSULTATIVE COMMITTEE

BLUE BOOK

VOLUME III – FASCICLE III.7

INTEGRATED SERVICES DIGITAL NETWORK (ISDN)
GENERAL STRUCTURE AND SERVICE CAPABILITIES

RECOMMENDATIONS I.110-I.257

IXTH PLENARY ASSEMBLY
MELBOURNE, 14-25 NOVEMBER 1988

Geneva 1989

ISBN 92-61-03371-7

Printed in Switzerland

CONTENTS OF THE CCITT BOOK
APPLICABLE AFTER THE NINTH PLENARY ASSEMBLY (1988)

BLUE BOOK

FASCICLE III.6 – Line transmission of non-telephone signals. Transmission of sound-programme and television signals. Series H and J Recommendations (Study Group XV).

FASCICLE III.7 – Integrated Services Digital Network (ISDN) – General structure and service capabilities. Recommendations I.110-I.257 (Study Group XVIII).

FASCICLE III.8 – Integrated Services Digital Network (ISDN) – Overall network aspects and functions, ISDN user-network interfaces. Recommendations I.310-I.470 (Study Group XVIII).

FASCICLE III.9 – Integrated Services Digital Network (ISDN) – Internetwork interfaces and maintenance principles. Recommendations I.500-I.605 (Study Group XVIII).

Volume IV

FASCICLE IV.1 – General maintenance principles: maintenance of international transmission systems and telephone circuits. Recommendations M.10-M.782 (Study Group IV).

FASCICLE IV.2 – Maintenance of international telegraph, phototelegraph and leased circuits. Maintenance of the international public telephone network. Maintenance of maritime satellite and data transmission systems. Recommendations M.800-M.1375 (Study Group IV).

FASCICLE IV.3 – Maintenance of international sound-programme and television transmission circuits. Series N Recommendations (Study Group IV).

FASCICLE IV.4 – Specifications for measuring equipment. Series O Recommendations (Study Group IV).

Volume V – Telephone transmission quality. Series P Recommendations (Study Group XII).

Volume VI

FASCICLE VI.1 – General Recommendations on telephone switching and signalling. Functions and information flows for services in the ISDN. Supplements. Recommendations Q.1-Q.118 *bis* (Study Group XI).

FASCICLE VI.2 – Specifications of Signalling Systems Nos. 4 and 5. Recommendations Q.120-Q.180 (Study Group XI).

FASCICLE VI.3 – Specifications of Signalling System No. 6. Recommendations Q.251-Q.300 (Study Group XI).

FASCICLE VI.4 – Specifications of Signalling Systems R1 and R2. Recommendations Q.310-Q.490 (Study Group XI).

FASCICLE VI.5 – Digital local, transit, combined and international exchanges in integrated digital networks and mixed analogue-digital networks. Supplements. Recommendations Q.500-Q.554 (Study Group XI).

FASCICLE VI.6 – Interworking of signalling systems. Recommendations Q.601-Q.699 (Study Group XI).

FASCICLE VI.7 – Specifications of Signalling System No. 7. Recommendations Q.700-Q.716 (Study Group XI).

FASCICLE VI.8 – Specifications of Signalling System No. 7. Recommendations Q.721-Q.766 (Study Group XI).

FASCICLE VI.9 – Specifications of Signalling System No. 7. Recommendations Q.771-Q.795 (Study Group XI).

FASCICLE VI.10 – Digital subscriber signalling system No. 1 (DSS 1), data link layer. Recommendations Q.920-Q.921 (Study Group XI).

FASCICLE VI.11 – Digital subscriber signalling system No. 1 (DSS 1), network layer, user-network management. Recommendations Q.930-Q.940 (Study Group XI).

FASCICLE VI.12 – Public land mobile network. Interworking with ISDN and PSTN. Recommendations Q.1000-Q.1032 (Study Group XI).

FASCICLE VI.13 – Public land mobile network. Mobile application part and interfaces. Recommendations Q.1051-Q.1063 (Study Group XI).

FASCICLE VI.14 – Interworking with satellite mobile systems. Recommendations Q.1100-Q.1152 (Study Group XI).

Volume VII

FASCICLE VII.1 – Telegraph transmission. Series R Recommendations. Telegraph services terminal equipment. Series S Recommendations (Study Group IX).

FASCICLE VII.2 – Telegraph switching. Series U Recommendations (Study Group IX).

FASCICLE VII.3 – Terminal equipment and protocols for telematic services. Recommendations T.0-T.63 (Study Group VIII).

FASCICLE VII.4 – Conformance testing procedures for the Teletex Recommendations. Recommendation T.64 (Study Group VIII).

FASCICLE VII.5 – Terminal equipment and protocols for telematic services. Recommendations T.65-T.101, T.150-T.390 (Study Group VIII).

FASCICLE VII.6 – Terminal equipment and protocols for telematic services. Recommendations T.400-T.418 (Study Group VIII).

FASCICLE VII.7 – Terminal equipment and protocols for telematic services. Recommendations T.431-T.564 (Study Group VIII).

Volume VIII

FASCICLE VIII.1 – Data communication over the telephone network. Series V Recommendations (Study Group XVII).

FASCICLE VIII.2 – Data communication networks: services and facilities, interfaces. Recommendations X.1-X.32 (Study Group VII).

FASCICLE VIII.3 – Data communication networks: transmission, signalling and switching, network aspects, maintenance and administrative arrangements. Recommendations X.40-X.181 (Study Group VII).

FASCICLE VIII.4 – Data communication networks: Open Systems Interconnection (OSI) – Model and notation, service definition. Recommendations X.200-X.219 (Study Group VII).

FASCICLE VIII.5 – Data communication networks: Open Systems Interconnection (OSI) – Protocol specifications, conformance testing. Recommendations X.220-X.290 (Study Group VII).

FASCICLE VIII.6 – Data communication networks: interworking between networks, mobile data transmission systems, internetwork management. Recommendations X.300-X.370 (Study Group VII).

FASCICLE VIII.7 – Data communication networks: message handling systems. Recommendations X.400-X.420 (Study Group VII).

FASCICLE VIII.8 – Data communication networks: directory. Recommendations X.500-X.521 (Study Group VII).

Volume IX – Protection against interference. Series K Recommendations (Study Group V). Construction, installation and protection of cable and other elements of outside plant. Series L Recommendations (Study Group VI).

Volume X

FASCICLE X.1 – Functional Specification and Description Language (SDL). Criteria for using Formal Description Techniques (FDTs). Recommendation Z.100 and Annexes A, B, C and E, Recommendation Z.110 (Study Group X).

FASCICLE X.2 – Annex D to Recommendation Z.100: SDL user guidelines (Study Group X).

FASCICLE X.3 – Annex F.1 to Recommendation Z.100: SDL formal definition. Introduction (Study Group X).

FASCICLE X.4 – Annex F.2 to Recommendation Z.100: SDL formal definition. Static semantics (Study Group X).

FASCICLE X.5 – Annex F.3 to Recommendation Z.100: SDL formal definition. Dynamic semantics (Study Group X).

FASCICLE X.6 – CCITT High Level Language (CHILL). Recommendation Z.200 (Study Group X).

FASCICLE X.7 – Man-Machine Language (MML). Recommendations Z.301-Z.341 (Study Group X).

CONTENTS OF FASCICLE III.7 OF THE BLUE BOOK

Part I – I.100-Series Recommendations

General structure

Part II – I.200-Series Recommendations

Service capabilities

PRELIMINARY NOTE

In this Volume, the expression "Administration" is used for shortness to indicate both a telecommunication Administration and a recognized private operating agency.

PART I

I.100-Series Recommendations

GENERAL STRUCTURE

PAGE INTENTIONALLY LEFT BLANK

PAGE LAISSEE EN BLANC INTENTIONNELLEMENT

SECTION 1

FRAME OF I-SERIES RECOMMENDATIONS
TERMINOLOGY

Recommendation I.110

PREAMBLE AND GENERAL STRUCTURE OF THE I-SERIES RECOMMENDATIONS FOR THE INTEGRATED SERVICES DIGITAL NETWORK (ISDN)

(Malaga-Torremolinos, 1984; amended at Melbourne, 1988)

1 Preamble

1.1 *Introduction*

An ISDN is a network, in general evolving from a telephony Integrated Digital Network (IDN), that provides end-to-end digital connectivity to support a wide range of services, including voice and non-voice services, to which users have access by a limited set of standard multi-purpose user-network interfaces.

This concept requires a family of CCITT Recommendations.

The I-Series Recommendations will provide principles and guidelines on the ISDN concept, as well as a detailed specification of the user-network and internetwork interfaces. They will further contain suitable references so that the detailed Recommendations on specific elements within the network can continue to be developed in the appropriate Recommendation series.

Figure 1/I.110 produces a broad outline of the structure of the I-Series of Recommendations and their relationship to other Recommendations. As shown in the Figure, the current structure of the I-Series documentation is subdivided into seven major parts. Other I-Series documents may be added as the need arises. In addition, to support the implementation of the ISDN concepts, Recommendations have been produced and others will be produced in other Series by the appropriate specialist group (see Recommendation I.111).

1.2 *Basis of the I-Series approach*

In order to standardize all necessary aspects of ISDN the CCITT has divided the subject matter into a number of distinct (but obviously related) areas (see Figure 2/I.110). Three of these areas are the following:

1) Services (I.200-Series of Recommendations);
2) Network aspects (I.300-Series of Recommendations);
3) User-network access and interfaces (I.400-Series of Recommendations).

Network aspects are further supported by other Recommendations both inside and outside the I-Series.

The I-Series Recommendations are directed at the following principles:

a) the standardization of services offered to subscribers, so as to enable services to be internationally compatible;
b) the standardization of user-network interfaces, so as to enable terminal equipment to be portable [and to assist in a)];
c) the standardization of network capabilities to the degree necessary to allow user-to-network and network-to-network interworking, so as to achieve a) and b) above.

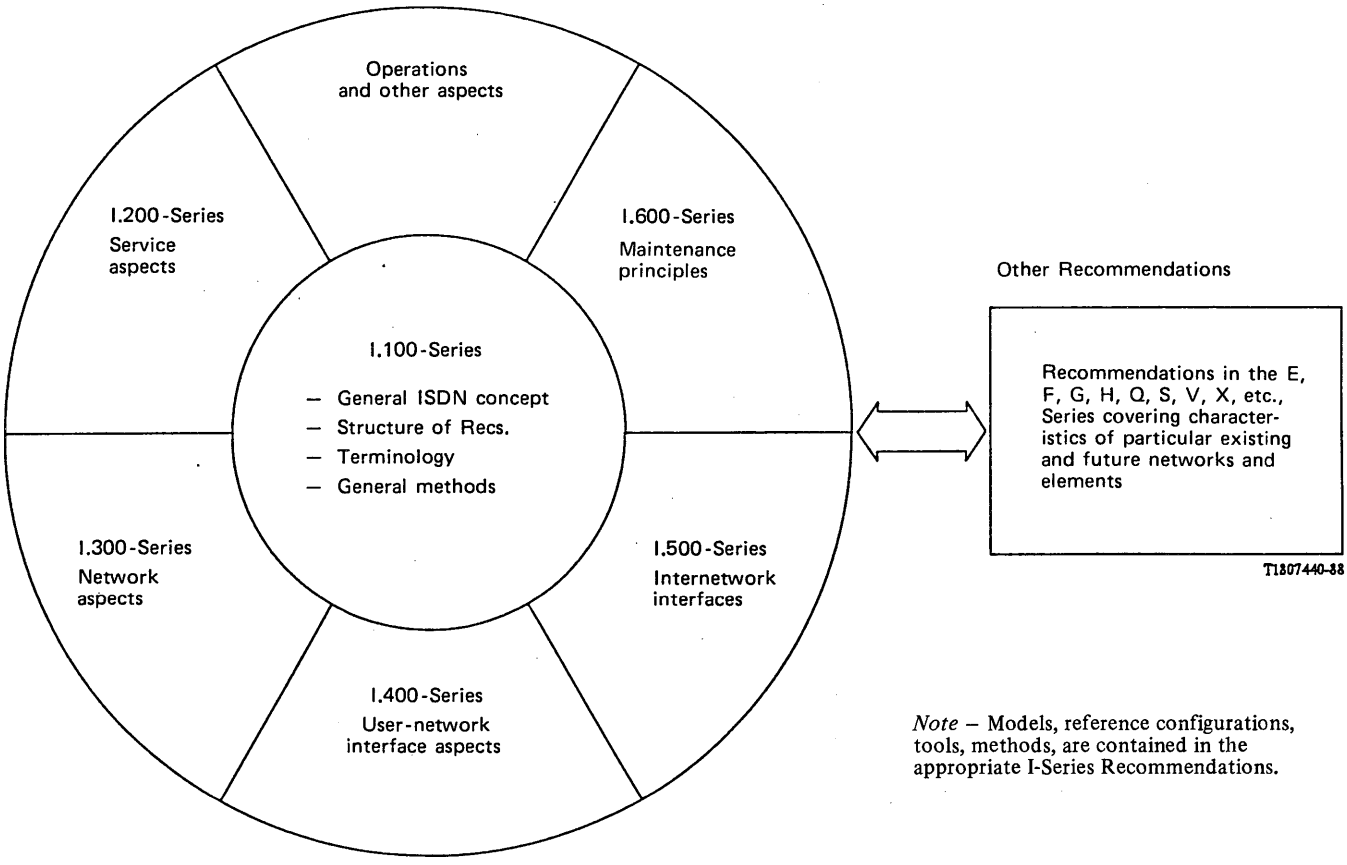


FIGURE 1/I.110

Structure of I-Series Recommendations and their relationship with other Recommendations

The distinction that has been made in this approach between services and network capabilities is perhaps the most important. In the past, each service which was a candidate for standardization was treated in isolation and the necessary standards developed. For the ISDN, a wide range of services has to be considered in a coordinated manner. In addition, in the past there has not been a conscious decision to separate the definition of standards required for services from the definition of the standards for the network capabilities to support these services.

The approach, in the development of the I-Series, has been, first, to establish the broad concepts of the two areas of standards, secondly, to uniquely define these two concepts, and thirdly, to show the relationship between them.

The fourth area shown in Figure 2/I.110, is user equipment. The I-Series includes reference configurations which identify key functional groupings and their physical relationship. The interfaces with the network are explicitly defined; however, the I-Series does not provide a detailed description of any specific terminal element.

Figure 3/I.110 illustrates the relationship between services and network capability areas from a first-order viewpoint; nevertheless the relationship can be seen to be recursive. The figure shows that the driving forces are:

a) what the user wants or is prepared to purchase;

b) the availability of the necessary technology;

c) the economics of developing and enhancing services and the network capabilities.

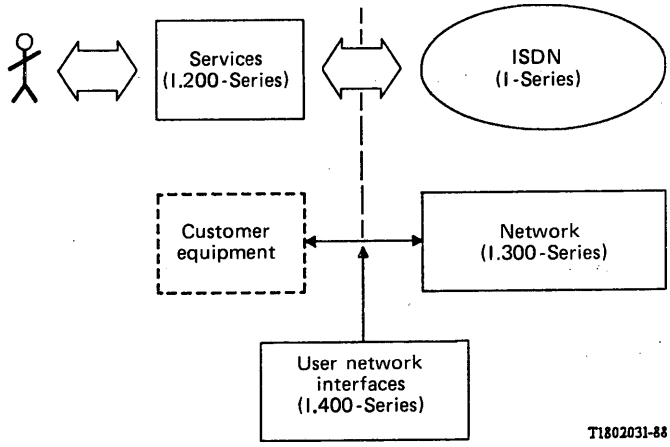


FIGURE 2/I.110

General areas of standardization

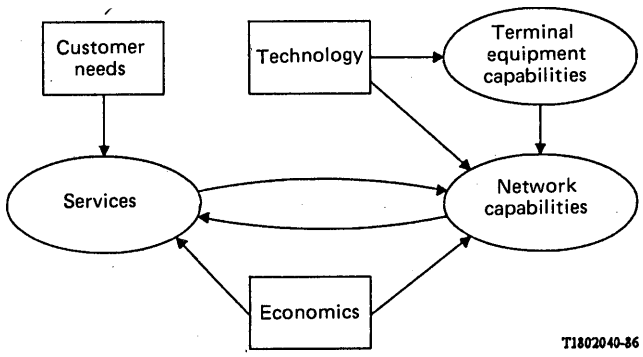


FIGURE 3/I.110

Relationship between services and network capabilities

2 List of Recommendations

Part I – General structure – I.100-Series

SECTION 1 – *Frame of I-Series Recommendations – Terminology*

I.110 Preamble and general structure of the I-Series Recommendations
I.111 Relationship with other Recommendations relevant to ISDNs
I.112 Vocabulary of terms for ISDNs
I.113 Vocabulary of terms for broadband aspects of ISDNs

SECTION 2 – *Description of ISDNs*

I.120 Integrated Service Digital Networks (ISDNs)
I.121 Broadband aspects of ISDNs
I.122 Framework for providing additional packet mode services

Part III – Overall network aspects and functions – I.300-Series

SECTION 1 – *Network functional principles*

I.310 ISDN – Network functional principles

SECTION 2 – *Reference models*

I.320 ISDN Protocol reference model

I.324 ISDN network architecture

I.325 Reference configurations for ISDN connection types

I.326 Reference configurations for relative network resource requirements

I.32x ISDN hypothetical reference connections

SECTION 3 – *Numbering, addressing and routing*

I.330 ISDN numbering and addressing principles

I.331 (E.164) Numbering plan for the ISDN era

I.332 Numbering principles for interwork between ISDNs and dedicated networks with different numbering plans

I.333 Terminal selection in ISDN

I.334 Principles relating ISDN numbers/subaddress to the OSI reference model network layer addresses

I.335 ISDN routing principles

SECTION 4 – *Connection types*

I.340 ISDN connection types

SECTION 5 – *Performance objectives*

I.350 General aspects of Quality of Service and network performance in digital networks, including ISDNs

I.351 Recommendations in other Series including network performance objectives that apply at T-reference points of an ISDN

I.352 Network performance objectives for call processing delays

Part IV – ISDN user-network interfaces – I.400-Series

SECTION 1 – *ISDN user-network interfaces*

I.410 General aspects and principles relating to Recommendations on ISDN user-network interfaces

I.411 ISDN user-network interfaces – Reference configurations

I.412 ISDN user-network interfaces – Interface structures and access capabilities

SECTION 2 – *Application of I-Series Recommendations to ISDN user-network interfaces*

I.420 Basic user-network interface

I.421 Primary rate user-network interface

SECTION 3 – *ISDN user-network interfaces: Layer 1 Recommendations*

I.430 Basic user-network interface – Layer 1 specification

I.431 Primary rate user-network interface – Layer 1 specification

I.43x Higher rate user-network interfaces

SECTION 4 – *ISDN user-network interfaces: Layer 2 Recommendations*

I.440 (Q.920) ISDN user-network interface data link layer – general aspects

I.441 (Q.921) ISDN user-network interface data link layer specification

SECTION 5 – *ISDN user-network interfaces: Layer 3 Recommendations*

I.450 (Q.930) ISDN user-network interface layer 3 – general aspects

I.451 (Q.931) ISDN user-network interface layer 3 specification for basic call control

I.452 (Q.932) ISDN user-network interface layer 3 specification – generic procedures for the control of ISDN supplementary services

SECTION 6 – *Multiplexing, rate adaptation and support of existing interfaces*

I.460 Multiplexing, rate adaptation and support of existing interfaces

I.461 (X.30) Support of X.21 and X.21 *bis* and X.20 *bis* based Data Terminal Equipments (DTEs) by an ISDN

I.462 (X.31) Support of packet mode terminal equipment by an ISDN

I.463 (V.110) Support of Data Terminal Equipments (DTEs) with V-series type interfaces by an ISDN

I.464 Multiplexing, rate adaptation and support of existing interfaces for restricted 64 kbit/s transfer capability

I.465 Support by an ISDN of data terminal equipment with V-Series type interfaces with provision for statistical multiplexing

SECTION 7 – *Aspects of ISDN affecting terminal requirements*

I.470 Relationship of terminal functions to ISDN

Part V – Internetwork interfaces – I.500-Series

I.500 General structure of ISDN interworking Recommendations

I.510 Definitions and general principles for ISDN interworking

I.511 ISDN-to-ISDN Layer 1 internetwork interface

I.515 Parameter exchange for ISDN interworking

I.520 General arrangements for network interworking between ISDNs

I.530 Network interworking between an ISDN and a public switched telephone network (PSTN)

I.540 (X.321) General arrangements for interworking between Circuit-Switched Public Data Networks (CSPDNS) and Integrated Services Digital Networks (ISDNs) for the provision of data transmission services

I.550 (X.325) General arrangements for interworking between Packet Switched Public Data Networks (PSPDNs) and Integrated Services Digital Networks (ISDNs) for the provision of data services

I.560 (V.202) Requirements to be met in providing the telex service within the ISDN

Part VI – Maintenance principles – I.600-Series

I.601	General maintenance principles of ISDN subscriber access and subscriber installation
I.602	Application of maintenance principles to ISDN subscriber installation
I.603	Application of maintenance principles to ISDN basic accesses
I.604	Application of maintenance principles to ISDN primary rate accesses
I.605	Application of maintenance principles to static multiplexed ISDN basic accesses

Recommendation I.111

RELATIONSHIP WITH OTHER RECOMMENDATIONS RELEVANT TO ISDNs

(Malaga-Torremolinos, 1984; amended at Melbourne, 1988)

The I-Series of Recommendations applies to the general concept and to the network capabilities of an ISDN mainly insofar as they appear at user-network interfaces and internetwork interfaces. Moreover, the detailed specifications of ISDN interfaces are contained in the I-Series of Recommendations.

The specific aspects within the network, and ancillary features that are necessary to support the above, will continue to be covered wholly or in part, by the appropriate Series of Recommendations. Such aspects may include:

- technical characteristics of component parts and their performance objectives (e.g. transmission systems, switching systems, interexchange signalling systems);
- network synchronization;
- maintenance and operation;
- services;
- tariffs and charging.

Some of the existing Recommendations for telephony and other dedicated service networks are directly applicable also to ISDNs. However, other Recommendations in those Series may need to be developed in order to cover applications in an ISDN.

References to other Recommendations relevant to ISDNs and/or used in developing I-Series Recommendations are listed in Table 1/I.111.

TABLE 1/I.111

References to other Recommendations relevant to ISDNs

Access, user-network (I.400-Series)
– Q.920, Q.930

Adaptation, terminal (I.460-Series)
– X.30, X.31
– V.110, V.120

Bearer services
– X.25, X.31, X.300
– G.711

Charging (I.141, I.326)
– D.93, D.200-Series

Digital switching
– Q.500-Series

Digital transmission
– G.700-Series, G.800-Series, G.900-Series

Exchange, digital local
– Q.511 to Q.517

Interworking: digital hierarchies
– G.802

Interworking, ISDN and other networks (I.500-Series)
– X.1, X.2, X.10, X.15, X.25, X.30, X.31, X.71, X.75, X.81
– X.180, X.181, X.300-Series
– V.110, V.120
– U.12, U.202
– Q.921, Q.931

Interworking, signalling systems
– Q.120 to Q.180, Q.251 to Q.300, Q.310 to Q.490
– Q.600-Series, Q.700-Series
– X.75

Management and maintenance (I.600-Series)
– M.20, M.21, M.22, M.24, M.30, M.36, M.40
– M.122, M.125
– M.250, M.251, M.550, M.555, M.557
– M.770, M.782
– G.601, G.700-Series, G.821, G.900-Series
– Q.512, Q.542, Q.940

Modelling (I.130-Series, I.140-Series, I.300-Series)
– Q.65, Q.71, Q.80, Q.500-Series, Q.700-Series
– X.200, X.300
– Z.100-Series

Numbering (I.330-Series)
– E.163, E.164, E.165, E.166, E.167
– F.69
– X.121, X.122, X.200
– Q.921, Q.931, Q.932
– T.90

Parameter exchange (I.515)
– V.32, V.100, V.110, V.120
– G.725
– X.21, X.21 *bis*, X.25, X.30, X.31
– Q.931, Q.932, Q.764

Performance (I.350-Series)
– G.100-Series
– G.821, G.822, G.823 and G.824
– P.56, P.66 and P.84

Protection
– K.20
– K.22
– K.23

Routing (I.335)
– E.164, E.170 to E.172, E.502
– G.801
– X.110
– Q.600-Series, Q.700-Series, Q.930, Q.931

Signalling, user-network (I.440-Series, I.450-Series)
– Q.920 to Q.940

Signalling, inter-exchange (SS No. 7)
– Q.701 to Q.714, Q.761 to Q.766, Q.771 to Q.774

Speech encoding
– G.711, G.721, G.722, G.723, G.725

Supplementary services (I.250-Series)
– Q.932
– Q.71 to Q.99
– X.2

Switching
– Q.500-Series

Telephony, transmission quality
– G.100-Series

Teleservices (I.240-Series)
– E-Series
– F-Series
– X-Series
– T-Series
– U.201
– G.711, G.722

Terminals (I.470)
– T.90
– E.330, E.331
– P.31
– V.110, V.120, V.230

Tones and announcements (I.530)
– E.184
– V.25

Transmission
– G.700-Series, G.800-Series, G.900-Series

Vocabulary (I.112, I.113)
– G.701

Recommendation I.112

VOCABULARY OF TERMS FOR ISDNs

(Malaga-Torremolinos, 1984; amended at Melbourne, 1988)

1 Introduction

This Recommendation consists primarily of those terms and definitions that are considered essential to the understanding and application of the principles of an Integrated Services Digital Network (ISDN). They are not exclusive to ISDNs and are also recommended for application, insofar as they are relevant, to other types of telecommunication networks.

Included are some terms that are already defined in other Recommendations. However, the definitions given here embrace only the essential concepts and on that basis it is considered that they are not inconsistent with the more specialized definitions that appear in those other Recommendations.

A small number of the terms and definitions in this Recommendation are duplicated in Recommendation G.701. References to these definitions are given in brackets, for example {1001}, as an aid to ensuring consistency between the two Recommendations in the event of future amendments.

According to the conventions applied in this Recommendation, any term in common usage but whose use is deprecated in the sense defined, is shown as in the following example: "419 functional group [functional grouping]".

Where a truncated term is widely used in an understood context the complete term is quoted following the colloquial form, for example, "111 circuit, telecommunication circuit".

Annex A to this Recommendation contains an alphabetical list of all of the terms contained in this Recommendation.

CONTENTS

2 Vocabulary of terms

2.1 *General*

101 **communication**

F: communication

S: comunicación

The transfer of information according to agreed conventions.

Note – In French and Spanish the corresponding terms "communications" and "comunicación" have additional specific meanings in telecommunication.

102 **signal** {1001}

F: signal

S: señal

A physical phenomenon one or more of whose characteristics may vary to represent information.

103 **analogue signal** {1002}

F: signal analogique

S: señal analógica

A signal one of whose characteristic quantities follows continuously the variations of another physical quantity representing information.

104 **discretely-timed signal** {1003}

F: signal (temporel) discret

S: señal discretamente temporizada

A signal composed of successive elements in time, each element having one or more characteristics which can convey information, for example, its duration, its waveform and its amplitude.

105 **digital signal** {2006}

F: signal numérique

S: señal digital

A discretely-timed signal in which information is represented by a number of well-defined discrete values that one of its characteristic quantities may take in time.

Note – The term may be qualified to indicate the digit rate, for example: "140 Mbit/s digital signal".

106 **transmission** {1004}

F: transmission

S: transmisión

The action of conveying signals from one point to one or more other points.

Note 1 – Transmission can be effected directly or indirectly, with or without intermediate storage.

Note 2 – The use of the English word "transmission" in the sense of "emission" is deprecated.

107 **digital transmission** {3001}

F: transmission numérique

S: transmisión digital

The transmission of digital signals by means of a channel or channels that may assume in time any one of a defined set of discrete states.

108 **channel, transmission channel** {1005}

F: voie, voie de transmission

S: canal, canal de transmisión

A means of unidirectional transmission of signals between two points.

Note 1 – Several channels may share a common path; for example each channel may be allocated a particular frequency band or a particular time slot.

Note 2 – The term may be qualified by the nature of the transmitted signals, by the bandwidth, by the digit rate, or by an arbitrary designation.

Note 3 – See also Term 414, access channel.

109 **digital channel, digital transmission channel** {3002}

F: voie numérique, voie de transmission numérique

S: canal digital, canal de transmisión digital

The means of unidirectional digital transmission of digital signals between two points.

110 **telecommunication** {1006}

F: télécommunication

S: telecomunicación

Any transmission and/or emission and reception of signals representing signs, writing, images and sounds or intelligence of any nature by wire, radio, optical or other electromagnetic systems.

111 **circuit, telecommunication circuit** {1007}

F: circuit, circuit de télécommunications

S: circuito, circuito de telecomunicación

A combination of two transmission channels permitting bi-directional transmission of signals between two points, to support a single communication.

Note 1 – If the telecommunication is by nature unidirectional (for example: long distance television transmission), the term "circuit" is sometimes used to designate the single channel providing the facility.

Note 2 – In a telecommunication network use of the term "circuit" is generally limited to a telecommunication circuit directly connecting two switching devices or exchanges, together with associated terminating equipment.

Note 3 – A telecommunication circuit may permit transmission in both directions simultaneously (duplex) or not simultaneously (simplex).

Note 4 – A telecommunication circuit that is used for transmission in one direction only is sometimes referred to as a unidirectional telecommunication circuit. A telecommunication circuit that is used for transmission in both directions (whether simultaneously or not) is sometimes referred to as a bidirectional telecommunication circuit.

112 **digital circuit, digital telecommunication circuit** {3003}

F: circuit numérique, circuit numérique de télécommunications

S: circuito digital, circuito de telecomunicación digital

A combination of two digital transmission channels permitting bidirectional digital transmission between two points, to support a single communication.

Note 1 – If the telecommunication is by nature unidirectional (for example: long distance television transmission), the term "digital circuit" is sometimes used to designate the single digital channel providing the facility.

Note 2 – In a telecommunication network, use of the term "digital circuit" is generally limited to a digital telecommunication circuit directly connecting two switching devices or exchanges, together with associated terminating equipment.

Note 3 – A digital telecommunication circuit may permit transmission in both directions simultaneously (duplex), or not simultaneously (simplex).

Note 4 – A digital telecommunication circuit that is used for transmission in one direction only is sometimes referred to as a unidirectional digital telecommunication circuit. A digital telecommunication circuit that is used for transmission in both directions (whether simultaneously or not) is sometimes referred to as a bidirectional digital telecommunication circuit.

113 **switching**

F: commutation

S: conmutación

The process of interconnecting functional units, transmission channels or telecommunication circuits for as long as is required to convey signals.

114 **digital switching**

F: commutation numérique

S: conmutación digital

Switching by means that may assume in time any one of a defined set of discrete signal states, in order to convey digital signals.

115 **exchange**

F: commutateur [central]

S: central

An aggregate of traffic carrying devices, switching stages, controlling and signalling means, and other functional units at a network node that enables subscriber lines, telecommunication circuits and/or other functional units to be interconnected as required by individual users.

116 **digital exchange**

F: commutateur numérique

S: central digital

An exchange that switches digital signals by means of digital switching.

117 **integrated digital transmission and switching**

F: transmission et commutation numériques intégrées

S: transmisión y conmutación digitales integradas

The direct (digital) concatenation of digital transmission and digital switching, that maintains a continuous digital transmission path.

2.2 *Services*

201 **service, telecommunication service**

F: service, service de télécommunications

S: servicio, servicio de telecomunicación

That which is offered by an Administation or RPOA to its customers in order to satisfy a specific telecommunication requirement.

Note – Bearer service and teleservice are types of telecommunication service. Other types of telecommunication service may be identified in the future.

202 **bearer service**

F: service support

S: servicio portador

A type of telecommunication service that provides the capability for the transmission of signals between user-network interfaces.

Note – The ISDN connection type used to support a bearer service may be identical to that used to support other types of telecommunication service.

203 **teleservice [telecommunication service]**

F: téléservice

S: teleservicio, servicio final

A type of telecommunication service that provides the complete capability, including terminal equipment functions, for communication between users according to protocols established by agreement between Administrations and/or RPOAs.

204 **teleaction service [telemetry service]**

F: service de téléaction [service de télémesure]

S: servicio de teleacción

A type of telecommunication service that uses short messages, requiring a very low transmission rate, between the user and the network.

Note – Examples of teleaction services are: telealarm, telecommand, telealerting.

205 **demand service, demand telecommunication service**

F: service à la demande, service de télécommunications à la demande

S: servicio por demanda, servicio de telecomunicación por demanda

A type of telecommunication service in which the communication path is established almost immediately, in response to a user request effected by means of user-network signalling.

206 **reserved circuit service, reserved circuit telecommunication service**

F: service de circuit réservé, service de circuit de télécommunications réservé

S: servicio de circuito reservado, servicio de telecomunicación de circuito reservado

A type of telecommunication service in which the communication path is established at a time specified in advance by the user, in response to a user request effected by means of user-network signalling.

Note – The duration of the communication, or the time of release of the communication path, may also be specified in advance by the user.

207 **permanent circuit service, permanent circuit telecommunication service**

F: service de circuit permanent, service de circuit de télécommunications permanent

S: servicio de circuito permanente, servicio de telecomunicación de circuito permanente

A type of telecommunication service in which the communication path is established in response to a customer request effected by means of an operational or administrative message.

Note – Release of the communication path is effected in a similar way to its establishment.

208 **service attribute, telecommunication service attribute**

F: attribut de service, attribut de service de télécommunications

S: atributo de servicio, atributo de servicio de telecomunicación

A specified characteristic of a telecommunication service.

Note – The value(s) assigned to one or more service attributes may be used to distinguish that telecommunication service from others.

2.3 *Networks*

301 **link, transmission link**

F: liaison, liaison de transmission

S: enlace, enlace de transmisión

A means of transmission with specified characteristics between two points.

Note – The type of the transmission path or the capacity is normally indicated, e.g. radio link, coaxial link, or 2048 kbit/s link.

302 **digital link, digital transmission link** {3005}

F: liaison numérique, liaison de transmission numérique

S: enlace digital, enlace de transmisión digital

The whole of the means of digital transmission of a digital signal of specified rate between two digital distribution frames (or equivalent).

Note 1 – A digital link comprises one or more digital sections and may include multiplexing and/or demultiplexing, but not switching.

Note 2 – The term may be qualified to indicate the transmission medium used, for example: "digital satellite link".

Note 3 – The term always applies to the combination of "go" and "return" directions of transmission, unless stated otherwise.

Note 4 – The term "digital path" is sometimes used to describe one or more digital links connected in tandem, especially between equipments at which the signals of the specified rate originate and terminate.

303 **node, switching node**

F: nœud, nœud de commutation

S: nodo, nodo de conmutación

A point at which switching occurs.

Note – The term "node" is sometimes used to refer to a point at which circuits are interconnected by means other than switching. In such a case a suitable qualification should be used, for example: "synchronization node".

304 **digital switching node**

F: nœud de commutation numérique

S: nodo de conmutación digital

A node at which digital switching occurs.

305 **network, telecommunication network**

F: réseau, réseau de télécommunications

S: red, red de telecomunicación

A set of nodes and links that provides connections between two or more defined points to facilitate telecommunication between them.

306 **digital network, integrated digital network**

F: réseau numérique, réseau numérique intégré

S: red digital, red digital integrada

A set of digital nodes and digital links that uses integrated transmission and switching to provide digital connections between two or more defined points to facilitate telecommunication between them.

307 **integrated services network**

F: réseau avec intégration des services

S: red de servicios integrados

A network that provides or supports a range of different telecommunication services.

308 **integrated services digital network (ISDN)**

F: réseau numérique avec intégration des services (RNIS)

S: red digital de servicios integrados (RDSI)

An integrated services network that provides digital connections between user-network interfaces.

309 **connection**

F: connexion, chaîne de connexion

S: conexión

A concatenation of transmission channels or telecommunication circuits, switching and other functional units set up to provide for the transfer of signals between two or more points in a telecommunication network, to support a single communication.

310 **digital connection** {3004}

F: connexion numérique

S: conexión digital

A concatenation of digital transmission channels or digital telecommunication circuits, switching and other functional units set up to provide for the transfer of digital signals between two or more points in a telecommunication network, to support a single communication.

311 **switched connection**

F: connexion commutée

S: conexión conmutada

A connection that is established by means of switching.

Note – A switched connection may be used to support both demand and reserved circuit services.

312 **non-switched connection**

F: connexion non commutée

S: conexión no conmutada

A connection that is established without the use of switching, for example by means of hard-wired joints.

313 **exchange connection**

F: connexion de commutateur

S: conexión de central

A connection that is established through an exchange, between the terminations on that exchange, of two or more channels or circuits.

314 **ISDN connection**

F: connexion RNIS

S: conexión de RDSI

A connection that is established through an ISDN between specified ISDN interfaces.

315 **connection attribute, ISDN connection attribute**

F: attribut de connexion, attribut de connexion RNIS

S: atributo de conexión, atributo de conexión de RDSI

A specified characteristic of an ISDN connection.

Note – The value(s) assigned to one or more connection attributes may be used to distinguish that connection from others.

316 **connection type, ISDN connection type**

F: type de connexion, type de connexion RNIS

S: tipo de conexión, tipo de conexión de RDSI

A description of a set of ISDN connections that consists of stated values of one or more ISDN connection attributes.

317 **connection element, ISDN connection element**

F: élément de connexion, élément de connexion RNIS

S: elemento de conexión, elemento de conexión de RDSI

A part of an ISDN connection which has stated values of one or more ISDN connection attributes.

318 **switched connection element, switched ISDN connection element**

F: élément de connexion commutée, élément de connexion RNIS commutée

S: elemento de conexión conmutada, elemento de conexión conmutada de RDSI

An ISDN connection element that is established by means of switching.

319 **non-switched connection element, non-switched ISDN connection element**

F: élément de connexion non commutée, élément de connexion RNIS non commutée

S: elemento de conexión no conmutada, elemento de conexión no conmutada de RDSI

An ISDN connection element that is established without switching.

320 **point-to-point ISDN connection**

F: connexion RNIS point-à-point

S: conexión de RDSI punto a punto

An ISDN connection that is established between two specified ISDN interfaces.

321 **point-to-multipoint ISDN connection**

F: connexion RNIS point-multipoints

S: conexión de RDSI punto a multipunto

An ISDN connection that is established between a single specified ISDN interface, and more than one other specified ISDN interface.

2.4 *Access*

401 **user, user of a telecommunication network**

F: usager, usager d'un réseau de télécommunications

F: usuario, usuario de una red de telecomunicación

A person or machine delegated by a customer to use the services and/or facilities of a telecommunication network.

402 **user access, user-network access**

F: accès d'usager, accès d'usager-réseau

S: acceso de usuario, acceso usuario-red

The means by which a user is connected to a telecommunication network in order to use the services and/or facilities of that network.

403 **function**

F: fonction

S: función

A set of processes defined for the purpose of achieving a specified objective.

Note – Functions may be ordered in a logical hierarchy.

404 **layer [level]**

F: couche [niveau]

S: capa [nivel]

A conceptual region that embodies one or more functions between an upper and a lower logical boundary within a hierarchy of functions.

Note – The Open Systems Interconnection (OSI) reference model has seven layers.

405 **protocol**

F: protocole

S: protocolo

A formal statement of the procedures that are adopted to ensure communication between two or more functions within the same layer of a hierarchy of functions.

406 **access protocol**

F: protocole d'accès

S: protocolo de acceso

A defined set of procedures that is adopted at an interface at a specified reference point between a user and a network to enable the user to employ the services and/or facilities of that network.

407 **user-user protocol**

F: protocole d'usager à usager

S: protocolo usuario-usuario

A protocol that is adopted between two or more users in order to ensure communication between them.

408 **interface** {1008}

F: interface

S: interfaz

The common boundary between two associated systems.

409 **user-network interface**

F: interface usager-réseau

S: interfaz usuario-red

The interface between the terminal equipment and a network termination at which interface the access protocols apply.

410 **layer interface**

F: interface de couche

S: interfaz de capa

The interface between adjacent layers of hierarchy of layers.

411 **physical interface**

F: interface physique

S: interfaz físico

The interface between two equipments.

412 **interface specification**

F: spécification d'interface

S: especificación de interfaz

A formal statement of the type, quantity, form and order of the interconnections and interactions between two associated systems, at their interface.

413 **physical interface specification [physical interface]**

F: spécification d'interface physique [interface physique]

S: especificación de interfaz físico [interfaz físico]

A formal statement of the mechanical, electrical, electromagnetic and optical characteristics of the interconnections and interactions between two associated equipments, at their interface.

414 **access channel [channel]**

F: canal d'accès [canal]

S: canal de acceso [canal]

A designated part of the information transfer capability having specified characteristics, provided at the user-network interface:

Note 1 – The term "transmission channel" is well understood to imply unidirectional working only, and then is commonly abbreviated to "channel". In the special case where the term "access channel" is used to encompass bidirectional working through the user-network interface, it must not be abbreviated to channel.

Note 2 – The term "access channel" may be qualified, for example by H, B or D in which case it is appropriate to abbreviate the term to "H-channel", to "B-channel" or to "D-channel".

Note 3 – Unless otherwise qualified, the access channel characteristics at the user-network interface are assumed to be bidirectional symmetric. When such characteristics are unidirectional, the term "unidirectional access channel" should be used.

415 **interface structure, ISDN user-network interface structure**

F: structure d'interface, structure d'interface RNIS usager-réseau

S: estructura de interfaz, estructura de interfaz usuario-red de la RDSI

The number and type of the access channels that appear at an ISDN user-network interface.

416 **access capability, ISDN access capability**

F: capacité d'accès, capacité d'accès au RNIS

S: capacidad de acceso, capacidad de acceso de la RDSI

The number and type of the access channels at an ISDN access interface that are actually available for telecommunication purposes.

417 **terminal equipment**

F: équipement terminal (ET)

S: equipo terminal

Equipment that provides the functions necessary for the operation of the access protocols by the user.

418 **network termination**

F: terminaison de réseau

S: terminación de red

Equipment that provides the functions necessary for the operation of the access protocols by the network.

Note – The network termination provides essential functions for transmission purposes.

419 **functional group [functional grouping]**

F: groupe fonctionnel [groupement fonctionnel]

S: grupo funcional [agrupación funcional]

A set of functions that may be performed by a single equipment.

420 **reference point**

F: point de référence

S: punto de referencia

A conceptual point at the conjunction of two non-overlapping functional groups.

421 **reference configuration**

F: configuration de référence

S: configuración de referencia

A combination of functional groups and reference points that shows possible network arrangements.

422 **multipoint access**

F: accès multipoint

S: acceso multipunto

User access in which more than one terminal equipment is supported by a single network termination.

423 **access contention**

F: conflit d'accès

S: contienda de accesso

A conflict between the demands made on a network termination in multipoint access.

424 **access contention resolution**

F: résolution des conflits d'accès

S: resolución de contienda de acceso

The arbitration of conflicting demands on a network termination in multipoint access.

2.5 *Signalling*

501 **signalling**

F: signalisation

S: señalización

The exchange of information specifically concerned with the establishment and control of connections, and with management, in a telecommunication network.

502 **channel-associated signalling**

F: signalisation voie par voie

S: señalización asociada al canal

A method of signalling in which signalling information relating to the traffic carried by a single channel is transmitted in the channel itself or in a signalling channel permanently associated with it.

503 **common channel signalling**

F: signalisation sur voie commune, signalisation par canal sémaphore

S: señalización por canal común

A method of signalling in which signalling information relating to a multiplicity of circuits or functions or for network management, is conveyed over a single channel by addressed messages.

504 **in-slot signalling**

F: signalisation dans le créneau temporel

S: señalización dentro del intervalo

Signalling associated with a channel and transmitted in a digit time-slot permanently (or periodically) allocated in the channel time-slot.

505 **out-slot signalling**

F: signalisation hors créneau temporel

S: señalización fuera del intervalo

Signalling associated with a channel and transmitted in one or more separate digit time-slots not within the channel time-slot.

506 **speech digit signalling**

F: signalisation par éléments numériques vocaux

S: señalización por dígitos de conversación

A type of channel-associated signalling in which digit time-slots primarily used for the transmission of encoded speech are periodically used for signalling.

ANNEX A

(to Recommendation I.112)

Alphabetical list of terms contained in this Recommendation [1)]

[1)] The number against a term indicates its location in the vocabulary.

Recommendation I.113

VOCABULARY OF TERMS FOR BROADBAND ASPECTS OF ISDN

(Melbourne, 1988)

1 Introduction

This Recommendation consists primarily of those terms and definitions that are considered essential to the understanding and application of the principles of Broadband Aspects of Integrated Services Digital Network (B-ISDN). They are not exclusive to broadband aspects of ISDN and are recommended also for application, insofar as they are relevant, to other types of telecommunication networks.

Included are terms that may already be defined in other CCITT/CCIR Recommendations. However, the definitions given here embrace only the essential concepts and on that basis it is considered that they are not inconsistent with the more specialized definitions that appear in those Recommendations.

According to the conventions applied in this Recommendation, any term in common usage, but whose use is deprecated, is shown in brackets as in the following example: "broadband [wideband]".

Where a truncated term is widely used in an understood context the complete term is quoted following the colloquial form, for example, "contribution, contribution application".

Some definitions include terms in bold face to indicate that these terms are defined elsewhere in this Recommendation.

Annex A to this Recommendation contains an alphabetical list of all the terms contained in this Recommendation.

2 Vocabulary of terms

(This section is divided into two sub-sections, 2.1 Services, and 2.2 Interfaces, channels and transfer modes. Within each sub-section the terms are listed and defined.)

2.1 *Services*

101 **broadband [wideband]**

F: large bande

S: banda ancha

A service or system requiring transmission channels capable of supporting rates greater than the primary rate.

102 **broadcast**

F: diffusion

S: difusión

A value of the service attribute "communication configuration", which denotes unidirectional distribution to all subscribers.

Note – This term should not be confused with the term "broadcasting service" as defined in the ITU Radio Regulations.

103 **connectionless service**

F: service sans connexion

S: servicio sin conexión

A service which allows the transfer of information among service subscribers without the need for end-to-end call establishment procedures.

Note – Connectionless services may be used to support both interactive and distribution services.

104 **contribution, contribution application**

F: contribution

S: contribución, aplicación de contribución

Use of a **broadband** service or channel for transferring audio or video information to user for further **post-production processing** and subsequent **distribution**.

105 **conversational service**

F: service conversationnel

S: servicio conversacional

An **interactive service** which provides for bidirectional communication by means of real-time (no store-and-forward) end-to-end information transfer from user to user or between user and host.

106 **distribution, distribution aplication**

F: distribution

S: disribución, aplicación de distribución

Use of a **broadband** service or channel for transferring audio or video information to a user or a number of users which will not apply **post-production processing** to the information.

107 **distribution service**

F: service de distribution

S: servicio de distribución

Service characterized by the unidirectional flow of information from a given point in the network to other (multiple) locations. Distribution services are subdivided into two classes: **distribution services without user individual presentation control** and **distribution services with user individual presentation control.**

108 **distribution service with user individual presentation control**

F: service distribué avec contrôle de présentation par l'usager

S: servicio de distribución con control de la presentación por el usuario

A **distribution service** in which the information is provided as a sequence of information entities (e.g., frames) with cyclical repetition, so that the user has the ability to select individual information entities and can control the start and order of the information.

109 **distribution service without user individual presentation control**

F: service distribué sans contrôle de présentation par l'usager

S: servicio de distribución sin control de la presentación por el usuario

A **distribution service** which users can access without having any control over the start and order of the presentation of the distributed information.

110 **enhanced-quality television**

F: télévision de qualité améliorée

S: televisión de calidad mejorada

Television of quality superior to **existing-quality television**, but less than the quality of high-definition television.

111 **existing-quality television**

F: télévision de qualité conventionnelle

S: televisión de calidad convencional

Television as defined in conventional 625-line and 525-line television standards, such as NTSC, PAL and SECAM.

112 **interactive service**

F: service interactif

S: servicio interactivo

A service which provides the means for bidirectional exchange of information between users or between users and hosts. Interactive services are subdivided into three classes of services: **conversational services, messaging services** and **retrieval services.**

113 **messaging service**

F: service de messagerie

S: servicio de mensajería

An **interactive service** which offers 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.

114 **mixed document**

F: document mixte

S: documento mixto

A document that may contain text, graphics, data, image, and moving picture information as well as voice annotation.

115 **multipoint**

F: multipoint

S: multipunto

A value of the attribute "communication configuration" which denotes that the communication involves more than two network terminations.

116 **post-production processing**

F: post-production (traitment après production)

S: tratamiento de posproducción

Further processing of contributed audio and video information, to change the form or presentation of the information prior to its final utilization.

117 **retrieval service**

F: service de consultation

S: servicio de consulta

An **interactive service** which provides the capability of accessing information stored in database centres. This information will be sent to the user on demand only. The information can be retrieved on an individual basis, i.e., the time at which an information sequence is to start is under the control of the user.

118 **sound retrieval service**

F: service de consultation de programmes sonores

S: servicio de consulta de programas sonoros

On-demand (user initiated) retrieval of music and other audio information.

119 **videomessaging**

F: messagerie vidéo

S: videomensajería

A **messaging service** for the transfer for moving pictures.

2.2 *Interfaces, channels and transfer modes*

201 **asynchronous time-division multiplexing**

F: multiplexage temporel asynchrone

S: multiplexación asíncrona por división en el tiempo

A multiplexing technique in which a transmission capability is organized in undedicated slots filled with **cells** with respect to each application's instantaneous real need. In this case, the terminal equipment – i.e. the customer application – defines the actual transmitted bit rate, whatever this rate is, possibly variable during the communication. This technique carries a **labelled interface structure** over a **frame** or a **self-delineating labelled interface.**

202 **asynchronous transfer mode (ATM)**

F: mode de transfert asynchrone (MTA)

S: modo de transferencia asíncrono (MTA)

A **transfer mode** in which the information is organized into **cells**; it is asynchronous in the sense that the recurrence of cells depends on the required or instantaneous bit rate. **Statistical** and **deterministic** values may also be used to qualify the **transfer mode**.

203 **block**

F: bloc

S: bloque

A unit of information consisting of a **header** and an information field.

204 **block payload**

F: charge utile de bloc

S: carga neta del bloque

The user information bits within a **block**.

205 **broadband access**

F: accès à large bande

S: acceso de banda ancha

An ISDN access able to contain at least one channel capable of supporting a rate greater than the primary rate, or supporting an equivalent information transfer rate.

206 **broadband communication channel**

F: voie de communication à large bande

S: canal de comunicación de banda ancha

A standard portion of the **information payload capacity**, available to the user for ISDN services. A **broadband** communication channel exists only during a call, as set-up by a signalling or administrative procedure. The **throughput** supported by the broadband communication channel may be **deterministic** or **statistical**.

207 **cell**

F: cellule

S: célula

A **block** of fixed length identified by a label at layer 1 of the OSI reference model.

208 **circuit transfer mode**

F: mode de transfert par circuit

S: modo de transferencia circuito, modo de transferencia por circuito

A **transfer mode** in which transmission and switching functions are achieved by permanent allocation of channels/bandwidth between the connections.

209 **deterministic, ATM deterministic transfer mode**

F: mode de transfert asynchrone déterministe

S: determinístico, modo de transferencia determinístico MTA

A specific **transfer mode** of the **asynchronous transfer mode** (ATM) in which the maximum information transfer capacity specified for a given service is provided to the user throughout a call.

210 **frame**

F: trame

S: trama

A **block** of variable length identified by a label at layer 2 of the OSI reference model, e.g. an HDLC block.

211 **framed interface**

F: interface tramée

S: interfaz entramado

An interface whose serial bit stream is segmented into **periodic physical frames**. Each frame is divided by a fixed partition into an overhead and an **information payload** portion.

212 **header, block header**

F: en-tête de bloc

S: encabezamiento, encabezamiento de bloque

The bits within a **block** allocated for **labelled multiplexing** functions.

213 **hybrid interface structure**

F: structure d'interface hybride

S: estructure híbrida de interfaz

An interface structure which has a mixture of **labelled channels** and **positioned channels**.

214 **information payload capacity**

F: capacité utile d'information

S: capacidad de carga neta de información

The **interface rate** minus the overhead. The bit rate of the **interface payload**.

215 **interface overhead**

F: charge supplémentaire d'interface

S: tara del interfaz

The remaining portion of the bit stream after deducting the **information payload**. The interface overhead may be essential (e.g. framing for an interface shared by users) or ancillary (e.g. performance monitoring).

216 **interface payload**

F: charge utile d'interface

S: carga neta del interfaz

The portion of the bit stream of a **framed interface** which can be used for telecommunication services. Any signalling is included in the **interface payload**.

217 **interface rate, interface bit rate**

F: débit (binaire) de l'interface

S: velocidad del interfaz, velocidad binaria del interfaz

The gross bit rate at the interface, e.g. the bit rate at the boundary between the physical layer and the physical medium.

218 **labelled channel**

F: voie étiquetée

S: canal etiquetado

A temporally-ordered collection of all **block payloads** having a common label value.

219 **labelled deterministic channel**

F: voie étiquetée déterministe

S: canal etiquetado determinístico

A **labelled channel** that, in each successive interval of specified constant duration, contains on the average a constant number of **blocks**.

220 **labelled interface structure**

F: structure d'interface étiquetée

S: estructura de interfaz etiquetado

An interface structure in which all services and signalling are provided by **labelled channels**. A labelled interface structure can be accommodated within a **framed interface** or a **self-delineating labelled interface**.

221 **labelled multiplexing**

F: multiplexage par étiquetage

S: multiplexación por etiquetado

The multiplexing of **labelled channels** by concatenating the **blocks** of the different channels.

222 **labelled statistical channel**

F: voie étiquetée statistique

S: canal etiquetado estadístico

A **labelled channel** in which the payload of the successive **blocks** of the channel is random and/or the block durations are random.

223 **logical signalling channel**

F: voie logique de signalisation

S: canal lógico de señalización

A logical channel for signalling information with a defined maximum capacity, which is contained within an information channel or a **physical signalling channel**.

224 **network node interface (NNI)**

F: interface de nœud du réseau (INR)

S: interfaz de nodo de red (INR)

The interface between two network nodes (e.g. synchronous digital multiplex equipments, digital exchanges).

225 **packet**

F: paquet

S: paquete

An information **block** identified by a label at layer 3 of the OSI reference model.

226 **packet transfer mode**

F: mode de transfert par paquet

S: modo de transferencia paquete, modo de transferencia por paquete

A **transfer mode** in which the transmission and switching functions are achieved by **packet** oriented techniques, so as to dynamically share network transmission and switching resources between a multiplicity of connections.

227 **payload module**

F: module de charge utile

S: módulo de carga neta, módulo de carga útil, módulo neto

That portion of the **information payload** within which one or more channels entirely exist.

228 **periodic frame**

F: trame périodique

S: trama periódica

A transmission segment which is repeated at intervals of equal duration (e.g. 125 μsec), and may be delineated by incorporating fixed periodic patterns into the bit stream.

229 **physical frame**

F: trame physique

S: trama física

A segment of a serial logical bit stream at an interface, partitioned into successive segments.

230 **physical signalling channel**

F: voie physique de signalisation

S: canal físico de señalización

A dedicated physical channel (e.g. D-channel) used for signalling information. It may be used to carry other information.

231 **positioned channel**

F: voie identifiée par sa position

S: canal posicionado, canal localizado

A channel that occupies bit positions which form a fixed periodic pattern (e.g. B, H and D-channels in ISDN user interfaces).

232 **positioned interface structure**

F: structure d'interface positionnée

S: estructura de interfaz posicionado

A structure in which all services and signalling are provided by **positioned channels**. Such a structure can exist only within a **framed interface**.

233 **self-delineating block**

F: bloc à auto-cadrage

S: bloque autodelimitado

A **block** with the property that its endpoints can be identified by examining the block itself. A defined pattern or flag at the beginning of each block might serve to demarcate the block.

234 **self-delineating labelled interface**

F: interface étiquetée à auto-cadrage

S: interfaz etiquetado autodelimitado

An interface whose entire serial bit stream consists of a self-delineating **labelled multiplexing**.

235 **statistical, ATM statistical transfer mode**

F: statistique, mode de transfert asynchrone statistique

S: estadístico, modo de transferencia estadístico MTA

A specific transfer mode of the **asynchronous transfer mode** (ATM) in which the average information transfer capacity specified for a given service is provided to the user throughout a call.

236 **synchronous time division multiplexing**

F: multiplexage temporel synchrone

S: multiplexación síncrona por division en el tiempo

A multiplexing technique supporting **the synchronous transfer mode** (STM).

237 **synchronous transfer mode (STM)**

F: mode de transfert (temporel) synchrone (MTS)

S: modo de transferencia síncrono (MTS)

A **transfer mode** which offers periodically to each connection a fixed-length word.

238 **throughput**

F: capacité utile

S: caudal de tráfico, caudal

The number of data bits contained in a **block** (e.g. between the address field and the CRC field of the LAPD-based frames) successfully transferred in one direction across a section per unit time.

239 **transfer mode**

F: mode de transfert

S: modo de transferencia

Aspects covering transmission, multiplexing and switching in a telecommunications network.

240 **transit delay**

F: délai de transfert

S: retardo de tránsito

The time difference between the instant at which the first bit of the address field of a frame crosses one designated boundary, and the instant at which the last bit of the closing flag of the frame crosses a second designated boundary.

241 **virtual circuit**

F: circuit virtuel

S: circuito virtual

A type of **asynchronous transfer mode** (ATM) connection involving establishment and release procedures such that the label associated with each **cell** need not contain complete routing information.

ANNEX A

(to Recommendation I.113)

Alphabetical list of terms contained in this Recommendation [1)]

[1)] The number against a term indicates its location in the vocabulary.

SECTION 2

DESCRIPTION OF ISDNs

Recommendation I.120

INTEGRATED SERVICES DIGITAL NETWORKS (ISDNs)

(Malaga-Torremolinos, 1984)

1 Principles of ISDN

1.1 The main feature of the ISDN concept is the support of a wide range of voice and non-voice applications in the same network. A key element of service integration for an ISDN is the provision of a range of services (see Part II of the I-Series in this Fascicle) using a limited set of connection types and multipurpose user-network interface arrangements (see Parts III and IV of the I-Series in Fascicle III.8).

1.2 ISDNs support a variety of applications including both switched and non-switched connections. Switched connections in an ISDN include both circuit-switched and packet-switched connections and their concatenations.

1.3 As far as practicable, new services introduced into an ISDN should be arranged to be compatible with 64 kbit/s switched digital connections.

1.4 An ISDN will contain intelligence for the purpose of providing service features, maintenance and network management functions. This intelligence may not be sufficient for some new services and may have to be supplemented by either additional intelligence within the network, or possibly compatible intelligence in the user terminals.

1.5 A layered protocol structure should be used for the specification of the access to an ISDN. Access from a user to ISDN resources may vary depending upon the service required and upon the status of implementation of national ISDNs.

1.6 It is recognized that ISDNs may be implemented in a variety of configurations according to specific national situations.

2 Evolution of ISDNs

2.1 ISDNs will be based on the concepts developed for telephone IDNs and may evolve by progressively incorporating additional functions and network features including those of any other dedicated networks such as circuit-switching and packet-switching for data so as to provide for existing and new services.

2.2 The transition from an existing network to a comprehensive ISDN may require a period of time extending over one or more decades. During this period arrangements must be developed for the interworking of services on ISDNs and services on other networks (see Part V).

2.3 In the evolution towards an ISDN, digital end-to-end connectivity will be obtained via plant and equipment used in existing networks, such as digital transmission, time-division multiplex switching and/or space-division multiplex switching. Existing relevant Recommendations for these constituent elements of an ISDN are contained in the appropriate series of Recommendations of CCITT and of CCIR.

2.4 In the early stages of the evolution of ISDNs, some interim user-network arrangements may need to be adopted in certain countries to facilitate early penetration of digital service capabilities. Arrangements corresponding to national variants may comply partly or wholly with I-Series Recommendations. However, the intention is that they not be specifically included in the I-Series.

2.5 An evolving ISDN may also include at later stages switched connections at bit rates higher and lower than 64 kbit/s.

Recommendation I.121

BROADBAND ASPECTS OF ISDN

(Melbourne, 1988)

Foreword

This Recommendation should be interpreted as a guideline to the objective of providing more detailed Recommendations on all broadband aspects of ISDN (B-ISDN) during the next Study Period (1989-1992).

The Recommendation was elaborated taking into account the following:

- the emerging demand for broadband services;
- the availability of high speed transmission, switching and signal processing technologies;
- the need for covering broadband aspects of ISDN, in CCITT Recommendations,
- the need to integrate both interactive and distribution services;
- the need to integrate both circuit and packet transfer modes into one universal broadband network;
- the need to provide flexibility to both user and operator.

1 Principles and concept

1.1 *Principles of B-ISDN*

The main feature of the ISDN concept is the support of a wide range of audio, video and data applications in the same network. A key element of service integration for an ISDN is the provision of a range of services using a limited set of connection types and multipurpose user-network interfaces.

In the context of this Recommendation, the term B-ISDN is used for convenience in order to refer to and emphasize the broadband aspects of ISDN. The intent, however, is that there be one comprehensive notion of an ISDN which provides broadband and other ISDN services.

B-ISDNs support both switched and non-switched connections. Connections in a B-ISDN support both circuit-mode and packet-mode services.

A B-ISDN will contain intelligence for the purpose of providing service features, maintenance and network management functions. This intelligence may not be sufficient for some new services and may have to be supplemented by either additional intelligence within the network, or possibly compatible intelligence in user terminals.

A layered structure should be used for the specification of the access protocol to a B-ISDN.

It is recognized that ISDNs may be implemented in a variety of configurations according to specific national situations.

1.2 *Evolution of B-ISDN*

1.2.1 *Target transfer mode*

Asynchronous transfer mode (ATM) is the target transfer mode solution for implementing a B-ISDN. It will influence the standardization of digital hierarchies and multiplexing structures, switching and interfaces for broadband signals.

ATM as used in this Recommendation concerns a specific packet-oriented transfer mode using the asynchronous time division multiplexing technique: the multiplexed information flow is organized in fixed size blocks, called cells. A cell consists of a user information field and a header; the primary role of the header is to identify cells belonging to the same virtual channel on an asynchronous time division multiplex. Cells are assigned on demand, depending on the source activity and the available resources. Cell sequence integrity on a virtual channel is preserved by the ATM layer.

ATM is a connection-oriented technique. Header values are assigned to each section of a connection when required and released when no longer needed. The connections identified by the headers remain unchanged during the lifetime of a call. Signalling and user information are carried on separate virtual channels.

ATM will offer a flexible transfer capability common to all services, including connectionless services.

1.2.2 *Evolution steps*

B-ISDN will be based on the concepts developed for ISDN and may evolve by progressively incorporating additional functions and services (e.g. high quality video applications).

The deployment of B-ISDN may require a period of time extending over one or more decades. Thus, arrangements must be developed for the interworking of services on B-ISDN and services on other networks.

In the evolution towards a B-ISDN, digital end-to-end connectivity will be obtained in part via plant and equipment used in existing and planned networks, such as digital transmission and switching. Relevant Recommendations for these constituent elements of a B-ISDN are contained in the appropriate series of Recommendations of CCITT and of CCIR.

In the early stages of the evolution of B-ISDN, some interim user-network arrangements [e.g. combinations of synchronous transfer mode (STM) and ATM techniques] may need to be adopted in certain countries to facilitate early penetration of digital service capabilities.

2 Service aspects of B-ISDN

2.1 *General*

The principles of services supported by an ISDN are described in the I.200-Series Recommendations. The description of B-ISDN services is based on the principles of the existing I-Series Recommendations.

This section describes the classification of broadband services, the definition of those service classes, and gives examples of services in each service class proposed to be supported by the ISDN.

This classification does not take into account the location of the implementation of the functions either in the network or in the terminals. This classification is primarily from the point of view of the network and not from the user point of view.

Depending on their communication functions and applications, the services to be supported by the B-ISDN may be internationally standardized and offered by the Administration as bearer services or teleservices.

2.2 *Service classes*

Depending on the different forms of the broadband communication and their applications, two main service categories have been identified: interactive services and distribution services. The interactive services are subdivided into three classes of services, viz., the conversational services, the messaging services, and the retrieval services. The distribution services are represented by the class of distribution services without user individual presentation control and the class of distribution services with user individual presentation control (see Figure 1/I.121).

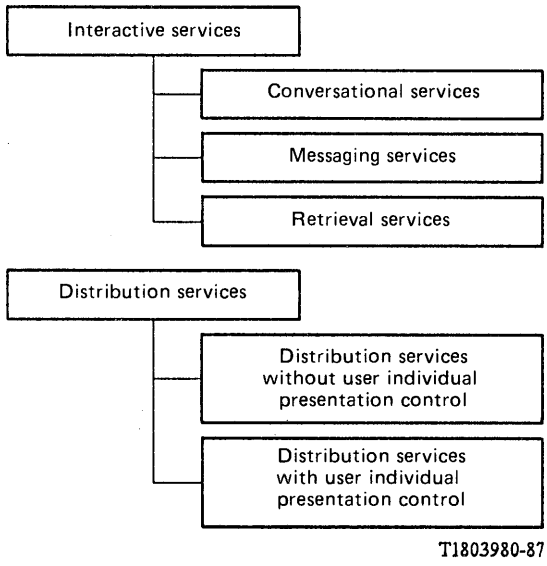


FIGURE 1/I.121

Classification of broadband services

2.3 *Definition of service classes*

2.3.1 **Conversational services**

Conversational services in general provide the means for bidirectional dialogue communication with real-time (no store-and-forward) end-to-end information transfer from user to user or between user and host (e.g. for data processing). The flow of the user information may be bidirectional symmetric, bidirectional asymmetric and in some specific cases (e.g. such as video surveillance), the flow of information may be unidirectional. The information is generated by the sending user or users, and is dedicated to one or more individual communication partners at the receiving site.

Examples of broadband conversational services are videotelephony, video conference and high speed data transmission.

2.3.2 **Messaging services**

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.

Examples of broadband messaging services are message handling services and mail services for moving pictures (films), high resolution images and audio information.

2.3.3 **Retrieval services**

The user of retrieval services can retrieve information stored in information centres and in general provided for public use. This information will be sent to the user on his demand only. The information can be retrieved on an individual basis. Moreover, the time at which an information sequence is to start is under the control of the user.

Examples are broadband retrieval services for film, high resolution image, audio information, and archive information.

2.3.4 **Distribution services without user individual presentation control**

These services include broadcast services. They provide a continuous flow of information which is distributed from a central source to an unlimited number of authorized receivers connected to the network. The user can access this flow of information *without* the ability to determine at which instant the distribution of a string of information will be started. The user cannot control the start and order of the presentation of the broadcast information. Depending on the point of time of the user's access, the information will not be presented from its beginning.

Examples are broadcast services for television and audio-programmes.

2.3.5 **Distribution services with user individual presentation control**

Services of this class also distribute information from a central source to a large number of users. However, the information is provided as a sequence of information entities (e.g. frames) with cyclical repetition. So, the user has the ability of individual access to the cyclical distributed information and can control the start and order of presentation. Due to the cyclical repetition, the information entities selected by the user will always be presented from its beginning.

One example of such a service is full channel broadcast videography.

2.4 *Examples of broadband services*

Table A-1/I.121 contains examples of possible services, their applications and some possible attribute values describing the main characteristics of the services.

Guideline prose definitions, service attributes and attribute values for describing a number of possible broadband services are presented in Annex B. Services described include:

- broadband unrestricted bearer services;
- high quality broadband video telephony:
- high quality broadband video conference;
- existing quality and high definition TV distribution;
- broadband Videotex.

2.5 *User-network interface from the service point of view*

2.5.1 *Need for simultaneous services*

The user-network interface will be required to support a varying mixture of services to broadband network users. The simultaneous services required at the interface will vary between customers, e.g. the requirements for residential customers may differ from those business customers. The capacity of the interface, the mix of simultaneous services, and the bit rate required for each service are all interrelated.

The user-network interface must be able to accommodate at least an H_4 user rate (see Note), (or an equivalent mix of services whose aggregate bit rate may be up to that of an H_4 user rate), plus some additional narrow-band services and signalling. Moreover, there may be a need to carry a greater volume of services and to provide the capability of supporting services whose rates exceed the H_4 user rate.

The study of simultaneous service requirements is important and will impact broadband aspects of ISDN such as bit rates, user interfaces, protocol processing, etc.

Note – The term H_4 user rate is used here to give an indication of the range of bit rates available to the user (see § 5). No implications for channel provision are intended.

2.5.2 *Flexibility of the user-network interface*

Not only will ISDNs in different environments need to support a large variety of customer requirements for different services, but also the access requirements of a given customer may often change from time to time.

For these reasons, it is necessary that the user network interface be flexible and capable of offering dynamic allocation of resources to services.

3 Architecture models

3.1 *Functional architecture*

The general architecture of the ISDN from the functional point of view is described in Recommendation I.324.

3.2 *Basic architectural model*

Figure 2/I.121 shows the main information transfer and signalling functional components of ISDN including broadband aspects:

- local functional capabilities (LFC), i.e. local exchange functions and possibly including remote switching cross-connect muldexes, etc.;
- inter-exchange signalling functional entities;
- 64 kbit/s based functional entities;
- broadband functional entities.

These components need not be provided by distinct networks but may be combined as appropriate for a particular implementation.

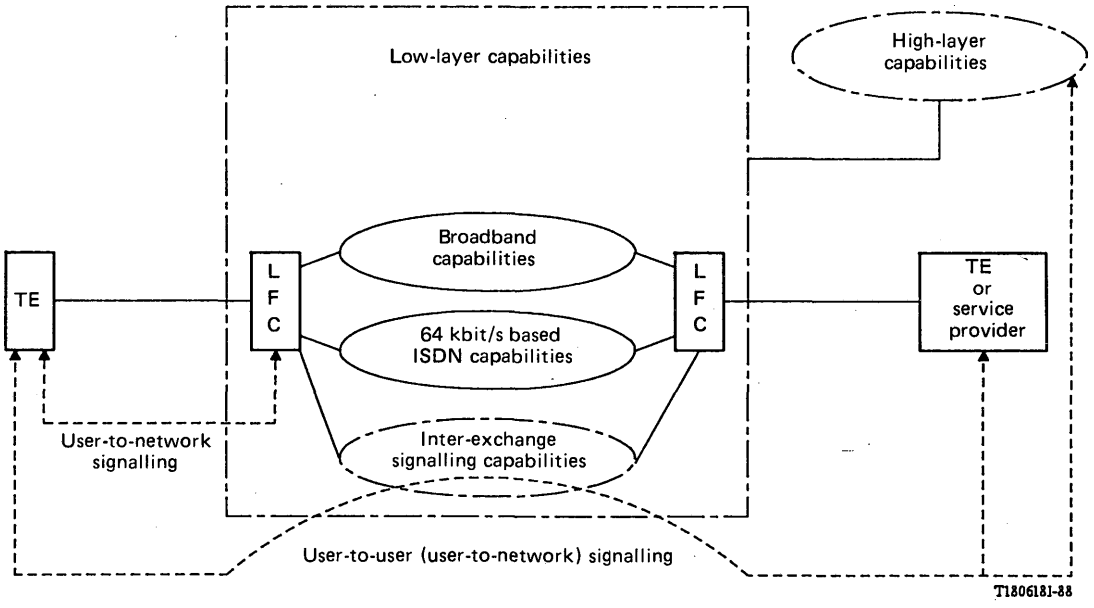


FIGURE 2/I.121

Basic architectural model of ISDN, including broadband aspects

3.3 *Reference configurations*

3.3.1 *Reference configuration for the user-network interface*

The reference configuration defined in Figure 1/I.411 and shown here as Figure 3/I.121 is considered sufficiently general to be applicable not only for a basic access and a primary rate access but also to a broadband access. Both reference points S and T are valid for broadband accesses.

The functions of the NT1 are, in principle, identical for 64 kbit/s based ISDN and B-ISDN. The same applies to the NT2.

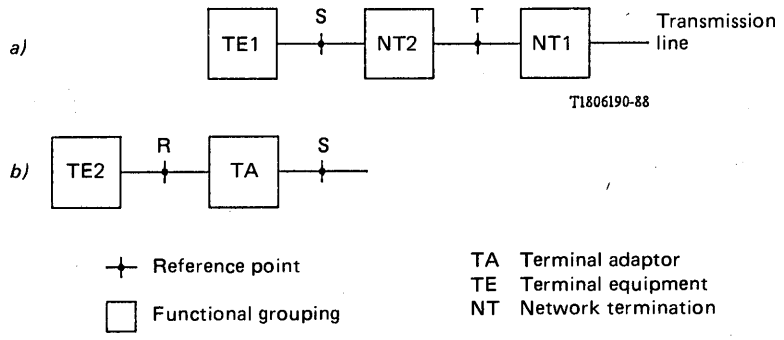


FIGURE 3/I.121

B-ISDN reference configuration

3.3.2 *Physical realization of reference configurations and user-network interfaces*

In order to clearly illustrate the broadband aspects, the notations for reference points and for functional groupings with broadband capabilities are appended with the letter B (e.g. B-NT1, T_B).

Interfaces at reference points S_B and T_B will be standardized. These interfaces will support all ISDN services.

Figure 4/I.121 gives examples of physical configurations illustrating combinations of physical interfaces at various reference points. The examples cover configurations that could possibly the supported by standardized interfaces and reference points S_B and T_B. Other configurations may also be supported.

Configurations *j)* and *k* in Figure 4/I.121 require that the interface specifications for S_B and for T_B have a high degree of commonality. Such commonality is highly desirable. The feasibility of achieving the needed commonality requires further study.

One objective in designing interfaces is to support multiple terminals simultaneously via simplified B-NT2 (e.g. a B-NT2 consisting solely of physical connections).

3.4 *B-ISDN protocol model for ATM*

The B-ISDN protocol model for ATM is shown in Figure 5/I.121. Two specific layers related to the ATM functions are:

- an ATM layer that is common to all services and provides cell transfer capabilities; and
- an adaptation layer that is service dependent.

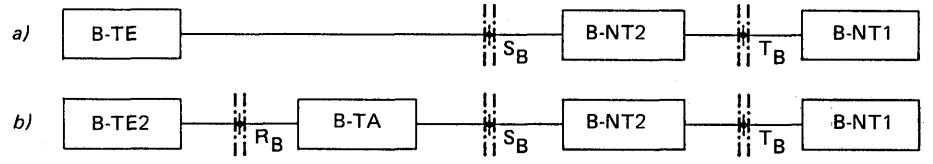
3.4.1 *ATM layer*

The boundary between the ATM layer and the service adaptation layer corresponds to the boundary between functions devoted to the header and functions devoted to the information field.

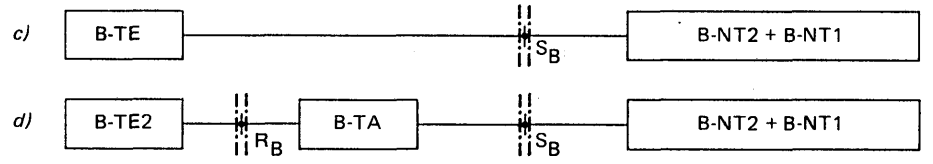
3.4.2 *Adaptation layer*

The adaptation layer supports higher layer functions of the user and control planes and supports connections between ATM and non-ATM interfaces. Information is mapped by the adaptation layer into ATM cells. At the transmitting end, information units (e.g. LAPD frames) are segmented or information units (e.g. PCM voice samples) are collected to be inserted into ATM cells. At the receiving end the information units are reassembled (e.g. LAPD frames) or read-out (e.g. PCM voice samples) from ATM cells. Any adaptation layer specific information (e.g. data field length, time stamps, sequence number) that must be passed between peer adaptation layers is contained in the information field of the ATM cell.

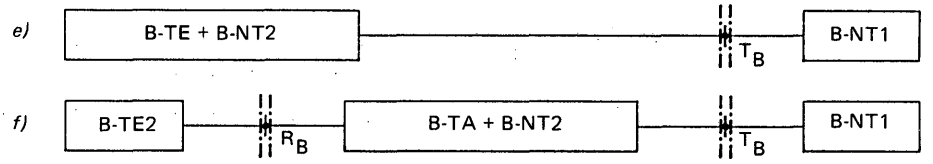
The adaptation layer could be terminated in a Network Termination (NT), Network Adapter (NA), Terminal Adapters (TA), Terminal Equipment (TE) and Exchange Termination (ET) (see Figure 6/I.121). Network adapter functions include those adaptation functions that are necessary between ATM and non-ATM parts of ISDN.



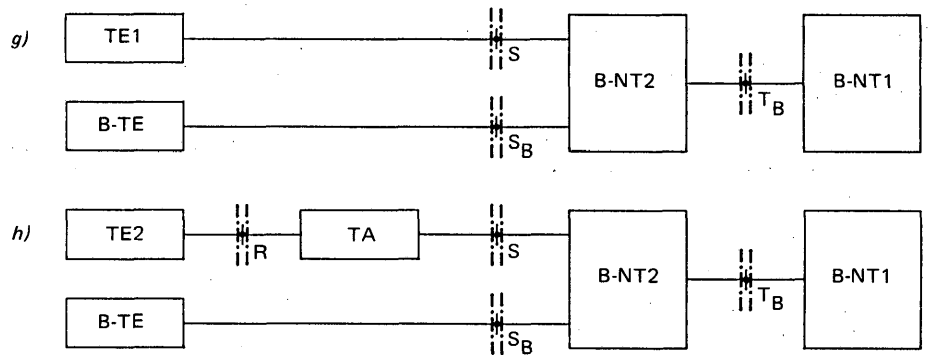
Configuration where B-ISDN physical interfaces occur at reference points S_B and T_B



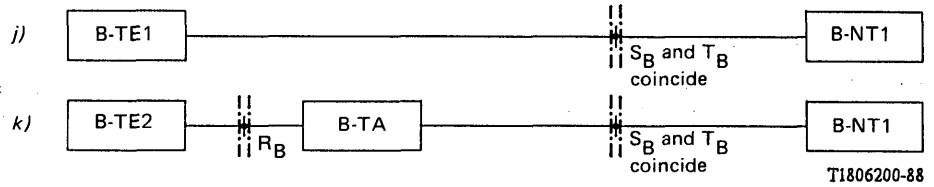
Configuration where B-ISDN physical interfaces occur at reference point S_B only



Configurations where B-ISDN physical interfaces occur at reference point T_B only



Configurations where B-ISDN and ISDN physical interfaces occur at reference points $S + S_B$ and T_B



Configurations where a single B-ISDN physical interface occurs at a location where both reference points S_B and T_B coincide

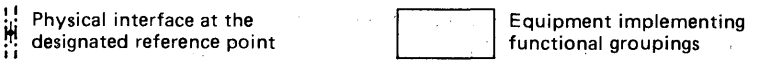


FIGURE 4/I.121

Examples of physical configurations for broadband user applications

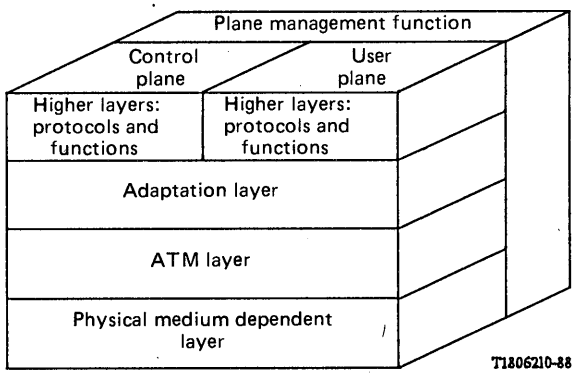
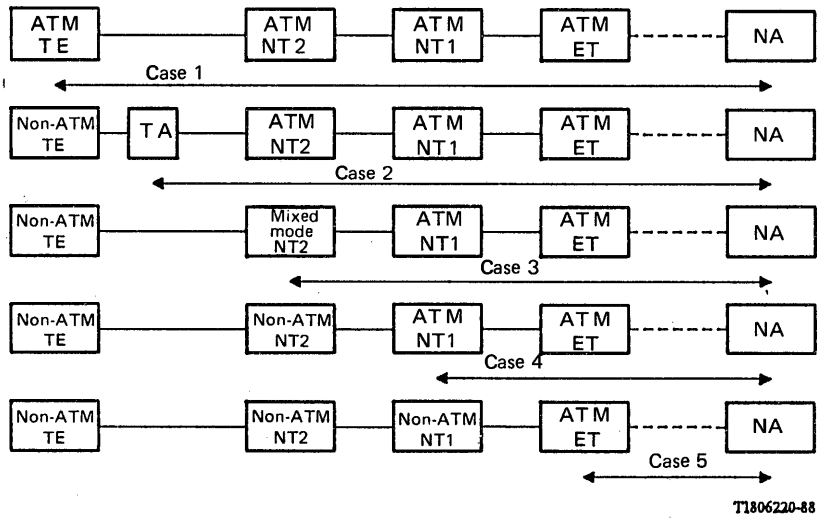


FIGURE 5/I.121

B-ISDN protocol model for ATM



Note – → indicates adaptation layer protocol termination point.

FIGURE 6/I.121

Scope of adaptation layer

3.4.3 *Adaptation layer functions*

Examples of adaptation functions include Continuous Bit Stream Oriented (CBO) services adaptation functions, existing packet mode services adaptation functions and connectionless services adaptation functions:

- CBO adaptation functions

  CBO oriented services are those which involve an uninterrupted flow of digital information; for example; 64 kbit/s PCM voice. The CBO adaptation functions support these services over an ATM network. Within the adaptation layer the following functions may be performed:

  1) cell assembly and disassembly;
  2) compensation for the variable delay of the ATM network;
  3) handling of lost cell conditions;
  4) clock recovery. Some alternatives are to synchronize the output bit stream to the network clock or to the source bit stream;
  5) mapping of the control signal (e.g. V.35) into the ATM cell stream.

- Existing packet mode services adaptation functions

  Existing packet mode services (e.g. LAPD) can be supported by the CBO adaptation functions. This does not take advantage of the idle periods between data transmission. The packet mode adaptation layer provides bandwidth savings by taking advantage of the bursty nature of packet services. Operations that may be carried out by the packet mode adaptation functions include:

  1) detection of information blocks from the higher layer;
  2) dividing information blocks into ATM cells;
  3) handling of partially filled cells;
  4) reassembling information blocks from received ATM cells;
  5) sending information blocks to the higher layer;
  6) rate adaptation;
  7) action on loss of cells.

- Adaptation functions may be defined for connectionless services.

4 Asynchronous transfer mode characteristics

4.1 *General considerations*

The information field is transported transparently by the ATM layer; no processing (e.g. error control) is performed on the information field at the ATM layer.

The header and the information field each consist of a fixed integer number of octets at a given reference point. The information field length is the same for all connections at all reference points where the ATM technique is applied.

4.2 *Header functions*

The header contains just the information required to transfer the information field through the ATM network. Application-oriented or service-oriented information does not appear inside the header.

The three following functions are mandatory:

- virtual channel identification (VCI);
- error detection on the header;
- unassigned cell indication.

The need for additional functions supported by the header is for further study. The following candidates have been identified:

- error correction on the header;
- Quality of Service identification (e.g. delay or loss priority);
- payload type (e.g. virtual circuit test cells);
- cell loss detection;
- access control at the user-network interface (UNI);

- cell sequence numbering;
- terminal identifier;
- virtual path identification;
- line equipment identification.

4.3 *Header format*

VCI and error control are supported by explicit fields. Whether identified functions are explicitly (by fields) or implicitly (by VCI) supported is for further study.

4.4 *Header size*

The size of the header should be chosen in the range of 3 to 8 octets. To determine the appropriate size, urgent study on the header functions mentioned in § 4.2 and on the capacity for future and additional uses is recommended. As an objective, the header size should be the same at all reference points. The feasibility of this is for further study.

4.5 *Information field size*

The size of the information field should be chosen in the range of 32 to 120 octets. To determine the appropriate size, the two following items need urgent study:

- end-to-end Quality of Service covering acceptable end-to-end delay and loss of information;
- transmission efficiency: the information field size-to-header size ratio should allow all existing and envisaged services to be efficiently supported on the transmission media.

5 Broadband channel rates

In this section channels refer to virtual channels with appropriate transmission channel bit rates. In addition to B, H_0 and H_1 channels, B-ISDN will support broadband channels H_2 and H_4 having the following bit rates:

1) H_{21} broadband channel: 32 768 kbit/s;
2) H_{22} broadband channel:
   - in the approximate range of 43 to 45 Mbit/s;
   - an integer multiple of 64 kbit/s;
   - not greater than the payload of existing third level asynchronous transmission systems of the 1.5 Mbit/s based hierarchy.

   Consistent with these three requirements, one objective is to maximize the bit rate of the H_{22} broadband channel.
3) H_4 broadband channel:
   - in the range of 132 to 138.240 Mbit/s;
   - an integer multiple of 64 kbit/s.

   When subsequently defining the exact bit rate, the following factors will be taken into account:
   - the ATM basis of the 150 Mbit/s user network interface;
   - the possible need, during an interim period, to use STM techniques to carry the bit stream of this channel in transmission systems based on the existing and the new digital hierarchy;
   - the possible need to support a television signal multiplex as specified by the CMTT.

The final specification of H_{22} and H_4 broadband channel rates should be such that:

$$4 \times H_{21} \text{ rate} \leqslant H_4 \text{ rate}$$
$$3 \times H_{22} \text{ rate} \leqslant H_4 \text{ rate}$$

Additional broadband channels may be defined if necessary.

6 User-network interface (UNI)

6.1 *General*

This section defines some structural, physical and functional characteristics of broadband user-network interfaces. The characteristics discussed apply to interfaces at the T_B and at the S_B reference points. The commonality between the interface of T_B and at S_B reference points is a matter of further study.

B-ISDN user-network interfaces will be standardized at two bit rates. One of these will be at approximately 150 Mbit/s and the other will be at approximately 600 Mbit/s. The broadband UNI need not be symmetrical. Each of these interfaces must be capable of supporting broadband services as well as 64 kbit/s based ISDN services.

As an objective, the target solution for both B-ISDN user-network interfaces is based on ATM.

Other interface capabilities such as maintenance are not considered in this section.

6.2 *Structure of 150 Mbit/s UNI*

The structure of 150 Mbit/s UNI will be unique and will be based on one of the following alternatives:

1) ATM

   This structure shown in case *a)* and case *b)* of Figure 7/I.121 uses only labelled multiplexing with cell interleaving. This category has two possible alternatives:

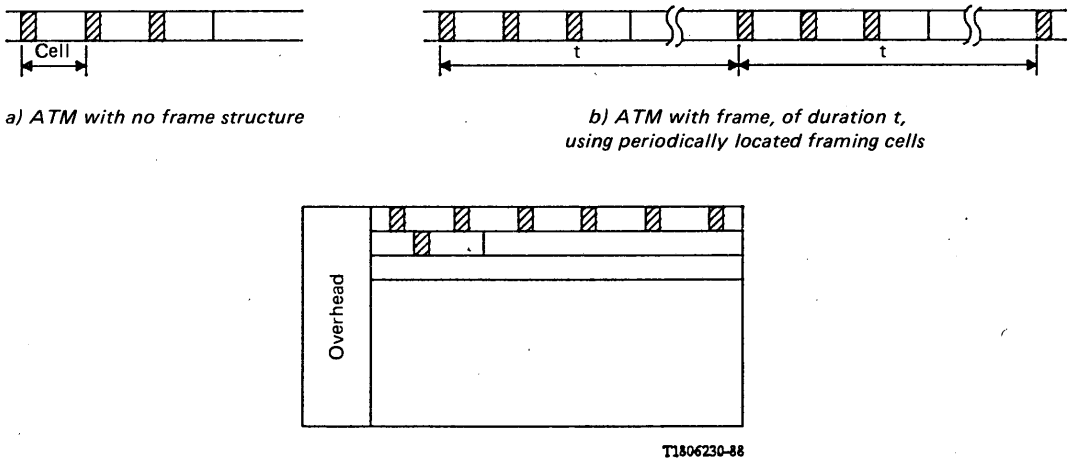
   a) no frame structure is imposed on this interface;

   b) all cells are aligned in a frame structure constructed by periodically located synchronization cells.

2) ATM within a non-ATM frame

   This structure, shown in case *c)* of Figure 7/I.121, places ATM cells in the payload of a frame constructed by using overhead not based on ATM cells.

Note – In the evolution to B-ISDN, a frame structure similar to case *e)* of Figure 8/I.121 may also be considered as one alternative.



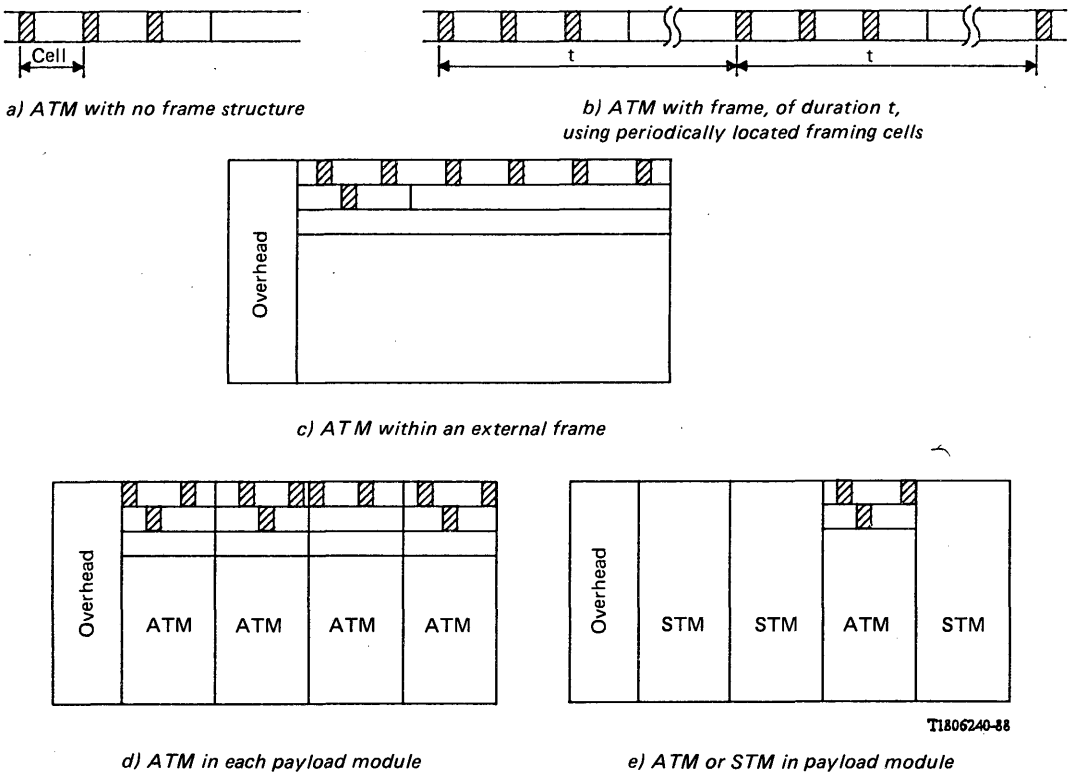
a) ATM with no frame structure

b) ATM with frame, of duration t, using periodically located framing cells

c) UNI structure with ATM within an external frame

FIGURE 7/I.121

Structures for 150 Mbit/s user-network interface (UNI)



a) ATM with no frame structure

b) ATM with frame, of duration t, using periodically located framing cells

c) ATM within an external frame

d) ATM in each payload module

e) ATM or STM in payload module

Note – These diagrams are illustrative only; the actual multiplexing methods are to be defined.

FIGURE 8/I.121

Structures for 600 Mbit/s user-network interface (UNI)

6.3 *Structure of 600 Mbit/s UNI*

Five candidate structures as shown in Figure 8/I.121 have been identified for the 600 Mbit/s UNI. Structures shown in cases *a), b)* and *c)* of Figure 8/I.121 are identical to cases *a), b)* and *c)* of Figure 7/I.121. Structures shown in cases *d)* and *e)* of Figure 8/I.121 have the payload partitioned into payload modules, where case *e)* shows some of these in STM, for possible use in an interim period.

The 600 Mbit/s UNI may be constructed as if derived by (bit, byte, cell) interleaving of four 150 Mbit/s structures and in this case, the gross bit rate of the 600 Mbit/s UNI will be four times the gross bit rate of the 150 Mbit/s UNI.

The structure of the 600 Mbit/s interface may need to provide for the capability of supporting services whose rates exceed the rate of the H_4 broadband channel. This item requires further study.

6.4 *Physical and functional characteristics*

6.4.1 *Physical characteristics*

Layer 1 of the broadband UNI requires electrical or optical transmission capable of supporting the requisite rate.

As an objective, the interfaces should allow for the support of point-to-multipoint configurations.

6.4.2 *Functional characteristics*

The channel mix need not be the same in both directions of transmission.

6.4.3 *Timing characteristics*

The NT1 will derive bit timing information from the aggregate bit stream received from the network.

In case *a)* of Figure 7/I.121 and of Figure 8/I.121, no frame timing is provided. Only cell delineation is provided using randomly located synchronization cells.

In case *b)* of Figure 7/I.121 and of Figure 8/I.121, frame timing is provided using periodically located synchronization cells.

In case *c)* of Figure 7/I.121 and cases *c), d)* and *e)* of Figure 8/I.121, frame timing is provided from the overhead information. The ATM stream within the payload or a payload module may be self delineated, i.e. cells are delineated by inserting synchronization cells randomly or periodically. Alternatively, cell delineation can be achieved by using the periodic structure of the payload.

In all cases the exact method for cell delineation is for further study.

7 Network aspects

7.1 *Generalities*

UNI will be defined according to user needs. Maximum commonality between UNI and the network node interfaces is aimed for.

7.2 *Transmission of ATM*

ATM can be supported by any digital transmission hierarchy or system (e.g. existing hierarchies of Rec. G.702, the proposed synchronous hierarchy of Rec. G.707, G.708, G.709 and any future hierarchy that may be defined). The transfer of information by means of a stream of cells is the basic concept of ATM. It is desirable to be able to perform this process at the highest practical bit rate. Standardization of a broadband digital transmission hierarchy has to accommodate these principles.

7.3 *Synchronization*

The need for synchronization in the ATM network requires further study.

7.4 *Signalling*

In B-ISDN, signalling and user information are carried on separate ATM virtual channels. A user may have multiple signalling entities connected to the network connection control management via separate ATM virtual channels. Enhanced or extended I.441 and I.451 access protocols will be used in B-ISDN to accommodate the additional B-ISDN capabilities.

7.5 *Traffic management and usage monitoring*

7.5.1 *Source characterization*

Two types of service sources can be classified according to the traffic patterns they produce:

- constant traffic sources. Constant traffic sources produce a fixed rate of information, e.g. PCM encoded speech;
- variable traffic sources. Variable traffic sources produce a variable rate of information, e.g. bursty data sources.

7.5.2 *Source indication at call establishment*

The signalling messages sent by a user to establish a call may include the following type of information:

- source traffic characteristics, e.g. burstiness;
- required network transport capabilities, e.g. Quality of Service parameters.

7.5.3 *Network resource management at call establishment*

In response to the source indication the network may manage resources in several ways, such as:

- dedicate resources to a given connection;
- share resources among multiple connections;
- share resources among a class of connections (e.g. connections supporting bursty data sources).

For each of the above-mentioned alternatives, networks may manage resources according to the following examples:

- *Case A*

  In this case sufficient resources are provided to accommodate the expected maximum source bit rate. It could be used for continuous bit stream oriented services, as well as other services.

- *Case B*

  In this case resources are provided at a level somewhere between the expected peak and average source bit rate. This strategy could be applied to bursty sources.

Other ways of managing resources may also be envisaged.

7.5.4 *Usage monitoring*

In ATM a user could attempt to send traffic exceeding the characteristic negotiated at call establishment. ATM networks will provide usage monitoring to detect such situations. When the negotiated capacity is being exceeded, appropriate action is taken by the network to protect the Quality of Service provided to other network users.

7.5.5 *Flow control*

For further study.

7.5.6 *Congestion handling*

For further study.

8 Adaptation between ATM and non-ATM parts of the ISDN

Interworking is envisaged between ATM based and 64 kbit/s based networks and terminals. For that purpose, network adaptations and terminal adaptations will be defined, for example:

- to connect a terminal according to standardized interfaces (I-Series Recommendations) to the ATM network;
- to provide internetworking between ATM and 64 kbit/s based parts of the ISDN.

This item requires further study.

ANNEX A

(to Recommendation I.121)

Examples of broadband services

Table A-1/I.121 contains examples of possible services, their applications and some possible attribute values describing the main characteristics of the services.

TABLE A-1/I.121

Possible broadband services in ISDN [a]

Service classes	Type of information	Examples of broadband services	Applications	Some possible attribute values [g], [h]
Conversational services	Moving pictures (video) and sound	Broadband [b], [c] video-telephony	Communication for the transfer of voice (sound), moving pictures, and video scanned still images and documents between two locations (person-to-person) [c] – Tele-education – Tele-shopping – Tele-advertising	– Demand/reserved/permanent – Point-to-point/multipoint – Bidirectional symmetric/bidirectional asymmetric – (Value for information transfer rate is under study)
		Broadband [b], [c] videoconference	Multipoint communication for the transfer of voice (sound), moving pictures, and video scanned still images and documents between two or more locations (personne-to-group, group-to-group [c] – Tele-education – Tele-shopping – Tele-advertising	– Demand/reserved/permanent – Point-to-point/multipoint – Bidirectional symmetric/bidirectional asymmetric
		Video-surveillance	– Building security – Traffic monitoring	– Demand/reserved/permanent – Point-to-point/multipoint – Bidirectional symmetric/unidirectional
		Video/audio information transmission service	– TV signal transfer – Video/audio dialogue – Contribution of information	– Demand/reserved/permanent – Point-to-point/multipoint – Bidirectional symmetric/bidirectional asymmetric
	Sound	Multiple sound-programme signals	– Multilingual commentary channels – Multiple programme transfers	– Demand/reserved/permanent – Point-to-point/multipoint – Bidirectional symmetric/bidirectional asymmetric

	Data	High speed unrestricted digital information transmission service	– High speed data transfer
			  – LAN (local area network) interconnection
			  – Computer-computer interconnection
			– Transfer of video and other information types
			– Still image transfer
			– Multi-site interactive CAD/CAM
				– Demand/reserved/permanent
				– Point-to-point/multipoint
				– Bidirectional symmetric/bidirectional asymmetric

		High volume file transfer service	– Data file transfer	– Demand – Point-to-point/multipoint – Bidirectional symmetric/bidirectional asymmetric

TABLE A-1/I.121 *(continued)*

Service classes	Type of information	Examples of broadband services	Applications	Some possible attribute values [g), h)]
Conversational services *(continued)*	Data *(continued)*	High speed teleaction	– Realtime control – Telemetry – Alarms	
	Document	High speed Telefax	User-to-user transfer of text, images, drawings, etc.	– Demand – Point-to-point/multipoint – Bidirectional symmetric/bi-directional asymmetric
		High resolution image communication service	– Professional images – Medical images – Remote games and game networks	
		Document communication service	User-to-user transfer of mixed documents [d)]	– Demand – Point-to-point/multipoint – Bidirectional symmetric/bi-directional asymmetric
Messaging services	Moving pictures (video) and sound	Video mail service	Electronic mailbox service for the transfer of moving pictures and accompanying sound	– Demand – Point-to-point/multipoint – Bidirectional symmetric/uni directional (for further study)
	Document	Document mail service	Electronic mailbox service for mixed documents [d)]	– Demand – Point-to-point/multipoint – Bidirectional symmetric/uni directional (for further study)
Retrieval services	Text, data, graphics, sound, still images, moving pictures	Broadband videotex	– Videotex including moving pictures – Remote education and training – Telesoftware – Tele-shopping – Tele-advertising – News retrieval	– Demand – Point-to-point – Bidirectional asymmetric
		Video retrieval service	– Entertainment purposes – Remote education and training	– Demand/reserved – Point-to-point/multipoint [f)] – Bidirectional asymmetric
		High resolution image retrieval service	– Entertainment purposes – Remote education and training – Professional image communications – Medical image communications	– Demand/reserved – Point-to-point/multipoint [f)] – Bidirectional asymmetric
		Document retrieval service	"Mixed documents" retrieval from information centres, archives, etc. [d), e)]	– Demand – Point-to-point/multipoint [f)] – Bidirectional asymmetric
		Data retrieval service	Telesoftware	

TABLE A-1/I.121 *(continued)*

Service classes	Type of information	Examples of broadband services	Applications	Some possible attribute values [g), h)]
Distribution services without user individual presentation control	Video	Existing quality TV distribution service (PAL, SECAM, NTSC)	TV programme distribution	– Demand (selection)/permanent – Broadcast – Bidirectional asymmetric/unidirectional
		Extended quality TV distribution service – Enchanced definition TV distribution service – High quality TV	TV programme distribution	– Demand (selection)/permanent – Broadcast – Bidirectional asymmetric/unidirectional
		High definition TV distribution service	TV programme distribution	– Demand (selection)/permanent – Broadcast – Bidirectional asymmetric/unidirectional
		Pay-TV (pay-per-view, pay-per-channel)	TV programme distribution	– Demand (selection)/permanent – Broadcast/multipoint – Bidirectional asymmetric/unidirectional
	Text, graphics, still images	Document distribution service	– Electronic newspaper – Electronic publishing	– Demand (selection/permanent – Broadcast/multipoint [f)] – Bidirectional asymmetric/unidirectional
	Data	High speed unrestricted digital information distribution service	– Distribution of unrestricted data	– Permanent – Broadcast – Unidirectional
	Moving pictures and sound	Video information distribution service	– Distribution of video/audio signals	– Permanent – Broadcast – Unidirectional
Distribution services with user individual presentation control	Text, graphics, sound, still images	Full channel broadcast videography	– Remote education and training – Tele-advertising – News retrieval – Telesoftware	– Permanent – Broadcast – Unidirectional

Notes to Table A-1/I.121:

a) In this table only those broadband services are considered which may require higher transfer capacity than that of the H_1 capacity. Services for sound retrieval, main sound applications and visual services with reduced or highly reduced resolutions are not listed.

b) This terminology indicates that a re-definition regarding existing terms has taken place. The new terms may or may not exist for a transition period.

c) The realization of the different applications may require the definition of different quality classes.

d) "Mixed document" means that a document may contain text, graphic, still and moving picture information as well as voice annotation.

e) Special high layer functions are necessary if post-processing after retrieval is required.

f) Further study is required to indicate whether the point-to-multipoint connection represents in this case a main application.

g) At present, the packet mode is dedicated to non-realtime applications. Depending on the final definition of the packet transfer mode, further applications may appear. The application of this attribute value requires further study.

h) For the moment this column merely highlights some possible attribute values to give a general indication of the characteristics of these services. The full specification of these services will require a listing of all values which will be defined for broadband services in Recommendations of the I.200-Series.

ANNEX B

(to Recommendation I.121)

Definitions of possible broadband service families and their attribute values

B.1 broadband unrestricted bearer services

B.1.1 *Definition*

Bearer services which provide unrestricted end-to-end transfer of digital information without alteration between S_B/T_B reference points and require broadband channel rates. User information is transferred over standardized broadband channels for STM (circuit) services or a virtual channel of defined capacity for ATM based services; signalling is provided over a signalling channel.

B.1.2 *Attribute description*

See Table B-1/I.121.

B.2 high quality broadband videotelephony services

B.2.1 *Definition*

High quality broadband videotelephony services are symmetrical real-time, bi-directional audio-visual services which provide person-to-person communication for the transfer of high quality voice (sound), moving pictures, and optionally video-scanned still images between two locations.

B.2.2 *Attribute description*

See Table B-2/I.121.

TABLE B-1/I.121

Broadband unrestricted bearer services

Attributes	Values		
Information transfer attributes 1. Information transfer mode [a]	STM (circuit)	ATM	
		Deterministic [b]	Statistical [b]
2. Information transfer rate (Mbit/s)	H_{21}, H_{22} or H_4 channel bit-rate		
2.1 Peak bit rate (throughput)		H_{21}, H_{22} or H_4 channel or other bit rate	H_{21}, H_{22} or H_4 channel or other bit rate
2.2 Average bit rate [c]		As peak bit rate	Under study
3. Information transfer capability	Unrestricted	Unrestricted	
4. Structure	Unstructured or 8 kHz integrity [d]	For further study	
5. Etablishment of communication	Demand/reserved/permanent	Demand/reserved/permanent	
6. Communication configuration	Point-to-point/multipoint/broadcast	Point-to-point/multipoint/broadcast	
7. Symmetry	Bidirectional symmetric/bidirectional asymmetric/unidirectional	Bidirectional symmetric/bidirectional asymmetric/unidirectional	
Access attributes 8. Access channel and rate (kbit/s) 8.1 User information	H_{21}, H_{22} or H_4 for user information	Virtual channel with H_{21}, H_{22} or H_4 channel or other bit rates	
8.2 Signalling/selecting	Signalling channel for signalling and OAM [e] – under study	Signalling channel for signalling and OAM [e] – under study	
9. Access protocols Signalling access Protocols 9.1 Layer 1 9.2 Layer 2 9.3 Layer 3 Information access protocols 9.4 Layer 1 9.5 Layer 2 9.6 Layer 3	To be defined I.440/441, I.450/451 } Need additions for broadband communication To be defined – [f] – [f]	To be defined I.440/441, I.450/451 } Need additions for broadband communication To be defined – [f] – [f]	
General attributes 10. Supplementary services provided	For further study	For further study	
11. Quality of service – End-to-end transfer delay – Delay jitter (cell jitter) – Error characteristics – Information loss probability	For further study	For further study	

TABLE B-1/I.121*(continued)*

Attributes	Values	
12. Interworking possibilities	For further study	For further study
13. Operational and commercial	For further study. This study should include maintenance facilities.	For further study. This study should include maintenance facilities.

a) The values for the information transfer mode attribute need further study. For example, the distinction between the STM (circuit) and the ATM (deterministic) values needs to be investigated.

b) In the ATM deterministic mode a transfer capacity of the peak bit rate will be provided to the user all the time (average bit rate = peak bit rate). In the ATM statistical mode a transfer capacity of only the average gross bit rate (i.e. the average net bit rate plus cell headers) will be provided to the user (depending on the throughput class).

c) Average over, for example, 100 ms.

d) Further study is needed.

e) For reserved/permanent service the operational, administrative and maintenance messages (OAM) related to this service may be conveyed over the signalling channel.

f) User defined.

TABLE B-2/I.121

High quality broadband videotelephony services [a]

Attributes	Values		
Information transfer attributes 1. Information transfer mode [b]	STM (circuit)	ATM	
		Deterministic [c]	Statistical [c]
2. Information transfer rate [d] (Mbit/s)	H_{21}, H_{22} or H_4 channel bit-rate		
2.1 Peak bit rate (throughput)		H_{21}, H_{22} or H_4 channel or other bit rate	H_{21}, H_{22} or H_4 channel or other bit rate
2.2 Average bit rate [e]		As peak bit rate	Under study
3. Information transfer capability	High quality video + 15 kHz audio + user-to-user messages	High quality video + 15 kHz audio + User-to-user messages	
4. Structure	Unstructured	For further study	
5. Establishment of communication	Demand/reserved/permanent	Demand/reserved/permanent	
6. Communication configuration	Point-to-point/multipoint	Point-to-point/multipoint	
7. Symmetry	Bidirectional symmetric	Bidirectional symmetric	
Access attributes 8. Access channel and rate	H_2 or H_4 (bit rates under study) for user information		
8.1 User information		Virtual channel with H_{21}, H_{22} or H_4 channel or other bit rate	Virtual channel with H_{21}, H_{22} or H_4 channel or other bit rate
8.2 Signalling	Signalling channel for signalling and OAM-under study	Signalling channel under study	
9. Access protocols Signalling access protocols 9.1 Layer 1 9.2 Layer 2 9.3 Layer 3	To be defined I.440/441, I.450/451 } Need additions for broadband communication	To be defined I.440/441, I.450/451 } Need additions for broadband communication	
Information access protocols 9.4 Layer 1 9.5 Layer 2 9.6 Layer 3	To be defined Under study	To be defined Under study	
High layer attributes 10. Type of user information	Moving pictures + sound + user-to-user messages		
11. Transport (layer 4) functions/protocol	Under study		
12. Session (layer 5) functions/protocol	Under study		

TABLE B-2/I.121 *(continued)*

Attributes	Values	
13. Presentation (layer 6) functions/protocol 13.1 Video 13.2 Audio 13.3 Auxiliary 13.4 User-to-user messages	Under study. This study should include video, sound, auxiliary information such as text, facsimile, etc., and user-to-user control messages	
14. Application (layer 7) function/protocol 14.1 Video 14.2 Audio 14.3 Auxiliary 14.4 User-to-user messages	Under study	
General attributes 15. Supplementary services provided	As for telephony; others under study	
16. Quality of service 16.1 Video	Equal to or higher than existing TV	
16.2 Audio	15 kHz stereo [f]	
– End-to-end transfer delay – Delay jitter (call jitter) – Error characteristics – Information loss probability	Under study	Under study
17. Interworking possibilities	With other videotelephone, telephone, and video-conference services	
18. Operational and commercial	For further study. This study should include maintenance facilities	

[a] The attribute values characterize a videoconference service providing high video quality equal or higher than existing TV standards. Until now only coding mechanisms for those video qualities have been available which require transfer bit rates equal to or higher than, the H_{21}-channel bit rate. Due to future development in research of coding algorithms and techniques, the transfer bit rates necessary for those video qualities may decrease.

[b] The values for the information transfer mode attribute need further study. For example, the distinction between the STM (circuit) and the ATM (deterministic) values needs to be investigated.

[c] In the ATM deterministic mode a transfer capability of the peak bit rate will be provided to the user all the time (average bit rate = peak bit rate). In the ATM statistical mode a transfer capacity of only the average gross bit rate (i.e. the average net bit rate plus cell headers) will be provided to the user (depending on the throughput class).

[d] The broadband network is free to process the bit-stream (e.g. compression, conversion to analogue etc.) as long as end-to-end service quality requirements are satisfied.

[e] Average over, for example, 100 ms.

[f] This value may be restricted to 7 kHz only at the electro-acoustic interface at the TE due to possible echo cancellation problems in case of band-free application.

B.3 high quality broadband videoconference services

B.3.1 *Definition*

High Quality Broadband Videoconference services provide person-to-person or group-to-group capability for the transfer of different high quality information types primarily including voice (sound), full motion video, moving pictures, and, optionally, video-scanned still images, documents and other video information, to support conferencing between two or more locations.

B.3.2 *Attribute description*

See Table B-3/I.121.

B.4 high definition TV and existing quality TV distribution services

B.4.1 *Definition*

High definition TV (HDTV)/existing quality TV distribution services provide the capability of distributing TV programmes with the quality of HDTV/existing quality TV as appropriate.

B.4.2 *Attribute description*

See Table B-4/I.121.

B.5 broadband videotex services

B.5.1 *Definition*

Broadband Videotex services are interactive services which provide, through appropriate access by standardized procedures, for users of broadband videotex terminals to communicate with data bases via telecommunications networks.

TABLE B-3/I.121

High quality broadband videoconference services [a]

Attributes	Values		
Information transfer attributes 1. Information transfer mode [b]	STM (circuit)	ATM	
		Deterministic [c]	Statistical [c]
2. Information transfer rate [d] (Mbit/s)	H_{21}, H_{22} or H_4 channel bit-rate		
2.1 Peak bit rate (throughput)		H_{21}, H_{22} or H_4 channel or other bit rate	H_{21}, H_{22} or H_4 channel or other bit rate
2.2 average bit rate [e]		As peak bit rate	Under study
3. Information transfer capability	High quality video + 15 kHz audio + user-to-user messages	High quality video + 15 kHz audio stereo + user-to-user messages	
4. Structure	Unstructured	For further study	
5. Establishment of communication	Demand/reserved/permanent	Demand/reserved/permanent	
6. Communication configuration	Multipoint/point-to-point	Multipoint/point-to-point	
7. Symmetry	Bidirectional symmetric/bidirectional asymmetric/others for further study	Bidirectional symmetric/bidirectional asymmetric/others for further study	
Access attributes 8. Access channel and rate	H_2 or H_4 for user information (multipoint communication)		
8.1 User information		Virtual channel with H_2 or H_4 channel bit rate	Virtual channel with H_4 channel bit rate
8.2 Signalling	Signalling channel for signalling and OAM – under study	Signalling channel under study	
9. Access protocols Signalling access protocols 9.1 Layer 1 9.2 Layer 2 9.3 Layer 3 Information access protocols 9.4 Layer 1 9.5 Layer 2 9.6 Layer 3	 To be defined I.440/441, I.450/451 } Need supplements for broadband communication To be defined Under study	 To be defined I.440/441, I.450/451 } Need supplements for broadband communication To be defined Under study	
High layer attributes 10. Type of user information	Moving pictures + sound + user-to-user messages		
11. Transport (layer 4) functions/protocol	Under study		
12. Session (layer 5) functions/protocol	Under study		

TABLE B-3/I.121 *(continued)*

Attributes	Values	
13. Presentation (layer 6) functions/protocol 13.1 Video 13.2 Audio 13.3 Auxiliary 13.4 User-to-user messages	Under study. This study should include video, sound auxiliary information such as text, facsimile, etc., and user-to-user control messages	
14. Application (layer 7) function/protocol 14.1 Video 14.2 Audio 14.3 Auxiliary 14.4 User-to-user messages	Under study	
General attributes 15. Supplementary services provided	As for telephony; others under study	
16. Quality of service 16.1 Video	Equal to or higher than existing TV	
16.2 Audio	15 kHz stereo [f]	
– End-to-end transfer delay – Delay jitter (cell jitter) – Error characteristics – Information loss probability	Under study	Under study
17. Interworking possibilities	With other videoconference, videotelephone, and telephone services	
18. Operational and commercial	For further study. This study should include maintenance facilities	

[a] The attribute values characterize a videoconference service providing high video quality equal to, or higher than, existing TV standards. Until now only coding mechanisms for those video qualities have been available which require transfer bit rates equal to, or higher than, the H_{21}-channel bit rate. Due to future development in research of coding algorithms and techniques, the transfer bit rates necessary for those video qualities may decrease.

[b] The values for the information transfert mode attribute need further study. For example, the distinction between the STM (circuit) and the ATM (deterministic) values needs to be investigated.

[c] In the ATM deterministic mode a transfer capability of the peak bit rate will be provided to the user all the time (average bit rate = peak bit rate). In the ATM statistical mode a transfer capacity of only the average gross bit rate (i.e. the average net bit rate plus cell headers) will be provided to the user (depending on the throughput class).

[d] The broadband network is free to process the bit-stream (e.g. compression, conversion to analogue etc.) as long as end-to-end service quality requirements are satisfied.

[e] Average over, for example, 100 ms.

[f] This value may be restricted to 7 kHz only at the electro-acoustic interface at the TE due to possible echo cancellation problems in case of band-free application.

TABLE B-4/I.121

High definition TV (HDTV) distribution services and existing quality TV distribution services

Attributes	Existing quality TV distribution service [a) b)]			HDTV distribution service	
	Values			Values	
Information transfer attributes 1. Information transfer mode [c)]	STM (circuit)	ATM		STM (circuit)	ATM
		Deterministic [d)]	Statistical [d)]		Deterministic [d)]
2. Information transfer rate (Mbit/s)	H_{21}, H_{22} or H_4-channel bit-rate			H_4-channel bit rate or greater	
2.1 Peak bit rate (throughput)		H_{21}, H_{22} or H_4 channel or other bit rate		n/a	H_4-channel bit rate or greater
2.2 Average bit rate [e)]		As peak bit rate	Under study	n/a	As peak bit rate
3. Information transfer capability	High quality video + 15 kHz audio stereo	High quality video + 15 kHz audio stereo		HDTV quality video + 15 kHz audio stereo	
4. Structure	Unstructured	Service data unit integrity		Unstructured	For further study
5. Establishment of communication	Demand/reserved	Demand/reserved		Demand/reserved	Demand/reserved
6. Communication configuration	Broadcast (other values for further study)	Broadcast (other values for further study)		Broadcast (other values for further study)	Broadcast (other values for further study)
7. Symmetry	Unidirectional	Unidirectional		Unidirectional	Unidirectional
Access attributes 8. Access channel and rate 8.1 User information	H_2 or H_4 (bits rates under study) for user information	Virtual channel with H_{21}, H_{22} or H_4 channel or other bit rate	Virtual channel with H_{21}, H_{22} or H_4 channel or other bit rate	Virtual channel dependent on the necessary information transfer rate	
8.2 Signalling/selecting	D channel or a special channel for distribution service signalling	D channel or special channel (under study)			D channel or special channel (under study)

TABLE B-4/I.121 *(continued)*

Attributes	Existing quality TV distribution service [a) b)]		HDTV distribution service	
	Values		Values	
9. Access protocols				
Signalling access protocols				
9.1 Layer 1	To be defined	To be defined	To be defined	To be defined
9.2 Layer 2	I.440/441 / I.450/451 Need supplements for broadband communication	I.440/441 / I.450/451 Need supplements for broadband communication	I.440/441 / I.450/451 Need supplements for broadband communication	
9.3 Layer 3	To be defined	To be defined	To be defined	To be defined
Information access protocols				
9.4 Layer 1				
9.5 Layer 2	Under study	Under study	Under study	Under study
9.6 Layer 3				
High layer attributes				
10. Type of user information	Moving picture + sound + data	Moving picture + sound + data	Moving picture + sound + data	
11. Transfer (layer 4) function/protocol	For further study	For further study	For further study	
12. Session (layer 5) function/protocol	For further study	For further study	For further study	
13. Presentation (layer 6) function/protocol 13.1 Video 13.2 Audio 13.3 Auxiliary 13.4 User-to-user messages	For further study, awaiting suitable coding schemes	For further study, awaiting suitable coding schemes	For further study, awaiting suitable coding schemes	
14. Application (layer 7) function/protocol 14.1 Video 14.2 Audio 14.3 Auxiliary 14.4 User-to-user messages	For further study	For further study	For further study	
General attributes				
15. Supplementary services provided	For further study	For further study	For further study	

TABLE B-4/I.121 *(continued)*

Attributes	Existing quality TV distribution service [a) b)]		HDTV distribution service	
	Values		Values	
16. Quality of service 16.1 Video	Equal to existing TV	Equal to existing TV (or better)	HDTV quality	
16.2 Audio	Equal to existing high fidelity stereo standards (or better)	Equal to existing high fidelity stereo standards (or better)	Equal to existing high fidelity stereo standards (or better)	
– End-to-end transfer delay – Delay jitter (cell jitter) – Error characteristics – Information loss probability	Under study	Under study	Under study	Under study
17. Interworking possibilities	For further study	For further study	For further study	For further study
18. Operational and commercial	For further study	For further study	For further study	For further study

a) The attribute values characterize a TV distribution service providing high video quality equal to, or higher than, existing TV standards. Until now only coding mechanisms for those video qualities have been available which require transfer bit rates equal to, or higher than, the H_{21}-channel bit rate. Due to future development in research of coding algorithms and techniques, the transfer bit rates necessary for those video qualities may decrease.

b) Preliminary name.

c) The values for the information transfer mode attribute need further study. For example, the distinction between the STM (circuit) and the ATM (deterministic) values needs to be investigated.

d) In the ATM deterministic mode a transfer capacity of the peak bit rate will be provided to the user all the time (average bit rate = peak bit rate). In the ATM statistical mode a transfer capacity of only the average gross bit rate (i.e. the average net bit rate plus cell headers) will be provided to the user (depending on the throughput class).

e) Average over, for example, 100 ms.

Recommendation I.122

FRAMEWORK FOR PROVIDING ADDITIONAL PACKET MODE BEARER SERVICES

(Melbourne, 1988)

1 Introduction

Packet mode bearer services supported by an ISDN are given in Recommendation I.232. Recommendation I.462 (X.31) specifies the procedures for two such bearer services, virtual call and permanent virtual circuit bearer services, for the support of X.25 packet mode terminals in ISDN.

This Recommendation establishes an architectural framework within which additional packet mode bearer services are described.

1.1 *Scope*

The architectural framework and service descriptions given in this Recommendation provide the basis for further work to be done by CCITT during the 1989-1992 Study Period. This method of work involves first the description of services and then the development of protocols to support them.

During the course of this work the first ISDN principle given in Recommendation I.120 should be followed. That is, a wide range of applications should be supported by the same network using a limited set of connection types and multipurpose user-network interface arrangements. From considerations in this Recommendation it is also desirable to limit the number of bearer services. It is recognized, however, that at this time it is premature to exclude any potential bearer services. The criteria on the basis of which the number of these bearer services could be reduced requires further study.

The Recommendation also provides a general description on interworking requirements between I.122 based services and I.462 (X.31) based services or PSPDNs.

1.2 *Objectives*

The principle of separation of the user and control planes for all telecommunication services has been established as a fundamental concept of the ISDN protocol reference model (Rec. I.320). This principle has been applied, however, only to circuit mode services. Packet mode services in ISDN are based on Recommendation I.462 (X.31). Recommendation I.462 (X.31) is a pragmatic approach that minimizes deployment and interworking difficulties, while at the same time providing access to packet services through an integrated physical interface.

The evolution of packet mode services in ISDN has been investigated, and an architectural framework for providing additional packet mode services has been established in this Recommendation. In undertaking this investigation the main objective was to establish a framework based on the ISDN protocol reference models described in Recommendation I.320. More specifically, this framework was aimed at achieving:

a) full integration of C-plane (control plane) procedures for all services, i.e. one set of protocols for call control; supplementary services and operational, administrative and maintenance messages (OAM) across all telecommunication services;

b) the decoupling of user information transfer requirements from C-plane transfer requirements. This allows the possibility of defining telecommunication services whose U-plane (user plane) characteristics are tailor-made only to the transfer needs of user information and not to those of C-plane information.

The bearer services supported within this architectural framework are in the virtual call and permanent virtual circuit bearer service category. All bearer services defined within this framework if and when included in Rec. I.232 will have recommended overall provision A (Additional).

1.3 *Definitions of terms*

In the context of this Recommendation, the following definitions apply:

Note – This list is not complete. For example, some of these definitions apply to terms relevant to only some of the bearer services discussed in this Recommendation.

1.3.1 **delivered duplicate frames**

A frame D received by a particular destination user is defined to be a duplicated frame if both of the following conditions are true:

a) D was not generated by the source user;

b) D is exactly the same as a frame that was previously delivered to that destination.

1.3.2 **delivered errored frames**

A delivered frame is defined to be an errored frame when the value of one or more bits in the frame is in error, or when some, but not all, bits in the frame are lost bits or extra bits (i.e. bits that were not present in the original signal). (See Rec. X.140).

1.3.3 **delivered out-of-sequence frames**

Consider a sequence of frames F_1, F_2, f_3, ..., F_n. Assume that F_1 is transmitted first, F_2 second, ... F_n last.

A delivered frame F_i is defined to be out-of-sequence if it arrives at the destination user after any of the frames $F_{(i+1)}$, $F_{(i+2)}$, ..., F_n.

1.3.4 **dynamic window control**

The term dynamic window control refers to a set of procedures based on which the transmitter's transmit window is modified, according to a user-perceived congestion condition in the network.

1.3.5 **end-to-end communication**

End-to-end communication is a direct peer-to-peer communication of TE to TE, or TE to a network interworking function (IWF) supporting, for example, PSPDN interworking.

1.3.6 **explicit congestion message**

Explicit congestion message is a message generated by the network and sent to a user terminal to indicate a congestion condition.

1.3.7 **implicit congestion control**

Implicit congestion control is a scheme under which user terminals first detct a possible congestion condition by means other than explicit congestion messages, and then take appropriate action to reduce their throughput.

1.3.8 **information integrity**

Information integrity is a network providing frame-relaying bearer service defines that all frames carried by the network shall satisfy the FCS check.

1.3.9 **logically separate (C-plane information)**

Logically separate means that C-plane information is sent separately from U-plane information in one of the following ways:

1) on a physically separate interface;

2) on another channel (time slot) within the same interface; or

3) on a separate logical link within the same channel (e.g., D-channel).

1.3.10 **lost frames**

A transmitted frame is declared to be a lost frame when the frame is not delivered to the intended destination user within a specified timeout period, and the network is responsible. (See Rec. X.140).

1.3.11 **misdelivered frames**

A misdelivered frame is a frame transferred from a source user to a destination user other than the intended destination user. It is considered inconsequential whether the information is correct or incorrect in content. (See Rec. X.140).

1.3.12 **quality of service (QOS)-parameter set** (See Rec. X.213)

For each QOS-parameter, a set of "subparameters" is defined from among the following possibilities:

a) a *target* value which is the QOS value desired by the calling user;

b) the *lower quality acceptable* value which is the lowest QOS value agreeable to the calling user. (When the lowest quality acceptable refers to throughput, the term "minimum" may be used, while when it refers to transit delay, the term "maximum" may be used.);

c) an *available* value which is the QOS that the network is willing to provide;

d) a *selected* value which is the QOS value to which the called user agrees.

1.3.13 **real time call establishment**

The term real time call establishment refers to a set of procedures based on which the communication can be started in a relatively short time (i.e. in the order of a few seconds) after the request is made. (See definition for demand communication establishment in Rec. I.130).

1.3.14 **residual error rate**

Residual error rate is defined for both the additional packet-mode bearer services and the corresponding layer services.

The layer services corresponding to the additional packet-mode bearer services are characterized by the exchange of service data units (SDUs). For frame relaying 1, SDUs are exchanged at the functional boundary between the core functions of Recommendation [1)] and the end-to-end protocol implemented above them. For frame relaying 2 and frame switching, SDUs are exchanged at the functional boundary between the complete I.441* and the end-to-end functions implemented above I.441*. For the X.25-based additional packet mode service (APMS), SDUs are exchanged at the functional boundary of X.25 PLP-DTP (packet layer protocol-data transfer part) and the end-to-end functions implemented above.

The network participates in this exchange by means of protocol data units (PDUs). In frame relaying 1 and 2, PDUs are frames as defined in the core functions of I.441*. In frame switching, PDUs are frames as defined in I.441*, while in X.25-based APMS, they are packets as defined in X.25 PLP.

The residual error rate for the corresponding layer service of APMS is defined as:

$$R = 1 - \frac{\text{Total correct SDUs delivered}}{\text{Total offered SDUs}}$$

The residual error rate for the APMS is defined as the ratio:

$$R = 1 - \frac{\text{Total correct PDUs delivered}}{\text{Total offered PDUs}}$$

[1)] I.441* is I.441 with appropriate extensions. The use of the extensions may depend on each bearer service and is for further study.

1.3.15 **throughput**

Throughput for a virtual connection section[2] in a network providing the frame relaying bearer service, is the number of data bits contained between the address field and the FCS field of the frames successfully transferred in one direction across that section per unit time. Successful transfer means that the FCS check for each frame is satisfied.

1.3.16 **transit delay**

Transit delay is defined only between pairs of section boundaries[3]. Transit delay of a frame protocol data unit (FPDU)[4] starts at the time t_1 at which the first bit of the FPDU crosses the first boundary, and ends at the time t_2 at which the last bit of the FPDU crosses the second boundary.

Transit delay $= t_2 - t_1$.

2 Service aspects

2.1 *General service characteristics*

This Recommendation describes a set of potential packet mode bearer services that have the following characteristics in common:

1) All C-plane procedures, if needed, are performed in a logically separate manner using protocol procedures that are integrated across all telecommunications services (i.e. I.451 with appropriate extensions).
2) The U-plane procedures share the same layer 1 functions based on Rec. I.430/I.431. Moreover, they share the same core procedres, defined in § 3.1, that among other functions allow for statistical multiplexing of user information flows immediately above the layer 1 functions.

The basic bearer service provided by the network is the order preserving bidirectional transfer (see § 2.3.1) of service data units (i.e. frames or packets) from one S/T reference point to another. The data units are routed through the network on the basis of an attached label (e.g. the data link connection identifier (DLCI) value of the frame). This label is a logical identifier with local significance. In the virtual call case, the value of the logical identifier and the other associated parameters are negotiated during the call set-up by means of C-plane procedures. Depending on the bearer service and parameters, the network may accept or reject the user requested service. In the permanent virtual circuit case, the logical identifier and the other associated parameters are defined by means of administrative procedures. The network treatment of the data units, (e.g. unacknowledged transfer, acknowledged transfer, error recovery) in addition to simple transfer, depends on the specific bearer service requested.

The user network interface structure at the S/T reference point allows for the establishment of multiple virtual calls and/or permanent virtual circuits to many destinations.

2.2 *Quality of Service parameters*

Each potential bearer service described in this Recommendation provides service quality that is characterized by the values of the following parameters:

1) throughput;
2) transit delay;
3) information integrity;
4) residual error rate;
5) delivered errored frames;
6) delivered duplicated frames;
7) delivered out-of-sequence frames;

---

[2] Virtual connection section is defined in Rec. X.134.

[3] The definition of section boundaries is given in Rec. X.134.

[4] The definition of FPDU is given above in residual error rate.

8) lost frames;

9) misdelivered frames;

10) others for further study.

Note – The applicability and values of these parameters for different bearer services are for further study.

2.3 *Individual bearer service descriptions*

This section contains descriptions of four specific potential bearer services proposed for standardization:

a) frame relaying 1,

b) frame relaying 2,

c) frame switching, and

d) X.25-based additional packet mode.

2.3.1 *Frame relaying 1 service description*

Frame relaying 1 shares with the other services the general service characteristics and quality of service parameters described in §§ 2.1 and 2.2, respectively.

The frame relaying 1 data units are frames as defined in Rec. I.441. The basic bearer service provided is the unacknowledged transfer of frames from S/T to S/T reference point. More specifically, in the U-plane:

1) it preserves their order as given at one S/T reference point if and when they are delivered at the other end.

   Note – Since the network does not terminate the upper part of I.441, sequence numbers are not kept by the network. Networks should be implemented in a way that, in principle, frame order is preserved;

2) it detects transmission, format and operational errors (e.g. frames of unknown DLCI);

3) frames are transported transparently (in the network), only the address and FCS field may be modified;

4) it does not acknowledge frames (within the network).

All of the above functions are based on Rec. I.441. Appropriate extensions to the core functions of Rec. I.441 may be needed, e.g. for congestion control. In the C-plane all signalling capabilities for call control, parameter negotiation, etc. are based on a common set of protocols (e.g. Rec. I.451 extended), as for all ISDN telecommunication services. In the case of permanent virtual circuits (PVC) no real time call establishment is necessary and parameters are agreed upon at subscription time.

However, additional functions are needed:

– to monitor throughput and to enforce it,

– to control congestion.

The mechanisms to achieve these functions are still under investigation.

Appropriate protocol capabilities should be available so that the network may discard erroneous frames if it elects to do so. Note that if networks elect to forward erroneous frames to the user, fraud and misdelivery of frames may occur.

From the service perspective, frame relaying 1 provides service quality characteristics with the following parameter values:

(Parameter values are for further study).

2.3.2 *Frame relaying 2 service description*

Frame relaying 2 shares with the other services the general service characteristics and Quality of Service parameters described in §§ 2.1 and 2.2, respectively.

The frame relaying data units are frames as defined in Rec. I.441. The basic bearer service provided is an unacknowledged transfer of frames from S/T to S/T reference point. More specifically, in the U-plane:

1) it preserves their order as given at one S/T reference point if and when they are delivered at the other end.

   Note – Since the network does not terminate th upper part of I.441, sequence numbers are not kept by the network. Networks should be implemented in a way that, in principle, frame order is preserved;

2) it detects transmission, format and operational errors (e.g. frames of unknown DLCI);

3) frames are transported transparently in the network, only the address and FCS field may be modified;

4) it does not acknowledge frames (within the network);

5) normally the only frames received by a user are those sent by the distant user. (Currently, implicit congestion control is preferred in which the network does not generate any congestion control messages toward the user. The generation of explicit congestion control messages by the network is for further study.)

All of the above functions are based on Rec. I.441. Appropriate extensions to Rec. I.441 may be needed, e.g. in relation to congestion control.

In the C-plane all signalling capabilities for call control, parameter negotiation, etc. are based on a common set of protocols (e.g. Rec. I.451 extended), as for all ISDN telecommunication services. In the case of permanent virtual circuits (PVC) no real time call establishment is necessary and any parameters are agreed upon at subscription time.

However, additional network functions are needed:

- to monitor throughput and to enforce it,
- to control congestion.

The mechanisms to achieve these functions are still under investigation.

Appropriate protocol capabilities should be available so that the network may discard erroneous frames if it elects to do so. Note that if networks elect to forward erroneous frames to the user, fraud and misdelivery of frames may occur.

The difference between the two types of frame relaying is that in frame relaying 2 the end points always implement, above the core functions, the upper part of Rec. I.441 extended. Consequently, in frame relaying 2 the network may take advantage of the knowledge of the layer 2 parameters in order to facilitate network operations such as charging and resource allocation. In frame relaying 1 the functions implemented end-to-end above the core functions are user selectable and may not be the upper part of Rec. I.441. Consequently, in frame relaying 1 the network in principle has no knowledge of the protocol used end-to-end.

From the service perspective, frame relaying 2 provides service quality characteristics with the following parameter values:

(Parameter values are for further study).

The terminal operates with an extended I.441 protocol. As a result the user perspective is the transparent transport of data end-to-end, with a quality influenced by the statistical multiplexing of data streams in the network. Acknowledgement of data is end-to-end as well as error detection and recovery.

2.3.3 *Frame switching service description*

Frame switching has general service characteristics and Quality of Service parameters as given in §§ 2.1 and 2.2, respectively.

In addition, in the U-plane, frame switching:

1) provides for the acknowledged transport of frames;

2) detects and recovers from transmission, format, and operational error;

3) detects and recovers from lost or duplicated frames;

4) provides flow control.

All of the above functions are based on Recommendation I.441. Appropriate extensions to Recommendation I.441 may be needed.

In the C-plane all signalling capabilities for all call control, parameter negotiation, etc. are based on a common set of protocols (e.g. Rec. I.451 extended), as for all ISDN telecommunication services. In the case of permanent virtual circuits no real time call establishment is necessary and any parameters are agreed upon at subscription time.

From the service perspective, frame switching provides service quality characteristics with the following parameter values:

(Parameter values are for further study).

2.3.4 *X.25-based additional packet mode service description*

X.25-based additional packet mode has general service characteristics and Quality of Service parameters similar to the packet mode services described in X.31.

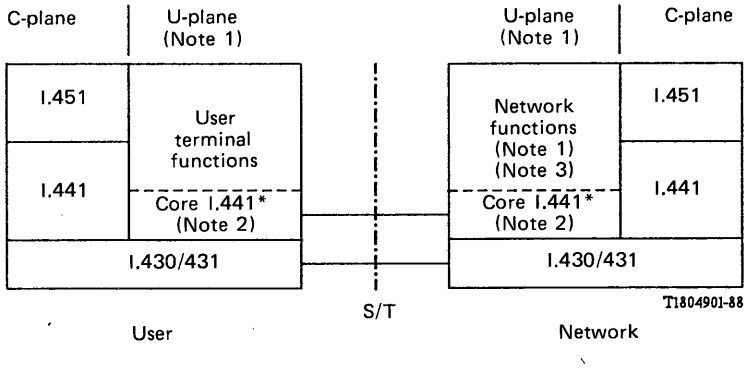
The U-plane capabilities are the same as in X.25 PLP Data Transfer Part (DTP)

In the C-plane all signalling capabilities for call control, parameter negotiation, etc. are based on a common set of protocols (e.g. Rec. I.451 extended), as for all ISDN telecommunication services. In the case of permanent virtual circuits (PVC) no real time call establishment is necessary and any parameters are agreed upon at subscription time.

3 User-network interface protocol reference model

Figure 1/I.122 is a direct application of the ISDN protocol reference model to the packet mode communications discussed in this Recommendation. It shows the user-network interface protocol architecture. Only those functions on the network side that are visible on the user side of the S/T reference point are shown.

On the user side, Recommendations I.430 or I.431 provide the layer 1 protocol for the U- (user) C- (control) planes. The C-plane uses the D-channel with Recommendations I.441 extended and I.451 extended as the layer 2 and 3 protocols, respectively. In the case of permanent virtual circuits (PVC) no real time call establishment is necessary and any parameters are agreed upon at subscription time. The U-plane may use any channel (D, B, H_0 and H_1) on which the user implements at least the lower part (the core functions) of Recommendation I.441.



Note 1 – The U-plane functions applicable to each bearer service are given in Table 1/I.122.

Note 2 – The core functions of Recommendation I.441 are described in § 3.1.

Note 3 – The U-plane functions provided by the network at the S/T reference point are determined by the network after negotiation with the user, based on the requested bearer service and associated parameters. These functions are user selectable for each call. A network may choose not to implement the full set of options. These functions may not be available one by one. So far only three groupings have been identified:

a) the null set,
b) the upper part of Rec. I.441, and
c) the upper part of Rec. I.441 and the data transfer part of X.25 PLP.

FIGURE 1/I.122

User/network interface protocol architecture

TABLE 1/I.122

U-plane functions applicable to each bearer service

Bearer service	User terminal (Note 1)	Network
Frame relaying 1	I.441* Core (Note 2)	I.441* Core
Frame relaying 2	I.441*	I.441* Core
Frame switching	I.441*	I.441*
X.25-based additional packet mode	I.441* X.25 DTP	I.441* X.25 DTP

Note 1 – Additional user selectable functions may be implemented.

Note 2 – I.441* is I.441 with appropriate extensions. The use of the extensions may depend on each bearer service and is for further study.

3.1 *Core functions of Rec. I.441*

The core functions are:

- frame delimiting, alignment, and transparency,
- frame multiplexing/demultiplexing using the address field,
- inspection of the frame to ensure that it consists of an integer number of octets prior to zero bit insertion or following zero bit extraction,
- inspection of the frame to ensure that it is neither too long nor too short (see Note),
- detection of transmission errors.

Note – The maximum and minimum frame lengths that apply to the Additional packet mode bearer services are for further study.

3.2 *Other user terminal functions*

If not already prescribed by the selected packet mode bearer service, the user may also implement functions such as, for example, recovery from detected transmission, format, and operational errors above the core functions using the full procedures of Recommendation I.441. Additional functions such as flow control may also be implemented. For example, X.25 data transfer functions may also be implemented above the preceding stack.

3.3 *Network functions*

On the network side, Recommendations I.430 or I.431 provide the layer 1 protocol for both C- and U-planes. The C-plane is handled just as on the user side, i.e. the network fully terminates the protocols of Recommendations I.441 and I.451. In the U-plane, at least the core functions of Recommendation I.441 protocol are terminated. The network may terminate additional protocol functions only as requested by the user and negotiated and agreed to by the user and the network. The U-plane protocols to be terminated by the network are determined by the specific bearer service requested by the user, and negotiated and agreed to by the user and network.

Interactions between the U- and C-planes of the terminal, and between the U- and C-planes of the network are independent. As a result, coordination between the U- and C-planes at the users equipment is not the responsibility of the network.

During the three phases of a call (call establishment, data transfer, and call clearing), C- and U-plane synchronization is achieved in a similar way as for all ISDN telecommunications services. That is, after the C-plane has established the connection, the U-plane may commence data transfer with or without an initialization procedure in the U-plane. In the case of permanent virtual circuit the establishment and call clearing is accomplished by administrative procedures.

3.4 *Further service requirements at the user-network interface*

Procedures at the user-network interface should be also applicable when two users are connected via a circuit mode bearer service (permanent or demand). Mechanisms that can be used to achieve this objective include, for example, the symmetrization of the procedure involved, or the use of additional procedures for the determination of the asymmetric relationships. The selection of such a mechanism is for further study.

3.5 *Potential bearer services*

Four potential bearer services are identified as part of this architectural framework. The first potential bearer service, frame relaying 1, is provided when no functions above the core functions are terminated by the network: if needed, such functions are terminated only end-to-end.

The second potential bearer service, frame relaying 2, is provided when no functions above the core functions are terminated by the network; I.441 upper functions are terminated only at the end points.

The third potential bearer service, frame switching, is provided when the full Recommendation I.441 protocol is terminated by the network.

The fourth potential bearer service, X.25-based additional packet mode, is provided when the full Recommendation I.441 protocol and the data transfer part (DTP) of Recommendation X.25 PLP (packet layer protocol) are terminated by the network.

Further information on the service characteristics of these four potential bearer services is given in Annex A.

4 Interworking requirements

4.1 *Interworking between packet mode services*

To interconnect different packet mode bearer services, it is necessary to provide interworking between an ISDN offering any of the bearer services described in this Recommendation, and:

1) an ISDN offering any of these additional packet mode bearer services,
2) an X.25-based service offered either by an ISDN or a PSPDN.

For interworking configuration 1), procedures for both the C-plane and the U-plane at an internetwork reference point which includes international gateway reference points, have to be standardized. In addition it would be desirable that these procedures be developed in such a way that they also could be used at an inter-exchange reference point within an ISDN offering any of the bearer services described in this Recommendation. Examples of such procedures may include: routing, address translation, security and accounting tasks.

For interworking configuration 2), interworking based on either call control mapping or port access is possible. A high level description of interworking arrangements is contained in Annex B.

4.2 *Support of existing terminals*

Additionally, terminal adapter functions should be provided that allow existing terminals (e.g. asynchronous, start/stop DTEs, X.25 packet mode DTEs and V-Series interface terminals) to access from an ISDN one or more of the bearer services described in this Recommendation.

4.3 *Interworking with circuit mode services*

Other service interworking configurations (e.g. with a CSPDN, or between different bearer services within an ISDN) may also need to be considered.

5 Support of OSI connection-oriented network layer service

In the interworking between an ISDN offering any of the bearer services described in this Recommendation and X.25-based service offered either by an ISDN or a PSPDN, an interworking function (IWF) is required.

To support network layer service (Rec. X.213) when the bearer service used is one of the bearer services described in this Recommendation, the use of additional end system functionality may be required and end-to-end (i.e. TE-to-TE or TE-to-IWF) compatibility must be ensured.

Annex C contains requirements for the support of network layer service (Rec. X.213).

6 Applications

Packet mode bearer services described in this Recommendation aim at data services up to 2 Mbit/s. Within this broad category, some specific applications are as follows:

1) *Block interactive data applications*

   An example of a block interactive application would be high resolution graphics (e.g. high resolution videotex, CAD/CAM). The main characteristics of this type of application are low delays [e.g. approximately less than ... ms (the exact value is for further study)] and throughput approximately in the range of 500 kbit/s to 2048 kbit/s.

2) *File transfer*

   The file transfer application is intended to cater for large file transfer requirements. Transit delay is not as critical for this application as it is for example in the first application. Higher throughput (e.g. 16 kbit/s to 2048 kbit/s) might be necessary in order to produce reasonable transfer times for large files.

3) *Multiplexed low bit rate*

   The multiplexed low bit rate application exploits the multiplexing capabilities of the layer 2 protocol in order to provide an economical access arrangement for a large group of low bit rate applications. The low bit rate sources should be multiplexed onto any ISDN-channel by an NT function which could take the form of a LAN, PABX, or Centrex. The delay requirements are in the area of ... ms (the exact value is for further study) and the throughput within the range of 16 kbit/s to 2048 kbit/s.

4) *Character-interactive traffic*

   An example of a character-interactive traffic is text editing. The main characteristics of this type of applications are short frames, low delays and low throughput.

Identification of additional applications and their characteristics (e.g. delay, throughput, etc.) for bearer services described in this Recommendation are desirable for the complete definition of the service requirements.

ANNEX A

(to Recommendation I.122)

Further service-related information

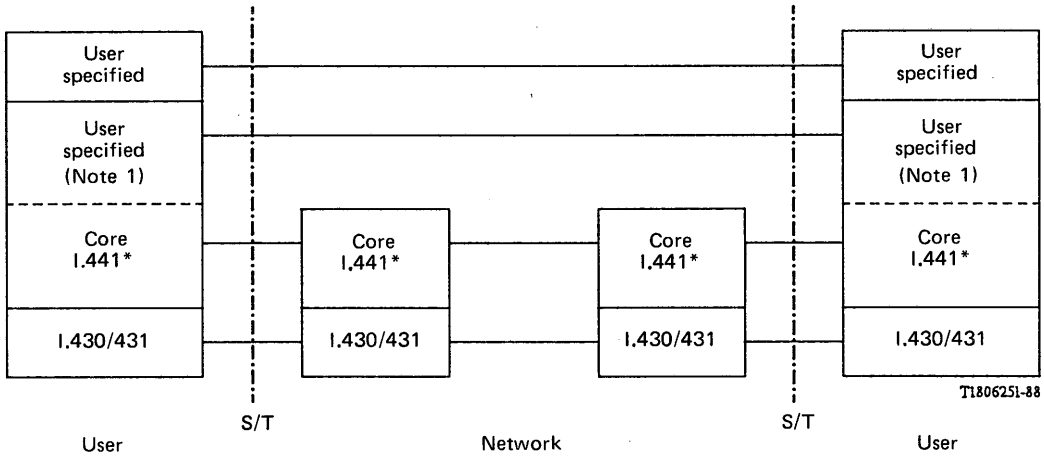
A.1 *Introduction*

This Annex contains further service related information on the I.122 based bearer services. The intent of this Annex is to clarify and supplement the service descriptions given in the main body of this Recommendation. Note that the information given in this Annex should not be interpreted as material that completes the service descriptions of the bearer services given in this Recommendation.

A.2 *Service related information*

A.2.1 *Frame relaying 1*

The U-plane configuration for this service is shown in Figure A-1/I.122.



Note – I.441* (upper) is one protocol. Other standard or proprietary protocols may also be used. Additional requirements may be placed on terminals depending on the congestion control and throughput enforcement used.

FIGURE A-1/I.122

Frame relaying 1 service U-plane

Figure A-1/I.122 shows the network in a generic way and illustrates all U-plane functions up to and including layer 3. In a specific network, frame relaying 1 may be implemented in one or more nodes, all other nodes in the network providing only circuit-mode functions.

Frame relaying 1 can be offered on both, basic and primary rate interfaces and on any ISDN channel (D, B, and H). Some restrictions (e.g. frame length) apply when in an end-to-end connection at least one of the access channels is the D-channel (16 kbit/s).

The bearer service provided by the network at the S/T reference point supports only the core functions defined in § 3.1. A frame received by such a point is discarded if the frame does not meet the I.441 core format requirements (for example, if the frame is too long, has an unknown label, etc.). Moreover, frames may be discarded due to internal network conditions, or other reasons such as throughput enforcement.

In all other cases, the frame is relayed to one of the adjacent nodes according to the routing plan established at call set-up time, or at subscription time (if the network is providing a permanent virtual circuit service).

No additional U-plane functions (see Note) visible to the users are performed by the network. If needed by the application, additional functions are performed end-to-end by layer(s) above the core functions.

Note – Some additional auxiliary U-plane functions such as reset or explicit congestion control may be defined if needed from the service perspective.

A.2.2 *Frame relaying 2*

The U-plane configuration for this service is shown in Figure A-2/I.122.

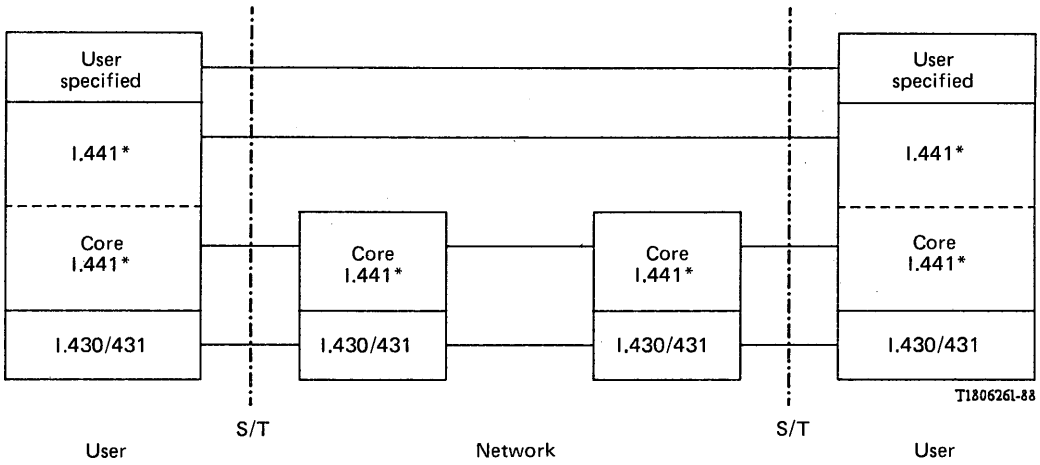


FIGURE A-2/I.122

Frame relaying 2 service, U-plane

Figure A-2/I.122 shows the network in a generic way and illustrates all U-plane functions up to and including layer 3. In a specific network, frame relaying 2 may be implemented in one or more nodes, all other nodes in the network providing only circuit-mode functions.

Frame relaying 2 can be offered on both, basic and primary rate interfaces and on any ISDN channel (D, B, and H). Some restrictions (e.g. frame length) apply when in an end-to-end connection at least one of the access channels is the D-channel (16 kbit/s).

The bearer service provided by the network at the S/T reference point supports only the core functions defined in § 3.1. A frame received by such a point is discarded if the frame does not meet the I.441 core format requirements (for example, if the frame is too long, has an unknown label, etc.). Moreover, frames may be discarded due to internal network conditions, or other possible reasons such as throughput enforcement.

The terminals operate end-to-end with the complete I.441* protocol. In all other cases, the frame is relayed to one of the adjacent nodes according to the routing plan established at call set-up time, or at subscription time (if the network is providing a permanent virtual circuit service).

No additional U-plane functions (see Note) visible to the users are performed by the network. If needed by the application, additional functions are performed end-to-end by layer(s) above the core functions.

Note – Some additional auxiliary U-plane functions such as reset or explicit congestion control may be defined if needed from the service perspective.

A.2.3 *Frame switching*

The U-plane configuration for this service is shown in Figure A-3/I.122.

Figure A-3/I.122 shows the network in a generic way and illustrates all functions up to and including layer 3. In a specific network, frame switching must be implemented in at least one node in the network.

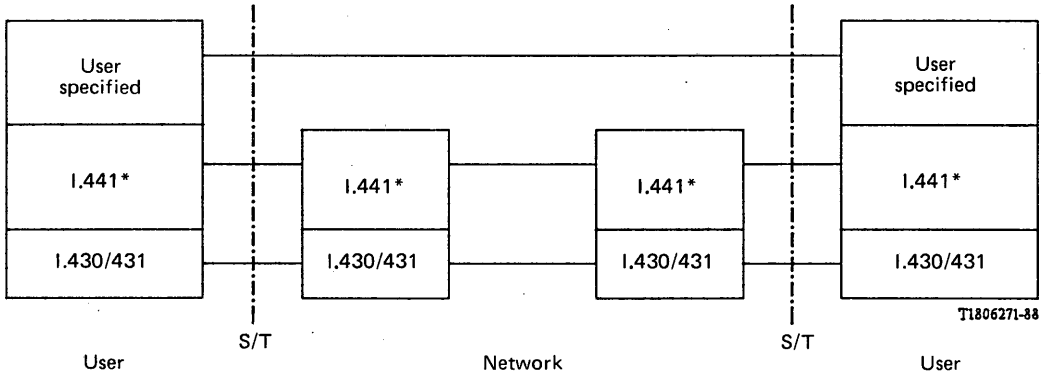


FIGURE A-3/I.122

Frame switching service, U-plane

Frame switching can be offered on both basic and primary rate interfaces and on any ISDN channel (D, B, and H). Some restrictions (e.g. frame length) apply when in an end-to-end connection at least one of the access channels is the D-channel (16 kbit/s).

The bearer service provided by the network at the S/T reference point supports the full Recommendation I.441 function. Received frames that satisfy the Recommendation I.441 procedure are passed on to an adjacent node according to a routine plan established at call set-up time, or at subscription time.

No additional U-plane functions visible to the users are performed in the network. If needed by the application, additional functions are performed end-to-end by layer(s) above layer 2.

A.2.4 *X.25-based additional packet mode*

The U-plane configuration can comprise several nodes having layer 1, layer 2, and layer 3 functions as is shown in Figure A-4/I.122. Figure A-4/I.122 shows the network in a generic way and illustrates all functions up to and including layer 3. Other configurations with nodes making use only of the core aspects of Recommendation I.441 as defined in § 3.1 of Recommendation I.122 are possible.

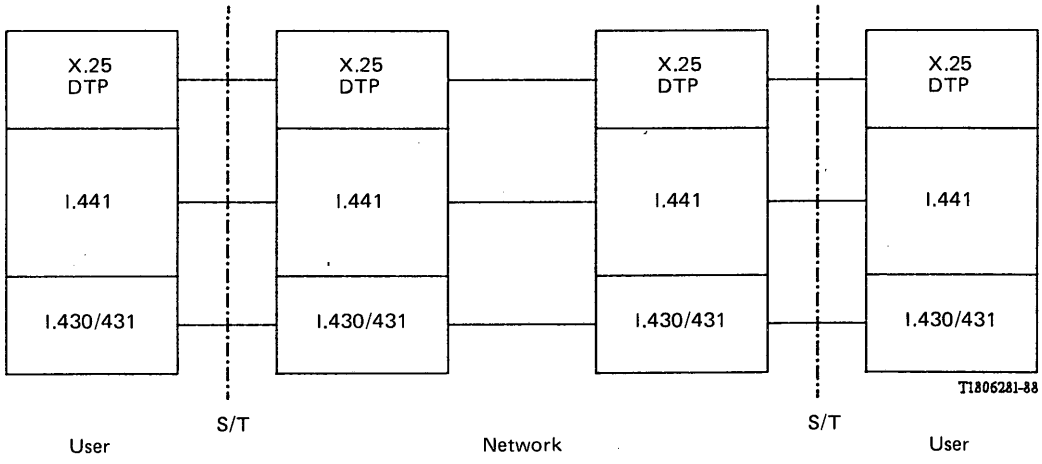


FIGURE A-4/I.122

X.25 based packet mode service, U-plane

X-25-based additional packet mode service can be offered on both the basic and primary rate ISDN access interfaces and on any ISDN channel (D, B, and H). Some restrictions (e.g. packet length) apply when in an end-to-end connection at least one of the access channels is the D-channel (16 kbit/s).

The bearer service provided by the network at the S/T reference point supports the full Recommendation I.441 and the data transfer part of Recommendation X.25 PLP functions.

The U-plane contains X.25-based layer 3 functions and the C-plane procedures use Recommendation I.451 extended to transfer the parameters necessary for the establishment and release of virtual circuits (e.g. throughput class, window size, etc.). The capability to negotiate some parameters must also be provided. Whether or not X.25 multiplexing is provided is for further study.

X.25 PLP-DTP consists of all X.25 PLP functions with the exception of the connection establishment and release functions, including user facilities (supplementary services). The exclusion of other X.25 PLP functions is for further study.

ANNEX B

(to Recommendation I.122)

General arrangement for interworking between an ISDN where I.122 bearer services are requested and an ISDN or a PSPDN providing service based on Recommendation X.25

B.1 *Possible scenarios*

Figure B-1/I.122 shows the interworking arrangements considered. When the interworking function IWF logically belongs to the ISDN (Recommendation I.122), interworking based on call control mapping takes place. In the case where the IWF logically belongs to the PSPDN (Recommendation X.25) or ISDN (Recommendation X.31), interworking based on either call control mapping or port access is possible. As shown in the figure, different interfaces can be specified for the different reference points, depending on whether the IWF logically belongs to the ISDN (Recommendation I.122), or to the PSPDN (Recommendation X.25) or ISDN (Recommendation X.31).

B.2 *IWF logically belonging to ISDN (Recommendation I.122)*

To enable interworking, the I.122 bearer services, in conjunction with an IWF, should provide full support of the X.213 network layer services. The association of an ISDN (Recommendation I.122) with an IWF in such a manner could therefore be considered globally as a Type I subnetwork, in the sense defined in Recommendation X.300.

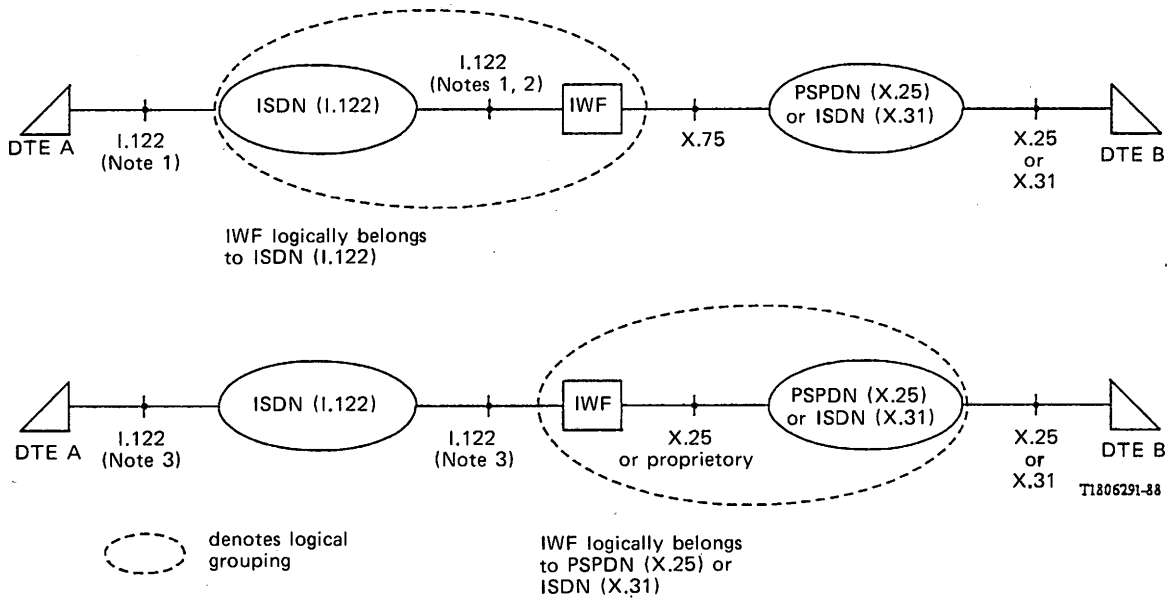
A PSPDN (Recommendation X.25) or an ISDN (Recommendation X.31) could also be considered as a Type I subnetwork.

As specified in Recommendation X.300, the interworking arrangement between two Type I subnetworks should be based on Recommendation X.75.

B.3 *IWF logically belonging to the PSPDN (Recommendation X.25)/ISDN (Recommendation X.31)*

The association of a PSPDN (Recommendation X.25)/ISDN (Recommendation X.31) with an IWF together behaves like a user terminal requesting I.122 service from an ISDN (Recommendation I.122). Therefore, the interworking arrangement can be based on Recommendation I.122.

In this arrangement, interworking based on either call control mapping or port access is possible. When port access method is used, existing call control procedures in Recommendation X.25 are used for the control of virtual circuits.



Note 1 – To achieve functional compatibility, additional procedures may be required in the U-plane. These procedures terminate at the IWF, and are mapped into X.75 procedures.

Note 2 – In the C-plane, Signalling System No. 7 or Rec. I.451 with appropriate extensions, or proprietary protocols with equivalent functions, may be used.

Note 3 – To achieve functional compatibility, additional procedures are required in the U-plane in the case of interworking based on port access. These procedures terminate at the IWF, and are mapped into Rec. X.25 procedures.

FIGURE B-1/I.122

Interworking between ISDN (Rec. I.122) and PSPDN (Rec. X.25) or ISDN (Rec. X.31)

ANNEX C

(to Recommendation I.122)

Support of network layer service (X.213) in an ISDN offering additional packet mode bearer services

C.1 Network layer service can be provided by using the X.25-based additional packet mode bearer service. In this case the mapping concerns enhanced Recommendations I.451 and X.25 data transfer functions. In the case of frame switching and frame relaying, the network layer service can be provided through the use of enhanced Recommendation I.451, with, in addition:

a) additional end system functionality, or

b) enhanced I.441 functions.

C.2 *C-plane enhancements*

Recommendation I.451 should be enhanced so that the OSI network service parameters can be paired with Recommendation I.451 messages and information elements for all bearer services. Serveral enhancements to Recommendation I.451 are needed to convey all connection establishment and release primitives and parameters in relevant I.451 protocol elements.

C.3 *U-plane enhancements*

For frame switching and frame relaying, there are two different approaches for the mapping of data transfer primitives into protocol elements:

1) layer 3 protocol elements supported by a DTE specific protocol which is transparent for the network (preferably X.25 PLP), and
2) I.441 protocol elements enhanced to map directly into the OSI network service data transfer primitives.

Further study is required for the selection and detailed definition of one of the two options.

ANNEX D

(to Recommendation I.122)

Congestion control in frame relaying service

Note – This Annex does not cover congestion control in frame switching and X.25-based additional packet mode bearer services. This is because in these services, there is termination of user data transfer protocol in the network and so existing mechanisms for congestion control can be used.

D.1 *General objectives of congestion control*

The term "congestion control" as used here refers to a set of mechanisms incorporated to attain certain network performance objectives, particularly in the peak periods, while optimizing or improving the network resource requirements.

1) The network should, with high probability, meet the Quality of Service in terms of throughput, delay and availability negotiated with the user. Therefore, the number of occurrences of user perceived congestion should be minimized.
2) Under heavy load, the network should not allow user interference to the extent where one user can monopolize network resource usage at the expense of other users.

Specific congestion control mechanisms to achieve these objectives are for further study. One possible approach of congestion control is presented below.

D.2 *User reaction to network congestion*

The network has no other direct control on the data flow of a user other than dropping frames. It does so without sending explicit congestion control messages to the user. Frame discard by a network may have charging implications. This requires further study.

Users should reduce their information transfer rate when they perceive the impact of network congestion. Reduction of throughput by a user may well result in an increase of the effective throughput available to the user during congestion.

It is suggested that a user of frame relaying 1 service implement some form of congestion-sensitive adaptation function that has the following characteristics:

i) no blocking of data flow under normal conditions,
ii) reduction to a lower throughput upon detection of network congestion,
iii) progressive increase to the maximum negotiated throughput upon congestion abatement.

For frame relaying 2 service, the user is required to implement the above congestion-sensitive adaptation function through the use of the windowing mechanism in Recommendation I.441. In this case, the user will base the detection of congestion on events available in the I.441 elements of procedure (e.g. receipt of a REJECT frame, detection of frame loss, etc.). The user dynamically adjusts its window size in accordance with network congestion condition.

D.3 *Control action by the network congestion*

Users of frame relaying services should reduce their information transfer rate when they perceive the impact of network congestion (see § 2). But the network cannot rely solely on the user's behaviour to control network congestion. This is the case for both frame relaying 1 and frame relaying 2 services.

The network should monitor the throughput of each call/interface and exercise a frame discard strategy under congestion conditions, for those calls/interfaces that exceed their negotiated throughput. However, because congestion can occur even when the calls do not exceed their negotiated throughput (e.g. network failures), the network should discard frames in a way that assures some fairness among users.

The selection of mechanism(s) which may be used by the network for this purpose are for further study.

SECTION 3

GENERAL MODELLING METHODS

Recommendation I.130

METHOD FOR THE CHARACTERIZATION OF TELECOMMUNICATION SERVICES SUPPORTED BY AN ISDN AND NETWORK CAPABILITIES OF AN ISDN

(Melbourne, 1988)

1 General considerations

The concept and the principles of ISDNs are described in Recommendation I.120. The purpose of this Recommendation is to provide a method for the characterization of telecommunication services (including supplementary services) and a definition of the needed network capabilities in an ISDN, in order to support the identified services.

The main objectives are:

a) to give a common framework and tools to be adopted for service description;

b) to show how, starting from the service definition, it is possible to define protocols and network resources for providing such services;

c) to make reference to those Recommendations which are relevant to the above two points.

2 Structure and application of the overall method

The method is divided into three main stages of activity: service aspects (stage 1), functional network aspects (stage 2) and network implementation aspects (stage 3).

Within each stage a number of steps have been identified, as shown in Figure 1/I.130. In principle, the application of the method is sequential, stage 1 given the service description from the user point of view, stage 2 offering an intermediate view of what happens at the user-network interface and inside the network between different exchanges, and stage 3 giving the actual switching and service nodes descriptions, as well as protocols and format to be adopted.

In order to classify and relate the various Recommendations relevant to the method, a three level structure is used where each level applies to the three above-mentioned stages.

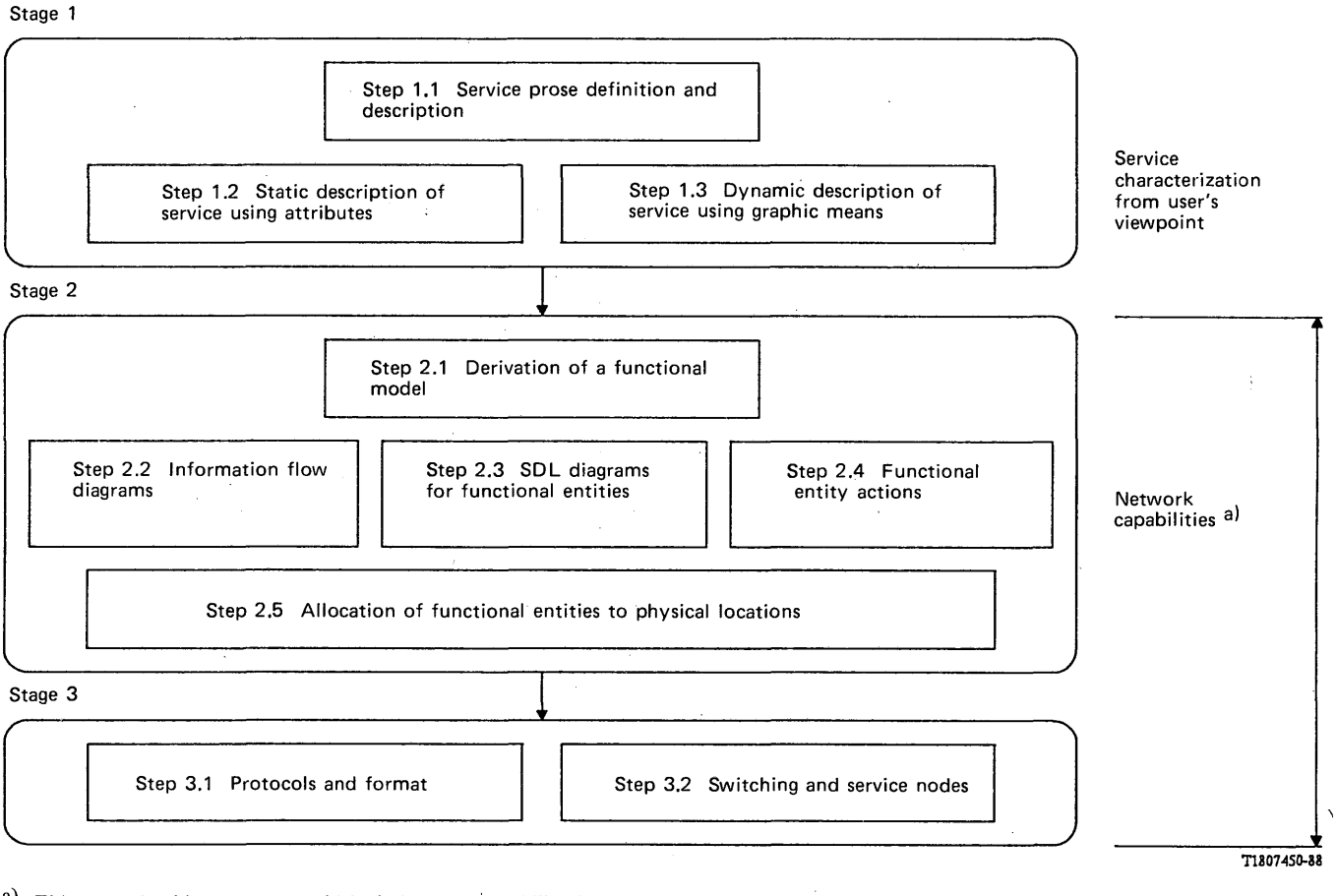
Level 1 is a description of the overall method, and is contained in this Recommendation.

Level 2 identifies and defines the tools for the work within each stage. Examples of these tools are frameworks for service prose descriptions, libraries of pre-defined functions, graphical conventions, etc. All these tools are covered by Recommendations.

Level 3 is the actual application of the method to each individual service and is contained in various Recommendations.

The application of the method for stage 1 results in a description of the service. Stage 2 results in one or more implementation independent scenarios, and stage 3 results in a set of protocol and switching Recommendations needed to realize the service for each scenario.

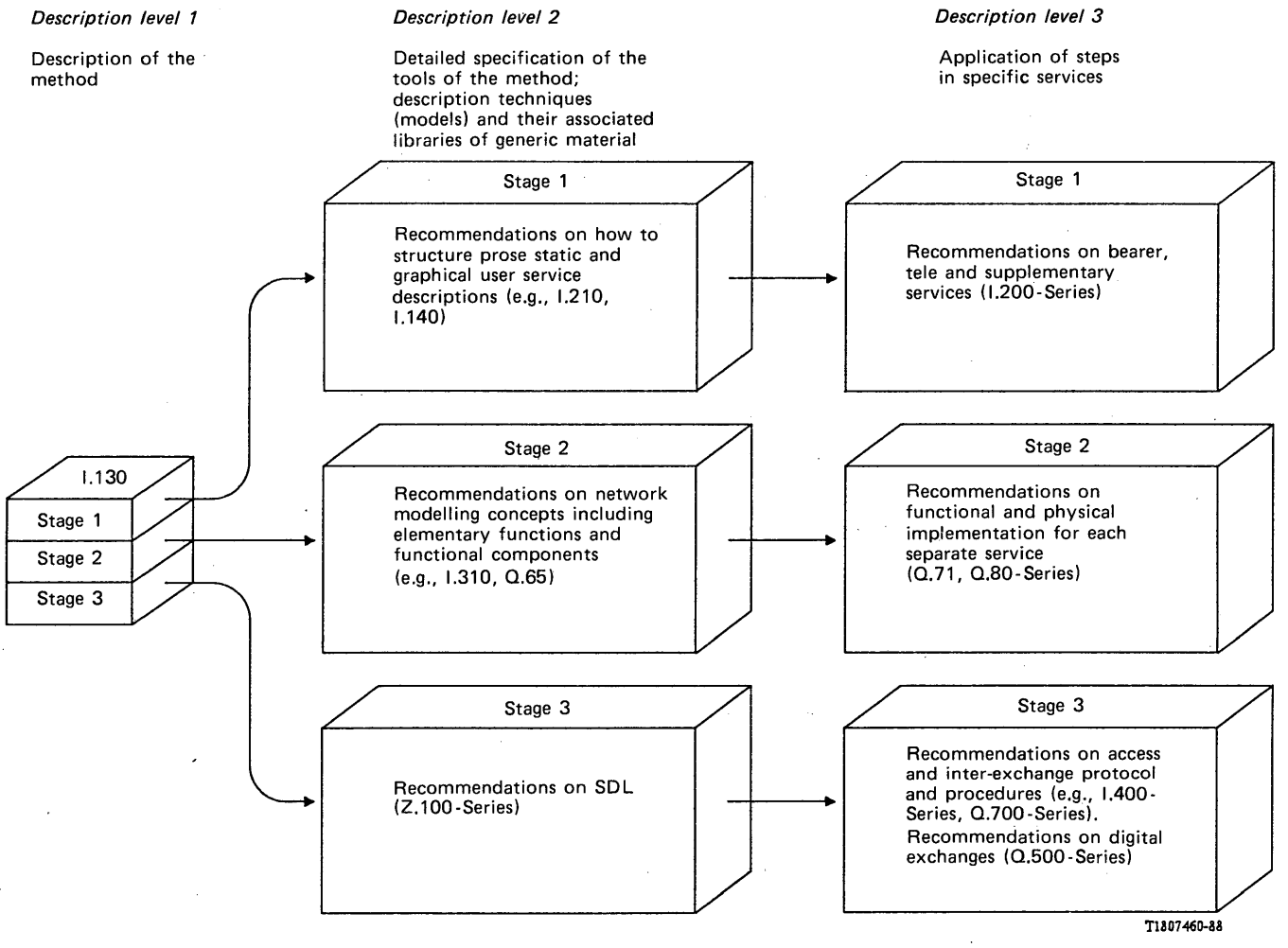
Figure 2/I.130 illustrates the concept of levels in relation to various Recommendations relevant to the method.



a) This term, in this context, could include some capability in the user equipment.

FIGURE 1/I.130

Graphical representation of the overall method for development of ISDN service Recommendations



Note – In the application of stages 1, 2 and 3 there may not be separate Recommendations for each service. A Recommendation may describe provisions for basic service and multiple supplementary services in an integrated way.

FIGURE 2/I.130

3 Description of the method

As referred to in § 2 above, there are three stages of the method as follows:

Stage 1 is an overall service description from the user's standpoint.

Stage 2 is an overall description of the organization of the network functions to map service requirements into network capabilities.

Stage 3 is the definition of switching and signalling capabilities needed to support services defined in stage 1.

Each stage consists of several steps.

3.1 *Stage 1*

Stage 1 is an overall service description from the user's point of view, but does not deal with the details of the human interface itself. The stage 1 service description is independent of the amount of functionality in the user's terminal, other than that required to provide the human interface. For example the conference calling service description is designed to be independent of whether the conference bridge is in the terminal, in the serving exchange or elsewhere.

The steps in stage 1 are:

Step 1.1 – Service prose definition and description

This step describes the service in terms of the perceptions of the user receiving the service and any other users involved in the service. It describes events in a generic term which does not constrain terminal or network design. It is intended to allow an understanding of the service without regard to implementation. The description should include operational, control, interworking and administrative aspects as well as interactions with other sevices. A detailed format and list of definitions for terms used for service prose definition and description is contained in Recommendation I.210.

Step 1.2 – Static description of the service using attributes

The static, that is, time-independent, aspects of a service can, in some cases, be efficiently described by attributes. An attribute is a characteristic or functional description which is common to several services and therefore needs to be described in detail only once. Subsequently, it can be referred to by a name or other designation. Within the scope of an attribute definition there may be multiple parameters or identified functional variations which are called attribute values.

The attribute technique is described more fully in Recommendation I.140. It contains an outline of the technique and definitions of attributes and attributes values, valid for both services and connection types. The attributes and attribute values identified for services can be found in Rec. I.210 (Annexes B and C) for bearer services and for teleservices. The use of the attribute technique in the description of supplementary services is for further study.

Step 1.3 – Dynamic description of the service using graphic means

The dynamic description of a service contains all the information that is sent and received by the user from activation invocation of the service to completion of the service. The information is presented in the form of an overall Specification and Description Language (SDL) diagram. An overall SDL diagram is a flow chart which identifies all possible actions relevant to the service as perceived by the user. It treats the network as a single entity, that is, no information flows within the network are considered. The method of using the overall SDL diagrams for service description is given in Recommendation I.210, Annex D.

3.2 *Stage 2*

Stage 2 identifies the functional capabilities and the information flows needed to support the service as described in stage 1. The stage 2 description will also include user operations not directly associated with a call (e.g. user change of call forwarding parameters via his sevice interface) as described in stage 1. Furthermore, it identifies various possible physical locations for the functional capabilities. The output of stage 2 which is signalling system independent is used as an input to the design of signalling system and exchange switching Recommendations.

The steps in stage 2 are:

Step 2.1 – Derivation of a functional model

A functional model is derived for each basic and for each supplementary service. The functions required to provide the service are grouped into functional entities. The functional model is the aggregate of the functional entities and their relationships. The concept of a functional entity is contained in the ISDN functional principles Recommendation (I.310). In the case of supplementary services the relationship between the supplementary service and the basic service is shown by a composite functional model.

Step 2.2 – Information flow diagrams

The distribution of the functions needed to provide a service as defined by the functional model requires that interactions be defined between functional entities. Such an interaction is referred to as an "information flow" and has a name descriptive of the intent of the information flow. Information flow diagrams are created for successful operation and may be created as appropriate for other cases. The semantic meaning and information content of each information flow is determined.

Step 2.3 – SDL diagrams for functional entities

The functions performed within a functional entity are identified and represented in the form of a Specification and Description Language (SDL) diagram. The inputs and outputs of the SDL diagram are to and from the users as described in stage 1 and are information flows to and from other functional entities.

SDL diagrams are defined for each functional entity based on the information flows defined for the successful operation of the service. The SDL diagram also covers the unsuccessful cases.

Step 2.4 – Functional entity actions

The actions performed within a functional entity are represented as a list, or sequence, of functional entity actions (FEAs) in prose form. These form the basis for understanding the meaning of the information flows and provide a basis for the stage 3 switching Recommendations.

Note – The relationship between the FEAs and the elementary functions (EFs), as listed in Recommendation I.310 is for further study.

Step 2.5 – Allocation of functional entities to physical locations

In this step, the functional entities and information flows identified in previous steps are allocated to specific types of physical locations, e.g. a PABX or an exchange. Each allocation is called a scenario. The relationship supported between two functional entities located in different physical locations must be realized wihin protocol(s) supported between those locations.

The detailed procedures and formats used and the concepts needed for the stage 2 description can be found in Recommendations Q.65 and I.310.

3.3 *Stage 3*

In stage 3 the information flow and SDL diagrams from the stage 2 output form the basis for producing the signalling system protocol Recommendations and the switching Recommendations.

The steps in stage 3 will need to be repeated for each service where, because of different allocations of functional entities to physical locations, different protocols and procedures are needed.

The steps in stage 3 are:

Step 3.1 – Protocols and formats

The messages needed to support the information flows and the modifications to existing information flows between the nodes are identified and the detailed message elements and procedures are designed into the relevant signalling systems.

Step 3.2 – Switching and service nodes

The requirements identified for switching functions (functional entity actions) are incorporated into the switching Recommendations (Q.500-Series).

PAGE INTENTIONALLY LEFT BLANK

PAGE LAISSEE EN BLANC INTENTIONNELLEMENT

SECTION 4

TELECOMMUNICATION NETWORK AND SERVICE ATTRIBUTES

Recommendation I.140

ATTRIBUTE TECHNIQUE FOR THE CHARACTERIZATION OF TELECOMMUNICATION SERVICES SUPPORTED BY AN ISDN AND NETWORK CAPABILITIES OF AN ISDN

(former Recommendation I.130 of the Red Book; amended at Melbourne, 1988)

1 General considerations

The purpose of this Recommendation is to introduce the attribute technique and to describe attributes and list attribute values. Attributes are used in the characterization of services and network capabilities provided by an ISDN. The attribute technique can also be used to describe the salient features of other objects of study in telecommunications, e.g. charging.

This Recommendation (in the general I.100-Series) will act as a library of all attributes and attribute values used in other I-Series Recommendations. The inclusion of a particular attribute value in this Recommendation does not mean that this particular object is being recommended by CCITT, but that it is a potential attribute (or attribute value) which may be used in a particular Recomendation in the I-Series (e.g. to describe a CCITT-recommended service).

Annex A includes all attributes and their values so far identified and defined.

2 Attribute technique

2.1 *Outline of the technique*

This technique is used to describe objects in a structured, simple manner and to highlight the important aspects of the object. In order to be able to identify comparable objects, e.g. bearer services, the general concept of the object is broken down in a number of salient features. The salient features are termed *attributes.* Each attribute is independent of the others so that a change in the value of one will not affect the others. To describe a particular object the attributes are assigned values which identify that object.

It is not always necessary or useful to describe an object in great detail and so attributes have been graded into three levels:

- dominant attributes: these define a sub-set containing similar objects, this sub-set is termed a class or category;
- secondary attributes: these define a particular object; and
- qualifying attributes: these define variants of an object.

Characterization of attributes should be used in the I-Series of Recommendations when appropriate.

2.2 *Basic rules*

- Each attribute is assigned a name and definition.
- Some attributes may apply to only one object, others may be applicable to several objects. In this case the same attribute name is used.
- A given value should have the same name and definition in all Recommendations.
- Depending on the nature of the object described, a particular attribute may need to be used more than once.
- Each attribute should be described by three perspectives; generic, service and network.

2.3 *Attribute lists*

2.3.1 *Generic attributes*

Information transfer mode
Information transfer rate
Information transfer capability
Establishment
Symmetry
Configuration
Structure
Channel (rate)
Control protocol
Information transfer protocol
Performance
Interworking
Operations
Type of user information
High layer protocol

Note – This list will be completed according to further results on studies of connectionless, multi-media, broadband and mobile services.

2.3.2 *Service attributes*

2.3.2.1 *Bearer services*

1	Information transfer mode
2	Information transfer rate [1]
3	Information transfer capability
4	Structure
5	Establishment of communication
6	Symmetry
7	Communication configuration
8	Access channel and rate
9-1	Signalling access protocol layer 1
9-2	Signalling access protocol layer 2
9-3	Signalling access protocol layer 3
9-4	Information access protocol layer 1 [2]
9-5	Information access protocol layer 2 [2]
9-6	Information access protocol layer 3 [2]
10	Supplementary services provided
11	Quality of service
12	Interworking possibilities
13	Operational and commercial

[1] Service information transfer rate considered at the access point.

[2] Information access protocol (layer 1-3) at the access point.

2.3.2.2 *Teleservices*

1, 2, 3, 4, 5, 6, 7, 8, 9-1, 9-2, 9-3, 9-4, 9-5, 9-6: refer to § 2.3.2.1.

10 Type of user information
11 Layer 4 protocol
12 Layer 5 protocol
13 Layer 6 protocol
14 Layer 7 protocol
15 Supplementary services provided
16 Quality of service
17 Interworking possibilities
18 Operational and commercial

2.3.2.3 *Supplementary services*

For further study.

2.3.2.4 *Charging*

For further study.

2.3.3 *Network attributes*

2.3.3.1 *Connection types*

1 Information transfer mode
2 Information transfer rate[3)]
3 Information transfer susceptance
4 Establishment of communication
5 Symmetry
6 Connection configuration
7 Structure
8 Channel (rate)
9 Connection control protocol
10 Information transfer coding/protocol[4)]
11 Network performance
12 Network interworking
13 Operations and management

2.3.3.2 *Connection elements*

1 Information transfer mode
2 Information transfer rate
3 Information transfer susceptance
4 Establishment of communication
5 Symmetry
6 Connection configuration
7 Structure
8 Channel (rate)
9 Connection control protocol
10 Information transfer coding/protocol
11 Network performance
12 Network interworking
13 Operations and management

---

3) Information transfer rate is considered between access points.

4) Information transfer protocol is considered between access points.

2.3.3.3 *Other network entities*

The definition of attributes for basic connection components, and network capabilities to support supplementary services needs further study.

2.4 *Attribute definition*

A list of definitions of attributes and attribute values is contained in Annex A to this Recommendation.

3 Application to the I-Series Recommendations

This technique has been applied in I.200-Series Recommendations for the specification of the telecommunications services supported by and ISDN and in Recommendation I.340 for the characterization of ISDN connection types and connection elements.

The application of the attribute technique for the characterization of multi-media services is for further study.

ANNEX A

(to Recommendation I.140)

List of definitions of attributes and attribute values

A.1 *Definitions of the attributes*

A.1.1 *Telecomunication service attribute definitions*

Information transfer mode

This attribute describes the operational mode for transferring (transporting and switching) user information through the ISDN.

Possible values: – circuit
– packet

Information transfer rate

This attribute describes either the bit rate (circuit mode) or the throughput (packet mode). It refers to the transfer of digital information at the access points.

Possible values: – appropriate bit or throughput rate

Information transfer capability

This attribute describes the capability associated with the transfer of different types of information through the ISDN.

Possible values: – unrestricted digital information
– speech
– 3.1 kHz audio
– 7 kHz audio
– 15 kHz audio
– video
– other values

Structure

This attribute refers to the capability of the ISDN to deliver information to the destination access point or reference point in a structure (e.g. time interval for circuit mode, service data unit for packet mode), that was presented in a corresponding signal structured at the origin (access point or reference point).

Possible values: – 8 kHz integrity
– service data unit integrity
– time slot sequence integrity
– restricted differential time delay
– unstructured

Establishment of communication

This attribute describes the mode of establishment associated to the telecommunication service used to establish and release a given communication.

Possible values: – demand
– reserved
– permanent

Symmetry

This attribute describes the relationship of information flow between two (or more) access points or reference points involved in a communication.

Possible values: – unidirectional
– bidirectional symmetric
– bidirectional asymmetric

Communication configuration

This attribute describes the spatial arrangement for transferring information between two or more access points. It completes the structure associated with a telecommunication service as it associates the relationship between the access points involved and the flow of information between these access points.

Possible values: – point-to-point
– multipoint
– broadcast

Access channel and rate

This attribute describes the channels and their bit rate used to transfer the user information and/or signalling information at a given access point.

Possible values: – name of the channel (letter) and the corresponding bit rate

Note – This attribute can be used several times for communication characterization.

Signalling access protocol layer 1-3, information access protocol layer 1-3

These attributes characterize the protocol on the signalling or user information transfer channel at a given access point or reference point.

Possible values: – appropriate protocol

Type of user information

Possible values: – speech
– sound
– text
– facsimile
– text-facsimile
– videotex
– video
– text-interactive

Layer 4 – 7 protocol

These attributes characterize the protocol on the user information transfer channel at a given access point or reference point.

Possible values: – appropriate protocol

Supplementary services provided

This attribute refers to the supplementary services associated with a given telecommunication service.

Quality of service

This attribute is described by a group of specific sub-attributes, for example: service reliability, service availability.

The values are under study.

Interworking possibilities

To be defined.

Operational and commercial

To be defined.

A.1.2 *Connection type attribute definitions*

Information transfer mode

This attribute describes the operational mode for transferring (transporting and switching) user information through the ISDN.

Possible values: – circuit
– packet

Information transfer rate

This attribute describes either the bit rate (circuit mode) or the throughput (packet mode). It refers to the transfer of digital information between access points or reference points.

Possible values: – appropriate bit or throughput rate

Information transfer susceptance

This attribute describes the capability associated with the transfer of different types of information through the ISDN.

Possible values: – unrestricted digital information
– speech
– 3.1 kHz audio
– 7 kHz audio
– 15 kHz audio
– video
– other values

Establishment of connection

This attribute describes the mode of establishment used to establish and release a given connection in an ISDN.

Possible values: – demand
– semi-permanent
– permanent

Symmetry

This attribute describes the relationship of information flow between two (or more) access points or reference points of a connection.

Possible values: – unidirectional
– bidirectional symmetric
– bidirectional asymmetric

Connection configuration

This attribute describes the spatial arrangement for transferring information on a given connection. It consists of two sub-attributes, topology and dynamics.

Structure

This attribute refers to the capability of the ISDN to deliver information to the destination access point or reference point in a structure (e.g. time interval for circuit mode, service data unit for packet mode), that was presented in a corresponding signal structured at the origin (access point or reference point).

Possible values: – 8 kHz integrity
– service data unit integrity
– time slot sequence integrity
– restricted differential time delay
– unstructured

Channel (rate)

This attribute describes the channels and their bit rate used to transfer the user information and/or signalling information at a given access point.

Possible values: – name of the channel (letter) and the corresponding bit rate

Note – This attribute can be used several times.

Connection control protocol, information transfer coding/protocol

These attributes characterize the protocol/coding on the signalling or user information transfer channel at a given access point or reference point.

Possible values: – appropriate protocol or coding

Network performance

This attribute describes the network performance that relates to an ISDN connection.

This performance attribute consists of sub-attributes, for example:

Error performance: the values are given in the appropriate Recommendations.

Slip performance: the values are given in the appropriate Recommendations.

The definition of further sub-attributes is for further study.

Network interworking

To be defined.

Operation and management

To be defined.

A.1.3 *Connection element attribute defintions*

Information transfer mode

This attribute describes the operational mode for transferring (transporting and switching) user information through the ISDN.

Possible values: – circuit
– packet

Information transfer rate

This attribute describes either the bit rate (circuit mode) or the throughput (packet mode). It refers to the transfer of digital information between access points or reference points.

Possible values: – appropriate bit or throughput rate

Information transfer susceptance

This attribute identifies equipment which may restrict the types of information which may pass through the ISDN.

Possible values: – speech processing equipment
– echo suppression equipment
– multi-satellite hope
– null

Establishment of connection

This attribute describes the mode of establishment used to establish and release a given connection element in an ISDN.

Possible values: – demand
– semi-permanent
– permanent

Symmetry

This attribute describes the relationship of information flow between two (or more) access points or reference points of a connection element.

Possible values: – undirectional
– bidirectional symmetric
– bidirectional asymmetric

Connection configuration

This attribute describes the spatial arrangement for transferring information across a given connection element. It consists of two sub-attributes, topology and uniformity.

Structure

This attribute refers to the capability of the ISDN to deliver information to the destination access point or reference point in a structure (e.g. time interval for circuit mode, service data unit for packet mode), that was presented in a corresponding signal structured at the origin (access point or reference point).

Possible values: – 8 kHz integrity
– service data unit integrity
– time slot sequence integrity
– 8 kHz integrity with restricted differential time delay
– unstructured

Channel (rate)

This attribute describes the channels and their bit rate used to transfer the user information and/or signalling information at a given access point.

Possible values: – name of the channel (letter) and the corresponding bit rate

Note – This attribute can be used several times.

Connection control protocol, information transfer coding/protocol

These attributes characterize the protocol/coding on the signalling or user information transfer channel at a given access point or reference point.

Possible values: – appropriate protocol or coding

Network performance

This attribute describes the network performance that relate to an ISDN connection element.

This performance attribute consists of sub-attributes, for example:

Error performance: The values are given in the appropriate Recommendations.

Slip performance: The values are given in the appropriate Recommendations.

The definition of further sub-attributes is for further study.

Network interworking

To be defined.

Operation and management

To be defined.

A.2 *Definition of the attribute values*

unrestricted digital information

Transfer of information sequence of bits at its specified bit rate without alteration.

This implies: – bit sequence independence
– digit sequence integrity
– bit integrity.

speech

Digital representation of speech coded according to a specified encoding rule (e.g. A-law, μ-law).

3.1 kHz audio

Digital representation of audio information such as voice-band data and speech with a bandwidth of 3.1 kHz, the encoding rule being specified (e.g. A-law, μ-law).

7 kHz audio

Digital representation of audio information with a bandwidth of 7 kHz, the encoding rule being specified.

15 kHz audio

Digital representation of audio information with a bandwidth of 15 kHz, the encoding rule being specified.

video

Digital representation of video image information, the encoding rule being specified.

8 kHz integrity

This value applies when:

i) at each user-network interface, intervals of 125 μs are implicitly or explicitly demarcated, and

ii) all bits submitted within a single demarcated 125 μs interval are delivered within a corresponding single demarcated 125 μs interval.

service data unit integrity

This value applies when:

i) at each user-network interface, protocols provide a mechanism for identifying the boundaries of service data units (e.g. X.25 complete packet sequence), and

ii) all bits submitted within a single service data unit are delivered in a corresponding service data unit.

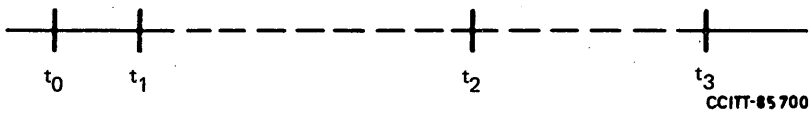
unstructured

This value is applicable when the telecommunication service or connection neither provides structural boundaries nor preserves structural integrity.

demand (communication)

The communication can be started as soon as possible after the request is made (e.g. $t_1 - t_0$ is as short as possible).

Communication and connection release occurs in response to the request of any of the users (calling or called users), $t_3 - t_2$ is as short as possible (see Figure A-1/I.140).



t_0 : time instant at which the request for communication and connection is made,

t_1 : time instant at which the connection and communication is established,

t_2 : time instant at which request for communication and connection release is made,

t_3 : time instant at which communication and connection is cleared.

Note – Recommendation I.112 provides also definitions for these three values (No. 205, 206, 207). However, the definitions proposed are more general (no reference to a time diagram) and are circuit-mode oriented.

FIGURE A-1/I.140

Establishment of communication and connection time diagram

reserved (communication)

The communication can be started at time instant t_1 explicitly specified at the time instant of communication and connection request, t_0. Communication and connection release occurs at time instant t_3 explicitly specified also at t_0. Communication and connection duration is predetermined: the communication and connection is set up for a specified period of time. As an option, connection release occurs at time instant t_3 following a release request made at time instant t_2 during the communication and *a priori* undetermined ($t_3 - t_2$ is as short as possible). This option corresponds to an unspecified duration of the communication and connection, or to a possibility of unanticipated release (see Figure A.1/I.140).

permanent (communication)

The communication can be started after the connection is set up at time instant t_1 in response to a subscription request for the service at time instant t_0. the duration may be unspecified. The communication and connection is released at time instant t_3 corresponding to the end of the subscription.

switched (connection)

ISDN circuit switched connections/connection elements are set up at any time on demand via e.g. a bit channel in response to signalling information received from subscribers, other exchanges or other networks, i.e. on a per-call-basis. Message/packet switched connections/connection elements provided by an ISDN may be set up on demand via circuit-mode channels (e.g. B-channels) and special packet switching units or via the D-channel subject to any D-channel priority/flow control restrictions that may be applicable.

Note – A more general definition of this value is also given in Recommendation I.112 (No.311).

semi-permanent (connection)

Semi-permanent connections/connection elements pass through a switching network.

Semi-permanent connections/connection elements between agreed points may be provided for an indefinite period of time after subscription, for a fixed period or for agreed periods during a day, week or other interval.

permanent (connection)

Permanent connections/connection elements are described by the following characteristics:

Permanent connections/connection elements are available to the connected subscriber at any time during the period of subscription between fixed network destination points requested by the subscribers.

unidirectional

This value applies when the information flow of messages is provided only in one direction.

bidirectional symmetric

This value applies when the information flow characteristics provided by the service are the same between two (or more) access points or reference points in the forward and backward directions.

bidirectional asymmetric

This value applies when the information flow characteristics provided by the service are different in the two directions.

point-to-point communication

This value applies when there are only two access points.

multipoint communication

This value applies when more than two access points (see Note) are provided by the service. The exact characteristics of the information flows must be specified separately based on functions provided by the ISDN.

Note – The number of access points can be undefined.

broadcast communication

This value applies when more than two access points (see Note) are provided by the service. The information flows from a unique point (source) to the others (destination) in only one direction.

Note – The number of destination access points is undefined.

point-to-point connection

This value applies when only two end points are provided by the connection.

multipoint connection

This value applies when more than two end points are provided by the connection, and thus many different information flows are possible.

broadcast connection

To be defined.

simple connection

A connection consisting of only one connection element.

tandem connection

Two or more connection elements in series form a connection.

parallel connection

Two or more connection elements in parallel form a connection.

star

To be defined.

mesh

To be defined.

uniform

This value applies when all connection elements have the same attribute values.

non uniform

This value applies in all other cases.

concurrent

The configuration of a connection is described as concurrent when all of the connection elements involved are established simultaneously and released simultaneously.

sequential

A connection has a sequential configuration when its connection elements are established and released sequentially i.e. only one of several connection elements or chains of connection elements exists at any given time.

add/remove

When connection elements can be established and released while other connection elements of the same connections still exist, the configuration of this connection is described as add/remove.

Symmetry and/or topology change

When the symmetry attribute value of the connection element can be changed during a call.

Time slot sequence integrity

This value applies when

i) at each user-network interface, time slots are implicitly or explicitly demarcated for each access channel of an aggregate of access channels, and

ii) the information parts delivered from the time slots at the receiving end are in the same order as submitted at the transmitting end.

Note – Preserving the order of bits within an individual time slot from the transmitting to the receiving end is not part of this definition.

8 kHz integrity with restricted differential time delay (RDTD)

This value applies when the following conditions are met:

– that at each point in a connection or connection element, time slots are explicity or implicitly demarcated for each information channel or an aggregate of information channels; and

– that the information parts submitted to the time slots at the transmitting end are delivered to the receiving end with a differential time delay of not more than 50 ms (provisional).

Recommendation I.141

ISDN NETWORK CHARGING CAPABILITIES ATTRIBUTES

(Melbourne, 1988)

1 Preamble

On the basis of charging principles provided in the D.200-Series, this Recommendation covers the method for identifying the network charging capabilities and provides a candidate list of attributes in Annex A.

2 General

ISDNs shall support a range of services as defined in the I.200-Series of Recommendations. Charging capabilities and mechanisms need to be associated with each service.

To ensure that service charging requirements may be supported by network charging facilities, it is essential that the service requirements be specified in a format which simplifies the identification of network requirements. The attribute technique is considered an appropriate mechanism by which service requirements may be related to network requirements and has thus been utilized in this Recommendation. (See Figure 1/I.141.)

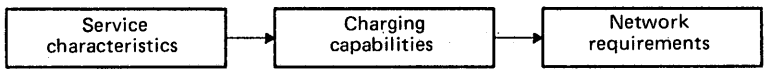


FIGURE 1/I.141

3 ISDN services characteristics

Specifically, the services to which network charging capabilities attributes should be applied are as given in Table 1/I.141.

TABLE 1/I.141

Service	Recommendations
Bearer services	I.230-Series
Teleservices	I.240-Series
Supplementary services	I.250-Series

4 Role and application of the attribute technique

For each service defined in the I.200-Series Recommendations, one set of attribute values should be selected for each network charging capability attribute. Assignment of attribute values for a specific service will allow the determination of the network requirements relating to this service.

The definition of charging requirements in terms of network charging capability attributes is intended to provide a link between the service charging characteristics and the respective network charging mechanisms.

Network charging capability attributes are also intended to indicate the range of information to be transferred either within the signalling network or by some other means.

Annex A lists the candidate network charging capability attributes and the possible values so far identified.

ANNEX A

(to Recommendation I.141)

Candidate network charging capability attributes

TABLE A-1/I.141

Attribute	Possible values
Charging capabilities	
Usage [a]	Service requested Call attempt [b] Call set-up Duration Volume Basis of provision
Modulation	Distance Time of usage
Billing capabilities	
Billing identification	Calling party (sent paid) Called party (reverse/collect) Transferred (third party)
Collection	Subscriber billing Credit card Coin box Debit card
Mode	On line Off line

[a] The identification and definition of values for supplementary services (e.g. registration, activation) is for further study.

[b] For further study.

PAGE INTENTIONALLY LEFT BLANK

PAGE LAISSEE EN BLANC INTENTIONNELLEMENT

PART II

I.200-Series Recommendations

SERVICE CAPABILITIES

PAGE INTENTIONALLY LEFT BLANK

PAGE LAISSEE EN BLANC INTENTIONNELLEMENT

Recommendation I.200

GUIDANCE TO THE I.200-SERIES OF RECOMMENDATIONS

(Melbourne, 1988)

1 General

The Recommendations in the I.200-Series cover the aspects of the telecommunications services supported by ISDNs. They contain the definitions, descriptions and details on the provision of bearer services, teleservices and their associated supplementary services.

In the layout of the I.200-Series of Recommendations the following objectives have been taken into account:

- to achieve a systematic structure which is open to future enhancement;
- to facilitate the requirements of different readers by separating, in specific Recommendations, general service concepts and definitions from Recommendations covering detailed characteristics of individual services;
- to use systematically the service description method given in Recommendation I.130 where, the stage 1, telecommunication services are described in three steps:
  1) prose definition and description;
  2) static description using attributes;
  3) dynamic description using graphic means.

2 Structure of the I.200-Series of Recommendations

Section 2.1 gives the layout and Figure 1/I.200 illustrates the structure of the I.200-Series of Recommendations.

The general service concepts and principles are given in Recommendation I.210. Annexes to Recommendation I.210 describe the application of the service description method to the three service families: bearer services, teleservices and supplementary services.

A separate section of the I.200-Series is allocated to each service family. Within each of these sections the first Recommendation gives an overview of the services within each family and the subsequent Recommendations specify in detail individual services. The reader interested in an overview of service concepts and principles, as well as the method to describe services, will find them in Recommendations I.210, I.230, I.240 and I.250.

The reader interested in the detailed characteristics of individual services will find them in Recommendations I.231, I.232, I.241 and I.251-I.257. Detailed items of common significance are defined and described in the I.220-Series of Recommendations.

Note – In the CCITT Red Book (1984) all ISDN service requirements were contained in three Recommendations, numbered I.210, I.211 and I.212. References have been made widely to these three Recommendations in other Recommendations and elsewhere, and to facilitate a translation to the new CCITT Blue Book (1988) version of the I.200 Recommendations Appendix I shows the mapping between the Red Book and Blue Book versions of the I.200-Series of Recommendations.

2.1 *Layout of the I.200-Series of Recommendations*

I.200 Guidance to the I.200-Series of Recommendations

SECTION 1 – *General aspects of services in an ISDN*

I.210 Principles of telecommunication services supported by an ISDN and the means to describe them

SECTION 2 – *Common aspects of services in an ISDN*

I.220 Common dynamic description of basic telecommunication services

I.221 Common specific characteristics of services

SECTION 3 – *Bearer services supported by an ISDN*

I.230 Definition of bearer services categories

I.231 Circuit mode bearer services categories

I.232 Packet mode bearer services categories

SECTION 4 – *Teleservices supported by an ISDN*

I.240 Definition of teleservices

I.241 Teleservices supported by an ISDN

SECTION 5 – *Supplementary services in an ISDN*

I.250 Definition of supplementary services

I.251 Number identification supplementary services

I.252 Call offering supplementary services

I.253 Call completion supplementary services

I.254 Multi-party supplementary services

I.255 "Community of Interest" supplementary services

I.256 Charging supplementary services

I.257 Additional information transfer supplementary services

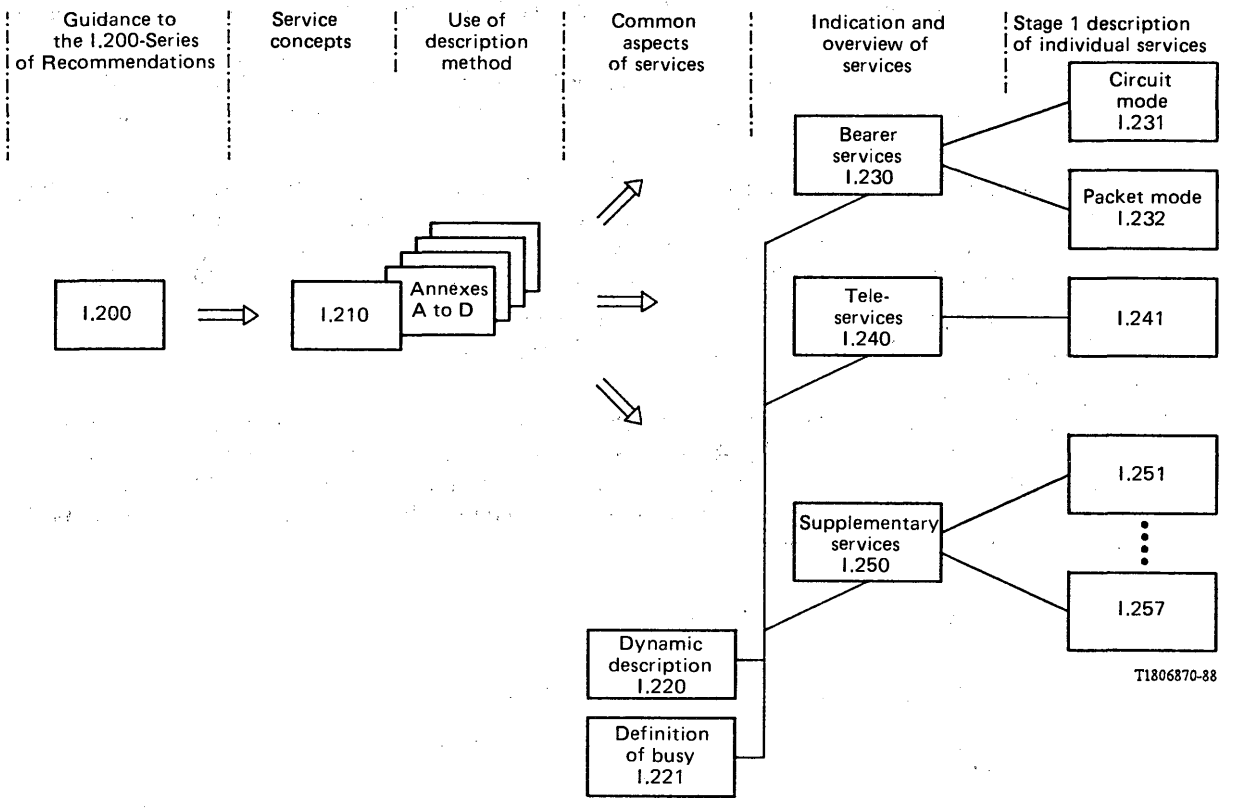


FIGURE 1/I.200

Structure of the I.200-Series of Recommendations

APPENDIX I

(to Recommendation I.200)

Mapping between the Red Book and Blue Book I.200-Series of Recommendations

Red Book Recommendations	*Blue Book Recommendations*
Rec. I.210 § 1-6	Rec. I.210 § 1-6
Rec. I.211 § 1	Rec. I.210 Annex B
2	I.230 § 2
2.1	2.1
2.1.1	I.231 § 1
2.1.2	2
2.1.3	3
2.1.4	4
2.1.5	Deleted
2.1.6	I.231 § 6
2.1.7	7
2.1.8	8
2.2	I.230 § 2.2
2.2.1	I.232 § 1
2.2.2	2
3	I.230 § 3
3.1.1	I.231 § 1.7.2
3.1.2	2.7.2
3.1.3	3.7.2
3.1.4	4.7.2
3.1.5	Deleted
3.1.6	I.231 § 6.7.2
3.1.7	7.7.2
3.1.8	8.7.2
3.2.1	I.232 § 1
3.2.2	2
Rec. I.212 § 1	Rec. I.210 § C.1
2	C.2

PAGE INTENTIONALLY LEFT BLANK

PAGE LAISSEE EN BLANC INTENTIONNELLEMENT

SECTION 1

GENERAL ASPECTS OF SERVICES IN ISDN

Recommendation I.210

PRINCIPLES OF TELECOMMUNICATION SERVICES SUPPORTED BY AN ISDN AND THE MEANS TO DESCRIBE THEM

(Malaga-Torremolinos, 1984; amended at Melbourne, 1988)

1 General

An ISDN will support a wide range of services as described generally in Recommendation I.120. The purpose of this Recommendation is to provide a classification of such services, the means for the description of such services based on the description method as defined in Recommendation I.130, and to give a basis for the definition of the network capabilities required by an ISDN. These network capabilities are defined in the I.300-Series of Recommendations.

Using the service concepts and the means for the description of services as given in this Recommendation, recommended bearer services are defined and described in the I.230-Series of Recommendations, recommended teleservices are defined and described in the I.240-Series of Recommendations and recommended supplementary services are defined and described in the I.250-Series of Recommendations.

2 Service concepts

2.1 Services supported by an ISDN are the communication capabilities made available to customers by telecommunication service providers. An ISDN will provide a set of network capabilities which are defined by standardized protocols and functions and enable telecommunication services to be offered to customers.

A service provision by a telecommunication service provider to a customer connected to an ISDN may cover the whole or only part of the means required to fully support the service. The operational and commercial features associated with provision of the service are included in the service concept.

The service classification and descriptions which follow are independent of different possible arrangements for ownership and provision to the customer of the means required to support a service. The customer may therefore be offered, by the Administration, services or service support.

2.2 The method used for the characterization of telecommunication services is described in Recommendation I.130 "Method for the characterization of telecommunication services supported by an ISDN and network capabilities of an ISDN". Within this method the first stage is an overall service description from the user's point of view. In stage 1 there are three steps:

Step 1.1 Prose service definition and description

Step 1.2 Static description of the service using attributes

Step 1.3 Dynamic description of the service using graphic means

Together these three steps define the service characteristics as they apply at a given reference point where the customer accesses the service.

Annexes A to D of this Recommendation give the format of stage 1 service descriptions as follows:

Annex A: Structure for prose service definition and description

Annex B: List of attributes and their possible values for describing bearer services

Annex C: List of attributes and their possible values for describing teleservices

Annex D: Dynamic description of the service using graphic means

Note 1 – Recommendation I.140 describes the use of attributes for this purpose.

Note 2 – The use of attributes for describing supplementary services is for further study.

This format allows the information contained within stage 1 to be structured in a consistent, comprehensive and logical manner. Only one overall format is recommended but it is recognized that certain sections of this format are only applicable to certain types of services.

2.3 Telecommunication services are classified using their static characteristics described by attributes. Therefore this Recommendation (except Annexes A and D) deals mainly with step 1.2 of the description method.

A telecommunication service is, from the static point of view, composed of:

- technical attributes as seen by the customer; and
- other attributes associated with the service provision, e.g. operational and commercial attributes.

Realization of the technical attributes of a telecommunication service requires a combination of network and terminal capabilities and other service providing systems.

2.4 Telecommunication services are divided in two broad families, i.e.

- bearer services, and
- teleservices.

A supplementary service modifies or supplements a basic telecommunication service. Consequently, it cannot be offered to a customer as a stand alone service. It must be offered together with or in association with a basic telecommunication service. The same supplementary service may be common to a number of telecommunication services.

Note – The concept of supplementary services corresponds to the concept of optional user facilities in the X-Series of Recommendations.

The concepts introduced here are illustrated in Table 1/I.210 and are defined in more detail in § 5.

TABLE 1/I.210

Classification of telecommunication services

<table>
<tr><td colspan="4">Telecommunication service</td></tr>
<tr><td colspan="2">Bearer service</td><td colspan="2">Teleservice</td></tr>
<tr><td>Basic bearer service</td><td>Basic bearer service + Supplementary services</td><td>Basic teleservice</td><td>Basic teleservice + Supplementary services</td></tr>
</table>

3 Customer access to telecommunication services supported by an ISDN

3.1 Considering the reference configurations defined in Recommendation I.411, customers can access various telecommunication services at different access points. Figure 1/I.210 shows these access points.

This figure takes into account that the network provider may offer to a customer connected to an ISDN the whole or only part of the means to fully support the service.

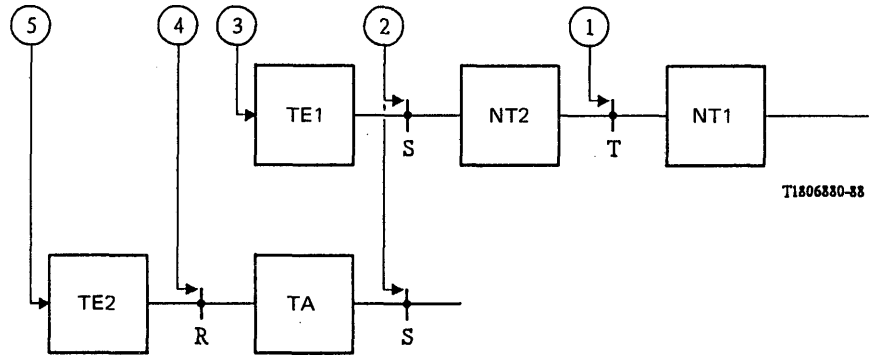


FIGURE 1/I.210

Customer access to services supported by an ISDN

3.2 The definitions of the access points introduced in Figure 1/I.210 are as follows:

i) access points 1 (reference point T) and 2 (reference point S) are the access points for bearer services supported by an ISDN. The choice between access point 1 (T) and 2 (S) depends on the ownership and form of provision (to the customer) of the communications equipment at the customer premises. The service classification and descriptions in the following are independent of different possible arrangements for such provision;

ii) at access point 4 (reference point R), depending on the type of terminal adaptors provided, other CCITT standardized services may be accessed, e.g. according to the X- and V-Series of Recommendations;

iii) at access points 3 and 5 (user-to-terminal interface), teleservices are accessed – the teleservice concept includes the terminal capabilities.

3.3 The following customer entities may be connected at access points 1 and 2:

– customer terminals;

– customer systems, e.g. PABXs, LANs, service vendor systems;

– private networks.

Note – Customer terminals and systems may be private or provided by Administrations.

All customer equipment connected to an ISDN interface at one of these access points should meet the specifications of the protocols at that interface for all the layers that are included in the definition of the telecommunication service used.

For some telecommunication services the service definition also covers some terminal functions and characteristics in addition to those specified by the protocols at the interface. This relates in particular to teleservices, and also to supplementary services (see Recommendation I.250).

3.4 From the user's point of view the telecommunication services as defined in the I.200-Series of Recommendations will be used for some applications. For example, the telephony teleservice will be typically used for a human conversation (application). Likewise bearer services will be used for applications. The area of applications is outside the scope of the I-Series of Recommendations. The user's application of services is the responsibility of the user and not of the network. The network can have no knowledge of what application is being used at any given time.

3.5 The telecommunication service, as described in this Recommendation, is time-independent, that is to say that the description is valid for all the time the service is available. Whenever a demand or reserved service is invoked by a user, then the particular instance of the service is referred to as a *call.* Similarly, the instance also applies to the application as described in § 3.4. The instance of an application is referred to as a *communication.*

4 Capabilities to support a telecommunication service

4.1 The capabilities required to fully support a telecommunication service for a customer connected to an ISDN include:

- network capabilities;
- terminal capabilities, when required;
- other services providing capabilities, when required;
- operational and commercial features associated with the service provision (i.e. sales or marketing aspects).

4.2 Network capabilities are described in detail in Recommendation I.310. Two different levels of ISDN network capabilities are introduced in that Recommendation:

- low layer capabilities which relate to bearer services;
- high layer capabilities which together with low layer capabilities relate to teleservices.

The low layer capabilities are defined as a set of Low Layer Functions (LLF) (relating to layers 1-3 in Recommendation X.200) which provide the capability for the carriage of user information over an ISDN connection. These functions include:

- Basic Low Layer Functions (BLLF) supporting the necessary layer 1-3 requirements;
- Additional Low Layer Functions (ALLF) supporting, in addition to BLLFs, lower layer requirements of supplementary services.

High layer capabilities are defined as a set of High Layer Functions (HLF) generally associated with layers 4-7 in Recommendation X.200.

High Layer Functions are sub-divided into Basic High Layer Functions (BHLF) and Additional High Layer Functions (AHLF).

Note – Depending on national regulations, ALLF, BHLF, and AHLF may be provided by Administrations, or other suppliers.

4.3 The concept of describing network capabilities in terms of low layer capabilities and high layer capabilities can equally be applied to describe terminal capabilities. In the description of teleservices the HLF and LLF are included in the service definition. In the case of bearer service definition the terminal capabilities are not included but the terminal must conform to the LLF of the bearer service.

Note – The relationships between service categories, network/terminal capabilities and functions are illustrated in Table 2/I.210.

TABLE 2/I.210

Relationship between service categories, network/terminal capabilities and functions

Telecommunication service	Network capabilities specified				Terminal capabilities specified				Commercial features/ Operational capabilities
	LLF		HLF		LLF		HLF		
	BLLF	ALLF [a]	BHLF [a]	AHLF [a]	BLLF	ALLF	BHLF	AHLF	
Bearer service	X	opt	–	–	–	–	–	–	X
Teleservice	X	opt	opt	opt	X	opt	X	opt	X

X: specified

–: not specified

opt: optional

[a] Depending on national regulations, ALLF, BHLF and AHLF may be provided by Administrations or other suppliers.

4.4 The operational service capabilities associated with a service offering may include capabilities for maintenance, charging, user control of service features, etc.

The use of such capabilities may involve terminal-network communication and may therefore be viewed as specific applications.

A more precise description of these capabilities and the relationship to Recommendation X.200 needs further study.

5 Telecommunication service classification

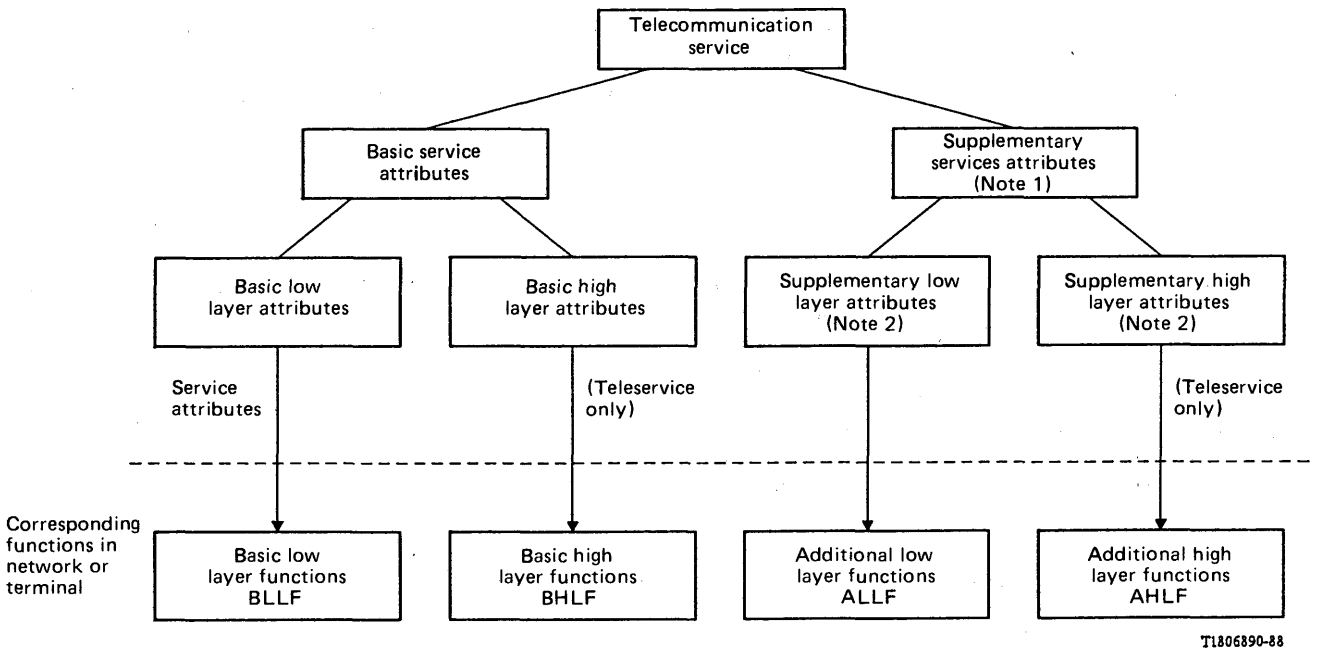
5.1 The static characteristics of a telecommunication service supported by an ISDN are described by service attributes. They are given in Annexes B and C.

There are two groups of service attributes applicable to user information flow:

- low layer attributes;
- high layer attributes.

Bearer services are defined as including only low layer attributes. Teleservices are defined as including both low layer attributes and high layer attributes.

The relationship between telecommunication service attributes and low/high layer functions is illustrated in Figure 2/I.210.



Note 1 – A supplementary service cannot be offered as a stand alone service. This attribute is mainly concerned with supplementary services associated to basic telecommunications services. It could be split into sub-attributes depending on results of further studies. Supplementary services could also have an influence on some attributes characterizing basic telecommunication services.

Note 2 – The characterization of supplementary services using attributes requires further studies.

FIGURE 2/I.210

Relationship between service attributes and low/high layer functions

5.2 *Bearer services supported by an ISDN*

5.2.1 Bearer services supported by an ISDN provide the capability for information transfer between ISDN access points 1 or 2 and involve only low layer functions.

The customer may choose any set of high layer (at least 4-7) protocols for his communication, and the ISDN does not ascertain compatibility at these layers between customers. An example of a bearer service is a demand circuit-mode, 64 kbit/s unrestricted, 8 kHz structured bearer service.

5.2.2 Bearer services are characterized from a static point of view by a set of low layer attributes given in Annex B. These attributes are classified into three categories:

- information transfer attributes;
- access attributes; and
- general attributes, including operational and commercial attributes.

The bearer capability defines the technical features of a bearer service as they appear to the user at the appropriate access point (1 or 2).

The bearer capability is characterized by information transfer and access attributes. A bearer capability is associated with every bearer service.

Note – It is likely that some Quality of Service parameters – such as error rate or call set-up delay – should be extracted in order to form a new attribute allocated to the information transfer category. Identification and definition of such parameters require further consideration.

Individual bearer services categories are defined and described in the I.230-Series of Recommendations.

5.2.3 A bearer service provides the user with the possibility of gaining access to various forms of communication, covering for example:

- information transfer between users employing the same access points (1 or 2) and access attributes (see Figure 3*a*/I.210);
- information transfer between users employing different access attributes at the access points (1 or 2) involved (see Figure 3*b*/I.210); and
- information transfer between a user and a separate resource providing high layer functions (see Figure 3*c*/I.210).

5.3 *Teleservices supported by an ISDN*

5.3.1 Teleservices provide the full capacity for communication by means of terminal and network functions and possibly functions provided by dedicated centres.

A teleservice supported by an ISDN should use only one (or a small number of) bearer capability(ies) recommended by the CCITT. It should be noted that in the case where more than one of the recommended bearer capabilities is used for a given teleservice, network interworking functions may be required under the responsibility of the teleservice provider. However, a user operating a specific application is not prevented from using a terminal compatible with a given teleservice in association with a bearer capability not recommended for this teleservice. Examples of teleservices are telephony, Teletex and Videotex.

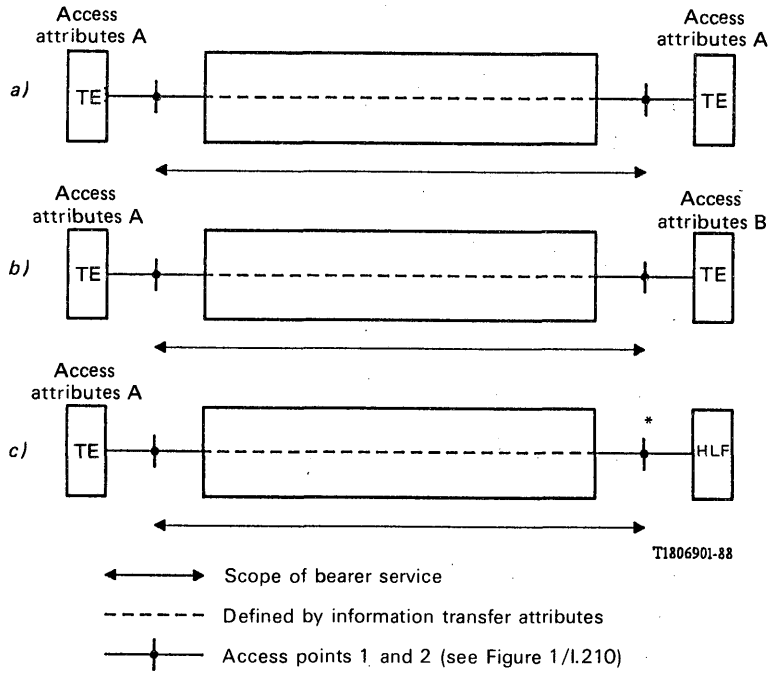
5.3.2 Teleservices are described from a static point of view by a set of low layer and high layer attributes, and operational and commercial attributes, as given in Annex C of this Recommendation.

Low layer attributes are those used to characterize the bearer capability (see § 5.2.2). High layer attributes are used in Recommendation I.241 to describe message-related (i.e. message on layer 7) characteristics of a service (basic high layer attributes) or of a supplementary service (supplementary high layer attributes). They refer to the functions and protocols of layers 4-7 in the Recommendation X.200 framework which are concerned with the transfer, storage and processing of user messages (provided by a subscriber's terminal, a retrieval centre, or a network service centre).

Therefore, not all these attributes can be applied directly at the user-to-terminal interface (access points 3 or 5) as they represent two kinds of features, the bearer capability and the terminal features, that are not directly perceived by the user.

The definition of appropriate attributes and the specifications of teleservices at this access point from the user point of view (man-machine interface) is for further study and the subject of E-and F-Series Recommendations.

Individual teleservices are defined and described in the I.240-Series of Recommendations.



* Access point to be defined but not necessarily subject to CCITT Recommendations (see Recommendation I.324).

Note 1 – Further study is required on bearer services extending beyond the ISDN.

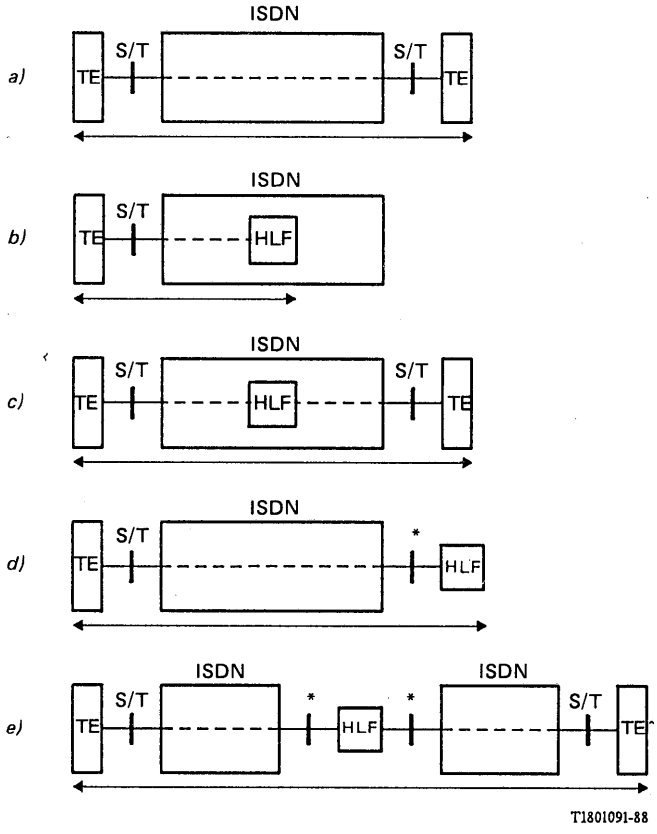
Note 2 – Further study is required on possible communications involving bearer services with different values allocated to information transfer attributes.

FIGURE 3/I.210

Examples of bearer service operation

5.3.3 A teleservice provides the user with the possibility of gaining access to various forms of applications (or teleservice applications) covering, for example:

- teleservice application involving two terminals providing the same teleservice attributes at both access points (3 or 5) – (see Figure 4*a*/I.210);
- teleservice application involving a terminal at one access point (3 or 5) and HLF functions located within the ISDN – (see Figure 4*b*/I.210);
- teleservice application involving terminals based on different teleservice attributes at each access point – in this case, the use of HLF functions in the ISDN is necessary (interworking situation) – (see Figure 4*c*/I.210);
- teleservice application involving a terminal at one access point (3 or 5) and a system providing HLF functions (see Figure 4*d*/I.210);
- teleservice application involving two terminals at both access points (3 or 5) and an intervening system providing HLF functions (see Figure 4*e*/I.210). In this case, teleservice attributes can be different at each terminal access point.



* Access point to be defined but not necessarily subject to CCITT Recommendations (see Recommendation I.324).

Note – Teleservices are accessed at access points 3 or 5, see Figure 1/I.210.

FIGURE 4/I.210

Examples of teleservice application

5.4 *Supplementary services supported by an ISDN*

Supplementary services supported by an ISDN provide additional capabilities to be used with bearer services and teleservices. They cannot be offered to a customer as a stand alone service.

Supplementary services are characterized by a prose definition and description following the layout given in Annex A and a dynamic description applying the means given in Annex D.

The use of the attribute technique for supplementary services is for further study. The individual supplementary services are described in the I.250-Series of Recommendations.

6 Provision of telecommunication services

6.1 A telecommunication service is provided by an Administration, and/or other service providers. Customer terminals and systems may be privately owned or provided by Administrations. Depending on the nature of customer ownership within the customer premises (TE or TE and NT2), a telecommunication service is provided at different access points.

6.2 The provision of telecommunication services implies:

- subscription ensuring the basic service and possibly subscription to supplementary services;
- registration into a service directory in the case where demand services are used;
- compatibility between terminals;
- interworking capabilities (this point needs further study).

6.3 The provision of individual bearer services is given in the I.230-Series, the provision of individual teleservices is given in the I.240-Series and the association of supplementary services to bearer services and teleservices is given in Recommendation I.250.

ANNEX A

(to Recommendation I.210)

Structure for prose service definition and description – Step 1.1 of description method (Recommendation I.130)

A.1 *Structure of prose service definition and description*

Prose service definition and description is the first step (1.1) of the stage 1 overall service description from the user's point of view (Recommendation I.130). The prose definition of a telecommunication service will be structured as follows:

1 *Definition*
2 *Description*
  2.1 General description
  2.2 Specific terminology
  2.3 Qualifications
3 *Procedures*
  3.1 Provision/withdrawal
  3.2 Normal procedures
    3.2.1 Activation/deactivation/registration
    3.2.2 Invocation and operation
    (3.2.3 Interrogation/editing)
  3.3 Exceptional procedures
    3.3.1 Activation/deactivation/registration
    3.3.2 Invocation and operation
    (3.3.3 Interrogation/editing)
  3.4 Alternative procedures
    3.4.1 Activation/deactivation/registration
    3.4.2 Invocation and operation
  (3.5 Verification)
4 *Network capabilities for charging*
5 *Interworking requirements*
6 *Interaction with other supplementary services*

Note 1 – Where a particular section would not be appropriate for a particular service (basic or supplementary) "not applicable" appears in that section for that service. Some such items have been identified by paragraph numbering in parenthesis.

Note 2 – Where information contained under one item (e.g. 3.2.1) for a particular service is extensive, then this item may be further sub-divided under sub-headings as necessary.

Note 3 – In a Recommendation containing prose definitions and descriptions, an additional digit is prefixed to the above numbering structure to make the section numbering conform to the presentation rules laid out in Recommendation A.15.

A.2 *Explanation of the terms and content of the items in the service prose definition and description*

1 *Definition*

This section provides a short description of the service in terms of the perceptions of the user receiving the service and any other users involved in the service.

2 *Description*

This section expands on the definition and summarizes the operation of the service in a generic form which does not constrain terminal or network design. It is intended to allow an understanding of the service without regard to implementation. It also includes any specific terminology used within the prose definition and description, and any qualifications. For basic services this section details the applications which could utilize the service whilst for supplementary services this section details their applicability to particular telecommunication services.

3 *Procedures*

The overall operation of the service in its various states is described in this section 3. These procedures relate to all actions between the user(s) and the network during the period that the service is available.

3.1 *Provision/withdrawal*

This section describes the means by which the service is made available by the service provider, e.g. it may be generally available to all customers, or only be available to those customers who have made a prior arrangement.

3.2 *Normal procedures*

The paragraphs under this heading describe the normal procedures for activation, deactivation, registration, invocation and operation for the service as appropriate. This section describes only the successful outcome of each procedure, and the procedures which are executed as a result of such successful outcomes. The procedures are described in a time-based sequence of events. They describe the interactions of the users involved in the service with the service provider and with each other which lead to, and are elements of, the successful operation of the service.

3.2.1 *Activation/deactivation/registration*

The procedures for activation, which is the operation of bringing the service into the "ready for invocation" state, and deactivation, which is the complementary action, are described in this section. For some services there may be a specific user procedure to allow activation and deactivation as necessary, whilst for others the service is permanently activated on provision and thus no procedure is provided.

Registration describes the procedures by which any specific information, necessary for the successful operation of the supplementary service, is given to the network. The need to register information with the network, e.g. a forwarding number, only applies to certain supplementary services.

3.2.2 *Invocation and operation*

This section describes the procedures for invocation, which is the action and conditions under which the service is brought into operation; in the case of a supplementary service this may only be on a particular call. It should be noted that although a supplementary service may be activated, it may not necessarily be invoked on all calls. (Invocation takes place either subsequent to or simultaneously with activation.)

In the case of basic services this section describes the events, perceived at the service access point, during the establishment, information transfer and clearing phases.

Operation is the procedure which occurs once a service has been invoked. In the case of a supplementary service this is described in terms of the way in which the supplementary service modifies/enhances the network's treatment of a call. This description gives details of the significant actions of the network, treated in principle as a single entity, and the perception of the users involved on the call. It includes details of the information exchanged between the network and relevant users and the indications given to each user, by the network, concerning the states of the call.

3.2.3 *Interrogation/editing*

Interrogation is the facility which enables a served user to determine, from the service provider, the current status of a particular service. Whether this facility is provided for the service being described, and if so, the procedures that accompany it, are detailed in this section.

Editing describes the process whereby any registered information (see section 3.2.1 under this § A.2) specific to a service may be erased or modified by the served user.

3.3 *Exceptional procedures*

The paragraphs under this heading describe, for each of the items shown under section 3.2 of this § A.2, the exceptional procedures which result in an unsuccessful outcome of the call. Included within this description are the details for such situations as invalid user action and the handling of certain network and interface conditions. For the case of basic services this includes the handling of such network conditions as congestion.

3.4 *Alternative procedures*

The paragraphs under this heading describe any alternative procedures, where available, for each of the items shown under section 3.2 of this § A.2. These either allow an alternative way of activating or invoking the service, or detail a possible alternative treatment of the call by the network.

3.5 *Verification*

This section describes the facilities that are provided by the network to enable the subscriber to verify the operation of the service once it has been activated. Not all services allow provision for verification of the operation of the service.

4 *Networking capabilities for charging*

This section details only those charging aspects specific to the service in question and includes, where necessary, both static (subscription) and dynamic (call related) aspects.

5 *Interworking requirements*

This section describes special aspects of the individual service, if the service is used in a connection which exists partly inside and partly outside a given ISDN, or which, for certain operational aspects, routes through more than one ISDN.

6 *Interaction with other supplementary services*

This section only applies in the case of supplementary services and describes all interactions of the supplementary service being described with other supplementary services as far as they have been identified and which are relevant for standardization.

For example, for some supplementary service pairs there is no interaction as the two supplementary services are not permitted to be both in operation at the same time. For other pairs, one or both supplementary services may be modified whilst the pair of services are in operation simultaneously.

It is recognized that although the layout, and the detailed work to date, has only dealt with the interactions between two supplementary services, further work is necessary on combinations of more than two supplementary services.

ANNEX B

(to Recommendation I.210)

List of attributes and their possible values for describing bearer services – Step 1.2 of description method (Recommendation I.130)

B.1 *Framework for the static description of bearer services supported by an ISDN*

Static description of the service using attributes is the second step (1.2) of the stage 1 overall service description from the user's point of view (Recommendation I.130). These attributes are described and defined in Recommendation I.140. Attributes to describe bearer services are intended to be independent and are grouped into three categories:

i) *information transfer attributes* which characterize the network capabilities for transferring information from one S/T reference point to one (or more) other S/T reference point(s), corresponding to access points 2 and 1 as defined in Recommendation I.210;

ii) *access attributes* which describe the means for accessing network functions or facilities as seen at one S/T reference point; and

iii) *general attributes* which deal with the service in general.

Figure B-1/I.210 shows the relation between the groups of attributes and their fields of applicability. § B.2 gives the list of the attributes. For the definitions and possible values of these attributes, see Recommendation I.140.

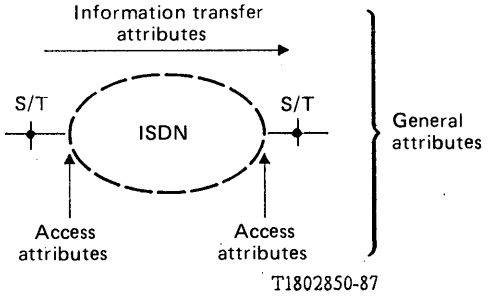


FIGURE B-1/I.210

Relationship between the groups of attributes and fields of applicability

B.2 *List of bearer service attributes*

Information transfer attributes

1. Information transfer mode
2. Information transfer rate
3. Information transfer capability
4. Structure
5. Establishment of communication
6. Symmetry
7. Communication configuration

Access attributes (Note)

8. Access channel and rate
9. Access protocol

General attributes

10. Supplementary services provided
11. Quality of Service
12. Interworking possibilities
13. Operational and commercial

Note – Different access attributes may apply at each of the (two or more) network interfaces involved in the use of a bearer service.

Table B-1/I.210 presents a list of possible values for each attribute. Where options exist for a given attribute, the selection is subject to agreement between the customer and the Administration.

According to Recommendation I.210 the bearer capability defines the technical features of a bearer service as they appear to the user at the S/T reference point. The bearer capability is characterized by information transfer and access attributes. A bearer capability is associated with every bearer service.

TABLE B-1/I.210

Values for each bearer service attribute

Attributes [a]	Possible values of attributes											
Information transfer attributes 1. Information transfer mode	Circuit										Packet	
2. Information transfer rate	Bit rate (kbit/s)										Throughput	
	64	2 × 64	384	1536	1920	Other values for further study					Options for further study	
3. Information transfer capability	Unrestricted digital information		Speech	3.1 kHz audio	7 kHz audio	15 kHz audio					Video	Others for further study
4. Structure	8 kHz integrity		Service data unit integrity [b]								Unstructured	TSSI [c] RDTD [d]
5. Establishment of communication [e]	Demand		Reserved								Permanent	
6. Symmetry	Unidirectional		Bidirectional symmetric								Bidirectional asymmetric	
7. Communication configuration	Point-to-point		Multipoint								Broadcast [f]	
Access attributes 8. Access channel and rate	D (16)	D (64)	B	H_0	H_{11}	H_{12}					Others for further study	
9.1 Signalling access protocol layer 1	Rec. I.430/ Rec. I.431	Rec. I.461	Rec. I.462	Rec. I.463	(Rec. V.120) Rec. I.465						Others for further study	
9.2 Signalling access protocol layer 2	Rec. I.440/ Rec. I.441		Rec. I.462	Rec. X.25	Others for further study							
9.3 Signalling access protocol layer 3	Rec. I.450/ Rec. I.451		Rec. I.461	Rec. I.462	Rec. X.25	Rec. I.463					Others for further study	
9.4 Information access protocol layer 1	Rec. I.430/ Rec. I.431	Rec. I.460 [g]	Rec. I.461	Rec. I.462	Rec. I.463	(Rec. V.120) Rec. I.465	Rec. G.711	Rec. G.722	Others for further study			
9.5 Information access protocol layer 2	HDLC LAPB	I.440/ I.441	Rec. X.25	Rec. I.462	Others for further study							
9.6 Information access protocol layer 3 [h]	T.70-3	Rec. X.25		Rec. I.462	Others for further study							
General attributes 10. Supplementary services provided 11. Quality of service 12. Interworking possibilities 13. Operational and commercial aspects	Under study											

Notes to Table B-1/I.210

a) The attributes are intended to be independent of each other.

b) The need for a "data sequence integrity" attribute is for further study.

c) Time slot sequence integrity (TSSI).

d) Restricted differential time delay (RDTD).

e) A definition of the establishment of communication is given in Recommendation I.140.

f) The characterization of the information transfer configuration attribute "broadcast" is for further study.

g) The inclusion of Recommendation I.460 implies the support of non-ISDN CCITT standardized services (e.g., at X.1 rate). The necessary user-network signalling is provided in Recommendation I.451.

h) The use of Recommendation I.451 as an information access protocol is for further study.

ANNEX C

(to Recommendation I.210)

List of attributes and their possible values for describing teleservices – Step 1.2 of description method (Recommendation I.130)

C.1 *Framework for the static description of teleservices supported by an ISDN*

A static description of the service using attributes is the second step (step 1.2) of the stage 1 overall service description from the user's point of view (Recommendation I.130). These attributes are described and defined in Recommendation I.140.

Attributes to describe teleservices supported by an ISDN are intended to be largely independent. They are grouped into three categories:

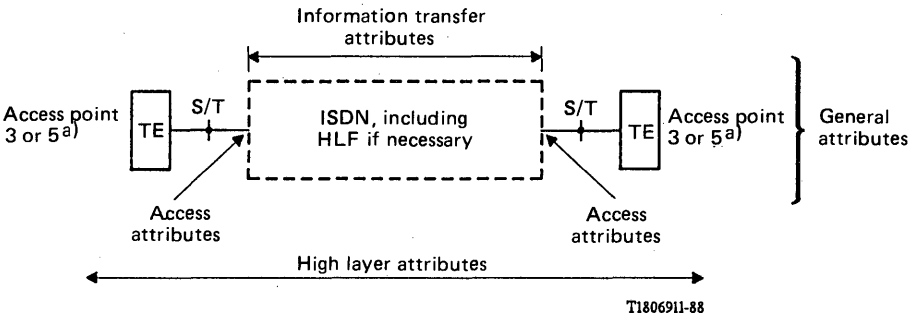
a) low layer attributes
   - information transfer attributes,
   - access attributes;

b) high layer attributes;

c) general attributes.

Note – Teleservices generally make use of underlying lower layer capabilities of bearer services specified in the I.230-Series of Recommendations. However, where teleservices are provided by a single administration, RPOAs or other service providers, the combination of values of lower layer attributes applicable to specific teleservices may not necessarily be identical to any of those identified for the bearer services appearing in the I.230-Series of Recommendations.

Figure C-1/I.210 shows the relationship between the different categories of service attributes and their scope within a teleservice.



a) See Figure 1/I.210

FIGURE C-1/I.210

Relationship between the categories of service attributes and their scope with a teleservice

C.2 *List of the teleservice attributes*

Low layer attributes

Information transfer attributes

1. Information transfer mode
2. Information transfer rate
3. Information transfer capability
4. Structure
5. Establishment of communication
6. Symmetry
7. Communication configuration

Access attributes

8. Access channel and rate
9. Access protocol
9.1 Signalling access protocol layer 1
9.2 Signalling access protocol layer 2
9.3 Signalling access protocol layer 3
9.4 Information access protocol layer 1
9.5 Information access protocol layer 2
9.6 Information access protocol layer 3

High layer attributes

10. Type of user information
11. Layer 4 protocol functions
12. Layer 5 protocol functions
13. Layer 6 protocol functions

- Resolution
- Graphic mode

} if applicable

14. Layer 7 protocol functions

- TE-to-TE protocol functions
- TE-to-HLF protocol functions

} if applicable (Note)

General attributes

15. Supplementary services provided
16. Quality of Service
17. Interworking possibilities
18. Operational and commercial

Note – These attribute values are shown in order to give an example of a description of a teleservice appliction involving terminals at both access points (3 or 5) and an intervening system providing HLF functions (see Figure 3*c*/I.210 and Figure 3*e*/I.210). A specific teleservice attribute description for this case is for further study.

Table C-1/I.210 presents a list of possible values for each service attribute. Where optional values of given attributes are offered, their selection is subject to agreement between the customer and service provider.

TABLE C-1/I.210

Possible values for each teleservice attribute

Attributes [a]	Possible values of attributes						
Information transfer attributes 1. Information transfer mode	Circuit						Packet
2. Information transfer rate	Bit rate (kbit/s)						Throughput
	64	Other values for further study					Options for further study
3. Information transfer capability	Unrestricted digital information	Speech	3.1 kHz audio	7 kHz audio	Others for further study		
4. Structure	8 kHz integrity	Service data unit integrity			Unstructured		Others for further study
5. Establishment of communication [b]	Demand	Reserved			Permanent		
6. Symmetry	Unidirectional	Bidirectional symmetric			Bidirectional asymmetric		
7. Communication configuration	Point-to-point	Multipoint			Broadcast [c]		
Access attributes 8. Access channel and rate	D (16)	D (64)		B	Others for further study		
9.1 Signalling access protocol layer 1	Rec. I.430/ Rec. I.431	Rec. I.461	Rec. I.462	Rec. I.463	Rec. I.465 (Rec. V.120)	Others for further study	
9.2 Signalling access protocol layer 2	Rec. I.440/ Rec. I.441		Rec. I.462	Rec. X.25	Others for further study		
9.3 Signalling access protocol layer 3	Rec. I.450/ Rec. I.451		Rec. I.461	Rec. I.462	Rec. X.25	Rec. I.463	Others for further study
9.4 Information access protocol layer 1	Rec. I.430/ Rec. I.431	Rec. I.460	Rec. I.461 (Rec. X.30)	Rec. I.462 (Rec. X.31)	Rec. I.463 (Rec. V.110)	Rec. I.465 (Rec. V.120)	Rec. G.711	Others for further study
9.5 Information access protocol layer 2	HDLC LAPB		Rec. I.440/ Rec. I.441	Rec. X.75 SLP	Rec. X.25 LAPB	Others for further study	
9.6 Information access protocol layer 3	ISO 8208 [d] (Rec. X.25 PLP)			Rec. X.25 PLP	Others for further study		

TABLE C-1/I.210 *(cont.)*

Possible values for each teleservice attribute

Attributes [a]	Possible values of attributes								
10. Type of user information	Speech (telephony)	Sound	Text (Teletex)	Facsimile (Telefax 4)	Text-facsimile (Mixed mode)	Videotex	Video	Text interactive (Telex)	Other
11. Layer 4 protocol	Rec. X.224			Rec. T.70		Others for further study			
12. Layer 5 protocol	Rec. X.225			Rec. T.62		Others for further study			
13. Layer 6 protocol	T.400-Series		Rec. G.711	Rec. T.61	Rec. T.6	Others for further study			
Resolution [e] [f]	200 ppi		240 ppi	300 ppi	400 ppi	Others for further study			
Graphic mode [f]	Alpha-mosaic	Geometric		Photographic		Others for further study			
14. Layer 7 protocol	Rec. T.60			T.500-Series		Others for further study			
General attributes	Under study								

SLP Single link protocol
PLP Packet layer protocol
ppi Picture elements per inch

[a] The attributes are intented to be independent of each other.

[b] A definition of the establishment of communication is given in Recommendation I.140.

[c] The characterization of the information transfer configuration attribute "broadcast" is for further study.

[d] For those teleservices that use circuit mode bearer capability X.25 PLP description is as per ISO 8208.

[e] These attribute values are mentioned in order to give an example of a specific presentation description of characteristics such as coding of the user information, resolution, and graphic mode. Attribute values for other presentation characteristics are for further study.

[f] If applicable.

ANNEX D

(to Recommendation I.210)

Dynamic description of the service using graphic means – Step 1.3 of description method (Recommendation I.130)

D.1 *Introduction*

Dynamic description of the service using graphic means is the third step (1.3) of the stage 1 overall service description from the user's point of view (Recommendation I.130).

The dynamic description of a service contains all the information that is sent and received by the user from activation/invocation of the service to completion of the service. The information is presented in the form of an Overall Specification and Description Language (SDL) diagram or state transition diagrams.

Note – Currently, state transition diagrams are not used for the dynamic descriptions of services.

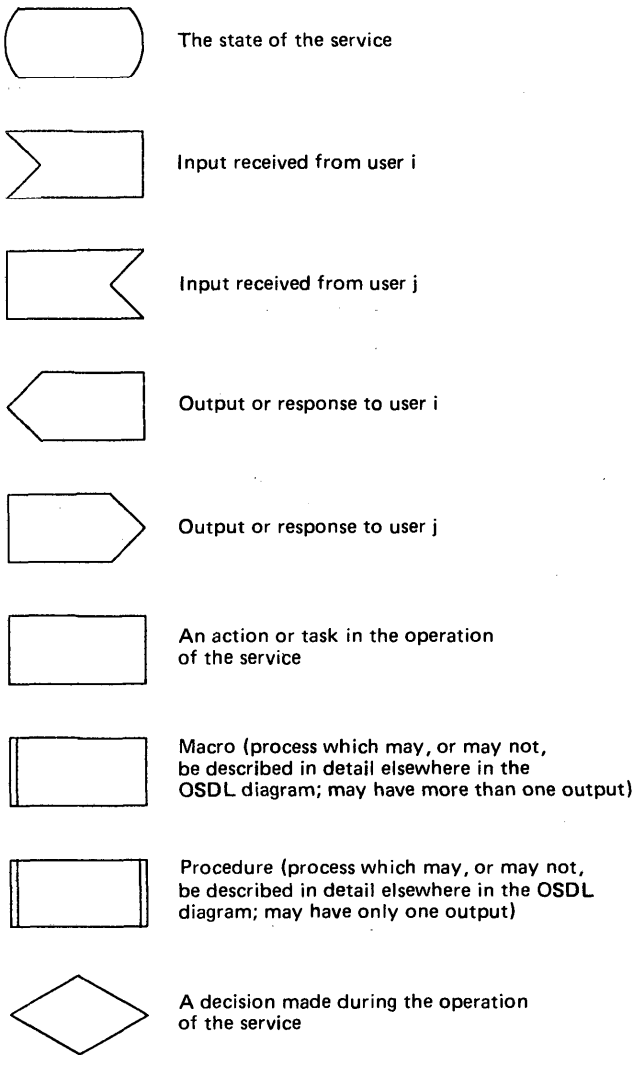
An overall SDL diagram shows the flow of events and states within the service, in a time-sequenced format, and identifies all possible actions relevant to the service as perceived by the user. It treats the network as a single entity, that is, no information flows between nodes within the network are considered.

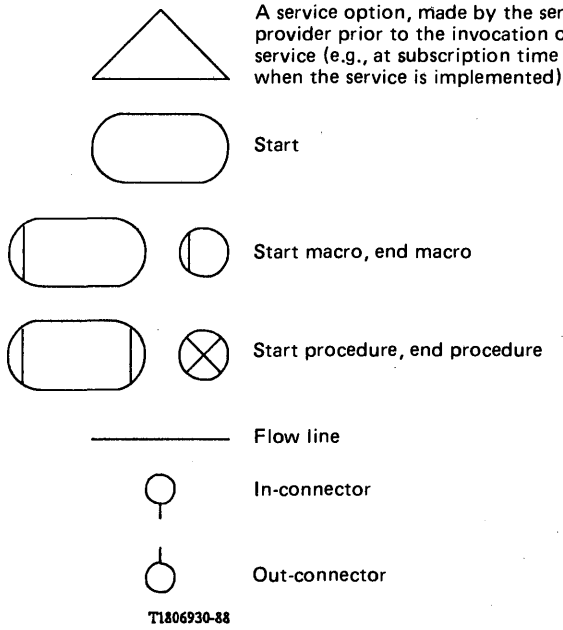
SDL diagrams, drawn according to the principles laid down in Recommendation Z.100, are included in step 1.3 in order to help to clarify and support the processing and information flows necessary for each service.

D.2 *Overall specifications and description language (OSDL) diagrams*

In this third step of stage 1 each service state is shown in conjunction with all the external or internal actions which cause state changes. The actions may be inputs from users or the outcome of an internal process. Ideally all situations are included in a single diagram although the diagram may have to be distributed over more than one document because of its complexity.

The symbols used in OSDL diagrams and their meanings are as follows:




A service option, made by the service provider prior to the invocation of the service (e.g., at subscription time or when the service is implemented)
Start
Start macro, end macro
Start procedure, end procedure
Flow line
In-connector
Out-connector
T1806930-88

PAGE INTENTIONALLY LEFT BLANK

PAGE LAISSEE EN BLANC INTENTIONNELLEMENT

SECTION 2

COMMON ASPECTS OF SERVICES IN THE ISDN

Recommendation I.220

COMMON DYNAMIC DESCRIPTION OF BASIC TELECOMMUNICATION SERVICES

(Melbourne, 1988)

1 Introduction

This Recommendation provides the dynamic description of basic telecommunication services. The dynamic description for basic telecommunication services using the circuit-mode means of service establishment/disestablishment is provided in § 2. The packet-mode description is for further study.

The dynamic description shows the flow of events, and states within the service, in a time-sequenced format and identifies all possible actions relevant to the service as perceived by end-users.

Although the service is described from the end-user perspective it does not concern details of the human-to-machine interface itself. In addition, the service description considers the network as a single entity. For example, information flows between nodes within the network are not shown.

End-user perceptions of the service are shown in terms of "user/network" interactions. Internal network actions are included whenever they are or can be perceived by an end-user during the operation of the service, and as required by SDL drawing rules.

The terminology and the meaning of the "user/network" interactions are provided in Annex A. The means for developing dynamic descriptions, e.g. the SDL symbols and their usage, is further elaborated in Recommendation I.210.

Note – In the development of the circuit-mode dynamic description, the bearer services (speech, 3.1 kHz audio, unrestricted) and the teleservices (telephony, Teletex, Telefax 4, mixed-mode and Videotex) were considered. Others are for further study.

2 Circuit-mode dynamic description of basic bearer services and teleservices

See Annex A for terminology used in Figures 1/I.220 to 6/I.220.

In Figures 1/I.220 to 6/I.220, the following notes are common:

Note 1 – This is an event which may occur at the S/T reference point and can be reflected at the user interface.

Note 2 – This is an event which may occur at the S/T reference point but is not reflected at the user interface.

Note 3 – In some networks this decision is optional, that is, multipoint operation is assumed.

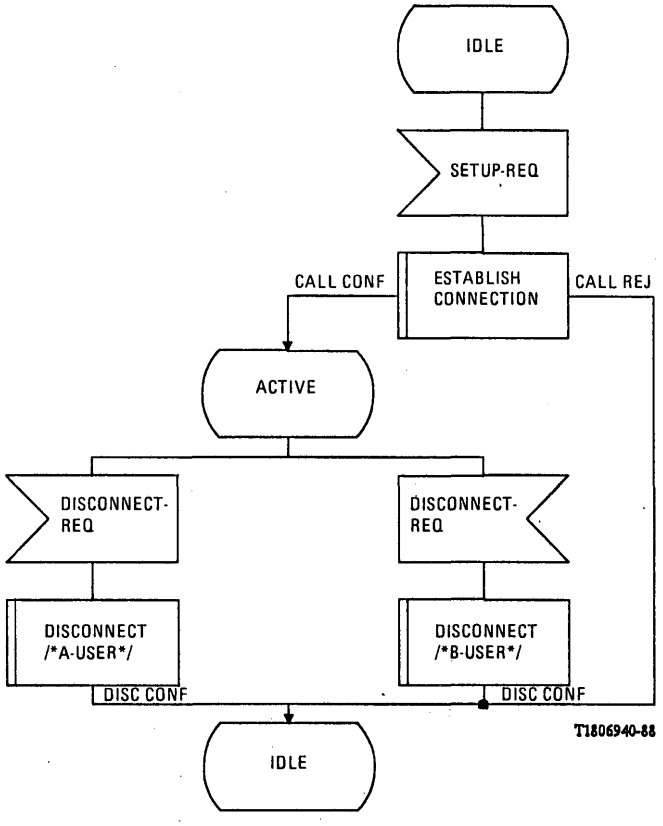


FIGURE 1/I.220

Basic call process

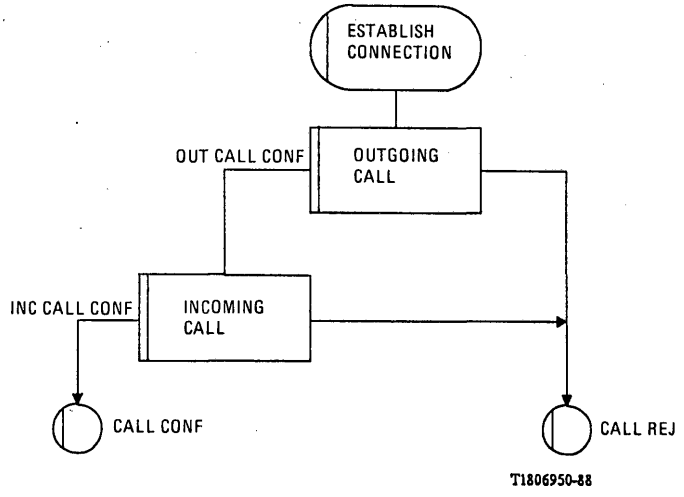
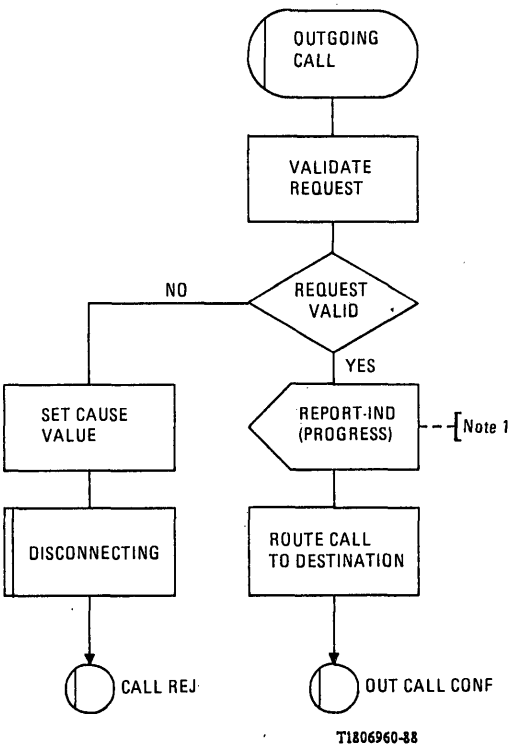


FIGURE 2/I.220

Basic call process; macro definition: establish connection



Note 1 – For Note 1 see beginning of § 2.

FIGURE 3/I.220

Basic call process; macro definition: outgoing call

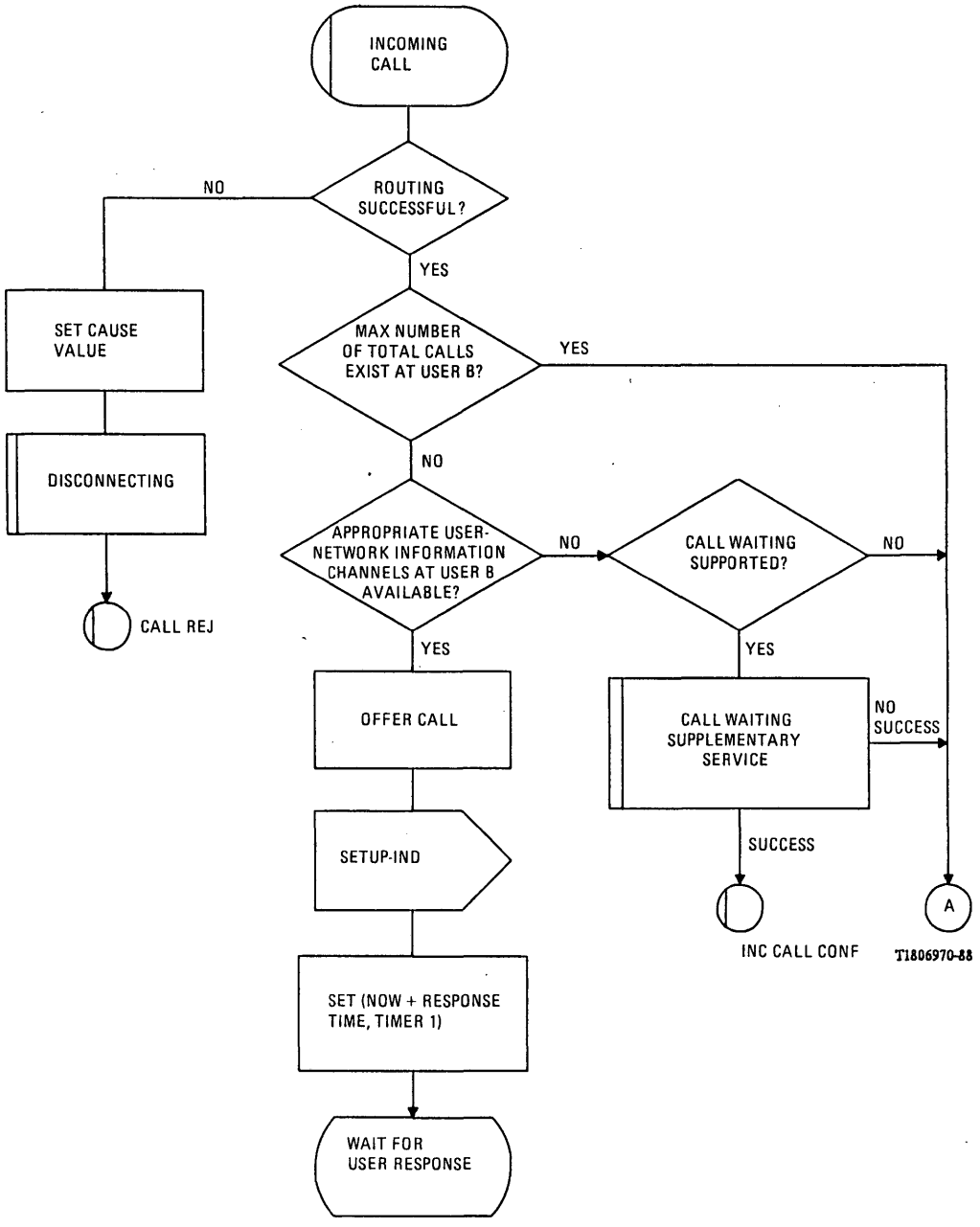
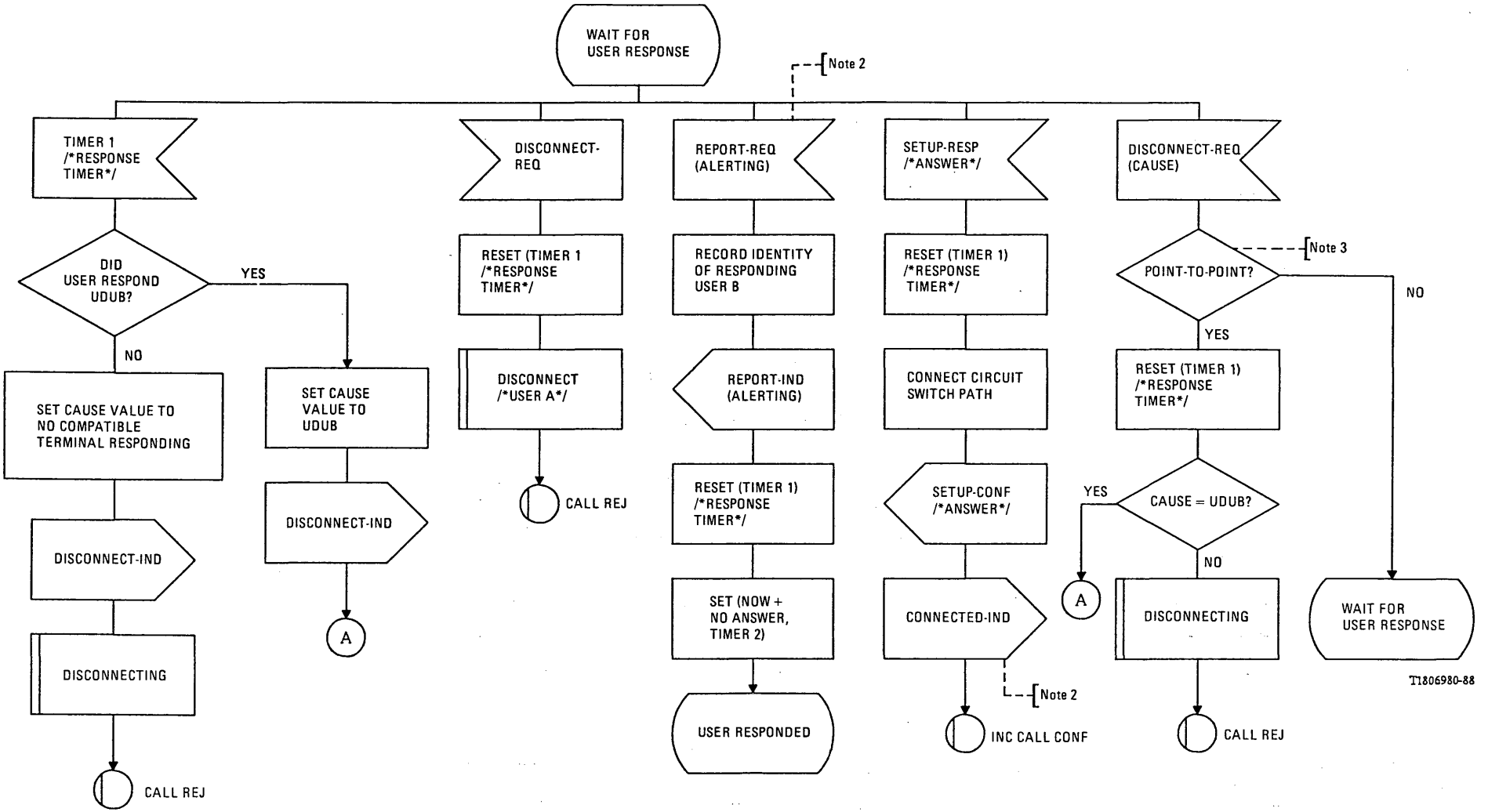


FIGURE 4/I.220 (sheet 1 of 4)

Basic call process; macro definition: incoming call

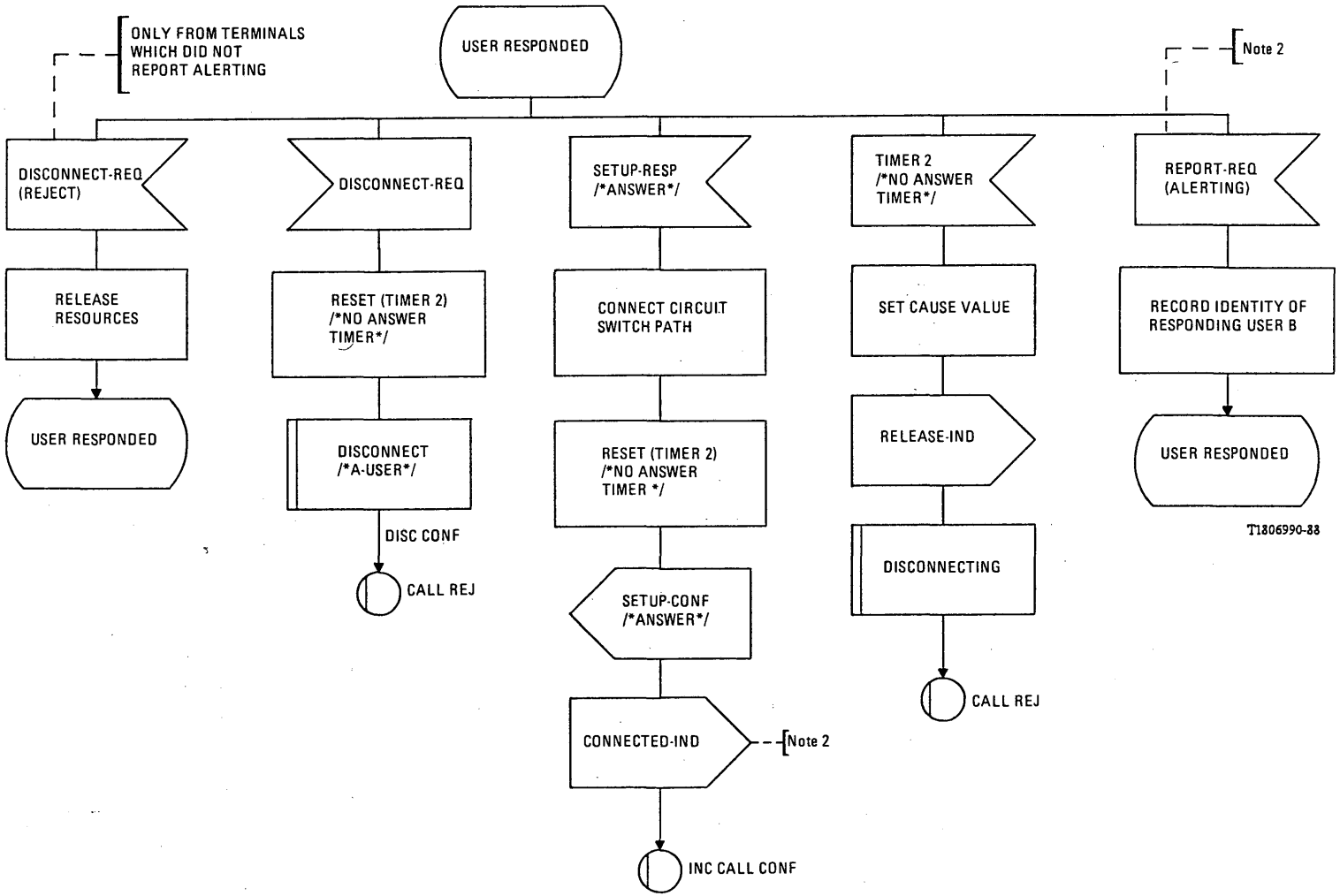


Note 2 – For Note 2 see beginning of § 2.

Note 3 – For Note 3 see beginning of § 2.

FIGURE 4/I.220 (sheet 2 of 4)

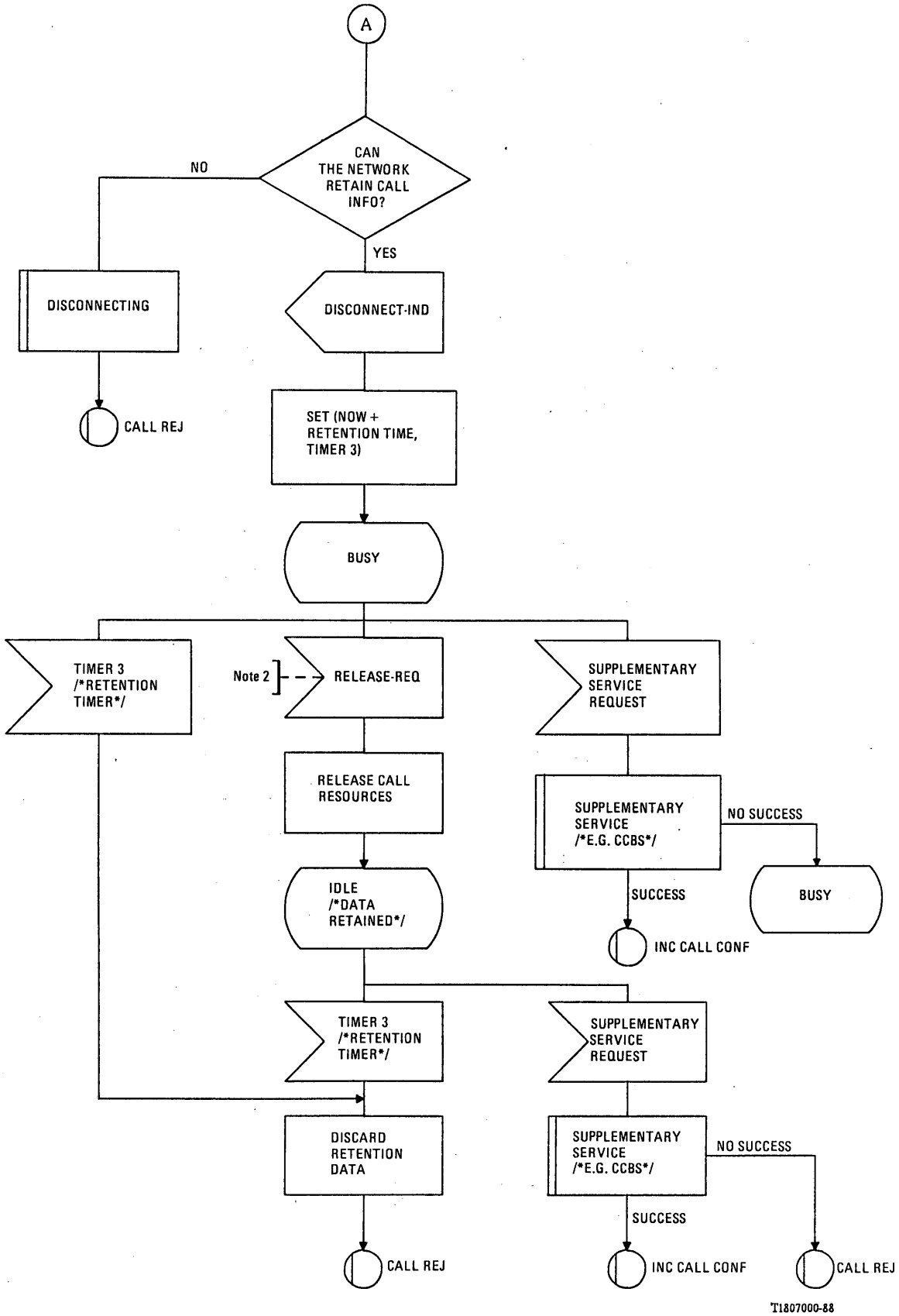
Basic call process; macro definition: incoming call



Note 2 – For Note 2 see beginning of § 2.

FIGURE 4/I.220 (sheet 3 of 4)

Basic call process; macro definition: incoming call

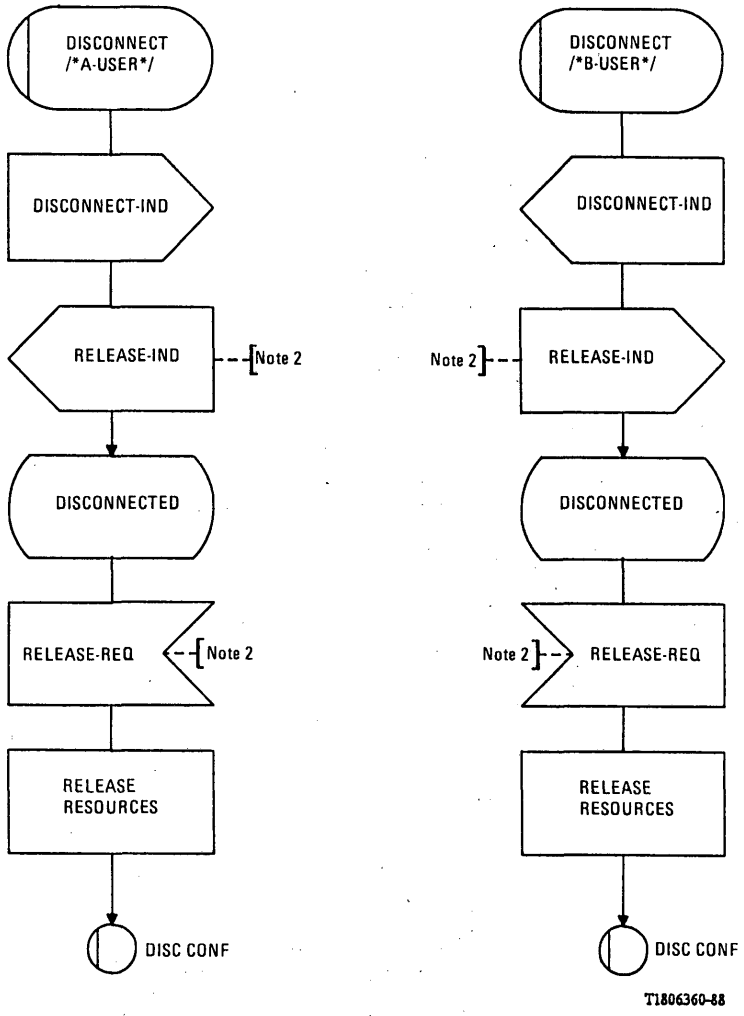


CCBS Completion of call to busy subscriber

Note 2 – For Note 2 see beginning of § 2.

FIGURE 4/I.220 (sheet 4 of 4)

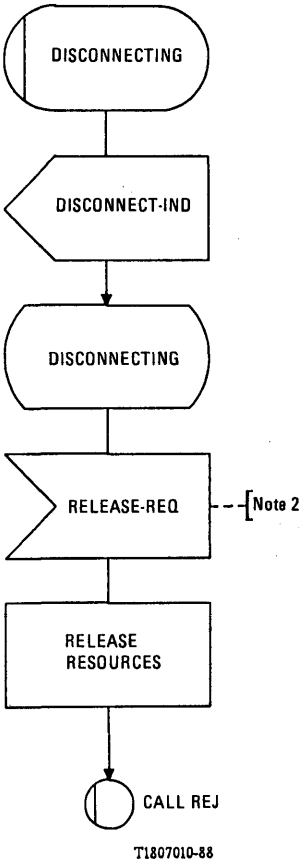
Basic call process; macro definition: incoming call



Note 2 – For Note 2 see beginning of § 2.

FIGURE 5/I.220

Basic call process; macro definitions:
disconnect/*A-user*/ and disconnect/*B-user*/



Note 2 – For Note 2 see beginning of § 2.

FIGURE 6/I.220

Basic call process; macro definition: disconnecting

ANNEX A

(to Recommendation I.220)

Terminology for "user/network" interactions

SETUP	Interaction across the "user/network" interface regarding a service request.
REPORT	Interaction across the "user/network" interface regarding alerting of the user's terminal function, interworking whih a non-ISDN network, or routing progress.
CONNECT	Interaction across the "user/network" interface regarding completion of circuit cut-through.
DISCONNECT	Interaction across the "user/network" interface regarding a user who has disconnected, or regarding a user A who cannot be connected (e.g. busy) to a user B.
RELEASE	Interaction across the "user/network" interface regarding freeing of resources associated with the call/connection, such as call references and channels.
NDUB	Network determined user busy.
UDUB	User determined user busy.

Recommendation I.221

COMMON SPECIFIC CHARACTERISTICS OF SERVICES

(Melbourne, 1988)

1 Introduction

The principles of telecommunication services supported by an ISDN and the means to describe them are given in Recommendation I.210.

The attribute technique and values of attributes, which form part of the standardized description method, (see Recommendation I.130) for services, are given in Recommendation I.140.

This Recommendation refers to and details the common specific characteristics of services for both basic services and supplementary services.

2 Scope and content of the Recommendation

This Recommendation identifies and describes those common specific characteristics of services which are a common feature of each of the individual services and which help to form a relationship between services.

These characteristics are used in a consistent manner throughout the ISDN services and are intended to be service independent. They are used, for instance, to help to identify the situations under which certain supplementary services are invoked during the operation of basic services.

3 Common specific characteristics

3.1 *Definition of "busy" in an ISDN*

3.1.1 *Scope*

This section describes the conditions under which a given ISDN destination is considered "busy". In general, this occurs whenever the resources associated with that destination (and needed to successfully complete the call) exist but are not available for the call. In existing networks, such as the PSTN, this is indicated to the calling subscriber by "busy tone".

In addition, the operation of certain ISDN supplementary services occurs when certain of these resources are busy. Therefore, these "resource busy" conditions are also described herein.

This section does not cover the cases where network resources not associated with a given destination are unavailable, or when such resources are out-of-service or otherwise non-funtional.

3.1.2 *Resources*

Two main categories of resources may become involved in the determination of "busy": interface resources and customer resources.

Interface resources include the signalling channel (D-channel), other physical channels (B- and H-channels), logical channels (for packet-mode services) and maximum number of calls supported. It is noted that with the ongoing activities on "calls versus connections" other interface resources may become important in the future.

For the purposes of this Recommendation, the signalling channel is considered to be always available and with sufficient capacity to handle signalling for new calls. Situations where this is not true are considered to be "failure conditions" and are not covered here. For the other interface resources, descriptions are given below of what is meant when they are considered busy.

Subscriber resources include the terminal(s) themselves and the persons or processes using them. For the purposes of this Recommendation, it is not considered significant which of the subscriber resources are busy, or why. An indication from the subscriber that (some, necessary) subscriber resources are busy is sufficient.

3.1.3 *Resource busy conditions*

Three resource busy conditions have been found necessary to refer to and are defined below:

1) channels busy: this condition occurs when there is no appropriate information channel (physical or logical) available for the network to use for the call.
2) maximum number of total calls reached: this condition occurs when the maximum number of total calls supported at the given subscriber's interface(s) has been reached.
3) subscriber busy: this condition is indicated by the subscriber's terminal equipment, e.g. by having all compatible terminals which could respond to the call request indicate "user busy" either when they are offered a call, or in response to an enquiry from the network.

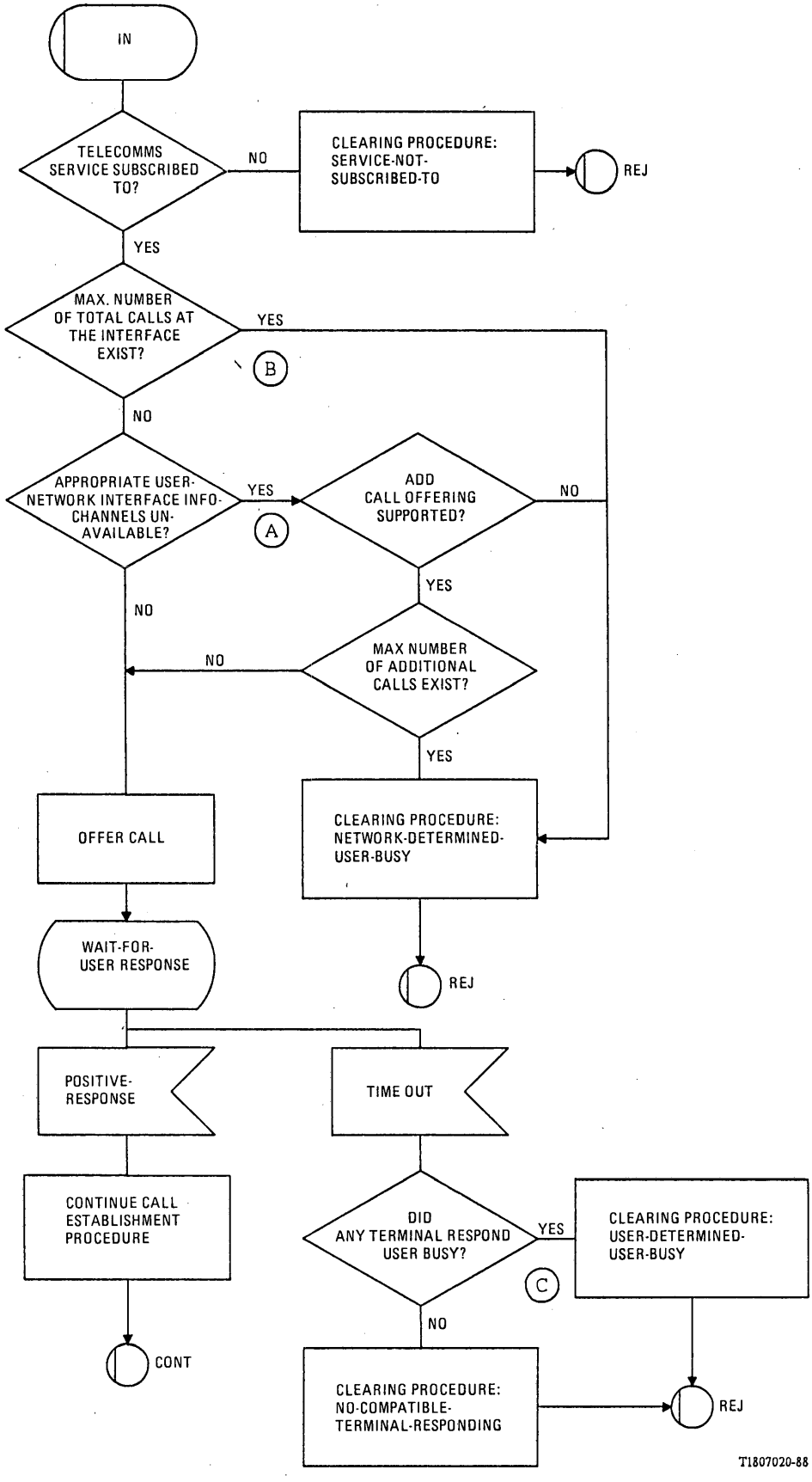
3.1.4 *Procedural aspects*

The resource busy conditions described above significantly influence the call offering procedures, both for the basic ISDN calls and for calls that may involve ISDN supplementary services. The procedural aspects of call offering are outlined below and shown in Figure 1/I.221.

1) Assume that a call of a telecommunications service subscribed to by the called subscriber is about to be offered.
2) If all of the appropriate user-network interface information channels are busy (i.e. channels busy) and either the network does not support the offering of additional calls beyond the number of appropriate channels, or the maximum number of such additional calls has been reached, the network will clear the call [see also item 7, below] and indicate "network determined user busy" back towards the calling subscriber.
3) Similarly, if the maximum number of total calls supported at the given subscriber's interface(s) has been reached, the network will clear the call (see also item 7 below) and indicate "network determined user busy" back towards the calling subscriber.
4) Otherwise, the network offers the call to the subscriber.
5) If any compatible terminal responds "positively" to the call offering, i.e. gives some indication that the call may progress towards successful completion, the normal call offering procedure should continue.
6) If no compatible terminal responds "positively" but one or more compatible terminal responds "user busy", then when the response-to-call-offering timeout occurs, the network will clear the call with the indication "user determined user busy".
7) It is recognized that for the determination of a "network determined user busy" condition, the network does not assume any knowledge of whether or not a compatible terminal exists at the called interface. This may mask the determination of a "no compatible terminal available" condition, i.e. a NDUB condition may be returned when, in fact, no compatible terminal is connected. The use of an explicit compatibility check to prevent this from occuring is a service provider option and is for further study.

3.1.5 *Definition of* **busy**

An ISDN destination is considered to be busy if either a "network determined user busy" or a "user determined user busy" condition occurs, as described above.



Note 1 – This figure illustrates the procedural aspects and the situations which give rise to a clearing procedure containing user busy information. It does not attempt to define any signalling protocol or the design of a network.

Note 2 – Points (A), (B) and (C) have been identified to assist in the description of ISDN supplementary services.

Note 3 – The capability to support additional call offerings and the determination of the maximum number of such additional calls, may involve the use of a supplementary service, e.g. call waiting.

FIGURE 1/I.221

Macro definition: busy-in-an-ISDN

SECTION 3

BEARER SERVICES SUPPORTED BY AN ISDN

Recommendation I.230

DEFINITION OF BEARER SERVICE CATEGORIES

(Melbourne, 1988)

1 General

Recommendation I.210 describes the principles for defining telecommunication services supported by an ISDN, including the concept of bearer services, bearer capabilities and teleservices. It also provides the tools for the definition and description of such services.

The purpose of this Recommendation is to define a recommended set of bearer service categories that may be supported by an ISDN together with their overall provision. These definitions form the basis for detailed descriptions of circuit mode bearer services as given in Recommendation I.231 and packet-mode bearer services as given in Recommendation I.232 and their associated bearer capabilities, which are used to define the network capabilities required.

Bearer services are fully described by prose definitions and descriptions, by attributes and by dynamic descriptions, which altogether define the service characteristics as they apply at a given reference point where the customer accesses the service. Recommendation I.140 and Recommendation I.210, Annex B describe the use of attributes for this purpose.

2 Definition of bearer services

This section identifies several bearer services accessed via the standard network access provided by an ISDN. The identification of possible additional services such as subrate services is left for further study.

These possible additional services would not lead to any additional requirements to those already identified for physical characteristics of interfaces to be applied at reference points S and/or T (see Recommendation I.411).

The definition of bearer services is based upon the list of attributes as given in Table B-1/I.210. The information transfer attributes Nos. 1-4 are called "dominant attributes". They are used to identify a particular bearer service category. Information transfer attributes Nos. 5-7 are called "secondary attributes". They are used to identify individual bearer services within one category. "Access attributes" as well as "general attributes" are used to further specify an individual bearer service. They are called "qualifying attributes". The principles of categorizing bearer services is presented in Figure 1/I.230.

2.1 *Circuit-mode bearer service categories*

These bearer service categories are typically characterized by the provision of user information over one type of channel and signalling over another type of channel.

The use of the channel which conveys signalling information also to provide user-to-user information transfer is described in the user-to-user signalling supplementary service as given in Recommendation I.257.

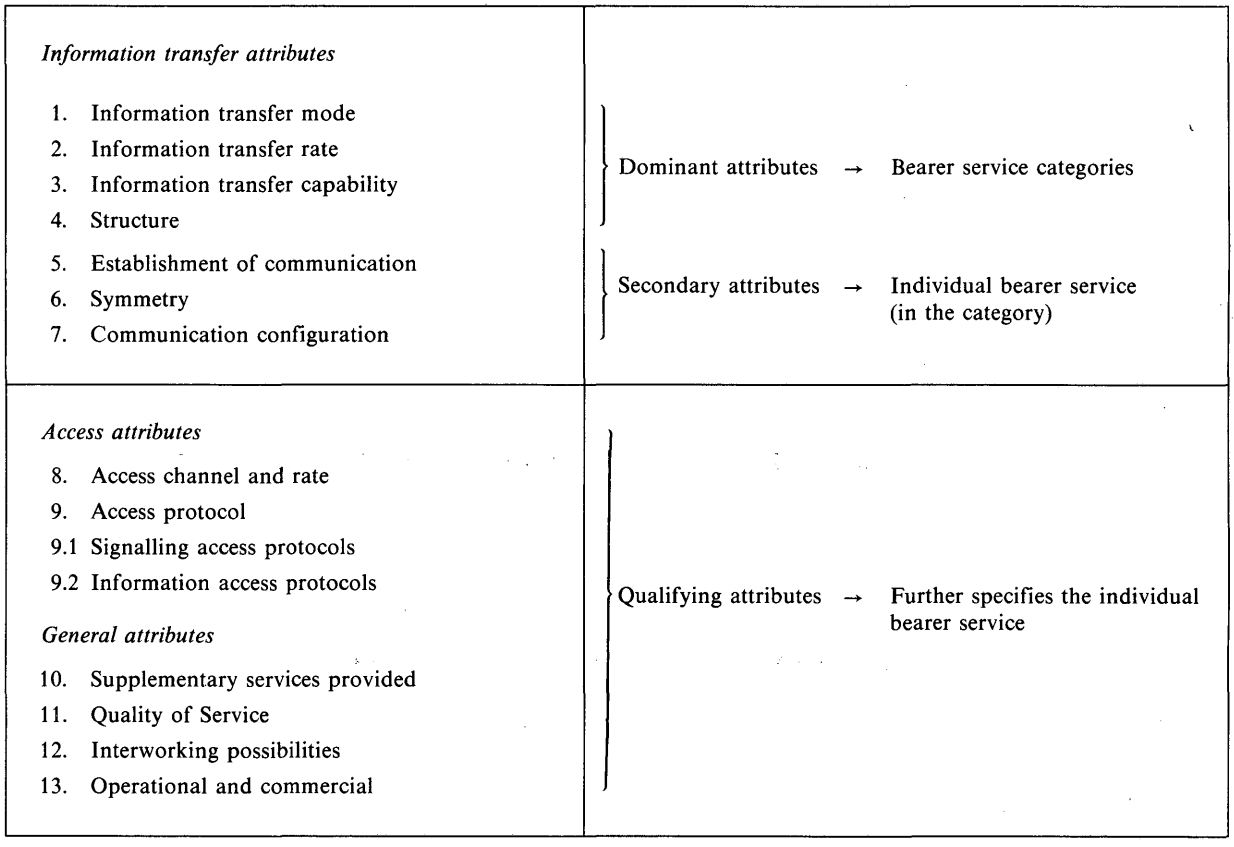


FIGURE 1/I.230

Categories of attributes

The following circuit-mode bearer service categories have been identified so far:

I.231.1 64 kbit/s unrestricted, 8 kHz structured

I.231.2 64 kbit/s, 8 kHz structured, usable for speech information transfer

I.231.3 64 kbit/s, 8 kHz structured, usable for 3.1 kHz audio information transfer

I.231.4 Alternate speech / 64 kbit/s unrestricted, 8 kHz structured

I.231.5 2 × 64 kbit/s unrestricted, 8 kHz structured

I.231.6 384 kbit/s unrestricted, 8 kHz structured

I.231.7 1536 kbit/s unrestricted, 8 kHz structured

I.231.8 1920 kbit/s unrestricted, 8 kHz structured

The prose descriptions (step 1.1) and static descriptions (step 1.2) of these services are given in Recommendation I.231. A common dynamic description (step 1.3) for I.231.1, I.231.2, and I.231.3 is given in Recommendation I.220 for demand services only.

2.2 *Packet-mode bearer service categories*

These bearer services involve packet handling functions.

The following packet-mode bearer service categories have been identified so far and are described in Recommendation I.232:

I.232.1 Virtual call and permanent virtual circuit

I.232.2 Connectionless (Note)

I.232.3 User signalling (Note)

Note – These services require further study and their descriptions are not yet included.

3 Recommended provision of bearer services

In order to facilitate the development of compatible ISDNs and related user equipment, Recommendations I.231 and I.232 outline the recommended provision of bearer services defined in this Recommendation. This consists of three parts:

a) description of the service category by the dominant attributes, i.e., information transfer mode, information transfer rate, type of information transfer capability and structure attributes. The recommended provision of services of the overall bearer service category is described as:

   E an essential bearer service category to be made available internationally

   A an additional bearer service category which may be available in some ISDNs and which may also be available internationally

   FS the recommended provision of this bearer service category is for further study.

b) within each bearer service category, a description of the agreed secondary attributes, i.e. establishment of communication, symmetry and information transfer configuration attributes. If an ISDN supports the bearer service category, the recommended provision of these secondary attribute combinations within this category are described as:

   E an essential combination of attributes to be made available internationally (when an ISDN supports the particular overall bearer service category).

   A an additional combination of attributes which may be available in some ISDNs and which may also be available internationally (when an ISDN supports the particular overall bearer service category).

   FS the recommended provision of this combination of attributes is for further study.

c) within each bearer service category a description of the agreed qualifying attributes, e.g. channel/rate and protocol access attributes for user information and for signalling OAM information. If an ISDN supports the bearer service category, the recommended provision of these qualifying attributes within this category are described as:

   E an essential access arrangement to be made available (when an ISDN supports the particular overall bearer service category)

   A an additional access arrangement which may be available in some ISDNs (when an ISDN supports the particular overall bearer service category).

   FS the recommended provision of this access arrangement is for further study.

Note 1 – During an evolutionary period, not all items marked "E" will be provided in all networks.

Note 2 – Attributes 10-13 are for further study.

The recommended overall provision of bearer service categories, as given in Recommendations I.231 and I.232, is summarized in Table 1/I.230.

4 Prose definitions of bearer service categories

In order to give an overview of the bearer service categories identified, their definitions as given in Recommendations I.231 and I.232 are reproduced in this section.

4.1 *Circuit-mode bearer service categories*

I.231.1 Circuit-mode, 64 kbit/s unrestricted, 8 kHz structured bearer service category

This bearer service category provides unrestricted information transfer between S/T reference points. It may, therefore, be used to support various user applications. Examples include:

- speech;
- 3.1 kHz audio;
- multiple subrate information streams multiplexed into 64 kbit/s by the user;
- transparent access to an X.25 public network [I.462 case a)].

User information is transferred over a B-channel, signalling is provided over a D-channel.

TABLE 1/I.230

Recommended overall provision of bearer service categories

Circuit-mode bearer service categories		
1)	64 kbit/s unrestricted	E
2)	Speech	E
3)	3.1 kHz audio	E
4)	Alternate speech / 64 kbit/s unrestricted	A
5)	2 × 64 kbit/s unrestricted	A
6)	384 kbit/s unrestricted	A
7)	1536 kbit/s unrestricted	A
8)	1920 kbit/s unrestricted	A
Packet-mode bearer service categories		
1)	Virtual call and permanent virtual circuit	E
2)	Connectionless	FS
3)	User signalling	FS

I.231.2 Circuit-mode 64 kbit/s, 8 kHz structured bearer service category usable for speech information transfer

This bearer service category is intended to support speech.

The digital signal at the S/T reference point shall conform to Recommendation G.711 (A-law or μ-law). The network may use processing techniques appropriate for speech such as analogue transmission, echo cancellation and low-bit rate voice encoding. Hence, bit integrity is not assured. This bearer service category is not intended to support modem derived voice-band data.

All Recommendations for the transfer of speech information in the network apply to this bearer service category.

I.231.3 Circuit-mode 64 kbit/s, 8 kHz structured bearer service category usable for 3.1 kHz audio information transfer

This bearer service category corresponds to the service which is currently offered in the PSTN. This bearer service category provides for the transfer of speech and of 3.1 kHz bandwidth audio information suh as voice-band data via modems and facsimile group 1, 2 and 3 information. The digital signal at the S/T reference point shall conform to Recommendation G.711 (A-law or μ-law).

Connections provided for these services should offer the transfer capability for the information indicated above. (This means that the network may include speech processing techniques provided they are appropriately modified or functionally removed prior to non-speech information transfer.) The control of echo control devices, speech processing devices, etc., is only made by use of disabling tones (see Recommendation V.25). Bit integrity is not assured. The network may use analogue transmission.

All Recommendations for the transfer of speech information in the network apply to this bearer service category.

I.231.4 Circuit-mode, alternate speech/64 kbit/s unrestricted, 8 kHz structured bearer service category

This bearer service category provides the alternate transfer of either speech or 64 kbit/s unrestricted digital information within the same call.

The request for this alternate capability and the intial mode desired by the user must be identified at call set-up time.

This bearer service category is provided for the support of multiple capability terminals or single capability terminals.

For the speech mode of this bearer service, the same applies as for the speech bearer service category. For the unrestricted mode of this bearer service category, the same applies as for the unrestricted bearer service category.

I.231.5 Circuit-mode 2 × 64 kbit/s unrestricted, 8 kHz structured bearer service category

This bearer service category provides the unrestricted transfer of two 64 kbit/s user information flows over two B-channels at the user network interface.

I.231.6 Circuit-mode 384 kbit/s unrestricted, 8 kHz structured bearer service category

This bearer service category provides the unrestricted transfer of 384 kbit/s user information over a H_0 channel at the S/T reference point. The transfer of OAM information for reserved and permanent services may be provided over a D-channel in the same or in another interface structure.

I.231.7 Circuit-mode 1536 kbit/s unrestricted, 8 kHz structured bearer service category

This bearer service category provides the unrestricted transfer of 1536 kbit/s user information over a H_{11} channel at the *S/T* reference point. The transfer of OAM information for reserved and permanent services may be provided via a D-channel in another interface structure.

I.231.8 Circuit-mode 1920 kbit/s unrestricted, 8 kHz structured bearer service category

This bearer service category provides the unrestricted transfer of 1920 kbit/s user information over a H_{12} channel at the S/T reference point. The transfer of OAM information for reserved and permanent services may be provided over a D-channel.

4.2 *Packet mode bearer service categories*

I.232.1 Virtual call and permanent virtual circuit bearer service category

This bearer service category provides the unrestricted transfer of user information in a packetized manner over a virtual circuit within a B- or D-channel at the S/T reference point. Signalling information for virtual call and/or possibly OAM information for permanent virtual circuit services are transferred via a D- or B-channel as described in Recommendation I.462 (X.31).

I.232.2 Connectionless packet-bearer service category

The defintion of services in this bearer service category is for further study.

I.232.3 User signalling bearer service category

The definition of services in this bearer service category is for further study.

CIRCUIT-MODE BEARER SERVICE CATEGORIES

(Melbourne, 1988)

Recommendation I.210 describes the principles for defining telecommunication services supported by an ISDN including the concept of bearer services, teleservices and supplementary services. It also provides the means for the definition and description of such services. A recommended set of circuit-mode bearer services categories is defined in Recommendation I.230.

The purpose of this Recommendation is to describe circuit-mode bearer service categories, to describe individual circuit-mode bearer services, and to recommend their provision in ISDN. The definitions and descriptions form the basis to define the network capabilities required for the support of the services in ISDN.

Bearer service categories are described by prose definitions and descriptions, by attributes and their values and by dynamic descriptions following the description method given in Recommendation I.130. The application of the attribute technique and the definitions of these attributes and attribute values is given in Recommendation I.140.

The following set of bearer service categories is currently identified and more may be identified in the future.

I.231.1 Circuit-mode 64 kbit/s unrestricted, 8 kHz structured bearer service category

I.231.2 Circuit-mode 64 kbit/s, 8 kHz structured bearer service category usable for speech information transfer

I.231.3 Circuit-mode 64 kbit/s, 8 kHz structured bearer service category usable for 3.1 kHz audio information transfer

I.231.4 Circuit-mode, alternate speech / 64 kbit/s unrestricted, 8 kHz structured bearer service category

I.231.5 Circuit-mode 2 × 64 kbit/s unrestricted, 8 kHz structured bearer service category

I.231.6 Circuit-mode 384 kbit/s unrestricted, 8 kHz structured bearer service category

I.231.7 Circuit-mode 1536 kbit/s unrestricted, 8 kHz structured bearer service category

I.231.8 Circuit-mode 1920 kbit/s unrestricted, 8 kHz structured bearer service category

1 I.231.1 – **Circuit-mode 64 kbit/s unrestricted, 8 kHz structured bearer service category** (Note 1)

1.1 *Definition*

This bearer service category provides unrestricted information transfer between S/T reference points, it may, therefore, be used to support various user applications. Examples include:

- speech (Note 2);
- 3.1 kHz audio (Note 2);
- multiple subrate information streams multiplexed into 64 kbit/s by the user;
- transparent access to an X.25 public network [Recommendation I.462 case a)].

User information is transferred over a B-channel, signalling is provided over a D-channel.

Note 1 – During an interim period some networks may only support restricted 64 kbit/s digital information transfer capability, i.e. information transfer capability solely restricted by the requirement that the all-zero octet is not allowed. For interworking the rules given in Appendix I of Recommendation I.520 should apply. The interworking functions have to be provided in the network with restricted 64 kbit/s capability. The ISDN with 64 kbit/s transfer capabilities will not be affected by this interworking other than by conveying the appropriate signalling message to and from the ISDN terminal.

Note 2 – Whilst speech and 3.1 kHz audio have been given as applications for this bearer service category, it is recognized that it is the responsibility of the customers to ensure that a compatible encoding scheme is in operation. Customers should also recognize that no network provision can be made for the control of such items as echo and loss, as the network is unaware of the application in use. Furthermore, the Quality of Service attribute value for information transfer delay will indicate the suitability of a particular version of this bearer service for speech.

1.2 *Description*

1.2.1 *General description*

This circuit-mode bearer service category allows:

- two users (e.g. terminals, PABXs) in a point-to-point configuration to communicate via the ISDN using 64 kbit/s digital signals over the B-channel, in both directions continuously and simultaneously for the duration of call;
- three or more users in a multipoint configuration (refer to Recommendation I.254 for the supplementary service description on Three-Party Service and Conference Calling).

1.2.2 *Specific terminology*

Retention timer: this timer specifies the amount of time that the network retains the call information of the original call upon encountering busy or being released. It is a network provider option. The value for this timer is greater than 15 seconds.

1.3 *Procedures*

1.3.1 *Provision/withdrawal*

1.3.1.1 Provision of this service will be by pre-arrangement with the Administration.

1.3.1.2 This bearer service is offered with several subscription options which apply separately to each ISDN number or group of ISDN numbers on the interface. For each subscription option, only one value can be selected. Subscription options for the interface are summarized below:

Subscription option	*Value*
Maximum number of information channels available at user B	– *m*, where *m* is not greater than the number of information channels on the interface
Maximum number of total calls present at user B	– *n*, where *n* is not greater than the number of information channels on the interface

User B can be an ISDN number or group of ISDN numbers on the interface.

Note – More than one ISDN number can be associated with the service/interface only as a part of a supplementary service such as multiple subscriber number. In the case of one ISDN number, the option given above for the number of calls can only exceed the number of information channels in association with a supplementary service (e.g. call waiting). As a network provider option, separate values may be specified for incoming and for outgoing calls for either or both of the limits.

1.3.2 *Normal procedures*

All user-network signalling is done on the D-channel.

a) *Originating the service (call set-up)*

The call is originated by the user requesting from the network the required bearer service; the request includes a number identifying the called user. Other information, as required, for the bearer service and for use by the network in supplementary services provided to the called user (e.g. calling line identity) may also be included. This request may be given to the network either *en bloc*, containing all the required information, or not *en bloc*.

b) Indications during call set-up

After initiating a call the calling user will receive an acknowledgement that the network is able to process the call. The called user will receive an indication of the arrival of an incoming call of this bearer service.

The calling user shall also be given an indication that the incoming call is being offered to the called user, when an indication is received by the network that the called user is being informed of this call. When the call reaches the called user and the connection is established, an indication of this is sent to the calling user.

The called user may also provide other information for use by the network in supplementary services provided to other users (e.g. connected line identity). The relationship of a connected user with the called user requires further study.

Once established, the B-channel is then available for the transmission of 64 kbit/s digital signals in both directions continuously and simultaneously, without alteration by the network. No restriction is placed by the network on the content of the digital signals (see Note 1 of § 1.1).

c) *Terminating the call*

The call may be terminated by either or both of the users by indicating this to the network. If one user terminates the call, an appropriate indication is sent to the other user.

1.3.3 *Exceptional procedures*

a) *Failure situations due to user error*

i) A user inputting a network-identifiable, improper service request will be given an appropriate failure indication by the network and the call set-up will be ceased.

ii) A user inputting a non-valid network number will be given an appropriate failure indication by the network and the call set-up will be ceased.

b) *Failure situations due to called user state*

i) A calling user attempting to establish a call to a user who is identified by the network to be busy (either network-determined user busy or user-determined user busy) will be given an appropriate failure indication by the network.

ii) A user attempting to establish a call to a user whose terminal equipment fails to respond will be given an appropriate failure indication by the network and the call set-up will be ceased.

iii) On a call to a user whose terminal equipment has responded that the called user is being informed of the call but has failed to answer within a defined period of time, the calling user attempting to establish the call will be given an appropriate failure indication by the network and the call set-up will be ceased.

c) *Failure situations due to network conditions*

A user attempting to establish a call but meeting call failure situations due to network conditions (e.g. congestion) will be given an appropriate failure indication by the network.

d) *Failure situations due to called user state and/or network conditions*

A user attempting to establish a call but meeting call failure situations due to network conditions (e.g. congestion) or called user state (e.g. busy) can have service data retained for a specified period of time, i.e. retention timer.

1.3.4 *Alternative procedures*

1.3.4.1 *Reserved service procedures*

For further study.

1.3.4.2 *Permanent service procedures*

For further study.

1.4 *Network capabilities for charging*

This Recommendation does not cover charging principles. Future Recommendations in the D-Series are expected to contain that information.

1.4.1 *Demand service charging*

It shall be possible to charge the subscriber accurately for the demand service.

1.4.2 *Reserved service charging*

It shall be possible to charge the subscriber accurately for the reserved service.

1.4.3 *Permanent service charging*

It shall be possible to charge the subscriber accurately for the permanent service.

1.5 *Interworking requirements*

Interworking between the ISDN and networks referred to as "digital PSTNs", pre-ISDNs, pilot ISDNs or extended IDNs as well as between the ISDN and PSTNs may be required for this bearer service category.

In advance of the provision of the ISDN, similar services supported by 64 kbit/s connectivity will be available to customers by RPOAs/network operators on what may be described as "digital PSTNs", pre ISDNs, pilot ISDNs or extended IDNs. Interworking with ISDN customers will therefore be required. To effect this, as a broad guideline, RPOAs/network operators need to ensure these networks have the necessary functionality at the interworking point to provide service connectivity with the ISDN.

A V-Series terminal connected to the ISDN via a terminal adaptor and using the 64 kbit/s unrestricted bearer service requires the use of an IWF (including a modem) in the network for calls to PSTN users. To effect the connection, a 64 kbit/s connection would need to be used to the IWF (interworking function) and a 3.1 kHz audio or equivalent connection would then need to be used to the PSTN user.

1.6 *Interaction with supplementary services*

Not applicable. Each supplementary service description identifies the applicability to this bearer service category.

1.7 *Attributes and values of attributes of the circuit-mode 64 kbit/s unrestricted, 8 kHz structured bearer service category*

Information transfer attributes

1.	Information transfer mode:	circuit
2.	Information transfer rate:	64 kbit/s
3.	Information transfer capability:	unrestricted
4.	Structure:	8 kHz integrity
5.	Establishment of communication:	demand/reserved/permanent
6.	Symmetry:	bidirectional symmetric/unidirectional
7.	Communication configuration:	point-to-point/multipoint

Access attributes

8.	Access channel:	B for user information, D for signalling (Note)
9.	Access protocol:	I-Series for D-channel

General attributes

10.	Supplementary services provided	– Refer to Recommendation I.250
11.	Quality of Service	for further study
12.	Interworking possibilities	
13.	Operational and commercial aspects	

Note – For reserved/permanent service the operational administrative and maintenance (OAM) messages related to these services may be conveyed over the D-channel.

1.8 *Provision of individual circuit-mode 64 kbit/s unrestricted, 8 kHz structured bearer services*

a) Overall provision[1]: E

b) Variations of secondary attributes:

	Establishment of communication	*Symmetry*	*Communication configuration*	*Provision*[1]
I.231.1/1	demand	bidirectional	pt-pt	E
I.231.1/2	reserved		pt-pt	A
I.231.1/3	permanent		pt-pt	E
I.231.1/4	demand	unidirectional	pt-pt	A
I.231.1/5	reserved		pt-pt	A
I.231.1/6	permanent		pt-pt	A
I.231.1/7	demand	bidirectional	multipt	A
I.231.1/8	reserved		multipt	A
I.231.1/9	permanent		multipt	A
I.231.1/10	demand	unidirectional	multipt	A
I.231.1/11	reserved		multipt	A
I.231.1/12	permanent		multipt	A

c) Access

Signalling and OAM (Note 1)		User information		Provision
Channel and rate	Protocols	Channel and rate	Protocols	
D(16)	I.451 (Note 2)	B(64)	User-defined	E
D(64)	I.451 (Note 2)	B(64)	User-defined	E

Note 1 – Definition of protocols for OAM is for further study.

Note 2 – Demand services only. Further study for reserved and permanent services.

1.9 *Dynamic description*

The dynamic description for this service on a demand basis is identical for a number of circuit-mode services and is therefore collectively given in Recommentation I.220.

[1] The definition of E (essential) and A (additional) can be found in Recommendation I.230

2 I.231.2 – Circuit-mode 64 kbit/s, 8 kHz structured bearer service category usable for speech information transfer

2.1 *Definition*

This bearer service category is intended to support speech.

The digital signal at the S/T reference point shall conform to Recommendation G.711 (A-law or μ-law). The network may use processing techniques appropriate for speech such as analogue transmission, echo cancellation and low bit-rate voice encoding. Hence, bit integrity is not assured. This bearer service is not intended to support modem derived voice-band data.

All Recommendations for the transfer of speech information in the network apply to this bearer service category.

2.2 *Description*

2.2.1 *General description*

This circuit-mode bearer service category allows:

- two users (e.g. terminals, PABXs) in a point-to-point configuration to communicate via the ISDN using speech encoding into 64 kbit/s digital signals over the B-channel, in both directions continuously and simultaneously for the duration of a call;
- three or more users in a multipoint configuration (refer to Recommendation I.254 for the supplementary service description for Three-Party Service and Conference Calling).

Tones and/or announcements to indicate the progress or otherwise of a call, are provided by the network.

2.2.2 *Specific terminology*

Retention timer: this timer specifies the amount of time that the network retains the call information of the original call upon encountering busy or being released. It is a network provider option. The value for this timer is greater than 15 seconds.

2.3 *Procedures*

2.3.1 *Provision/withdrawal*

2.3.1.1 Provision of this service will be by pre-arrangement with the Administration.

2.3.1.2 This bearer service is offered with several subscription options which apply separately to each ISDN number or group of ISDN numbers on the interface. For each subscription option, only one value can be selected. Subscription options for the interface are summarized below:

Subscription option	*Value*
Maximum number of information channels available at user B	– *m*, where *m* is not greater than the number of information channels on the interface
Maximum number of total calls present at user B	– *n*, where *n* is not greater than the number of information channels on the interface

User B can be an ISDN number or group of ISDN numbers on the interface.

Note – More than one ISDN number can be associated with the service/interface only as a part of a supplementary service such as multiple subscriber number. In the case of one ISDN number, the option given above for the number of calls can only exceed the number of information channels in association with a supplementary service (e.g. call waiting). As a network provider option, separate values may be specified for incoming and for outgoing calls for either or both of the limits.

2.3.2 *Normal procedures*

Out-of-band messages shall always be provided to indicate call progress, etc. However, network-generated in-band tones and announcements shall always be provided for this bearer service category.

a) *Originating the service (call set-up)*

The call is originated by the user requesting the required bearer service; the request includes a number identifying the called user. Other information, as required, for the bearer service and for use by the network in supplementary services provided to the called user (e.g. calling line identity) may also be included. This request may be given to the network either *en bloc*, containing all the required information, or not *en bloc*.

b) Indications during call set-up

All indications entail signalling messages and shall include, where appropriate, in-band tones or announcements.

After initiating a call the calling user will receive an acknowledgement that the network is able to process the call. The called user will receive an indication of the arrival of an incoming call of this bearer service.

The calling user shall also be given an indication that the incoming call is being offered to the called user, when an indication is received by the network that the called user is being informed of this call. When the call reaches the called user and the connection is established, an indication of this is sent to the calling user.

The called user may also provide other information for use by the network in supplementary services provided to other users (e.g. connected line identity). The relationship of a connected user with a called user requires further study.

Once established, the B-channel is then available for the transmission of speech signals in both directions continuously and simultaneously

c) Terminating the call

The call may be terminated by either or both of the users by indicating this to the network. If one user terminates the call, an appropriate indication is sent to the other user.

2.3.3 *Exceptional procedures*

a) *Failure situations due to user error*

i) A user inputting a network-identifiable, improper service request will be given an appropriate failure indication by the network and the call set-up will be ceased.

ii) A user inputting a non-valid network number will be given an appropriate failure indication by the network and the call set-up will be ceased.

b) *Failure situations due to called user state*

i) A calling user attempting to establish a call to a user who is identified by the network to be busy (either network-determined user busy or user-determined user busy) will be given an appropriate failure indication by the network.

ii) A user attempting to establish a call to a user whose terminal equipment fails to respond will be given an appropriate failure indication by the network and the call set-up will be ceased.

iii) On a call to a user whose terminal equipment has responded that the called user is being informed of the call but has failed to answer within a defined period of time, the calling user attempting to establish the call will be given an appropriate failure indication by the network and the call-set up will be ceased.

c) *Failure situations due to network conditions*

A user attempting to establish a call but meeting call failure situations due to network conditions (e.g., congestion) will be given an appropriate failure indication by the network.

d) *Failure situations due to called user state and/or network conditions*

A user attempting to establish a call but meeting call failure situations due to network conditions (e.g. congestion) or called user state (e.g. busy) can have service data retained for a specified period of time, i.e. retention timer.

2.3.4 *Alternative procedures*

2.3.4.1 *Reserved service procedures*

For further study.

2.3.4.2 *Permanent service procedures*

For further study.

2.4 *Network capabilities for charging*

This Recommendation does not cover charging principles. Future Recommendations in the D-Series are expected to contain that information.

2.4.1 *Demand service charging*

It shall be possible to charge the subscriber accurately for the demand service.

2.4.2 *Reserved service charging*

It shall be possible to charge the subscriber accurately for the reserved service.

2.4.3 *Permanent service charging*

It shall be possible to charge the subscriber accurately for the permanent service.

2.5 *Interworking requirements*

Interworking is required between the ISDN and the PSTN for this bearer service category.

2.6 *Interaction with supplementary services*

Not applicable. Each supplementary service description indentifies the applicability with this bearer service category.

2.7 *Attributes and values of attributes of the circuit-mode 64 kbit/s, 8 kHz structured bearer service category usable for speech information transfer*

Information transfer attributes

1.	Information transfer mode:	circuit
2.	Information transfer rate:	64 kbit/s
3.	Information transfer capability:	speech (encoded according to Recommendation G.711 A-law, μ-law) (Note 1)
4.	Structure:	8 kHz integrity
5.	Establishment of communication:	demand/reserved/permanent
6.	Symmetry:	bidirectional symmetric/unidirectional
7.	Communication configuration:	point-to-point/multipoint

Access attributes

8.	Access channel:	B for user information, D for signalling (Note 2)
9.	Access protocol:	I-Series for D-channel, Rec. G.711 for B-channel

General attributes

10. Supplementary services provided – Refer to Recommendation I.250
11. Quality of Service
12. Interworking possibilities
13. Operation and commercial aspects

} for further study (may be different from I.231.1)

Note 1 – When crossing an international boundary between Administrations which employ different encoding laws, the network shall perform the necessary A-μ law conversion (see Recommendation G.711).

Note 2 – For reserved/permanent service the operational administrative and maintenance (OAM) messages related to these services may be conveyed over the D-channel.

2.8 *Provision of individual circuit-mode 64 kbit/s, 8 kHz structured bearer services usable for speech information transfer*

a) Overall provision[2]: E

Note – Some networks will offer this service in a manner identical to the 3.1 kHz audio service.

b) Variations of secondary attributes:

	Establishment of communication	*Symmetry*	*Communication of configuration*	*Provision*[2]
I.231.2/1	demand	bidirectional	pt-pt	E
I.231.2/2	reserved		pt-pt	A
I.231.2/3	permanent		pt-pt	E
I.231.2/4	demand	unidirectional	pt-pt	A
I.231.2/5	reserved		pt-pt	A
I.231.2/6	permanent		pt-pt	A
I.231.2/7	demand	bidirectional	multipt	A
I.231.2/8	reserved		multipt	A
I.231.2/9	permanent		multipt	A
I.231.2/10	demand	unidirectional	multipt	A
I.231.2/11	reserved		multipt	A
I.231.2/12	permanent		multipt	A

c) Access

Signalling and OAM (Note 1)		User information		Provision
Channel and rate	Protocols	Channel and rate	Protocols	
D(16)	I.451 (Note 2)	B(64)	G.711	E
D(64)	I.451 (Note 2)	B(64)	G.711	E

Note 1 – Definition of protocols for OAM is for further study.

Note 2 – Demand services only. Further study for reserved and permanent services.

[2] The definition of E (essential) and A (additional) can be found in Recommendation I.230

2.9 *Dynamic description*

The dynamic description for this service on a demand basis is identical for a number of circuit mode services and is therefore collectively given in Recommentation I.220.

3 I.231.3 – Circuit-mode 64 kbit/s, 8 kHz structured bearer service category usable for 3.1 kHz audio information transfer

3.1 *Definition*

This bearer service category corresponds to the service which is currently offered in the PSTN. It provides for the transfer of speech and of 3.1 kHz bandwidth audio information such as voice-band data via modems and facsimile group 1, 2 and 3 information (Note). The digital signal at the S/T reference point shall conform to Recommendation G.711 (A-law or μ-law).

Connections provided for these services should offer the transfer capability for the information indicated above. (This means that the network may include speech processing techniques provided they are appropriately modified or functionally removed prior to non-speech information transfer.) The control of echo control devices, speech processing devices, etc., is only made by use of disabling tones (see Recommendation V.25). Bit integrity is not assured. The network may use analogue transmission.

All Recommendations for the transfer of speech information in the network apply to this bearer service category.

Note – The maximum modem bit rate that can be used by users in applications of this bearer service category depends on the modulation standard employed by the user and on the transmission performance within an Administration or between different Administrations. The extent of support is a matter concerning the network or agreed to bilaterally.

3.2 *Description*

3.2.1 *General description*

This circuit-mode bearer service category allows:

- two users (e.g. terminals, PABXs) in a point-to-point configuration to communicate via the ISDN using 3.1 kHz audio information encoding into 64 kbit/s digital signals over the B-channel, in both directions continuously and simultaneously for the duration of a call;
- three or more users in a multipoint configuration (refer to Recommendation I.254 for the supplementary service descriptions on Three-party Service and Conference Calling).

Tones and/or announcements to indicate the progress or otherwise of a call, are provided by the network.

3.2.2 *Specific terminology*

Retention timer: this timer specifies the amount of time that the network retains the call information of the original call upon encountering busy or being released. It is a network provider option. The value for this timer is greater than 15 seconds.

3.3 *Procedures*

3.3.1 *Provision/withdrawal*

3.3.1.1 Provision of this service will be by pre-arrangement with the Administration.

3.3.1.2 This bearer service is offered with several subscription options which apply separately to each ISDN number or group of ISDN numbers on the interface. For each subscription option, only one value can be selected. Subscription options for the interface are summarized below:

Subscription option	*Value*
Maximum number of information channels available at user B	– *m*, where *m* is not greater than the number of information channels on the interface
Maximum number of total calls present at user B	– *n*, where *n* is not greater than the number of information channels on the interface

User B can be an ISDN number or group of ISDN numbers on the interface.

Note – More than one ISDN number can be associated with the service/interface only as a part of a supplementary service such as multiple subscriber number. In the case of one ISDN number, the option given above for the number of calls can only exceed the number of information channels in association with a supplementary service (e.g. call waiting). As a network provider option, separate values may be specified for incoming and for outgoing calls for either or both of the limits.

3.3.2 *Normal procedures*

Out-of-band messages shall always be provided to indicate call progress, etc. However, network-generated in-band tones and announcements shall always be provided for this bearer service.

a) *Originating the service (call set-up)*

The call is originated by the user requesting the required bearer service; the request includes a number identifying the called user. Other information, as required, for the bearer service and for use by the network in supplementary services provided to the called user (e.g. calling line identity) may also be included.This request may be given to the network either *en bloc*, containing all the required information, or not *en bloc*.

b) *Indications during call set-up*

All indications entail signalling messages and may also include in-band tones or announcements.

After initiating a call the calling user will receive an acknowledgement that the network is able to process the call. The called user will receive an indication of the arrival of an incoming call of this bearer service.

The calling user shall also be given an indication that the incoming call is being offered to the called user, when an indication is received by the network that the called user is being informed of this call. When the call reaches the called user and the connection is established, an indication of this is sent to the calling user.

The called user may also provide other information for use by the network in supplementary services provided to other users (e.g. connected line identity). The relationship of a connected user with a called user requires further study.

Once established, the B-channel is then available for the transmission of the requested (i.e. speech or 3.1 kHz audio information) signals in both directions continuously and simultaneously.

c) *Terminating the call*

The call may be terminated by either or both of the users by indicating this to the network. If one user terminates the call, an appropriate indication is sent to the other user.

3.3.3 *Exceptional procedures*

a) *Failure situations due to user error*

i) A user inputting a network-identifiable, improper service request will be given an appropriate failure indication by the network and the call set-up will be ceased.

ii) A user inputting a non-valid network number will be given an appropriate failure indication by the network and the call set-up will be ceased.

b) *Failure situations due to called user state*

i) A calling user attempting to establish a call to a user who is identified by the network to be busy (either network-determined user busy or user-determined user busy) will be given an appropriate failure indication by the network.

ii) A user attempting to establish a call to a user whose terminal equipment fails to respond will be given an appropriate failure indication by the network and the call set-up will be ceased.

iii) On a call to a user whose terminal equipment has responded that the called user is being informed of the call but has failed to answer within a defined period of time, the calling user attempting to establish the call will be given an appropriate failure indication by the network and the call set-up will be ceased.

c) *Failure situations due to network conditions*

A user attempting to establish a call but meeting call failure situations due to network conditions (e.g. congestion) will be given an appropriate failure indication by the network.

d) *Failure situations due to called user state and/or network conditions*

A user attempting to establish a call but meeting call failure situations due to network conditions (e.g., congestion) or called user state (e.g. busy) can have service data retained for a specified period of time, i.e. retention timer.

3.3.4 *Alternative procedures*

3.3.4.1 *Reserved service procedures*

For further study.

3.3.4.2 *Permanent service procedures*

For further study.

3.4 *Network capabilities for charging*

This Recommendation does not cover charging principles. Future Recommendations in the D-Series are expected to contain that information.

3.4.1 *Demand service charging*

It shall be possible to charge the subscriber accurately for the demand service.

3.4.2 *Reserved service charging*

It shall be possible to charge the subscriber accurately for the reserved service.

3.4.3 *Permanent service charging*

It shall be possible to charge the subscriber accurately for the permanent service.

3.5 *Interworking requirements*

Interworking is required between the ISDN and the PSTN for this bearer service category.

3.6 *Interaction with supplementary services*

Not applicable. Each supplementary service description identifies the applicability to this bearer service category.

3.7 *Attributes and values of attributes of the circuit-mode 64 kbit/s, 8 kHz structured bearer service category usable for 3.1 kHz audio information transfer*

Information transfer attributes

1.	Information transfer mode:	circuit
2.	Information transfer rate:	64 kbit/s
3.	Information transfer capability:	3.1 kHz audio (Note)
4.	Structure:	8 kHz integrity
5.	Establishment of communication:	demand/reserved/permanent
6.	Symmetry:	bidirectional symmetric/unidirectional
7.	Communication configuration:	point-to-point/multipoint

Access attributes

8.	Access channel:	B for user information, D for signalling and/or operational, administrative and maintenance (OAM) messages
9.	Access protocol:	Recommendation G.711 for B-channel, I-Series for D-channel

General attributes

10.	Supplementary services provided	– Refer to Recommendation I.250
11.	Quality of Service	for further study
12.	Interworking possibilities	
13.	Operation and commercial aspects	

Note – When crossing an international boundary between Administrations which employ different encoding laws the network shall perform the necessary A-μ law conversion (see Recommendation G.711).

3.8 *Provision of individual circuit-mode 64 kbit/s, 8 kHz structured bearer services usable for 3.1 kHz audio information transfer*

a) Overall provision[3]: E

b) Variations of secondary attributes:

	Establishment of communication	*Symmetry*	*Communication of configuration*	*Provision*[3]
I.231.3/1	demand	bidirectional	pt-pt	E
I.231.3/2	reserved		pt-pt	A
I.231.3/3	permanent		pt-pt	E
I.231.3/4	demand	unidirectional	pt-pt	A
I.231.3/5	reserved		pt-pt	A
I.231.3/6	permanent		pt-pt	A
I.231.3/7	demand	bidirectional	multipt	A
I.231.3/8	reserved		multipt	A
I.231.3/9	permanent		multipt	A
I.231.3/10	demand	unidirectional	multipt	A
I.231.3/11	reserved		multipt	A
I.231.3/12	permanent		multipt	A

[3] The definition of E (essential) and A (additional) can be found in Recommendation I.230

c) Access

Signalling and OAM (Note 1)		User information		Provision
Channel and rate	Protocols	Channel and rate	Protocols	
D(16)	I.451 (Note 2)	B(64)	G.711	E
D(64)	I.451 (Note 2)	B(64)	G.711	E

Note 1 – Definition of protocols for OAM is for further study.

Note 2 – Demand services only. Further study for reserved and permanent services.

3.9 *Dynamic description*

The dynamic description for this service on a demand basis is identical for a number of circuit mode services and is therefore collectively given in Recommendation I.220.

4 I.231.4 – Circuit-mode, alternate speech / 64 kbit/s unrestricted, 8 kHz structured bearer service category

4.1 *Definition*

This bearer service category provides the alternate transfer of speech or 64 kbit/s unrestricted digital information within the same call.

The request for this alternate capability and the initial mode desired by the user must be identified at call set-up time.

This bearer service category is provided for the support of multiple capability terminals or single capability terminals (Note 1).

For the speech mode of this bearer service category, the same applies as for the speech bearer service category. For the unrestricted mode of this bearer service category, the same applies as for the unrestricted (Note 2) bearer service category.

Note 1 – Initially, this service will only be applicable to multiple capability terminals. The use of this service by, and the network support of, single capability terminals is for further study, (e.g. how does a user change terminals). All references to single capability terminals reflect possible future enhancements and are subject to change and have only been included for information.

Note 2 – During an interim period some networks may only support restricted 64 kbit/s digital information transfer capability, i.e. information transfer capability solely restricted by the requirement that the all-zero octet is not allowed. For interworking, the rules given in the Appendix I of Recommendation I.520 should apply. The interworking functions have to be provided in the network with restricted capability. The ISDN with 64 kbit/s transfer capabilities will not be affected by this interworking, other than by conveying the appropriate signalling message to or from the ISDN terminal.

4.2. *Description*

4.2.1 *General description*

Once the connection is established, the user may repeatedly request via appropriate signalling messages, to alternate from speech mode to 64 kbit/s unrestricted digital mode, or vice versa. The in-call modification shall be provided on a per call basis.

4.2.2 *Specific terminology*

None identified.

4.2.3 *Qualifications on the applicability to telecommunications services*

None identified.

4.3 *Procedures*

4.3.1 *Provision/withdrawal*

This service shall be provided by pre-arrangement with the Administration.

4.3.2 *Normal procedures*

4.3.2.1 *Activation/deactivation/registration*

Not applicable.

4.3.2.2 *Invocation and operation*

At the start of the call the request for an alternate speech/64 kbit/s unrestricted call and the initial mode of either speech or 64 kbit/s unrestricted call must be identified. Following call set-up, the calling or called party may choose to modify the characteristics of the call during the conversation/data phase. During call establishment, the network shall choose a suitable route according to the information included in the set-up message.

Depending on the terminal capability type the following procedures will apply:

a) For multiple capability terminals the requesting user will send an *invoke in-call modification request* to the network.

b) For single capability terminals the requesting user will change over the connection from the first terminal to the second terminal before sending an *invoke in-call modification request* to the network.

The network will, on receipt of the *in-call modification request* from the calling/called party, check if that call modification is allowed and if the necessary resources are available.

If acceptable, the resources are reserved and an *invoke in-call modification request* is sent to the distant end. A timer will be started to supervise that the in-call modification is received successfully.

Depending on the terminal configuration at the destination end, the procedures will be the following:

a) For multiple capability terminals the distant user, if agreeing with the service changeover, will transmit a *return result indication* while the resources in the network are switched in, if reserved previously and the *call modification indication* will be sent to the initiating party.

b) For single capability terminals a call changeover will be performed from the first terminal to the second terminal. An *in-call modification return result* will be sent to the network which will switch in the resources, if reserved previously.

4.3.3 *Exceptional procedures*

4.3.3.1 *Activation/deactivation/registration*

Not applicable.

4.3.3.2 *Invocation and operation*

If the network fails to change resources on receipt of the *in-call modification return result*, the connection will be cleared with a cause indication "temporary failure".

If on receipt of a *call modification invocation request* an exchange determines that in-call modification is not allowed or not possible a *call modification return error indication* will be sent. Receipt of the *call modification return error indication* will cause the reserved resources to be freed and a *call modification return error indication* to be delivered to the initiating party.

In case of in-call modification failure, the initiating terminal after having received the *in-call modification return error indication*, will resume to transmit and receive the bit stream for the previous service.

4.3.4 *Alternative procedures*

None identified.

4.4 *Network capabilities for charging*

This Recommendation does not cover charging principles. Future Recommendations in the D-Series are expected to contain that information.

It shall be possible to charge the subscriber accurately for the service.

4.5 *Interworking requirements*

For further study.

4.6 *Interactions with supplementary services*

For further study.

4.7 *Attributes and values of attributes of the circuit-mode, alternate speech / 64 kbit/s unrestricted, 8 kHz structured bearer service category*

Information transfer attributes

1.	Information transfer mode:	circuit
2.	Information transfer rate:	64 kbit/s
3.	Information transfer capability:	alternately speech (Note 1) or unrestricted digital information
4.	Structure:	8 kHz integrity
5.	Establishment of communication:	demand/reserved/permanent
6.	Symmetry:	bidirectional symmetric/unidirectional
7.	Communication configuration:	point-to-point/multipoint

Access attributes

8.	Access channel:	B for user information, D for signalling (Note 2)
9.	Access protocol:	I-Series for D-channel

General attributes

10.	Supplementary services provided	for further study
11.	Quality of Service (Note 3)	
12.	Interworking possibilities	
13.	Operation and commercial aspects	

Note 1 – When crossing an international boundary between Administrations which employ different encoding laws, the network shall perform the necessary A-μ law conversion (see Recommendation G.711).

Note 2 – For reserved/permanent service the operational, administrative and maintenance (OAM) messages related to these services may be conveyed over theD-channel.

Note 3 – A short service changeover time (with a high probability of not being exceeded) has been tentatively identified as a requirement.

4.8 *Provision of individual circuit mode, alternate speech/64 kbit/s unrestricted, 8 kHz structured bearer services*

a) Overall provision[4]: A

Note – Some networks will offer the speech phase of these services in a manner identical to the 3.1 kHz audio service.

b) Variations of secondary attributes:

	Establishment of communication	*Symmetry*	*Communication of configuration*	*Provision*[4]
I.231.4/1	demand	bidirectional	pt-pt	E
I.231.4/2	reserved		pt-pt	A
I.231.4/3	permanent		pt-pt	E
I.231.4/4	demand		multipt	A
I.231.4/5	reserved		multipt	A
I.231.4/6	permanent		multipt	A

c) Access

Signalling and OAM (Note 1)		User information		Provision
Channel and rate	Protocols	Channel and rate	Protocols	
D(16)	I.451 (Note 2)	B(64)	G.711/user-defined	E
D(64)	I.451 (Note 2)	B(64)	G.711/user-defined	E

Note 1 – Definition of protocols for OAM is for further study.

Note 2 – Demand services only; further study for reserved and permanent services. The protocols for initiating the changeover between speech and unrestricted digital information, and synchronizing this changeover are for further study.

[4] The definition of E (essential) and A (additional) can be found in Recommendation I.230

4.9 *Dynamic description*

The dynamic description for this service needs further study and is not yet available.

5 I.231.5 – Circuit-mode 2 × 64 kbit/s unrestricted, 8 kHz structured bearer service category

5.1 *Definition*

This bearer service category provides the unrestricted transfer of two 64 kbit/s user information flows over two B-channels at the user network interface.

5.2 *Description*

For further study.

5.3 *Procedures*

For further study.

5.4 *Network capabilities for charging*

This Recommendation does not cover charging principles. Future Recommendations in the D-Series are expected to contain that information.

It shall be possible to charge the subscriber accurately for the service.

5.5 *Interworking requirements*

For further study.

5.6 *Interaction with supplementary services*

For further study.

5.7 *Attributes and values of attributes of the circuit mode 2 × 64 kbit/s unrestricted, 8 kHz structured bearer service category*

Information transfer attributes

1.	Information transfer mode:	circuit
2.	Information transfer rate:	2 × 64 kbit/s
3.	Information transfer capability:	unrestricted (Note)
4.	Structure:	8 kHz integrity with restricted differential time delay (RDTD)
5.	Establishment of communication:	demand/reserved/permanent
6.	Symmetry:	bidirectional symmetric/bidirectional asymmetric/unidirectional
7.	Communication configuration:	point-to-point/multipoint

Access attributes

8.	Access channel:	two B(64) for user information
9.	Access protocol:	I-Series for D-channel

General attributes

10.	Supplementary services provided	for further study
11.	Quality of Service	
12.	Interworking possibilities	
13.	Operation and commercial aspects	

Note – Digit sequence integrity (DSI) is ensured for each elementary 64 kbit/s information.

5.8 *Provision for individual circuit-mode 2 × 64 kbit/s, unrestricted, 8 kHz structured bearer services*

a) Overall provision[5] : A

b) Variations of secondary attributes :

	Establishment of communication	*Symmetry*	*Communication of configuration*	*Provision*[5]
I.231.5/1	demand	bidirectional	pt-pt	E
I.231.5/2	reserved		pt-pt	A
I.231.5/3	permanent		pt-pt	E
Other combinations				A

c) Access

Signalling and OAM (Note 1)		User information		Provision
Channel and rate	Protocols	Channel and rate	Protocols	
D(16)	I.451 (Note 2)	2 × B(64)	User-defined	E
D(64)	I.451 (Note 2)	2 × B(64)	User-defined	E

Note 1 – Definition of protocols for OAM is for further study.

Note 2 – Demand services only. Further study for reserved and permanent services.

5.9 *Dynamic description*

The dynamic description for this service needs further study and is not yet available.

6 I.231.6 – Circuit-mode 384 kbit/s unrestricted, 8 kHz structured bearer service category

6.1 *Definition*

This bearer service category provides the unrestricted transfer of 384 kbit/s user information over a H_0 channel at the S/T reference point. The transfer of OAM information for reserved and permanent services may be provided over a D-channel in the same or in another interface structure.

6.2 *Description*

For further study.

6.3 *Procedures*

For further study.

[5] The definition of E (essential) and A (additional) can be found in Recommendation I.230

6.4 *Network capabilities for charging*

This Recommendation does not cover charging principles. Future Recommendations in the D-Series are expected to contain that information.

It shall be possible to charge the subscriber accurately for the service.

6.5 *Interworking requirements*

For further study.

6.6 *Interaction with supplementary services*

For further study.

6.7 *Attributes and values of attributes of the circuit-mode 384 kbit/s unrestricted, 8 kHz structured bearer service category*

Information transfer attributes

1.	Information transfer mode:	circuit
2.	Information transfer rate:	384 kbit/s
3.	Information transfer capability:	unrestricted
4.	Structure:	8 kHz integrity
5.	Establishment of communication:	demand/reserved/permanent
6.	Symmetry:	bidirectional symmetric/bidirectional asymmetric/unidirectional (Note)
7.	Communication configuration:	point-to-point/multipoint

Access attributes

8.	Access channel:	H_0 (384) for user information D(16) or D(64) for OAM information
9.	Access protocol:	I-Series for D-channel

General attributes

10.	Supplementary services provided	for further study
11.	Quality of Service	
12.	Interworking possibilities	
13.	Operation and commercial aspects	

Note – Bidirectional-asymmetric services are for further study.

6.8 *Provision of individual circuit-mode 384 kbit/s unrestricted, 8 kHz structured bearer services*

a) Overall provision[6]: A

b) Variations of secondary attributes:

	Establishment of communication	*Symmetry*	*Communication of configuration*	*Provision*[6]
I.231.6/1	demand	bidirectional	pt-pt	A
I.231.6/2	reserved		pt-pt	E
I.231.6/3	permanent		pt-pt	E
I.231.6/4	reserved	unidirectional	pt-pt	A
I.231.6/5	permanent		pt-pt	A
I.231.6/6	reserved	bidirectional	multipt	A
I.231.6/7	permanent		multipt	A
I.231.6/8	reserved	unidirectional	multipt	A
I.231.6/9	permanent		multipt	A

[6] The definition of E (essential) and A (additional) can be found in Recommendation I.230

c) Access

Signalling and OAM (Note 1)		User information		Provision
Channel and rate	Protocols	Channel and rate	Protocols	
D(64)	I.451 (Note 2)	$H_0(384)$	User-defined	E
D(16)	I.451 (Note 2)	$H_0(384)$	User-defined	E

Note 1 – Definition of protocols for OAM is for further study.

Note 2 – Demand services only. Further study for reserved and permanent services.

6.9 *Dynamic description*

The dynamic description for this service needs further study and is not yet available.

7 I.231.7 – Circuit-mode 1536 kbit/s unrestricted, 8 kHz structured bearer service category

7.1 *Definition*

This bearer service category provides the unrestricted transfer of 1536 kbit/s user information over a H_{11} channel at the S/T reference point. Transfer of OAM information for reserved and permanent services may be provided via a D-channel in another interface structure.

7.2 *Description*

For further study.

7.3 *Procedures*

For further study.

7.4 *Network capabilities for charging*

This Recommendation does not cover charging principles. Future Recommendations in the D-Series are expected to contain that information.

It shall be possible to charge the subscriber accurately for the service.

7.5 *Interworking requirements*

For further study.

7.6 *Interaction with supplementary services*

For further study.

7.7 *Attributes and values of attributes of the circuit-mode 1536 kbit/s unrestricted, 8 kHz structured bearer service category*

Information transfer attributes

1.	Information transfer mode:	circuit
2.	Information transfer rate:	1536 kbit/s
3.	Information transfer capability:	unrestricted
4.	Structure:	8 kHz integrity
5.	Establishment of communication:	demand/reserved/permanent
6.	Symmetry:	bidirectional symmetric/bidirectional asymmetric/unidirectional (Note)
7.	Communication configuration:	point-to-point/multipoint

Access attributes

8.	Access channel:	H_{11} (1536) for user information D(16) or D(64) for OAM signalling
9.	Access protocol:	I-Series for D-channel

General attributes

10.	Supplementary services provided	for further study
11.	Quality of Service	
12.	Interworking possibilities	
13.	Operation and commercial aspects	

Note – Bidirectional-asymmetric services are for further study.

7.8 *Provision of individual circuit-mode 1536 kbit/s unrestricted, 8 kHz structured bearer services*

a) Overall provision[7]: A

b) Variations of secondary attributes:

	Establishment of communication	*Symmetry*	*Communication of configuration*	*Provision*[7]
I.231.7/1	demand	bidirectional	pt-pt	A
I.231.7/2	reserved		pt-pt	E
I.231.7/3	permanent		pt-pt	E
I.231.7/4	reserved	unidirectional	pt-pt	A
I.231.7/5	permanent		pt-pt	A
I.231.7/6	reserved	bidirectional	multipt	A
I.231.7/7	permanent		multipt	A
I.231.7/8	reserved	unidirectional	multipt	A
I.231.7/9	permanent		multipt	A

[7] The definition of E (essential) and A (additional) can be found in Recommendation I.230

c) Access

Signalling and OAM (Note 1)		User information		Provision
Channel and rate	Protocols	Channel and rate	Protocols	
D(16) (Note 2)	I.451 (Note 3)	H_{11}(1536)	User-defined	E
D(64) (Note 2)	I.451 (Note 3)	H_{11}(1536)	User-defined	E

Note 1 – Definition of protocols for OAM is for further study.

Note 2 – Located on another interface.

Note 3 – Demand services only. Further study for reserved and permanent services.

7.9 *Dynamic description*

The dynamic description for this service needs further study and is not yet available.

8 I.231.8 – Circuit-mode 1920 kbit/s unrestricted, 8 kHz structured bearer service category

8.1 *Definition*

This bearer service category provides the unrestricted transfer of 1920 kbit/s user information over a H_{12} channel at the S/T reference point. The transfer of OAM information for reserved and permanent services may be provided over a D-channel.

8.2 *Description*

For further study.

8.3 *Procedures*

For further study.

8.4 *Network aspects for charging*

This Recommendation does not cover charging principles. Future Recommendations in the D-Series are expected to contain that information.

It shall be possible to charge the subscriber accurately for the service.

8.5 *Interworking requirements*

For further study.

8.6 *Interaction with supplementary services*

For further study.

8.7 *Attributes and values of attributes of the circuit-mode 1920 kbit/s unrestricted, 8 kHz structured bearer service category*

Information transfer attributes

1.	Information transfer mode:	circuit
2.	Information transfer rate:	1920 kbit/s
3.	Information transfer capability:	unrestricted
4.	Structure:	8 kHz integrity
5.	Establishment of communication:	demand/reserved/permanent
6.	Symmetry:	bidirectional symmetric/bidirectional asymmetric/unidirectional (Note)
7.	Communication configuration:	point-to-point/multipoint

Access attributes

8.	Access channel:	H_{12}(1920) for user information D(64) for OAM information
9.	Access protocol:	I-Series for D-channel

General attributes

10.	Supplementary services provided	– Refer to Recommendation I.250
11.	Quality of Service	for further study
12.	Interworking possibilities	
13.	Operation and commercial aspects	

Note 1 – Bidirectional-asymmetric services are for further study.

8.8 *Provision of individual circuit-mode 1920 kbit/s unrestricted, 8 kHz structured bearer services*

a) Overall provision[8]: A

b) Variations of secondary attributes:

	Establishment of communication	*Symmetry*	*Communication of configuration*	*Provision*[8]
I.231.8/1	demand	bidirectional	pt-pt	A
I.231.8/2	reserved		pt-pt	E
I.231.8/3	permanent		pt-pt	E
I.231.8/4	reserved	unidirectional	pt-pt	A
I.231.8/5	permanent		pt-pt	A
I.231.8/6	reserved	bidirectional	multipt	A
I.231.8/7	permanent		multipt	A
I.231.8/8	reserved	unidirectional	multipt	A
I.231.8/9	permanent		multipt	A

[8] The definition of E (essential) and A (additional) can be found in Recommendation I.230

c) Access

Signalling and OAM (Note 1)		User information		Provision
Channel and rate	Protocols	Channel and rate	Protocols	
D(64)	I.451 (Note 2)	H_{12}(1920)	User-defined	E

Note 1 – Definition of protocols for OAM is for further study.

Note 2 – Demand services only. Further study for reserved and permanent services.

8.9 *Dynamic description*

The dynamic description for this service needs further study and is not yet available.

Recommendation I.232

PACKET-MODE BEARER SERVICES CATEGORIES

(Melbourne, 1988)

Recommendation I.210 describes the principles for defining telecommunication services supported by an ISDN including the concept of bearer services, teleservices and supplementary services. It also provides the means for the definition and description of such services.

The purpose of this Recommendation is to define a recommended set of packet-mode bearer services categories, to describe individual packet-mode bearer services and to recommend their provision in ISDN. The definitions and descriptions form the basis to define the network capabilities required for the support of the services in ISDN.

Bearer service categories are described by prose definitions and descriptions, by attributes and their values and by dynamic descriptions following the description method given in Recommendation I.130. The application of the attribute technique and the definitions of these attributes and attribute values is given in Recommendation I.140.

The following set of bearer service categories is currently identified and more may be identified in the future:

I.232.1 Virtual call and permanent virtual circuit bearer service category,

I.232.2 Connectionless bearer service category,

I.232.3 User signalling bearer service category.

1 I.232.1 – Virtual call and permanent virtual circuit bearer service category

1.1 *Definition*

This bearer service category provides the unrestricted transfer (without alteration) of user information in a packetized manner over a virtual circuit within a B- or D-channel at the S/T reference point. Signalling information for virtual call and/or possibly OAM information for permanent virtual circuit services are transferred via B- or D-channels as described in Recommendation I.462 (X.31).

1.2 *Description*

1.2.1 *General description*

This packet-mode bearer service category allows users (e.g. terminals) in a point-to-point communication configuration to communicate via the ISDN using X.25 encoding, by means of Recommendation I.462 (X.31) procedures over either B- or D-channels, in both directions continuously and simultaneously for the duration of a call.

1.2.2 *Specific terminology*

Not applicable.

1.2.3 *Qualifications*

Not applicable.

1.3 *Procedures*

Detailed procedures for virtual calls appear in Recommendation I.462 (X.31), case B. The description below is a synopsis of those procedures. For actual, complete procedures, refer to Recommendation I.462.

1.3.1 *Provision/withdrawal*

For further study.

1.3.2 *Normal procedures*

1.3.2.1 *Activation/deactivation/registration*

Not applicable.

1.3.2.2 *Invocation and operation*

1.3.2.2.1 *Virtual call procedures*

a) *Call establishment*

For virtual calls, X.25 will be used on an active channel (B or D) to the packet handler. In order to establish that channel and/or to negotiate the type of channel to be used, out-of-band signalling procedures may be used. Once connected to the packet handler, remaining call information, including called user address, are signalled in the X.25 call request.

b) *Data transfer phase*

Once established, the virtual circuit is then available for unrestricted X.25 data transfer in both directions continuously and simultaneously. During the data transfer phase, information exchange occurs with the following characteristics, among others:

- packetized;
- flow control;
- delivery confirmation (optional);
- reset/interrupt.

c) *Terminating the call*

The call may be terminated by either or both of the users by indicating this to the network. In either case, an appropriate indication is sent to the other user. The active channel may be released after the termination of the last virtual call on that channel.

1.3.2.2.2 *Permanent virtual circuit procedures*

For permanent virtual circuits on B- or D-channels, there is no call set-up or clearing. For permanent virtual circuits using B-channel access, a semi-permanent connection of the channel to the packet handler must be in place. The procedures for the control of packets between user terminal equipment and network are covered by X.25 data transfer phase.

1.3.2.3 *Interrogation/editing*

Not applicable.

1.3.3 *Exceptional procedures*

1.3.3.1 *Activation/deactivation/registration*

Not applicable.

1.3.3.2 *Invocation and operation*

1.3.3.2.1 *Virtual call*

In case of failure situations due to calling/called user error, user state, or network conditions, appropriate failure indications will be signalled from the network and the call set-up or established call may be terminated. For detailed procedures, see Recommendation I.462.

1.3.3.2.2 *Permanent virtual circuit*

In case of failure situations due to user error, user state, or network conditions, appropriate failure indications will be signalled from the network. For detailed procedures, see Recommendation I.462.

1.3.3.3 *Interrogation/editing*

Not applicable.

1.3.4 *Alternative procedures*

Not applicable.

1.3.5 *Verification*

Not applicable.

1.4 *Network capabilities for charging*

This Recommendation does not cover charging principles. Future Recommendations in the D-Series are expected to contain that information.

1.4.1 *Virtual call charging*

It shall be possible to charge the subscriber accurately for the virtual call service.

1.4.2 *Permanent virtual circuit charging*

It shall be possible to charge the subscriber accurately for the permanent virtual circuit service.

1.5 *Interworking requirements*

General interworking arrangements for this bearer service category are defined in Recommendation X.300. Specific interworking procedures are in Recommendation I.462.

1.6 *Interaction with supplementary services*

Not applicable.

1.7 *Attributes and values of attributes of the virtual call and permanent virtual circuit bearer service category*

Information transfer attributes

1.	Information transfer mode:	packet
2.	Information transfer rate:	maximum throughput of a given virtual circuit is less than or equal to the maximum bit rate of the user information access channel and the throughput class of the virtual circuit (Note)
3.	Information transfer capability:	unrestricted
4.	Structure:	service data unit integrity
5.	Establishment of communication:	demand (virtual call)/permanent (permanent virtual circuit)
6.	Symmetry:	bidirectional symmetric
7.	Communication configuration:	point-to-point

Access attributes

8.	Access channel:	user information over virtual circuit within B- or D-channel. When D-channel is used, maximum packet size and Quality of Service may be restricted. Signalling may be provided via D-channel and/or virtual circuit within B-channel
9.	Access protocol:	as specified in Recommendations I.440, I.450, I.451, I.462 and X.25 (layers 2 and 3)

General attributes

10.	Supplementary services provided:	as listed in Recommendation X.2. Others are for further study
11.	Quality of Service	for further study
12.	Interworking possibilities	for further study
13.	Operational and commercial aspects	for further study

Note – The exact values of information transfer rates for the virtual call and permanent virtual circuit are for further study.

1.8 *Provision of virtual call and permanent virtual circuit bearer service*

a) Overall provision: E

b) Variations of secondary attributes:

Establishment de of communication	*Symmetry*	*Communication of configuration*	*Provision*
demand	bidirectional symmetric	pt-pt	E
permanent		pt-pt	E

c) *Access*

Access channel control Signalling and OAM (Notes 1 and 2)		Virtual call control Signalling and OAM (Notes 1 and 3)		User information		Provision
Channel and rate	Protocols	Channel and rate	Protocols	Channel and rate	Protocols	
D(16)	I.451 I.441 I.430	B(64)	X.25, L3 X.25, L2 I.430	B(64)	X.25, L3 X.25, L2 I.430	A
D(64)	I.451 I.441 I.431	B(64)	X.25, L3 X.25, L2 I.431	B(64)	X.25, L3 X.25, L2 I.431	A
D(16)	I.451 I.441 I.430	D(16)	X.25, L3 I.441 I.430	D(16)	X.25, L3 I.441 I.430	A
D(64)	I.451 I.441 I.431	D(64)	X.25, L3 I.441 I.431	D(64)	X.25, L3 I.441 I.431	A

L1, L2 and L3 Layer 1, layer 2 and layer 3

Note 1 – The definition of other protocols for OAM is for further study.

Note 2 – The protocols listed in this column are for establishing communications with the packet handling function using out-of-band call control signals. This procedure does not apply in certain cases (for example, semi-permanent D-channel connection).

Note 3 – The protocols listed in this column are for the establishment of a virtual circuit using X.25 procedures. These procedures do not apply to permanent virtual circuits.

1.9 *Dynamic description*

Dynamic descriptions for the Recommendation I.462 procedures in the virtual call and permanent virtual circuit bearer service category are for future study. State transition diagrams for layer 3 of Recommendation X.25 (Annex B) apply for virtual call and permanent virtual circuit.

2 I.232.2 – Connectionless bearer service category

Note – This connectionless bearer service category is a different concept from, and should not be confused with, the OSI Connectionless Mode Network Service. Thus, the name of this service may change as the service is better defined.

Further aspects of this bearer service category are for further study.

3 I.232.3 – User signalling bearer service category

Note – This service is different from, and should not be confused with, the user-to-user signalling supplementary service (see Recommendation I.257). The user-to-user signalling supplementary service is used in conjunction with either a bearer service or a teleservice. The user signalling bearer service category stands on its own and is not used in conjunction with a bearer service or a teleservice.

Further aspects of this bearer service category are for further study.

SECTION 4

TELESERVICES SUPPORTED BY AN ISDN

Recommendation I.240

DEFINITION OF TELESERVICES

(Melbourne, 1988)

1 General

Recommendation I.210 describes the principles for defining telecommunication services supported by an ISDN, including the concept of bearer services, bearer capabilities and teleservices. It also provides the tools for the definition and description of such services.

The purpose of this Recommendation is to define a recommended set of teleservices to be supported by an ISDN. These definitions form the basis for detailed descriptions of teleservices as given in Recommendation I.241 which are used to define the network capabilities required.

Teleservices are described by prose definitions and descriptions, by attributes and by dynamic descriptions, which altogether define the service characteristics at a given access point where the customer accesses the service. Recommendation I.140 and Recommendation I.210, Annex C describe the use of attributes for this purpose.

2 Definition of teleservices in ISDN

This section defines the teleservices identified so far to be supported by an ISDN. Additional teleservices are for further study.

The definition of teleservices is based upon the list of attributes given in Recommendation I.210, Annex C.

The higher layer attribute values (i.e. the layer 4 to 7 protocol functions and "type of user information") the low layer attribute values (i.e., the information transfer attributes, the access attributes and the general attributes) are the recommended functions for teleservices. The "type of user information" attribute is considered the only dominant attribute. The value of this attribute is the same as the service name used in the E- and F-series Recommendations for the particular service being provided in ISDN.

The information transfer and access attribute values for teleservices given in the service descriptions are the proposed values when using the circuit-mode and packet-mode bearer capabilities of the ISDN. For the case of telephony, only the circuit-mode is to be used. Implementations using alternative low layer attribute values are permitted but are for further study. From a service interworking perspective it is desirable that the possible combinations of values of the low layer attributes of teleservices be the same as the bearer capabilities of the bearer services defined in I.230-series of Recommendations.

The following teleservices have been identified so far to be supported by an ISDN:

I.241.1 Telephony

I.241.2 Teletex

I.241.3 Telefax 4

I.241.4 Mixed mode

I.241.5 Videotex

I.241.6 Telex

The prose descriptions (step 1.1) and static descriptions (step 1.2) of these services are given in Recommendation I.241. The common dynamic description (step 1.3) for demand bearer services given in Recommendation I.220 is also applicable to teleservices.

Note – Prose descriptions for mixed mode, Videotex and telex are not yet included.

3 Recommended support of teleservices

In order to facilitate the development of compatible ISDNs and related user equipment, Recommendation I.241 outlines the recommended support of teleservices defined in this Recommendation. This outline consists of two parts:

a) description of the overall support of a teleservice by its dominant attribute value, i.e., the value of the high layer attribute: type of user information. The recommended overall support of a teleservice is described as:

   E an essential teleservice to be made available internationally;

   A an additional teleservice which may be available in some ISDNs, and which may also be available internationally;

   FS the recommended support of this teleservice is for further study,

b) with each teleservice, a description of the agreed non-dominant attributes, e.g. values of the high layer attributes: layer 4 to 7 protocol functions. If an ISDN supports the teleservice, the recommended support of the values of these secondary attribute combinations within this teleservice is described as:

   E an essential combination of attribute values to be made available internationally (when an ISDN supports the particular teleservice);

   A an additional combination of attribute values which may be available in some ISDNs, and which may also be available internationally (when an ISDN supports the particular teleservice);

   FS the recommended support of this combination of attributes is for further study.

Note – During an evolutionary period, not all items marked "E" will be provided in all networks.

The recommended overall support of teleservices as given in Recommendation I.241 is summarized in Table 1/I.240.

4 Prose definitions of teleservices

In order to give an overview of the teleservices identified, their definitions, as given in Recommendation I.241, are reproduced below.

I.241.1 Telephony

The "telephony service" provides users with the ability for real-time two-way speech conversation via the network.

I.241.2 Teletex

Teletex is an international service enabling subscribers to exchange office correspondence in the form of documents containing Teletex coded information on an automatic memory-to-memory basis via the ISDN.

I.241.3 Telefax 4

Telefax 4 is an international service enabling subscribers to exchange office correspondence in the form of documents containing facsimile coded information automatically via the ISDN.

TABLE 1/I.240

Recommended overall support of teleservices by ISDNs

No.	Service	Support
I.241.1	Telephony	E/A [a]
I.241.2	Teletex	A
I.241.3	Telefax 4	A
I.241.4	Mixed mode	A
I.241.5	Videotex	A
I.241.6	Telex	FS

[a] It is anticipated that ISDNs will offer telephony as a basic telecommunication service. Some networks will offer this as a teleservice. However, due to national regulation policies, some networks will offer telephony as a bearer service rather than as a teleservice.

I.241.4 **Mixed mode**

This service provides combined text and facsimile communication (mixed mode) for end-to-end transfer of documents containing mixed information of text and fixed images. The high layer attributes are based on the Recommendations for Teletex and Telefax 4.

I.241.5 **Videotex**

The Videotex service in the ISDN is an enhancement of the existing Videotex service with retrieval and mailbox functions for text (alpha) and graphic information.

I.241.6 **Telex**

This service provides interactive text communication. The digital signal at the S/T reference point follows the internationally agreed Recommendations for telex above the ISDN physical layer.

Recommendation I.241

TELESERVICES SUPPORTED BY AN ISDN

(Melbourne, 1988)

Recommendation I.210 describes the principles for defining telecommunication services supported by an ISDN including the concept of bearer services, teleservices, and supplementary services. It also provides the means for the definition and description of such services.

In Recommendation I.240, six teleservices are identified to be supported by an ISDN, i.e. telephony, Teletex, Telefax 4, mixed mode, Videotex and telex.

This Recommendation contains the service descriptions for these teleservices. Descriptions for other teleservices are for further study. The description of teleservices is structured in accordance with the three steps in stage 1 of the service description method.

The recommended support for these teleservices is given in § . . .8 (i.e. 1.8, 2.8, 3.8 etc.) of each individual service description.

1 I.241.1 – **Telephony**

1.1 *Definition*

The "telephony service" provides users with the ability for real-time two-way speech conversation via the network.

1.2 *Description*

1.2.1 *General description*

The "telephony service" provides speech transmission at an audio bandwidth of 3.1 kHz. The communication is bidirectional, with both directions continuously and simultaneously active during the speech phase. The network may use processing techniques appropriate for speech such as analogue transmission, echo cancellation and low bit-rate encoding.

The digital signal at the S/T reference point follows the encoding laws for speech (according to Recommendation G.711), A-law or μ-law and the network may use digital signal processing techniques. It may also be necessary to use echo cancellation techniques in particular when interworking with other networks such as the PSTN. User information is provided over a B-channel, signalling is provided over the D-channel. Tones and announcements are provided by the network, encoded according to Recommendation G.711, although terminals can generate tones or other indications based on the messages received.

1.2.2 *Specific terminology*

a) *Voice quality* – The required acoustic performance is described in terms of loudness ratings, frequency response, quantizing distortion, etc. Overall requirements are given in the Recommendations of the P-Series.

b) *Transmission delay* – The maximum delay is that specified for the general telephone network (cf. Recommendation G.114). The permissible variation of the actual delay is for further study.

c) *Retention timer* – This timer specifies the amount of time that the network retains the call information of the original call upon encountering busy or being released. It is a network provider option. The value for this timer is greater than 15 seconds.

1.3 *Procedures*

1.3.1 *Provision/withdrawal*

1.3.1.1 Provision of this service will be by pre-arrangement with the Administration.

1.3.1.2 The teleservice is offered with several subscription options which apply separately to each ISDN number or group of ISDN numbers on the interface. For each subscription option, only one value can be selected. Subscription options for the interface are summarized below:

Subscription Option	*Value*
Maximum number of information channels available at user B	– *m*, where *m* is not greater than the number of information channels on the interface
Maximum number of total calls present at user B	– *n*, where *n* is not greater than the number of information channels on the interface

User B can be an ISDN number or group of ISDN numbers on the interface.

Note – More than one ISDN number can be associated with the service/interface only as a part of a supplementary service such as multiple subscriber number. In the case of one ISDN number, the option given above for the number of calls can only exceed the number of information channels in association with a supplementary service (e.g. call waiting). As a network provider option, separate values may be specified for incoming and for outgoing calls for either or both of the limits.

1.3.2 *Normal procedures*

a) *Originating the service (call set-up)*

The service is originated by the originating user activating the terminal, performing service selection (if applicable) for the originating terminal, and terminating customer selection. During this process the originating user is given appropriate indications as to the state of the call.

i) A service selection is required on a multi-service terminal.

ii) Terminating customer selection is selecting the required termination (user/network interface) by an appropriate means [for example, the use of direct-dialling-in (DDI), or multiple subscriber number].

iii) Indications during call origination may include an indication that the network is ready to receive the network address information (proceed indication) and an indication that the call is progressing through the network. It shall be possible to have audible indications which may be accompanied by other indications.

b) *Call acceptance (answer)*

Selection of the terminating customer is indicated to each user by appropriate indications (*call arrival indication* and *awaiting answer indication*). The acceptance of the call by the terminating user, i.e. answer, causes the indications to be removed and bidirectional communication paths to be provided. The call is now termed in the "speech phase".

c) *Call release*

A request to terminate the service may be generated by either user. If one user terminates the service the other user is given an appropriate indication as to the state of the call.

d) *Failure situations due to user error*

The following failure situations may occur due to user error:

i) user taking too long to input the network address information will be given a failure indication, e.g. during overlap sending (see Recommendations I.451 and I.220);

ii) user inputting a non valid network address, e.g. an unallocated address, will be given a failure indication.

e) *Failure indications due to terminating termination state*

i) User attempting to set up a call to a termination where no free B-channels are available will receive a busy indication unless call waiting or another supplementary service is in operation.

Note – In support of some supplementary services (e.g. call waiting, line hunting), it may optionally be necessary for the subscriber to register some additional parameters (e.g. destination number used to distinguish PSTN telephony calls) with the network to allow the network to know when a channel is busy with telephony.

ii) User attempting to set up a call to a termination where the call is not accepted, i.e. no response indicating call acceptance is received, will, after a defined period, be given a call failure indication (see Recommendations I.451 and I.220).

f) *Failure situations due to network conditions*

User attempting to set up a call but meeting problems in the network (e.g. congestion) will be given a suitable indication.

1.4 *Network capabilities for charging*

This Recommendation does not cover charging principles. Future Recommendations in the D-Series are expected to contain that information.

It shall be possible to charge the subscriber accurately for the service.

1.5 *Interworking requirements*

1.5.1 Interworking is required between the ISDN and PSTN.

1.6 *Interaction with supplementary services*

Not applicable. Each supplementary service description identifies the applicability with this teleservice.

1.7 *Attributes and values of attributes of the telephony service*

a) *LOW LAYER ATTRIBUTES*

Information transfer attributes

1.	Information transfer mode:	circuit
2.	Information transfer rate:	64 kbit/s
3.	Information transfer capability:	speech
4.	Structure:	8 kHz integrity
5.	Establishment of communication:	on demand
6.	Symmetry:	bidirectional symmetric
7.	Communication configuration:	point-to-point

Access attributes

8.	Access channel (and rate):	B(64) for user information, D for signalling (Note)
9.	Access protocol	
9.1	Signalling access protocol layer 1:	I.430/I.431
9.2	Information access protocol layer 2:	I.440/I.441
9.3	Signalling access protocol layer 3:	I.450/I.451
9.4	Information access protocol layer 1:	I.430/I.431; G.711
9.5	Signalling access protocol layer 2:	not applicable
9.6	Information access protocol layer 3:	not applicable

b) *HIGH LAYER ATTRIBUTES*

10.	Type of user information:	speech
11.	Layer 4 protocol functions:	not applicable
12.	Layer 5 protocol functions:	not applicable
13.	Layer 6 protocol functions:	Recommendation G.711
14.	Layer 7 protocol functions:	not applicable

c) *GENERAL ATTRIBUTES*

15.	Supplementary services provided:	further study
16.	Quality of Service:	further study
17.	Interworking possibilities:	to and from PSTN
18.	Operational and commercial:	further study

Note – For reserved/permanent services, the operational, administrative and maintenance messages (OAM) related to these services may be conveyed over the D-channel.

1.8 *Recommended support of telephony by an ISDN*

a) Overall support[1]: E/A

Note – It is anticipated that ISDNs will offer telephony as a basic telecommunication service. Some networks will offer this as a teleservice. However, due to national regulation policies, some networks will offer telephony as a bearer service rather than as a teleservice.

[1] The definition of E (essential) and A (additional) can be found in Recommendation I.240.

b) Variations of non-dominant attributes :

1) Information transfer mode
– Circuit : E

2)

Establishment of communication	*Symmetry*	*Communication configuration*	*Support*[2)]
demand		pt-pt	E
reserved	bidirectional	pt-pt	FS
permanent	symétrique	pt-pt	A
demand		multipt	A
reserved	bidirectional	pt-pt	FS
permanent	symétrique	multipt	A

3) Access

Signalling and OAM (Note 1)		User information		Support
Channel and rate	Protocols	Channel and rate	Protocols	
D(16)	I.430, I.440, I.441, I.450, I.451 (Note 2)	B(64)	I.430, G.711	E
D(64)	I.431, I.440, I.441, I.450, I.451 (Note 2)	B(64)	I.431, G.711	E

Note 1 – Definition of protocols for OAM is for further study.

Note 2 – Demand services only. Others are for further study.

1.9 *Dynamic description*

The circuit-mode dynamic description appears in Recommendation I.220.

2 I.241.2 – Teletex

The prose description of the Teletex service is an extract of Recommendation F.200. If more detail is required this Recommendation should be referred to. As such, this service description does not strictly follow step 1.1 of the service description method. Further alignment with this description method requires further study.

[2)] The definition of E (essential) and A (additional) can be found in Recommendation I.240.

2.1 *Definition*

Teletex is an international service, enabling subscribers to exchange office correspondence in the form of documents containing Teletex coded information on an automatic memory-to-memory basis via the ISDN.

2.2 *Description*

2.2.1 *Scope*

The Teletex service provides communication between Teletex equipment[3)] which are used for the preparation, editing and printing of correspondence containing text information using a standardized character set (see Recommendation T.61).

The basic element of the correspondence between users is the page which is the smallest unit of text treated as an entity. No restrictions shall exist concerning the operator procedures for generation of the text or the positioning of text within the printable area on a page.

Note 1 – This does not necessarily imply that the characters used to construct a graphic symbol are transmitted in the same sequence as that in which they are keyed.

Note 2 – This does not necessarily imply that the order in which text on a page is transmitted is the same as that in which it was keyed.

Note 3 – An exception to this rule is the application of the processable mode of operation for which the page, as a basic element of correspondence, cannot be used. The processable mode of operation within the Teletex service is defined in Recommendation F.220.

2.2 *Operation*

2.2.2.1 *General*

The Teletex service in each country and the international interconnection between countries or networks shall use automatic switching so that it is possible for any Teletex subscriber to reach any other Teletex subscriber using fully automatic selection.

It is a requirement to allow the through-connection of a call between a Teletex terminal connected to a private automatic branch exchange (or similar systems) and those connected to public exchanges used for the Teletex service.

A virtual dialogue mode of operation, which appears to the subscriber as an interactive mode, should be possible, although this is not a basic requirement of the Teletex service.

A virtual dialogue mode of operation, which appears to the subscriber as an interactive mode, may become possible as a new standardized option within the Teletex service, allowing both communications between persons and data base access (see Recommendation I.210).

Processable mode of operation, as a standardized option within the Teletex service, allows the transfer of text containing information to permit convenient further editing and processing by the recipient (see Recommendation F.220).

Mixed mode of operation using the techniques of Telefax 4 for the transfer of facsimile-coded information and of Teletex for the transfer of character-coded text is described as a standardized option within the Teletex service in Recommendation F.230.

Two-way alternate (TWA) communication is a capability of the Teletex service, which also includes one-way communication (OWC); the calling subscriber will have full control of the Teletex call.

---

3) Teletex equipment may be a Teletex terminal or a system.

2.3 *Procedures*

2.3.1 *Provision/withdrawal*

The national and international facilities of the Teletex service, including the Teletex/telex conversion facilities, shall be open continuously.

Teletex subscriber equipment for which call numbers are published in the directories shall, in principle, be available to accept calls continuously.

In order to facilitate the 24-hour duration of the service, it is permitted to use a centralized storage in the network to realize the receiving memory capability of the terminal.

2.3.2 *Call phases*

The operations for each call may be divided into the following three phases:

a) Preparation
   - preparation of the information in local mode;
   - loading of the information into a memory,

b) Transmission (in principle, automatic)
   - call establishment;
   - pre-information phase (see Note);
   - information transfer from memory-to-memory (see Note);
   - post information phase (see Note);
   - call clearing.

   Note – During these parts of the transmission phase the network must be transparent with respect to control procedures.

c) Output
   - emptying the memory.

Note – The information may consist of one or more Teletex documents each consisting of one or more Teletex pages.

The control procedures as specified in Recommendation T.62 shall be used as end-to-end communication procedures between any Teletex equipment in the basic service.

The lower layer protocols and the network independent basic transport protocol to be used for Teletex are specified in Recommendations T.70 and T.90.

The network-dependent control procedures for the Teletex are those that are defined for ISDN.

2.3.3 *Call identification line*

The Teletex procedures include the exchange of reference information prior to sending any document. This reference information includes identification of the parties to the call as well as the date and time. Also, supplementary reference information is exchanged during a call to allow reference to an individual document or page for error recovery or other purposes.

This reference information, taken together, is defined to be printable on a single line called the call identification line. Use of this information is a local decision except in recovering from an interrupted transmission.

The call identification line is composed of four fields as follows (see Figure 1/I.241):

- Field 1: identification of the called Teletex equipment;
- Field 2: identification of the calling Teletex equipment;
- Field 3: date and time;
- Field 4: supplementary reference information.

Field 1		Field 2		Field 3		Field 4
Identification of the called Teletex equipment	/	Identification of the calling Teletex equipment	/	Date and time	/	Supplementary reference information
24 characters	1	24 characters	1	14 characters	1	7 characters
72 characters						

Field 1 - (identification of the called equipment) contains the identification of the called equipment. It is originated in the control procedures by the called equipment.

Field 2 - (identification of the calling equipment) contains the identification of the calling equipment. It is originated in the control procedures by the calling equipment.

Field 3 - (date and time) contains the date and time reference information showing the year, month, day, hour and minute in the fixed format of 14 characters thus YY-MM-DD-HH:MM. This field is originated in the control procedures by the calling equipment which obtains this information from the network. This time represents the local time at the calling equipment and is intended to represent the time of call origination.

Field 4 - (supplementary reference information) contains a document reference number, a hyphen (coding 2/13) as a separator and a page reference number as number as defined in Recommendation T.62. This field has a fixed length of seven character positions and is originated in the control procedures by the Teletex equipment that is sending the associated documents.

FIGURE 1/I.241

Format of the call identification line

2.3.4 *Error protection*

Within the Teletex service a high layer error detection and correction is provided in the session layer for all those errors which are not corrected by the network layers.

To ensure call integrity, error protection will be provided by Teletex control procedures (see Recommendations T.62, T.70 and T.90). The error rate on the pre-information, information and post-information phases should not exceed 1 in 10^6 characters.

2.4 *Network capabilities for charging*

This Recommendation does not cover charging principles. Future Recommendations in the D-Series are expected to contain that information.

It shall be possible to charge the subscriber accurately for the service.

2.5 *Interworking requirements*

2.5.1 Within the Teletex service, interworking between terminals connected to different networks is required. Real-time connection between terminals operating at different speeds has to be provided on the basis of at least 2.4 kbit/s.

2.5.2 *Intercommunication with other services*

2.5.2.1 The Teletex service will provide the ability for intercommunication in both directions with the telex service by means of conversion facilities (see Recommendations F.201, U.201, T.390).

2.5.2.2 Intercommunication between basic mode and mixed mode Teletex terminals and Classes I, II and III Group 4 facsimile terminals is shown in Table 1/I.241 (see Recommendation F.184).

2.5.2.3 The Teletex service allows for intercommunication with telex and with the Interpersonal Messaging Service (IPM) (see Recommendations F.421, F.422).

TABLE 1/I.241

Current status of direct intercommunication for Teletex and Group 4 facsimile terminals on the same network

From \ To	Facsimile Group 4, Class I	Facsimile Group 4, Class II	Facsimile Group 4, Class III	Teletex basic mode	Teletex mixed mode	Teletex processable mode 1
Facsimile Group 4, Class I	F	F	F			
Facsimile Group 4, Class II	F	F	F			
Facsimile Group 4, Class III	F	T, F, MM	T, F, MM	T	T, MM	T
Teletex basic mode		T	T	T	T	T
Teletex mixed mode		T, MM	T, MM	T	T, MM	T
Teletex processable mode 1		T	T	T	T	T, PM1

T: Basic Teletex document with character coded information only.

F: Group 4 facsimile document with facsimile coded information only.

MM: Mixed-mode document with character and facsimile coded information.

PM1: Processable mode document with character coded information only.

2.6 *Interaction with supplementary services*

Each supplementary service description identifies the applicability with this teleservice.

For the ISDN, the international supplementary services which may be used for Teletex in the circuit mode using a B-Channel are:

i) closed user group;
ii) multiple subscriber number;
iii) user-to-user signalling;
iv) calling line identification presentation;
v) calling line identification restriction;
vi) connected line identification presentation;
vii) connected line identification restriction;
viii) direct-dialling-in.

The use of other supplementary services is for further study.

Supplementary services for Teletex with a packet-mode of operation are for further study.

a) *LOW LAYER ATTRIBUTES*

Information transfer attributes

		Circuit-mode bearer capability	*Packet-mode bearer capability*
1.	Information transfer mode	circuit	packet
2.	Information transfer rate	64 kbit/s	maximum throughput of a given virtual circuit is less than or equal to the maximum bit rate of the user information access channel and the throughput class of the virtual circuit
3.	Information transfer capability	unrestricted (Note 1)	unrestricted
4.	Structure	unstructured (Note 2)	service data unit integrity
5.	Establishment of communication	demand	demand (VC), permanent (PVC)
6.	Symmetry	bidirectional symmetric	bidirectional symmetric
7.	Communication configuration	point-to-point	point-to-point

		Circuit-mode bearer capability	*Packet-mode bearer capability*
8.	Access channel:	B for user information D for signalling	user information over virtual circuit within B- or D-channel. When D-channel is used, maximum packet size and quality of service may be restricted. Signalling may be provided via D-channel and/or virtual circuit within B-channel.
9.	Access protocol		
9.1	Signalling access protocol layer 1:	Rec. I.430/I.431	Rec. I.430/I.431
9.2	Signalling access protocol layer 2:	Rec. I.440/I.441	Rec. I.440/I.441, X.31
9.3	Signalling access protocol layer 3:	Rec. I.450/I.451	Rec. I.450/I.451, X.31
9.4	Information access protocol layer 1:	Rec. I.430/I.431	Rec. I.430/I.431
9.5	Information access protocol layer 2:	Rec. X.75 (SLP)	Rec. X.25 (LAPB)
9.6	Information access protocol layer 3:	ISO 8208	Rec. X.25 (PLP)

b) *HIGH LAYER ATTRIBUTES*

10.	Type of user information:	Teletex
11.	Layer 4 protocol functions:	T.70
12.	Layer 5 protocol functions:	T.62
13.	Layer 6 protocol functions:	T.61
14.	Layer 7 protocol functions:	T.60

c) *GENERAL ATTRIBUTES*

15.	Supplementary services provided:	see § 2.6
16.	Quality of service:	for further study
17.	Interworking possibilities:	see § 2.5
18.	Operational and commercial:	for further study

SLP – Single link protocol

PLP – Packet layer protocol

VC – Virtual circuit

PVC – Permanent virtual cirtcuit

Note 1 – The interworking arrangements with networks having a restricted 64 kbit/s information transfer capability require further study.

Note 2 – Even if no structure is required the network may provide 8 kHz integrity.

2.8 *Recommended support of Teletex by an ISDN*

a) Overall support[4]: A

b) Variations of non-dominant attributes:

1) Information transfer mode

Note – In the interim period, the circuit mode method of operation is preferred
– circuit: A
– packet: A

2)

Establishment of communication	*Symmetry*	*Communication configuration*	*Support*[4]
demand	bidirectional symmeric	pt-pt	E

[4] The definition of E (essential) and A (additional) can be found in Recommendation I.240.

3) *Access*

Signalling and OAM (Note 1)		User information		Support
Channel and rate	Protocols	Channel and rate	Protocols	
Circuit mode				
D(16)	I.430, I.440, I.441, I.450, I.451 (Note 2)	B(64)	I.430, X.75 (SLP), ISO 8208	A
D(64)	I.431, I.440, I.441, I.450, I.451 (Note 2)	B(64)	I.431, X.75 (SLP), ISO 8208	A
Packet mode				
D(16)	I.430, I.440, I.441, I.450, I.451, X.31	B(64) or D(16)	I.430, X.25 LAPB, X.25 (PLP)	A
D(64)	I.431, I.440, I.441, I.450, I.451, X.31	B(64)	I.431, X.25 LAPB, X.25 (PLP)	FS
VC in B(64)	for futher study	B(64)	for futher study	FS

Note 1 – Definition of protocols for OAM is for further study.

Note 2 – Demand services only. Others are for further study.

2.9 *Dynamic description*

The circuit-mode dynamic description appears in Recommendation I.220.

3 I.241.3 – **Telefax 4**

The prose description of the Telefax 4 service is an extract of Recommendation F.184. (If more detail is required this Recommendation should be referred to.) Therefore it does not strictly follow Step 1.1 of the service description method. Closer alignment with the method requires further study.

3.1 *Definition*

Telefax 4 is an international service enabling subscribers to exchange office correspondence in the form of documents containing facsimile coded information, automatically via the ISDN.

3.2 *Description*

3.2.1 *General description*

The Telefax 4 service provides a basic level of compatibility between all terminals participating in the service. It offers bidirectional communication between two users via the ISDN using 64 kbit/s digital signals over the B-channel.

There are three classes of Group 4 facsimile terminals:

Class I – In this class the minimum requirement terminal is a terminal able to send and receive documents containing facsimile encoded information (in accordance with Recommendation T.6 and the T.400-Series).

Class II – In this class the minimum requirement terminal is a terminal able to transmit documents that are facsimile encoded (in accordance with Recommendation T.6 and the T.400-Series). In addition, the terminal must be capable of receiving documents which are facsimile coded (in accordance with Recommendation T.6 and the T.400-Series), teletex coded (in accordance with the basic coded character repertoire as defined in Recommendation T.61) and also mixed-mode documents (in accordance with Recommendations of the T.400-Series).

Class III – In this class the minimum requirement terminal is a terminal that is capable of generating, transmitting and receiving facsimile coded documents (in accordance with Recommendation T.6 and the T.400-Series), teletex coded documents (in accordance with the basic coded character repertoire as defined in Recommendation T.61) and mixed-mode documents (in accordance with Recommendations of the T.400-Series).

The basic element of the correspondence between users is the page which is the smallest unit of text treated as an entity. No restrictions shall exist concerning the operator procedures for generation of the text or the positioning of text within the reproducible area on a page.

3.2.2 *Operation – General*

The Telefax 4 service in each country and the interconnection between countries or networks shall use automatic switching so that it is possible for any Telefax 4 subscriber to reach any other Telefax 4 subscriber using fully automatic selection.

It is a requirement to allow the through-connection of a call between Group 4 facsimile terminals connected to a private automatic branch exchange (or similar systems) and those connected to public exchanges used for the Group 4 facsimile service.

Two-way alternate (TWA) communication is a capability of the Telefax 4 service, which also includes one-way communication (OWC); the calling subscriber will have full control of the Group 4 facsimile call.

3.3. *Procedures*

3.3.1 *Provision/withdrawal*

The national and international Telefax 4 service shall be open continuously.

Telefax 4 terminals for which call numbers are published in the directories shall, in principle, be available to accept calls continuously.

In order to facilitate the 24-hour duration of service it is permitted to use a centralized storage in the network to realize the receiving memory capability of the terminal.

3.3.2 *Call phases*

The operations for each call may be divided into the following three phases:

a) preparation:
   - preparation of the information to be transmitted;

b) transmission:
   - call establishment (automatic);
   - pre-information phase (see Note);
   - information transfer (see Note);
   - post information phase (see Note);
   - call clearing.

   Note – During these parts of the transmission phase the network must be transparent with respect to control procedures.

c) output:

- displaying the message either by immediate printing or from a storage medium upon control by the operator.

Note – The information may consist of one or more Telefax 4 documents each consisting of one or more Telefax pages.

The control procedures as specified in Recommendation T.62 and Recommendations of the T.400-Series shall be used as end-to-end communication procedures between terminals in the service.

The low layer protocols and the network independent basic transport protocol for Telefax 4 are specified in Recommendations T.70 and T.90.

The network-dependent control procedures for the Telefax 4 service are those that are defined for ISDN.

3.3.3 *Call identification line*

The Telefax 4 procedures include the exchange of reference information prior to sending any document. This reference information includes identification of the parties to the call as well as the date and time. Also, supplementary reference information is exchanged during a call to allow reference to an individual document or page for error recovery or other purposes. Date and time have to be provided by the network and sent to the calling terminal in the call set-up phase.

This reference information, taken together, is defined to be printable on a single line called the call identification line. Use of this information is a local decision except in recovering from an interrupted transmission. In the case of automatic linking, the use of this information is for further study.

For the format of the call identification line see Recommendation F.200.

3.3.4 *Error protection*

To ensure call integrity, error protection will be provided by Telefax 4 control procedures (see Recommendations T.62, T.70 and T.90). Besides the error detection and correction mechanism in layer 2 (and 3) an additional error detection and correction mechanism is provided in the session layer. By this mechanism, errors of the higher layer functions (e.g. command/response sequence error) and transmission errors, which are not corrected by the lower layers, will be corrected, for example, by retransmission of one or several pages.

The error rate on the pre-information, information and post-information phases should not exceed 1×10^{-6}.

3.4 *Network capabilities for charging*

This Recommendation does not cover charging principles. Future Recommendations in the D-Series are expected to contain that information.

It shall be possible to charge the subscriber accurately for the service.

3.5 *Interworking requirements*

3.5.1 Within the Telefax 4 service, interworking between terminals connected to different networks is required for:

a) Telefax 4 (ISDN) – Telefax 4 (CSPDN: Circuit switched public data network)

b) Telefax 4 (ISDN) – Telefax 4 (PSPDN: Packet switched public data network)

c) Telefax 4 (ISDN) – Telefax 4 (PSTN: Public switched telephone network)

In the case of international interworking between Group 4 facsimile terminals connected to dissimilar networks, Recommendation X.300 shall apply. For international interworking between PSTN and ISDN, a (separate) Telefax 4 interworking unit may be necessary.

International routes between ISDNs for the Telefax 4 service shall be capable of supporting user data rates up to 64 kbit/s.

3.5.2 *Intercommunication with other services*

3.5.2.1 Intercommunication between basic mode and mixed mode Teletex terminals and Classes I, II and III Group 4 facsimile terminals connected to the Telefax 4 service is shown in Table 2/I.241.

In both the Teletex and Telefax 4 services, the equipment providing mixed mode should enable a direct exchange of documents in accordance with Recommendations T.6, T.61 and of the T.400-Series.

TABLE 2/I.241

Current status of direct intercommunication for Teletex and Group 4 facsimile terminals on the same network

From \ To	Facsimile Group 4, Class I	Facsimile Group 4, Class II	Facsimile Group 4, Class III	Teletex basic mode	Teletex mixed mode	Teletex processable mode 1
Facsimile Group 4, Class I	F	F	F			
Facsimile Group 4, Class II	F	F	F			
Facsimile Group 4, Class III	F	T, F, MM	T, F, MM	T	T, MM	T
Teletex basic mode		T	T	T	T	T
Teletex mixed mode		T, MM	T, MM	T	T, MM	T
Teletex processable mode 1		T	T	T	T	T, PM1

T: Basic Teletex document with character coded information only.

F: Group 4 facsimile document with facsimile coded information only.

MM: Mixed-mode document with character and facsimile coded information.

PM1: Processable mode document with character coded information only.

3.5.2.2 Intercommunication is desirable between terminals of the Telefax 4 service and terminals of services other than Telefax 4 provided over ISDN and other public switched networks.

Intercommunication possibilities between Telefax 4 terminals and Telefax 3 terminals have to be provided (see also Recommendation F.180):

a) Telefax 4 (ISDN) – Telefax 3 (PSTN)

b) Telefax 4 (ISDN) – Telefax 3 (ISDN, via terminal adaptors)

In case a) Telefax 4 terminals use specific service features in ISDN. Intercommunication should be supported by ISDN-PSTN interworking units.

In case b) Telefax 3 terminals and Telefax 4 terminals which are to be connected in the PSTN can also be connected to the ISDN via terminal adaptors.

3.6 *Interaction with supplementary services*

Each supplementary service description identifies the applicability with this teleservice.

For the ISDN, the international supplementary services for the Telefax 4 service in the circuit mode using a B-channel are:

i) closed user group;

ii) multiple subscriber number;

iii) user-to-user signalling;

iv) calling line identification presentation;

v) calling line identification restriction;

vi) connected line identification presentation;

vii) connected line identification restriction;

viii) direct-dialling-in.

The use of other supplementary services is for further study.

Supplementary services for Telefax 4 with a packet mode of operation are for further study.

3.7 *Attributes and values of attributes of the Telefax 4 service*

a) *LOW LAYER ATTRIBUTES*

Information transfer attributes

		Circuit-mode bearer capability	*Packet-mode bearer capability*
1.	Information transfer mode	circuit	packet
2.	Information transfer rate	64 kbit/s	maximum throughput of a given virtual circuit is less than or equal to the maximum bit rate of the user information access channel and the throughput class of the virtual circuit
3.	Information transfer capability	unrestricted (Note 1)	unrestricted
4.	Structure	unstructured (Note 2)	service data unit integrity
5.	Establishment of communication	demand	demand (VC)/permanent (PVC)
6.	Symmetry	bidirectional symmetric	bidirectional symmetric
7.	Communication configuration	point-to-point	point-to-point

Access attributes

		Circuit-mode bearer capability	*Packet-mode bearer capability*
8.	Access channel	B for user information D for signalling	User information over virtual circuit within B- or D-channel. When D-channel is used, maximum packet size and quality of service may be restricted. Signalling may be provided via D-channel and/or virtual circuit within B-channel (Note 3)
9.	Access protocol		
9.1	Signalling access protocol layer 1	Rec. I.430/I.431	Rec. I.430/I.431
9.2	Signalling access protocol layer 2	Rec. I.440/I.441	Rec. I.440/I.441, X.31
9.3	Signalling access protocol layer 3	Rec. I.450/I.451	Rec. I.450/I.451, X.31
9.4	Information access protocol layer 1	Rec. I.430/I.431	Rec. I.430/I.431
9.5	Information access protocol layer 2	Rec. X.75 (SLP)	Rec. X.25 (LAPB)
9.6	Information access protocol layer 3	ISO 8208	Rec. X.25 (PLP)

b) *HIGH LAYER ATTRIBUTES*

10.	Type of user information:	Telefax 4
11.	Layer 4 protocol functions:	T.70
12.	Layer 5 protocol functions:	T.62
13.	Layer 6 protocol functions:	T.400-Series (Note 4)
13.1	Resolution [pixels per inch (ppi)]:	200 × 200 standard; 240 × 240, 300 × 300, 400 × 400 optional
14.	Layer 7 protocol functions:	T.503, T.521, T.563

c) *GENERAL ATTRIBUTES*

15.	Supplementary services provided:	see § 3.6
16.	Quality of service:	for further study
17.	Interworking possibilities:	see § 3.5
18.	Operational and commercial:	for further study

Note 1 – The interworking arrangements with networks having a restricted 64 kbit/s information transfer capability require further study.

Note 2 – Even if no structure is required the network may provide 8 kHz integrity.

Note 3 – User information transferred via virtual channel on the D-channel is for further study.

Note 4 – Further study is required to identify a more precise reference in the T.400-Series of Recommendations.

3.8 *Recommended support of Telefax 4 by an ISDN*

a) Overall support:[5] A

b) Variations of non-dominant attributes:

1) Information transfer mode

Note – In the interim period, the circuit mode method of operation is preferred.
– circuit: A
– packet: A

2)

Establishment of communication	*Symmetry*	*Communication configuration*	*Support*[5]
demand	bidirectional symmetric	pt-pt	E

[5] The definition of E (essential) and A (additional) can be found in Recommendation I.240.

3) Access

Signalling and OAM (Note 1)		User information		Support
Channel and rate	Protocols	Channel and rate	Protocols	
Circuit mode				
D(16)	I.430, I.440, I.441, I.450, I.451 (Note 2)	B(64)	I.430, X.75 (SLP), ISO 8208	A
D(64)	I.431, I.440, I.441, I.450, I.451 (Note 2)	B(64)	I.431, X.75 (SLP), ISO 8208	A
Packet mode				
D(16)	I.430, I.440, I.441, I.450, I.451, X.31	B(64) or D(16)	I.430, X.25 LAPB, X.25 (PLP)	A
D(64)	I.431, I.440, I.441, I.450, I.451, X.31	B(64)	I.431, X.25 LAPB, X.25 (PLP)	FS
VC in B(64)	for further study	B(64)	FS	FS

Note 1 – Definition of protocols for OAM is for further study.

Note 2 – Demand services only. Others are for further study.

3.9 *Dynamic description*

The circuit mode dynamic description appears in Recommendation I.220.

4 I.241.4 – **Mixed mode**

The prose definition of the mixed mode service is an extract of Recommendation F.230.

4.1 *Definition*

This service provides combined text and facsimile communication for end-to-end transfer of documents containing mixed information of text and fixed images. The high layer attributes are based on the CCITT Recommendations for Teletex and Telefax 4.

4.2 *Description*

For further study.

4.3 *Procedures*

For further study.

4.4 *Network capabilities for charging*

This Recommendation does not cover charging principles. Future Recommendations in the D-Series are expected to contain that information.

It shall be possible to charge the subscriber accurately for the service.

4.5 *Interworking requirements*

For further study.

4.6 *Interaction with supplementary services*

For further study.

4.7 *Attributes and values of attributes of the mixed mode service*

a) *LOW LAYER ATTRIBUTES*

Information transfer attributes

		Circuit-mode bearer capability	*Packet-mode bearer capability*
1.	Information transfer mode	circuit	packet
2.	Information transfer rate	64 kbit/s	maximum throughput of a given virtual circuit is less than or equal to the maximum bit rate of the user information access channel and the throughput class of the virtual circuit
3.	Information transfer capability	unrestricted (Note 1)	unrestricted
4.	Structure	unstructured (Note 2)	service data unit integrity
5.	Establishment of communication	demand	demand (VC), permanent (PVC)
6.	Symmetry	bidirectional symmetric	bidirectional symmetric
7.	Communication configuration	point-to-point	point-to-point

		Circuit-mode bearer capability	*Packet- mode bearer capability*
8.	Access channel	B for user information D for signalling	user information over virtual circuit within B- or D-channel. When D-channel is used, maximum packet size and quality of service may be restricted. Signalling may be provided via D-channel and/or virtual circuit within B-channel (Note 3)
9.	Access protocol		
9.1	Signalling access protocol layer 1	Rec. I.430/I.431	Rec. I.430/I.431
9.2	Signalling access protocol layer 2	Rec. I.440/I.441	Rec. I.440/I.441, X.31
9.3	Signalling access protocol layer 3	Rec. I.450/I.451	Rec. I.450/I.451, X.31
9.4	Information access protocol layer 1	Rec. I.430/I.431	Rec. I.430/I.431
9.5	Information access protocol layer 2	Rec. X.75 (SLP)	Rec. X.25 (LAPB)
9.6	Information access protocol layer 3	ISO 8208	Rec. X.25 (PLP)

b) *HIGH LAYER ATTRIBUTES*

10.	Type of user information:	mixed mode
11.	Layer 4 protocol functions:	X.224, X.214
12.	Layer 5 protocol functions:	X.225, X.215
13.	Layer 6 protocol functions:	T.61, X.226, X.216
13.1	Resolution [pixels per inch (ppi)]:	300 × 300 240 × 240 400 × 400 optional, 600, 1200
14.	Layer 7 protocol functions:	T.501, T.522, T.561

c) *GENERAL ATTRIBUTES*

15.	Supplementary services provided:	for further study
16.	Quality of service:	for further study
17.	Interworking possibilities:	ISDN Teletex, ISDN Telefax 4 (others for further study)
18.	Operational and commercial:	for further study

Note 1 – The interworking arrangements with networks having restricted 64 kbit/s information transfer capability require further study.

Note 2 – Even if no structure is required the network may provide 8 kHz integrity.

Note 3 – User information transferred via virtual channel on the D-channel is for further study.

4.8 *Recommended support of mixed mode by an ISDN*

a) Overall support:[6] A

b) Variation of non-dominant attributes:

1) Information transfer mode

- circuit: A
- packet: A

2)

Establishment of communication	*Symmetry*	*Communication configuration*	*Support*[6]
demand	bidirectional symmetric	pt-pt	E

3) Access

Signalling and OAM (Note 1)		User information		Support
Channel and rate	Protocols	Channel and rate	Protocols	
Circuit mode				
D(16)	I.430, I.440, I.441, I.450, I.451 (Note 2)	B(64)	I.430, X.75 (SLP), ISO 8208	A
D(64)	I.431, I.440, I.441, I.450, I.451 (Note 2)	B(64)	I.431, X.75 (SLP), ISO 8208	A
Packet mode				
D(16)	I.430, I.440, I.441, I.450, I.451, X.31	B(64) or D(16)	I.430, X.25 LAPB, X.25 (PLP)	FS
D(64)	I.431, I.440, I.441, I.450, I.451, X.31	B(64)	I.431, X.25 LAPB, X.25 (PLP)	FS
VC in B(64)	for further study	B(64)	for further study	FS

Note 1 – Definition of protocols for OAM is for further study.

Note 2 – Demand services only. Others are for further study.

4.9 *Dynamic description*

The circuit mode dynamic description appears in Recommendation I.220.

5 I.241.5 – Videotex

The prose description for the Videotex service in ISDN is for further study and is intended to be based on Recommendation F.300.

[6] The definition of E (essential) and A (additional) can be found in Recommendation I.240.

5.1 *Definition*

The Videotex service in the ISDN is an enhancement of the existing Videotex service with retrieval and mailbox functions for text (alpha) and graphic information.

5.2 *Description*

For further study.

5.3 *Procedures*

For further study.

5.4 *Network capabilities for charging*

This Recommendation does not cover charging principles. Future Recommendations in the D-Series are expected to contain that information.

It shall be possible to charge the subscriber accurately for the service.

5.5 *Interworking requirements*

For further study.

5.6 *Interaction with supplementary services*

For further study.

5.7 *Attributes and values of attributes of the Videotex service*

a) *LOW LAYER ATTRIBUTES*

Information transfer attributes

		User to Videotex centre	Videotex centre to Videotex centre, external computers
1.	Information transfer mode:	circuit (Note 1)	circuit/packet
2.	Information transfer rate:	64 kbit/s	further study
3.	Information transfer capability:	unrestricted	further study
4.	Structure:	further study	further study
5.	Establishment of communication:	demand	demand/permanent
6.	Symmetry:	bidirectional symmetric	bidirectional symmetric
7.	Communication configuration:	point-to-point	demand/permanent point-to-point, multipoint

Access attributes

8.	Access channel:	B for user information (Note 2) D for signalling
9.	Access protocol	
9.1	Signalling access protocol layer 1:	I.430/I.431
9.2	Signalling access protocol layer 2:	I.440/I.441
9.3	Signalling access protocol layer 3:	I.450/I.451
9.4	Information access protocol layer 1:	I.430/I.431
9.5	Information access protocol layer 2:	X.75 (SLP)
9.6	Information access protocol layer 3:	ISO 8208

b) *HIGH LAYER ATTRIBUTES*

10.	Type of user information: Videotex	
11.	Layer 4 protocol functions	For further study
12.	Layer 5 protocol functions	
13.	Layer 6 protocol functions	
13.1	Resolution [pixels per inch (ppi)]	
13.2	Graphic mode	
14.	Layer 7 protocol functions	

c) *GENERAL ATTRIBUTES:* for further study

Note 1 – The use of packet-mode is for further study.

Note 2 – The use of the D-channel for Videotex information is for further study.

5.8 *Recommended support of Videotex by an ISDN*

a) Overall support[7]: A

b) Variations of non-dominant attributes:

1) Information transfer mode

– circuit	user terminal-to-Videotex centre	A
	videotex centre to Videotex centre, external computer	A
– packet	videotex centre to Videotex centre, external computer	A

2)

Establishment of communication	*Symmetry*	*Communication configuration*	*Support*[7]
demand permanent (Note)	bidirectional symmetric	pt-pt	E
demand permanent (Note)	bidirectional symmetric	multipoint (Note)	A

Note – Between Videotex centres and to external computers.

[7] The definition of E (essential) and A (additional) can be found in Recommendation I.240.

3) Access

Signalling and OAM (Note 1)		User information		Support
Channel and rate	Protocols	Channel and rate	Protocols	
Circuit mode				
D(16)	I.430, I.440, I.441, I.450, I.451 (Note 2)	B(64)	I.430, X.75 (SLP), ISO 8208	A
D(64)	I.431, I.440, I.441, I.450, I.451 (Note 2)	B(64)	I.431, X.75 (SLP), ISO 8208	A
Packet mode				
D(16)	FS	B(64) or D(16)	FS	FS
D(64)	FS	B(64)	FS	FS
VC in B(64)	FS	B(64)	FS	FS

Note 1 – Definition of protocols for OAM is for further study.

Note 2 – Demand services only. Others are for further study.

5.9 *Dynamic description*

The circuit mode dynamic description appears in Recommendation I.220.

6 I.241.6 – **Telex**

6.1 *Definition*

This service provides interactive text communication. The digital signal at the S/T reference point follows the internationally agreed Recommendations for telex above the ISDN physical layer.

6.2 *Description*

For further study.

6.3 *Procedures*

For further study.

6.4 *Network capabilities for charging*

This Recommendation does not cover charging principles. Future Recommendations in the D-Series are expected to contain that information.

It shall be possible to charge the subscriber accurately for the service.

6.5 *Interworking requirements*

For further study.

6.6 *Interaction with supplementary services*

For further study.

6.7 *Attributes and values of attributes of the telex service*

a) *LOW LAYER ATTRIBUTES*

Information transfer attributes

1.	Information transfer mode:	circuit (packet is for further study (Note))
2.	Information transfer rate:	64 kbit/s
3.	Information transfer capability:	unrestricted
4.	Structure:	8 kHz integrity
5.	Establishment of communication:	reserved/permanent
6.	Symmetry:	bidirectional
7.	Communication configuration:	point-to-point

Access attributes

8.	Access channel:	B for user information D for signalling (D for telex user information is for further study (Note))
9.	Access protocol:	
9.1	Signalling access protocol layer 1:	I.430/I.431
9.2	Signalling access protocol layer 2:	U.202
9.3	Signalling access protocol layer 3:	U.202
9.4	Information access protocol layer 1:	I.430/I.431
9.5	Information access protocol layer 2:	U.202
9.6	Information access protocol layer 3:	for further study

b) *HIGH LAYER ATTRIBUTES*

10.	Type of user information: telex	
11.	Layer 4 protocol functions	For further study
12.	Layer 5 protocol functions	
13.	Layer 6 protocol functions	
14.	Layer 7 protocol functions	

c) *GENERAL ATTRIBUTES*

15.	Supplementary services provided:	for further study
16.	Quality of Service:	for further study
17.	Interworking possibilities:	Telex, Teletex (others: for further study)
18.	Operational and commercial:	for further study

Note – Subject to satisfying telex quality of service on D-channel.

6.8 *Recommended support of Telex by an ISDN*

a) Overall support:[8] FS

b) Variations of non-dominant attributes:

1) Information transfer mode

– circuit: FS
– packet: FS

[8] The definition of E (essential) and A (additional) can be found in Recommendation I.240.

2)

Establishment of communication	*Symmetry*	*Communication configuration*	*Support* [9]
demand		pt-pt	E
reserved	bidirectional	pt-pt	FS
permanent	symmetric	pt-pt	A
demand		multipt	A
reserved	bidirectional	multipt	FS
permanent	symmetric	multipt	A

3) Access

Signalling and OAM (Note 1)		User information		Support
Channel and rate	Protocols	Channel and rate	Protocols	
Circuit mode				
D(16)	I.430, I.440, I.441, I.450, I.451 (Note 2)	B(64)	I.430, U.202 (Note 3)	FS
D(64)	I.431, I.440, I.441, I.450, I.451 (Note 2)	B(64)	I.431, U.202 (Note 3)	FS
Packet mode				
D(16)	FS (Note 4)	D(16)	FS	FS

Note 1 – Definition of protocols for OAM is for further study.

Note 2 – Layer 2 and 3 protocols are for further study.

Note 3 – Others are for further study.

Note 4 – Subject to satisfying telex quality of service on D-channel.

6.9 *Dynamic description*

For further study.

[9] The definition of E (essential) and A (additional) can be found in Recommendation I.240.

SECTION 5

SUPPLEMENTARY SERVICES IN ISDN

Recommendation I.250

DEFINITION OF SUPPLEMENTARY SERVICES

(Melbourne, 1988)

1 General

Recommendation I.210 describes the principles for defining telecommunication services supported by an ISDN including the concept of bearer services, teleservices and supplementary services. It also provides the means for the definition and description of such services.

The purpose of this Recommendation is to define a recommended set of supplementary services to be used in association with basic bearer services and with basic teleservices. These definitions form the basis for detailed descriptions as given in Recommendations I.251 to I.257, which are used to define the network capabilities required.

Supplementary services are described by prose definitions and descriptions and by dynamic descriptions following the description method given in Recommendation I.130. The application for supplementary services of the attribute technique described in Recommendation I.140 is for further study.

Note – Alignment and interworking between user facilities as defined in Recommendations X.2 and X.301 for the provision of data transmission services and the supplementary services in the I.250-Series and interworking in the I.500-Series of Recommendations require further study.

2 List of supplementary services

The following set of supplementary services is currently identified and more may be identified in the future:

Recommendation	I.251	Number Identification supplementary services
	I.251.1	Direct-Dialling-In (DDI)
	I.251.2	Multiple Subscriber Number (MSN)
	I.251.3	Calling Line Identification Presentation (CLIP)
	I.251.4	Calling Line Identification Restriction (CLIR)
	I.251.5	Connected Line Identification Presentation (COLP)
	I.251.6	Connected Line Identification Restriction (COLR)
	I.251.7	Malicious Call Identification (MCI) (Note)
	I.251.8	Sub-addressing (SUB) (Note)

Recommendation	I.252	Call Offering supplementary services
	I.252.1	Call Transfer (CT)
	I.252.2	Call Forwarding Busy (CFB)
	I.252.3	Call Forwarding No Reply (CFNR)
	I.252.4	Call Forwarding Unconditional (CFU)
	I.252.5	Call Deflection (CD) (Note)
	I.252.6	Line Hunting (LH)
Recommendation	I.253	Call Completion supplementary services
	I.253.1	Call Waiting (CW)
	I.253.2	Call Hold (HOLD)
	I.253.3	Completion of Calls to Busy Subscribers (CCBS) (Note)
Recommendation	I.254	Multiparty supplementary services
	I.254.1	Conference Calling (CONF)
	I.254.2	Three Party Service (3PTY)
Recommendation	I.255	Community of Interest supplementary services
	I.255.1	Closed User Group (CUG)
	I.255.2	Private Numbering Plan (PNP) (Note)
Recommendation	I.256	Charging supplementary services
	I.256.1	Credit Card Calling (CRED) (Note)
	I.256.2	Advice of Charge (AOC)
	I.256.3	Reverse Charging (REV) (Note)
Recommendation	I.257	Additional Information Transfer supplementary service
	I.257.1	User-to-User Signalling (UUS)

Note – This service having been identified now requires further study; its description is not yet included.

3 Association of supplementary services to bearer services and teleservices

Table 1/I.250 shows the association of supplementary services to basic bearer services and basic teleservices identified so far. Their provision in a particular ISDN is a network provider's option. Other associations are for further study.

Service Recommendations of the F-Series may recommend the individual provision of supplementary services with teleservices, for example, the provision with the telematic services Teletex, Telefax, Mixed Mode, etc.

4 Definitions of supplementary services

a) At stage 1 of the description method the services are described from the user's perspective, but do not concern details of the human interface itself. For example, in Call Waiting there is a statement that the served user "shall be informed" that a call is waiting. It does not specify whether this shall be accomplished by a bell, a light, a synthesized voice, etc.

b) Similarly, the stage 1 service description is independent of the amount of functionality in the user's terminal other than that required to provide the human interface. For example, the Conference Calling Service description is designed to be independent of whether the conference bridge is in the terminal, in the serving exchange, or elsewhere.

c) While the service descriptions are directly applicable to public networks, it is expected that the design of private networks will take these descriptions into account in order to ease the interworking between public and private networks.

d) Although reference is made to human users, there is no restriction on a machine or procedures being the user of these supplementary services. Examples include automatic answering terminals, voice announcement systems, etc.

e) Combining points a) to d), there is no prohibition against "machines" (e.g. call distributors) that *use* the CCITT described services and then *offer* the same or other (e.g. customized) services to *their* users.

f) Lastly, the "machine" referred to above could, in fact, be an entire private network.

TABLE 1/I.250

Association of supplementary services to basic bearer services and to basic teleservices supported by ISDN

Supplementary services	Circuit mode bearer services						Teleservices				
	64 kbit/s unrestricted demand	64 kbit/s speech demand	64 kbit/s, 3.1 kHz audio demand	64 kbit/s unrestricted permanent	64 kbit/s, 3.1 kHz audio permanent	1920 kbit/s unrestricted permanent	Telephony	Teletex	Telefax 4	Videotex	Mixed mode
Direct-dialling-in	X	X	X				X	X	X	X	X
Multiple subscriber number	X	X	X				X	X	X	X	X
Calling line identification presentation	X	X	X	b)	b)	b)	X	X	X	X	X
Calling line identification restriction	X	X	X	b)	b)	b)	X	X	X	X	X
Connected line identification presentation	X	X	X	b)	b)	b)	X	X	X	X	X
Connected line identification restriction	X	X	X	b)	b)	b)	X	X	X	X	X
Malicious calls identification a)											
Sub-addressing a)											
Call transfert	X	X	X				X				
Call forwarding busy	X	X	X				X				
Call forwarding no reply	X	X	X				X			X	
Call forwarding unconditional	X	X	X				X			X	
Call deflection a)											
Line hunting	X	X	X				X				
Call waiting	X	X	X				X				
Call hold	X	X	X				X				
Completion of calls to busy subscribers a)											
Conference calling	X	X	X				X				

TABLE 1/I.250 *(continued)*

Supplementary services	Circuit mode bearer services						Teleservices				
	64 kbit/s unrestricted demand	64 kbit/s speech demand	64 kbit/s, 3.1 kHz audio demand	64 kbit/s unrestricted permanent	64 kbit/s, 3.1 kHz audio permanent	1920 kbit/s unrestricted permanent	Telephony	Teletex	Telefax 4	Videotex	Mixed mode
Three party service	X	X	X				X				
Closed user group	X	X	X				X	X	X	X	X
Private numbering plan [a]											
Credit card calling [a]											
Advice of charge	X	X	X				X	X	X	X	X
Reserve charging [a]											
User-to-user signalling	X	X	X	[b]	[b]	[b]	X	X	X		X

X denotes applications of supplementary services identified within each supplementary service description; other associations are for further study.

[a] This supplementary service is not yet included in the descriptions.

[b] Further study is required on the association of this supplementary service to this circuit mode bearer service.

4.1 *Number Identification supplementary services* (Recommendation I.251)

I.251.1 **Direct Dialling In (DDI)** is a supplementary service which enables a user to directly call another user on a ISPBX or other private system without attendant intervention.

I.251.2 **Multiple Subscriber Number (MSN)** is a supplementary service which provides the possibility for assigning multiple ISDN numbers to a single interface.

I.251.3 **Calling Line Identification Presentation (CLIP)** is a supplementary service offered to the called party which provides the calling party's ISDN-number, possibly with sub-address information, to the called party.

I.251.4 **Calling Line Identification Restriction (CLIR)** is a supplementary service offered to the calling party to restrict presentation of the calling party's ISDN-number and sub-address to the called party.

I.251.5 **Connected Line Identification Presentation (COLP)** is a supplementary service offered to the calling party which provides the connected party's ISDN-number to the calling party.

I.251.6 **Connected Line Identification Restriction (COLR)** is a supplementary service offered to the connected party to restrict presentation of the connected party's ISDN-number to the calling party.

I.251.7 Malicious call identifiction (Definition not yet included, further study is needed).

I.251.8 Sub-addressing (Definition not yet included, further study is needed).

4.2 *Call Offering supplementary services* (Recommendation I.252)

I.252.1 **Call Transfer** is a supplementary service which enables a user to transfer an established (i.e. active) call to a third party. For the original call, the served user may have been either the calling or called party (i.e. it may have been either an incoming or outgoing call).

I.252.2 **Call Forwarding Busy (CFB)** is a supplementary service which permits a served user to have the network send to another number all incoming calls for the served user's ISDN number (or just those associated with a specified basic service) which meet busy at the served user's ISDN number. The served user's originating service is unaffected.

I.252.3 **Call Forwarding No Reply (CFNR)** is a supplementary service which permits a served user to have the network send to another number all incoming calls for the served user's ISDN number which meet no reply (or just those associated with a specific basic service which meet no reply). The served user's originating service is unaffected.

I.252.4 **Call Forwarding Unconditional (CFU)** is a supplementary service which permits a served user to have the network send to another number all incoming calls for the served user's ISDN number (or just those associated with a specified basic service). The served user's originating service is unaffected. If this service is activated, calls are forwarded regardless of the condition of the termination.

I.252.5 Call Deflection (Definition not yet included, further study is needed).

I.252.6 **Line Hunting** is a supplementary service which enables incoming calls to a specific ISDN number to be distributed over a group of interfaces.

4.3 *Call Completion supplementary services* (Recommendation I.253)

I.253.1 **Call Waiting** is a supplementary service which permits a subscriber to be notified of an incoming call (as per Basic Call procedures) with an indication that no interface information channel is available. The user then has the choice of accepting, rejecting or ignoring the waiting call (as per Basic Call procedures).

I.253.2 **Call Hold** is a supplementary service which allows a user to interrupt communications on an existing call/connection and then subsequently, if desired, reestablish.communications.

I.253.3 Completion of Calls to Busy Subscribers (Definition not yet included, further study is needed).

4.4 *Multiparty supplementary services* (Recommendation I.254)

I.254.1 **Conference Calling** is an ISDN supplementary service which allows a user to communicate simultaneously with multiple parties, which may also communicate among themselves.

I.254.2 **Three-Party Service** is a supplementary service which enables a user who is active on a call to hold that call, make an additional call to a third party, switch from one call to the other as required (privacy being provided between the two calls), and/or release one call and return to the other. Optionally, the served user could subscribe to an ability to join the two calls together into a three-way conversation.

4.5 *Community of Interest supplementary services* (Recommendation I.255)

I.255.1 **Closed User Group (CUG)** is a supplementary service which enables users to form groups, to and from which access is restricted. A specific user may be a member of one or more CUGs. Members of a specific CUG can communicate among themselves but not, in general, with users outside the group. Specific CUG members can have additional capabilities that allow them to originate calls outside the group, and/or to receive calls from outside the group. Specific CUG members can have additional restrictions that prevent them from originating calls to other members of the CUG, or from receiving calls from other members of the CUG.

I.255.2 Private Numbering Plan (Definition not yet included, further study is needed).

4.6 *Charging supplementary services* (Recommendation I.256)

I.256.1 Credit Card Calling (Definition not yet included, further study is needed).

I.256.2 **Advice of Charge** is a supplementary service allowing the user paying for a call to be informed of usage-based charging information.

This service may include one or more of the following cases:

1) Charging information at the end of the call.
2) Charging information during a call.
3) Charging information at call setup time.

I.256.3 Reverse charging (Definition not yet included, further study is needed).

4.7 *Additional information transfer supplementary service* (Recommendation I.257)

I.257.1 **User-to-User Signalling (UUS)** is a supplementary service which allows an ISDN user to send/receive a limited amount of information to/from another ISDN user over the signalling channel in association with a call to the other ISDN user.

Recommendation I.251

NUMBER IDENTIFICATION SUPPLEMENTARY SERVICES

(Melbourne, 1988)

The purpose of this Recommendation is to provide the stage 1 description of the method defined in Recommendation I.130 using the means given in Recommendation I.210.

Supplementary services are described by a prose definition and description (step 1.1) and by a dynamic description (step 1.3). The application of the attribute technique (step 1.2), as defined in Recommendation I.140, for supplementary services is for further study.

This Recommendation describes the following Number Identification supplementary services:

I.251.1 Direct-Dialling-In (DDI)

I.251.2 Multiple Subscriber Number (MSN)

I.251.3 Calling Line Identification Presentation (CLIP)

I.251.4 Calling Line Identification Restriction (CLIR)

I.251.5 Connected Line Identification Presentation (COLP)

I.251.6 Connected Line Identification Restriction (COLR)

I.251.7 Malicious Call Identification (MCI) (Note)

I.251.8 Sub-addressing (SUB) (Note)

Note – This service having been identified now requires further study, its description is not yet included.

1 I.251.1 – **Direct-Dialling-In**

1.1 *Definition*

Direct-Dialling-In (DDI) enables a user to directly call another user on an integrated services private branch exchange (ISPBX) or other private system without attendant intervention.

1.2 *Description*

1.2.1 *General description*

A part of the ISDN number, which is significant to the called user, is passed to that user during call establishment. This supplementary service is based on the use of the ISDN number and does not include sub-addressing.

Note 1 – A similar method to select a terminal on a passive bus is described in the supplementary service MSN.

Note 2 – The caller may or may not find the ISDN number in the public directory.

1.2.2 *Specific terminology*

None.

1.2.3 *Qualifications on the applicability to telecommunication services*

No restrictions.

1.3 *Procedures*

1.3.1 *Provision/withdrawal*

This service shall be provided/withdrawn after pre-arrangement with the service provider. The service provider shall allocate a set of ISDN numbers.

1.3.2 *Normal procedures*

1.3.2.1 *Activation/deactivation/registration*

Activation through subscription.

1.3.2.2 *Invocation and operation*

Call initiation procedures are the same as for the basic service. The calling and called users perceive the same completion procedures as for the basic service, without attendant intervention. Upon answer, the calling user is connected to the called user designated by the ISDN number.

Note – When the connection from the caller to the ISPBX is established, the called ISPBX might use the connection for call progress signalling transmission.

1.3.3 *Exceptional procedures*

1.3.3.1 *Activation/deactivation/registration*

Not applicable.

1.3.3.2 *Invocation and operation*

If the called user is busy or does not answer, the procedures for basic calls will apply.

If a call is made by sending incomplete address information, the call will be released by time supervision within the public exchange. A corresponding time supervision within the ISPBX may also be convenient.

1.3.4 *Alternative procedures*

1.3.4.1 *Activation/deactivation/registration*

None identified.

1.3.4.2 *Invocation and operation*

None identified.

1.4 *Network capabilities for charging*

This Recommendation does not cover charging principles. Future Recommendations in the D-Series are expected to contain that information.

It shall be possible to charge the subscriber accurately for the service.

1.5 *Interworking requirements*

No problems identified.

1.6 *Interaction with other supplementary services*

1.6.1 *Call Waiting*

No impact, i.e. neither supplementary service affects the operation of the other supplementary service.

1.6.2 *Call Transfer*

No impact, i.e. neither supplementary service affects the operation of the other supplementary service.

1.6.3 *Connected Line Identification Presentation*

For further study.

1.6.4 *Connected Line Identification Restriction*

No impact, i.e. neither supplementary service affects the operation of the other supplementary service.

1.6.5 *Calling Line Identification Presentation*

No impact, i.e. neither supplementary service affects the operation of the other supplementary service.

1.6.6 *Calling Line Identification Restriction*

No impact, i.e. neither supplementary service affects the operation of the other supplementary service.

1.6.7 *Closed User Group*

No impact, i.e. neither supplementary service affects the operation of the other supplementary service.

1.6.8 *Conference Calling*

No impact, i.e. neither supplementary service affects the operation of the other supplementary service.

1.6.9 *Direct-Dialling-In*

Not applicable.

1.6.10 *Call Diversion (i.e. Call Forwarding) services*

1.6.10.1 *Call Forwarding Busy*

No impact, i.e. neither supplementary service affects the operation of the other supplementary service.

1.6.10.2 *Call Forwarding No Reply*

No impact, i.e. neither supplementary service affects the operation of the other supplementary service.

1.6.10.3 *Call Forwarding Unconditional*

No impact, i.e. neither supplementary service affects the operation of the other supplementary service.

1.6.11 *Line Hunting*

No impact, i.e. neither supplementary service affects the operation of the other supplementary service.

1.6.12 *Three-Party Service*

No impact, i.e. neither supplementary service affects the operation of the other supplementary service.

1.6.13 *User-to-User Signalling*

No impact, i.e. neither supplementary service affects the operation of the other supplementary service.

1.6.14 *Multiple Subscriber Number*

No impact, i.e. neither supplementary service affects the operation of the other supplementary service.

1.6.15 *Call Hold*

No impact, i.e. neither supplementary service affects the operation of the other supplementary service.

1.6.16 *Advice of Charge*

No impact, i.e. neither supplementary service affects the operation of the other supplementary service.

1.7. *Dynamic description*

The dynamic description is as for basic services.

2 I.251.2 – **Multiple Subscriber Number**

2.1 *Definition*

Multiple Subscriber Number (MSN) provides the possibility for assigning multiple ISDN numbers to a single interface. For example, this service:

1) allows dialling from a line connected to a public network directly to terminals connected to a basic access which has subscribed to MSN (e.g. in a passive bus configuration);
2) enables the network to determine which ISDN number is applicable on originating calls (e.g. for charging purposes, for notification to the called party and application for supplementary services).

It is considered:

- that some Administrations may not have knowledge or control over what is connected to the basic access, e.g. an NT2 or passive bus;
- that Administrations have differing numbering methods;
- that common international terminal specifications are desired.

2.2 *Description*

2.2.1 *General description*

The addressing of terminals on a basic access may be achieved by applying a set of ISDN numbers to the single basic access. When a call with one of these ISDN numbers is delivered, the called number is indicated to the MSN user, either directly or through a mapping by the network.

In general, any set of numbers may be sent from the network to the subscriber's equipment during call establishment. However, it is recognized that administrative practices and certain equipment designs may lead to the adoption of restricted numbering sequences, e.g. by relating the last digit(s) of a fixed length ISDN number to the terminals to be connected. The actual method of relating the ISDN number to a particular terminal is a matter of national implementation but may, for example, be done by central intelligence or by distributed intelligence within the terminals.

The essential difference between this supplementary service and DDI concerns the length of the number sent to, and processed by, the user's installation. In the DDI situation the user (ISPBX) will be tailored on a per installation basis to receive the particular number of digits necessary to identify the terminals of this user (ISPBX).

With the multiple subscriber number supplementary service however, the service provider will fix the length of the number to be transmitted to the user's installation. It may comprise 1 or 2 or 3 of the last digits up to the full ISDN number. This number will be sent to the user network interface.

The digit(s) significant for terminal differentiation is/are an integral part of the ISDN numbering scheme.

Note – MSN is independent from and does not impose any constraints on "service indication" and "sub-addressing".

2.2.2 *Specific terminology*

None.

2.2.3 *Qualifications on the applicability to telecommunication services*

No restrictions.

2.3 *Procedures*

2.3.1 *Provision/withdrawal*

The service shall be provided after pre-arrangement with the service provider.

The service provider shall allocate a set of ISDN numbers (not necessarily consecutive). At the option of the service provider, one of these numbers may be designated by the MSN subscriber as the default number for the interface. At the option of the service provider, the user may specify a mapping arrangement between ISDN number and MSN digit(s).

2.3.2 *Normal procedures*

2.3.2.1 *Activation/deactivation/registration*

Activation through subscription.

2.3.2.2 *Invocation and operation*

The destination number sent by the calling user will be analyzed in the network. If the called user subscribes to this supplementary service, the network sends the available part of the ISDN number or at least the relating digit(s):

i) identical to that last digit(s) of the ISDN number; or

ii) generated by the network on the basis of a mapping process between ISDN number(s) and MSN digit(s).

Terminals compatible to the MSN service will react on a call as follows:

- if MSN digit(s) equal to their own preadjusted identity is (are) presented, they react to it in a predetermined way;
- if there is a set-up message without MSN digit(s), the terminal will interpret it as a normal call. (This may happen if a terminal with MSN capabilities is used on an interface, where MSN is not subscribed for.)

Terminals not compatible to the MSN service will react to a call as follows:

- whether there is (are) MSN digit(s) or not, the call will be interpreted as a normal call.

On outgoing calls a terminal compatible with the MSN service may provide the ISDN number (or MSN digits) when placing the call. The network will carry this identity unchanged or will replace the digit(s) by the associated ISDN number. The ISDN number of the calling terminal will then be sent to the called user with the incoming call (refer to § 3, CLIP supplementary service).

It is possible to allocate one ISDN number to one or more terminals. Similarly, one terminal may allow the assignment of one or more than one number. Further, as an administrative option a specific digit or sequence of digits may be allocated to enable all terminals in a point-to-multipoint configuration to react in the same way as they would if the supplementary service MSN were not subscribed to.

2.3.3 *Exceptional procedures*

2.3.3.1 *Activation/deactivation/registration*

Not applicable.

2.3.3.2 *Invocation and operation*

An ISDN number or MSN digits, generated by a terminal at an interface where MSN is in operation shall be discarded by the network unless this number is subscribed to by this interface. A default number may be provided by the network.

2.3.4 *Alternative procedures*

2.3.4.1 *Activation/deactivation/registration*

None identified.

2.3.4.2 *Invocation and operation*

None identified.

2.4 *Network capabilities for charging*

This Recommendation does not cover charging principles. Future Recommendations in the D-Series are expected to contain that information.

It shall be possible to charge the subscriber accurately for the service.

2.5 *Interworking requirements*

None identified.

2.6 *Interaction with other supplementary services*

In case of interaction with other supplementary services, these services could be applicable to the individual MSN rather than to the subscriber access.

2.6.1 *Call Waiting*

No impact, i.e. neither supplementary service affects the operation of the other supplementary service.

2.6.2 *Call Transfer*

No impact, i.e. neither supplementary service affects the operation of the other supplementary service.

2.6.3 *Connected Line Identification Presentation*

See COLP (§ 5) interaction with MSN.

2.6.4 *Connected Line Identification Restriction*

No impact, i.e. neither supplementary service affects the operation of the other supplementary service.

2.6.5 *Calling Line Identification Presentation*

Upon call initiation, if the ISDN number indicated by the MSN user terminal is not subscribed to for the interface, or if no numbering information is indicated, a default number (if designated by the MSN subscriber) or a number unavailable indication is provided to the CLIP user.

2.6.6 *Calling Line Identification Restriction*

No impact, i.e. neither supplementary service affects the operation of the other supplementary service.

2.6.7 *Closed User Group*

For further study.

2.6.8 *Conference Calling*

No impact, i.e. neither supplementary service affects the operation of the other supplementary service.

2.6.9 *Direct-Dialling-In*

No impact, i.e. neither supplementary service affects the operation of the other supplementary service.

2.6.10 *Call Diversion (i.e. Call Forwarding) services*

2.6.10.1 *Call Forwarding Busy*

No impact, i.e. neither supplementary service affects the operation of the other supplementary service.

2.6.10.2 *Call Forwarding No Reply*

No impact, i.e. neither supplementary service affects the operation of the other supplementary service.

2.6.10.3 *Call Forwarding Unconditional*

No impact, i.e. neither supplementary service affects the operation of the other supplementary service.

2.6.11 *Line Hunting service*

For further study.

2.6.12 *Three-Party Service*

No impact, i.e. neither supplementary service affects the operation of the other supplementary service.

2.6.13 *User-to-User Signalling*

No impact, i.e. neither supplementary service affects the operation of the other supplementary service.

2.6.14 *Multiple Subscriber Number*

Not applicable.

2.6.15 *Call Hold*

No impact, i.e. neither supplementary service affects the operation of the other supplementary service.

2.6.16 *Advice of Charge*

No impact, i.e. neither supplementary service affects the operation of the other supplementary service.

2.7 *Dynamic description*

The dynamic description is as for the basic services.

3 I.251.3 – Calling Line Identification Presentation

3.1 *Definition*

Calling Line Identification Presentation (CLIP) is a supplementary service offered to the called party which provides the calling party's ISDN-number, possibly with sub-address information, to the called party.

3.2 *Description*

3.2.1 *General description*

When CLIP is applicable and activated, the network provides the called party with the number of the calling party at call set-up on all incoming calls.

The calling party number may be accompanied by a sub-address.

The network should be capable of transmitting at least 15 digits (maximum length of an ISDN number). In addition, if provided by the calling party, the network should be capable of transmitting a sub-address.

The network to which the calling party belongs should attempt to ensure that enough digits are transmitted to enable the called party to return the call, based on the calling number presented.

3.2.2 *Specific terminology*

None identified.

3.2.3 *Qualifications on the applicability to telecommunication services*

This supplementary service is applicable to all telecommunication services.

It is to be noted that in the Telematic services an exchange of terminal identification (TID) occurs at a higher layer subsequent to a successful call establishment.

For Telematic services this supplementary service shall consist only of the access number of the calling party and this shall be provided by the network. For other non-voice services this supplementary service is for further study. The presentation of the calling party's ISDN-number by Telematic terminals and by other non-voice terminals is for further study.

3.3 *Procedures*

3.3.1 *Provision/withdrawal*

CLIP may be provided on a subscription basis or be generally available. CLIP may be withdrawn at the request of the subscriber or by the network provider for administrative reasons.

3.3.2 *Normal procedures*

3.3.2.1 *Activation/deactivation/registration*

CLIP is activated on provision and deactivated on withdrawal. No information needs to be registered with the network for this supplementary service.

3.3.2.2 *Invocation and operation*

The number presented shall unambiguously identify the access of the calling party. The number presented is either:

i) completely provided by the network;

ii) completely provided by the calling party; or

iii) partially provided by the network with the rest provided by the calling party (e.g. the access number is provided by the network and the additional digits to make the number complete by the calling party).

Where either the complete calling number, or part of the calling number is initially provided by the calling party, the network shall check its validity. If this check is successful, then this number is used by the network. For complete calling numbers, this validity check shall determine whether the number is allocated to the access; for partially provided numbers this check shall, for example, determine whether the digits are within the allocated range.

3.3.3 *Exceptional procedures*

3.3.3.1 *Activation/deactivation/registration*

None identified.

3.3.3.2 *Invocation and operation*

If the network check on a calling party-provided number is unsuccessful, the network will use the default number as the number of the calling party.

There are two cases where the calling party number is not presented to the called party:

i) when the calling party has an arrangement (see definition of Calling Line Identification Restriction) whereby presentation of his number is not allowed; and

ii) when the calling party number is not available, e.g., due to interworking with the analogue telephone network (PSTN).

In such cases no number is presented to the called party, but he shall receive an indication that the number of the calling party is unavailable.

3.3.4 *Alternative procedures*

3.3.4.1 *Activation/deactivation/registration*

None identified.

3.3.4.2 *Invocation and operation*

In some cases where a calling party has an arrangement such that presentation of his number is not allowed, there may be certain categories of called party that have the ability to override this restriction and have the calling number presented. This function is a national option.

Problems may occur when the calling party does not belong to the same network as the called party and in the calling party's network the override category does not exist, while, in the called party's network it does. A problem occurs when a calling party who restricts presentation and assumes that his number is *never* presented, makes a call to a called party who is in the override category.

The cases where the override category is applied is a national matter. Depending on bilateral agreement about the application of the override category in country B, and the "presentation not allowed" arrangement of the calling party in country A, country A may or may not deliver the calling line identification to country B. Agreements are also needed with any transit network.

3.4 *Network capabilities for charging*

This Recommendation does not cover charging principles. Future Recommendations in the D-Series are expected to contain that information.

It shall be possible to charge the subscriber accurately for the service.

3.5 *Interworking requirements*

On calls incoming from some non-ISDN networks, the calling number may be delivered to the destination ISDN without the ability to indicate whether presentation is allowed or not. How the ISDN should behave in this case is for further study.

From some other non-ISDN networks, no calling party number may be available to the ISDN and therefore the full number of the calling party cannot be given to the called party who has been provided with CLIP. In this situation a partial number, or a "number unavailable" indication, is given to the called party.

As a national option, the originating network shall have the possibility to restrict any information identifying the calling party from being forwarded to another network. If a destination network receives a calling party ISDN number without any indication of presentation allowed or restricted, the destination network (host network) will act according to its own rules and regulations.

3.6 *Interaction with other supplementary services*

3.6.1 *Call Waiting*

No impact, i.e. neither supplementary service affects the operation of the other supplementary service.

If an ISDN user(s) who has subscribed to the Call Waiting service at his B access, has been given a call waiting indication and has subscribed to the CLIP service, then the calling party's number shall be presented to the ISDN user(s) at B at the time the call waiting indication is given. The presentation of the CLIP information shall be the same as when the ISDN user(s) at B receives a normal call.

3.6.2 *Call Transfer*

Refer to Recommendation I.252, § 1.6.5, interaction with CLIP.

3.6.3 *Connected Line Identification Presentation*

No impact, i.e. neither supplementary service affects the operation of the other supplementary service.

3.6.4 *Connected Line Identification Restriction*

No impact, i.e. neither supplementary service affects the operation of the other supplementary service.

3.6.5 *Calling Line Identification Presentation*

Not relevant.

3.6.6 *Calling Line Identification Restriction*

The calling line identification will not be presented if the calling user has an arrangement to inhibit the presentation of his number to the called party. The only occasion when a user subscribing to CLIP can take precedence over CLIR is when the user is in an override category. This is a national option.

3.6.7 *Closed User Group*

No impact, i.e. neither supplementary service affects the operation of the other supplementary service.

3.6.8 *Conference Calling*

Any party that has subscribed to CLIP will receive the number of a calling conference controller when:

- the party is to be included as a "new party" during the invocation of a conference call; or
- the party is being added to an existing conference call.

3.6.9 *Direct Dialling In*

No impact, i.e. neither supplementary service affects the operation of the other supplementary service.

3.6.10 *Call Diversion (i.e. Call Forwarding) services*

If an incoming call to the party to which CLIP has been provided has already been forwarded, then the calling party's number should be the number of the original calling party.

3.6.10.1 *Call Forwarding Busy*

Refer to Recommendation I.252, § 2.6.5, interaction with CLIP.

3.6.10.2 *Call Forwarding No reply*

Refer to Recommendation I.252, § 3.6.5, interaction with CLIP.

3.6.10.3 *Call Forwarding Unconditional*

Refer to Recommendation I.252, § 4.6.5, interaction with CLIP.

3.6.11 *Line Hunting*

No impact, i.e. neither supplementary service affects the operation of the other supplementary service.

The Line Hunting service occurs before CLIP. The Line Hunting service would first provide a selection of an interface for presentation of a call. Once the service selects an interface, normal call processing would occur including the presentation of the calling party's number to a selected interface who has subscribed to CLIP.

3.6.12 *Three-Party service*

No impact, i.e. neither supplementary service affects the operation of the other supplementary service.

3.6.13 *User-to-User Signalling*

No impact, i.e. neither supplementary service affects the operation of the other supplementary service.

3.6.14 *Multiple Subscriber Number*

Refer to § 2.6.5 above, interaction with CLIP.

3.6.15 *Call Hold*

No impact, i.e. neither supplementary service affects the operation of the other supplementary service.

3.6.16 *Advice of Charge*

No impact, i.e. neither supplementary service affects the operation of the other supplementary service.

3.7 *Dynamic description*

The dynamic description for this service is shown in Figure 1/I.251.

4 I.251.4 – Calling Line Identification Restriction

4.1 *Definition*

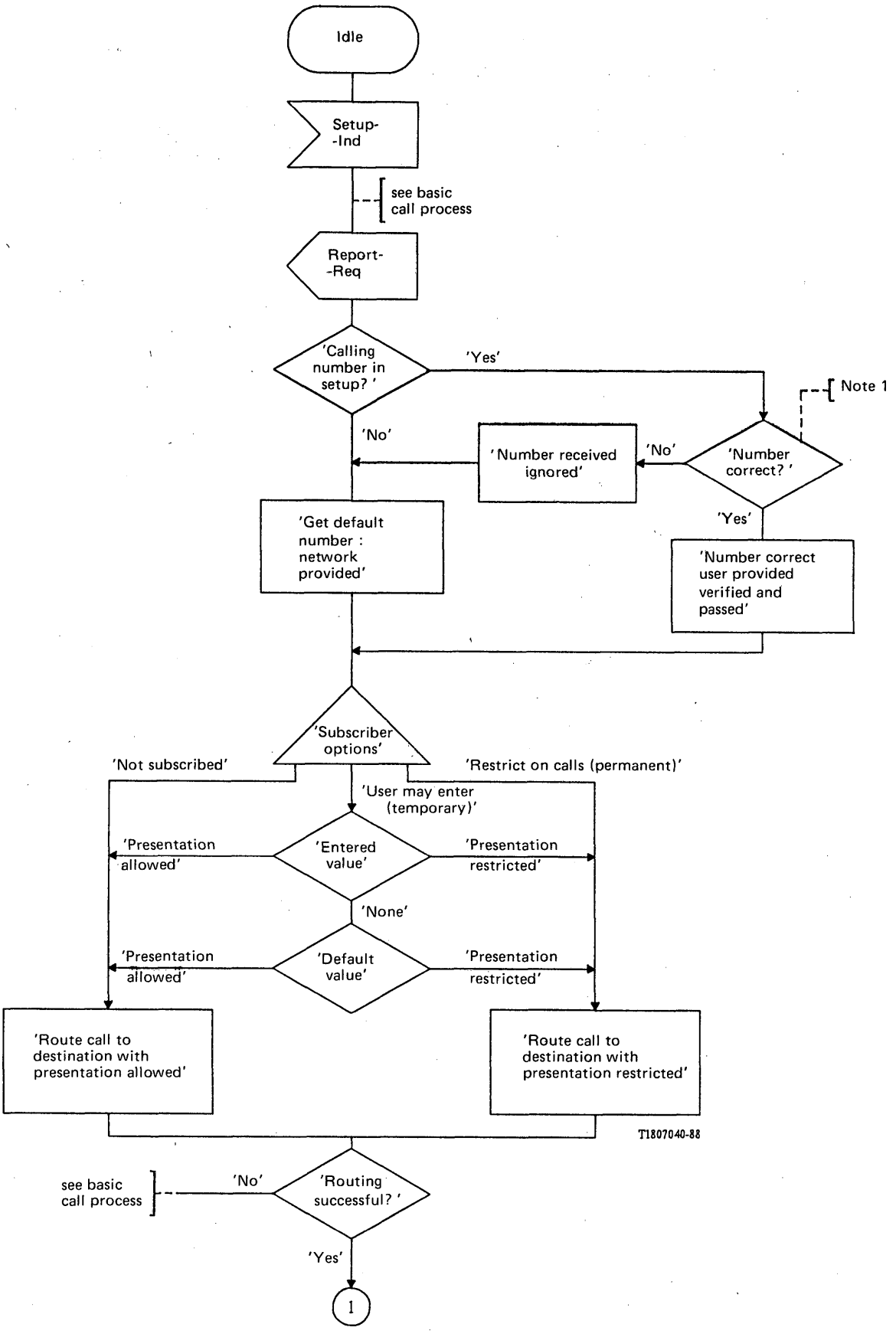
Calling Line Identification Restriction (CLIR) is a supplementary service offered to the calling party to restrict presentation of the calling party's ISDN number and sub-address to the called party.

4.2 *Description*

4.2.1 *General description*

When CLIR is applicable and activated, the originating node provides the destination node with a notification that the calling party's ISDN number and any sub-address information are not allowed to be presented to the called party. In this case no calling party number is included in the call offering to the called party's installation.

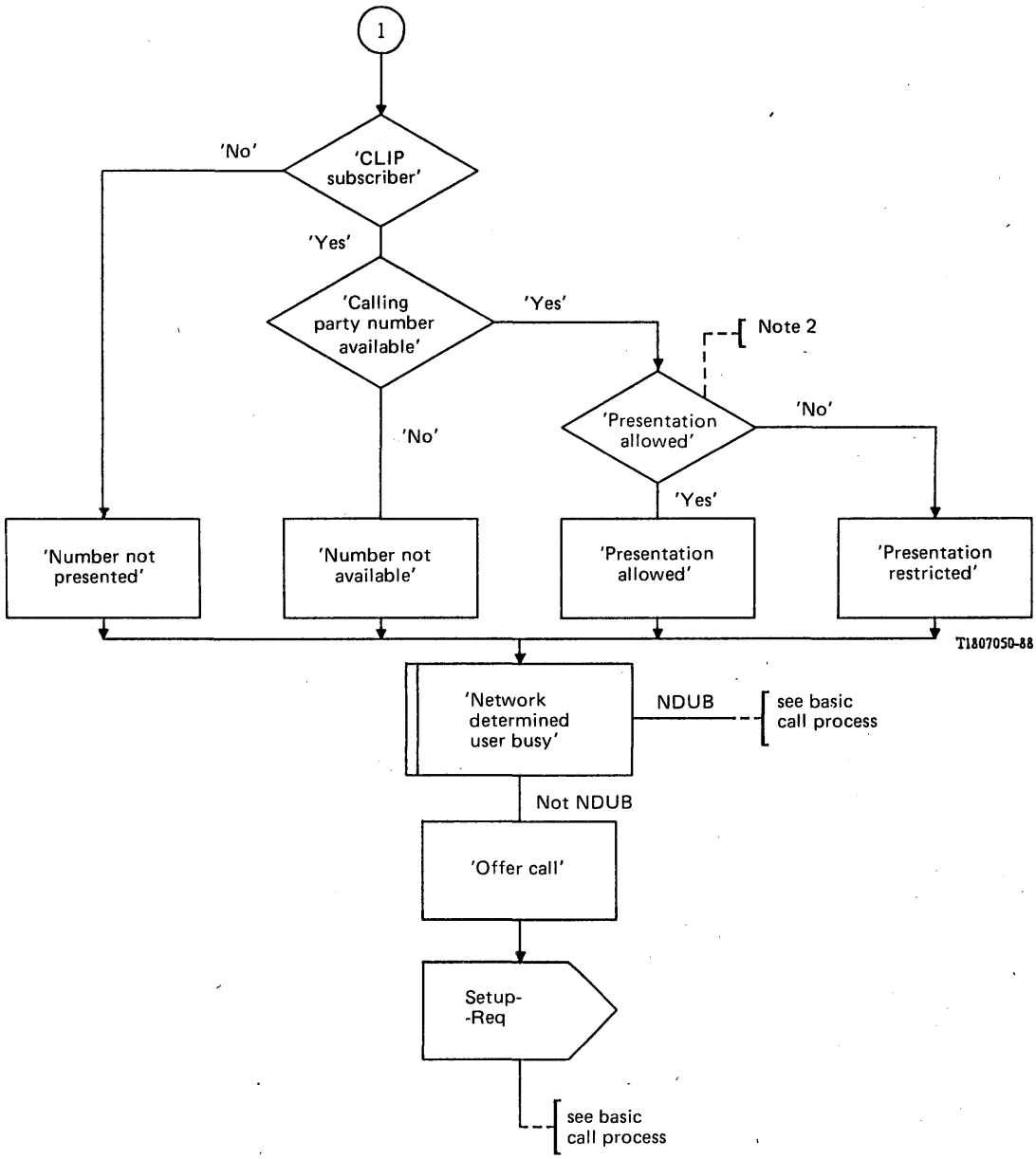
Note – When CLIR is subscribed to, some network providers may not wish to send the originating identity of the calling customer to other network providers.



Note 1 – Number correct:
a) if a full number is received, a check is performed to see if this number is allocated;
b) if only a partial number is received, a check is performed to see if the format is correct (e.g., to see if the extension number has the correct number of digits).

FIGURE 1/I.251 (sheet 1 of 2)

Overall SDL diagram for calling line identification presentation/restriction



Note 2 – In some Administrations certain categories of customers (e.g., the police) may have the ability to override the restriction of presentation.

FIGURE 1/I.251 (sheet 2 of 2)

Overall SDL diagram for calling line identification presentation/restriction

4.2.2 *Specific terminology*

None identified.

4.2.3 *Qualifications on the applicability to telecommunication services*

None identified, i.e., this supplementary service is applicable to all telecommunication services.

4.3 *Procedures*

4.3.1 *Provision/withdrawal*

CLIR can be provided on a subscription basis or can be generally available.

As a network provider option, CLIR can be offered with several subscription options. The options apply separately to each ISDN number. Subscription options are summarized below:

Subscription option	*Values*
CLIR mode	– permanent (active for all calls) – temporary (specified by user per call)
Default (only for temporary mode)	– presentation restricted – presentation not restricted

It is a network provider option to specify either or both of the above options for all subscribers, for instance, in an exchange or network.

4.3.2 *Normal procedures*

4.3.2.1 *Activation/deactivation/registration*

If subscribed to in the permanent mode, CLIR is always activated. If subscribed to on a temporary basis, CLIR is activated upon explicit request for the service, or on default, on a particular call and is deactivated after that call.

4.3.2.2 *Invocation and operation*

If the called party subscribes to Calling Line Identification Presentation and the calling party has CLIR activated, the called party shall receive an indication that the calling party number is not available.

4.3.3 *Exceptional procedures*

4.3.3.1 *Activation/deactivation/registration*

No exceptional procedures identified.

4.3.3.2 *Invocation and operation*

No exceptional procedures identified.

4.3.4 *Alternative procedures*

4.3.4.1 *Activation/deactivation/registration*

No alternative procedures identified.

4.3.4.2 *Invocation and operation*

Certain countries may define categories of subscribers that have the ability to override the presentation restriction and have the calling party's ISDN number and any sub-address presented (e.g., the police).

The ability to have such an override option is a national matter.

When a call originates in one ISDN and terminates in another ISDN and CLIR is applied, the rules and regulations of the destination network (the host network) should apply. For example, if the override category is not applicable in the originating network but it is in the destination network, a call with CLIR applied can still be overridden in the destination network, whenever information on the calling line is available for this network.

4.4 *Network capabilities for charging*

This Recommendation does not cover charging principles. Future Recommendations in the D-Series are expected to contain that information.

It shall be possible to charge the subscriber accurately for the service.

4.5 *Interworking requirements*

On calls to or via non-ISDNs, it cannot be assured that a CLIR indication can be carried to the destination network. As a national option the originating network shall have the possibility to restrict any information identifying the calling party from being forwarded to the destination network when CLIR is applicable. If a network receives a calling party ISDN number without any indication of presentation allowed or restricted, the destination network (the host network) will act according to its rules and regulations.

4.6 *Interaction with other supplementary services*

4.6.1 *Call Waiting*

No impact, i.e. neither supplementary service affects the operation of the other supplementary service.

Assume that a call from a user at C, who has subscribed to the CLIR service, invokes Call Waiting at a user(s) at B. The user(s) at B would receive a call waiting indication but would not receive the number of the calling user at C when the call waiting indication is given.

4.6.2 *Call Transfer*

Assume that a user A has an established call with user B and wishes to transfer this call with user B to user C. If user A has subscribed to CLIR, then user C shall not receive a calling number when user A invokes any call transfer procedure. If user B has subscribed to CLIR, then user C shall not receive a calling number during the transfer of user B to user C.

4.6.3 *Connected Line Identification Presentation*

No impact, i.e. neither supplementary service affects the operation of the other supplementary service.

4.6.4 *Connected Line Identification Restriction*

No impact, i.e. neither supplementary service affects the operation of the other supplementary service.

4.6.5 *Calling Line Identification Presentation*

CLIR will take precedence over Calling Line Identification Presentation (CLIP).

The only occasion when a user subscribing to CLIP can take precedence over CLIR is when the user has an override category. This is a national option.

4.6.6 *Calling Line Identification Restriction*

Not relevant.

4.6.7 *Closed User Group*

No impact, i.e. neither supplementary service affects the operation of the other supplementary service.

4.6.8 *Conference Calling*

No impact, i.e. neither supplementary service affects the operation of the other supplementary service.

4.6.9 *Direct-Dialling-In*

No impact, i.e. neither supplementary service affects the operation of the other supplementary service.

4.6.10 *Call Diversion (i.e. Call Forwarding) services*

4.6.10.1 *Call Forwarding Busy*

When CLIR is applicable and activated, the calling party's ISDN-number will not be presented to the "forwarded-to" user unless this user is in an override category. The latter is a national option.

4.6.10.2 *Call Forwarding No Reply*

When CLIR is applicable and activated, the calling party's ISDN-number will not be presented to the "forwarded-to" user unless this user is in an override category. The latter is a national option.

4.6.10.3 *Call Forwarding Unconditional*

When CLIR is applicable and activated, the calling party's ISDN-number will not be presented to the "forwarded-to" user unless this user is in an override category. The latter is a national option.

4.6.11 *Line Hunting*

No impact, i.e. neither supplementary service affects the operation of the other supplementary service.

4.6.12 *Three-Party Service*

No impact, i.e. neither supplementary service affects the operation of the other supplementary service.

4.6.13 *User-to-User Signalling*

No impact, i.e. neither supplementary service affects the operation of the other supplementary service.

4.6.14 *Multiple Subscriber Number*

No impact, i.e. neither supplementary service affects the operation of the other supplementary service.

4.6.15 *Call Hold*

No impact, i.e. neither supplementary service affects the operation of the other supplementary service.

4.6.16 *Advice of Charge*

No impact, i.e. neither supplementary service affects the operation of the other supplementary service.

4.7 *Dynamic description*

The dynamic description for this service is shown in Figure 1/I.251.

5 I.251.5 – Connected Line Identification Presentation

5.1 *Definition*

Connected Line Identification Presentation (COLP) is a supplementary service offered to the calling party which provides the connected party's ISDN-number to the calling party.

5.2 *Description*

5.2.1 *General description*

When COLP is applicable and activated, the network provides the calling party with the number of the connected party when the connected party answers the incoming call. The network should be capable of transmitting at least 15 digits (maximum length of an ISDN number).

Note – The possibility of enhancing this service to provide the called party number before the called party answers the call is for further study.

5.2.2 *Specific terminology*

None identified.

5.2.3 *Qualifications on the applicability to telecommunication services*

This supplementary service is applicable to all telecommunication services.

It is to be noted that in the Telematic services an exchange of Terminal Identification (TID) occurs at a higher layer subsequent to a successful call establishment.

For Telematic services this supplementary service shall consist only of the access number of the connected party and this shall be provided by the network. For other non-voice services this supplementary service is for further study. The presentation of the connected party's ISDN number by Telematic terminals and by other non-voice terminals is for further study.

5.3 *Procedures*

5.3.1 *Provision/withdrawal*

The COLP supplementary service may be provided on a subscription basis or be generally available.

COLP may be withdrawn at the request of the subscriber or by the network provider for administrative reasons.

5.3.2 *Normal procedures*

5.3.2.1 *Activation/deactivation/registration*

COLP is activated on provision and deactivated on withdrawal.

No information needs to be registered with the network for this supplementary service.

5.3.2.2 *Invocation and operation*

The number presented shall unambiguously identify the access of the connected party. The number presented is either:

i) completely provided by the network;

ii) completely provided by the connected party; or

iii) partially provided by the network with the rest provided by the connected party (e.g. the access number is provided by the network and the additional digits to make the number complete by the connected party).

Where either the complete connected number, or part of the connected number is initially provided by the connected party, the network shall check its validity. If this check is successful then this number is used by the network.

5.3.3 *Exceptional procedures*

5.3.3.1 *Activation/deactivation/registration*

None identified.

5.3.3.2 *Invocation and operation*

There are two cases where the connected party number is not presented to the calling party:

i) when the connected party has an arrangement whereby presentation of his number is not allowed (see definition of Connected Line Identification Restriction); or

ii) when the connected party number is not available (e.g. due to interworking with the analogue telephone network (PSTN)).

In such cases the calling party shall be given a number unavailable indication.

If the network check on the connected party provided number is unsuccessful, the network default number will be used instead.

5.3.4 *Alternative procedures*

5.3.4.1 *Activation/deactivation/registration*

None identified.

5.3.4.2 *Invocation and operation*

In some cases where a connected party has an arrangement such that presentation of his number is not allowed, there may be certain categories of calling party that have the ability to override this restriction and have the connected number presented. This function is a national matter.

Problems may occur when the connected party does not belong to the same network as the calling party and in the connected party's network the override category does not exist, while in the calling party's network, it does exist. A problem occurs when a connected party who restricts presentation and assumes that his number is *never* presented, receives a call from a calling party who is in the override category.

The cases where the override category is applied is a national matter. Depending on bilateral agreement about the application of the override category in country A, and the presentation not allowed arrangement of the connected party in country B, country B may or may not deliver the connected line identification to country A. Agreements are also needed with any transit network.

5.4 *Network capabilities for charging*

This Recommendation does not cover charging principles. Future Recommendations in the D-Series are expected to contain that information.

It shall be possible to charge the subscriber accurately for the service.

5.5 *Interworking requirements*

On calls destined to some non-ISDN networks, the connected number may be delivered to the originating ISDN without the ability to indicate whether presentation is allowed or not. How the ISDN should behave in this case is for further study.

On calls destined to some other non-ISDN networks, no connected party number may be available to the ISDN and therefore the full number of the connected party cannot be given to the calling party who has been provided with COLP. In this situation a partial number shall be given unless no information is available, whereupon a "number unavailable indication" is given to the calling party.

5.6. *Interaction with other supplementary services*

5.6.1 *Call Waiting*

No impact, i.e. neither supplementary service affects the operation of the other supplementary service.

5.6.2 *Call Transfer*

Assume the situation where a user A has an established call with a user B and wishes to transfer this call with user B to a user C.

Except in the case where user C prohibits the presentation of his number, user C's number shall be presented:

- to user B upon successful completion of the transfer to user C (independent of the type of transfer procedure invoked by user A) provided that user B has subscribed to COLP;
- to user A when user A is using normal or explicit transfer procedures and has subscribed to COLP. The connected party's number will not be presented to user A if user A invokes the single step Call Transfer procedure.

Note – The connected number presentation may not be possible if interworking with a non-ISDN network is invoked in the call transfer.

5.6.3 *Connected Line Identification Presentation*

Not applicable.

5.6.4 *Connected Line Identification Restriction*

The connected line identification will not be presented if the connected user has subscribed to COLR.

5.6.5 *Calling Line Identification Presentation*

No impact, i.e. neither supplementary service affects the operation of the other supplementary service.

5.6.6 *Calling Line Identification Restriction*

No impact, i.e. neither supplementary service affects the operation of the other supplementary service.

5.6.7 *Closed User Group*

No impact, i.e. neither supplementary service affects the operation of the other supplementary service.

5.6.8 *Conference Calling*

A conference controller who has also subscribed to COLP should be presented with the connected party's number when that party is either part of the initial activation of the conference or is added as a new conferee to an existing conference.

Conferees in an existing conference who have subscribed to COLP will not receive a new party's number whenever a conference controller adds a new party to the conference.

5.6.9 *Direct-Dialling-In*

For further study.

5.6.10 *Call Diversion (i.e. Call Forwarding) services*

5.6.10.1 *Call Forwarding Busy (CFB)*

No impact, i.e. neither supplementary service affects the operation of the other supplementary service.

Assume a calling user A, who has subscribed to COLP, places a call to a user B who is busy and this call is forwarded to a user C. If user B has also subscribed to a notification option with his CFB service, calling user A may receive the forwarded-to user C's number with the notification of the forwarding. In any event, assuming user C answers the call, user C's number will be returned to user A unless user C has subscribed to COLR.

5.6.10.2 *Call Forwarding No Reply (CFNR)*

No impact, i.e. neither supplementary service affects the operation of the other supplementary service.

Assume a calling user A, who has subscribed to COLP, places a call to a user B who has subscribed to the CFNR service, and who does not reply to the call within the subscribed time interval. If user B has also subscribed to a notification option with his CFNR service, calling user A may receive the forwarded-to user C's number with the notification of the forwarding. In any event, assuming user C answers the call, user C's number will be returned to user A unless user C has subscribed to COLR.

5.6.10.3 *Call Forwarding Unconditional (CFU)*

No impact, i.e. neither supplementary service affects the operation of the other supplementary service.

Assume a calling user A, who has subscribed to COLP, places a call to a user B who has subscribed to the CFU service. This call to user B would then be forwarded to user C. If user B has also subscribed to a notification option with his CFU service, calling user A may receive the forwarded-to user C's number with the notification of the forwarding. In any event, assuming user C answers the call, user C's number will be returned to user A unless user C has subscribed to COLR.

5.6.11 *Line Hunting*

No impact, i.e. neither supplementary service affects the operation of the other supplementary service.

5.6.12 *Three-Party Service*

No impact, i.e. neither supplementary service affects the operation of the other supplementary service.

5.6.13 *User-to-User Signalling*

No impact, i.e. neither supplementary service affects the the other supplementary service.

5.6.14 *Multiple Subscriber Number*

Assume user A, who has subscribed to COLP, places a call to a user B to whom the network is applying the MSN service. Assuming user B answers the call, the connected number at B (which may be identical to the called number) will be returned to user A unless user B has subscribed to COLR. Other interactions are for further study.

5.6.15 *Call Hold*

No impact, i.e. neither supplementary service affects the operation of the other supplementary service.

5.6.16 *Advice of charge*

No impact, i.e. neither supplementary service affects the operation of the other supplementary service.

5.7 *Dynamic description*

The dynamic description for this service is shown in Figure 2/I.251.

6 I.251.6 – Connected Line Identification Restriction

6.1 *Definition*

Connected Line Identification Restriction (COLR) is a supplementary service offered to the connected party to restrict presentation of the connected party's ISDN-number to the calling party.

6.2 *Description*

6.2.1 *General description*

When COLR is applicable and activated, the destination node provides the originating node with a notification that the connected party's ISDN number is not allowed to be presented to the calling party. In this case no connected party number is included in the call connected information to the calling party's installation.

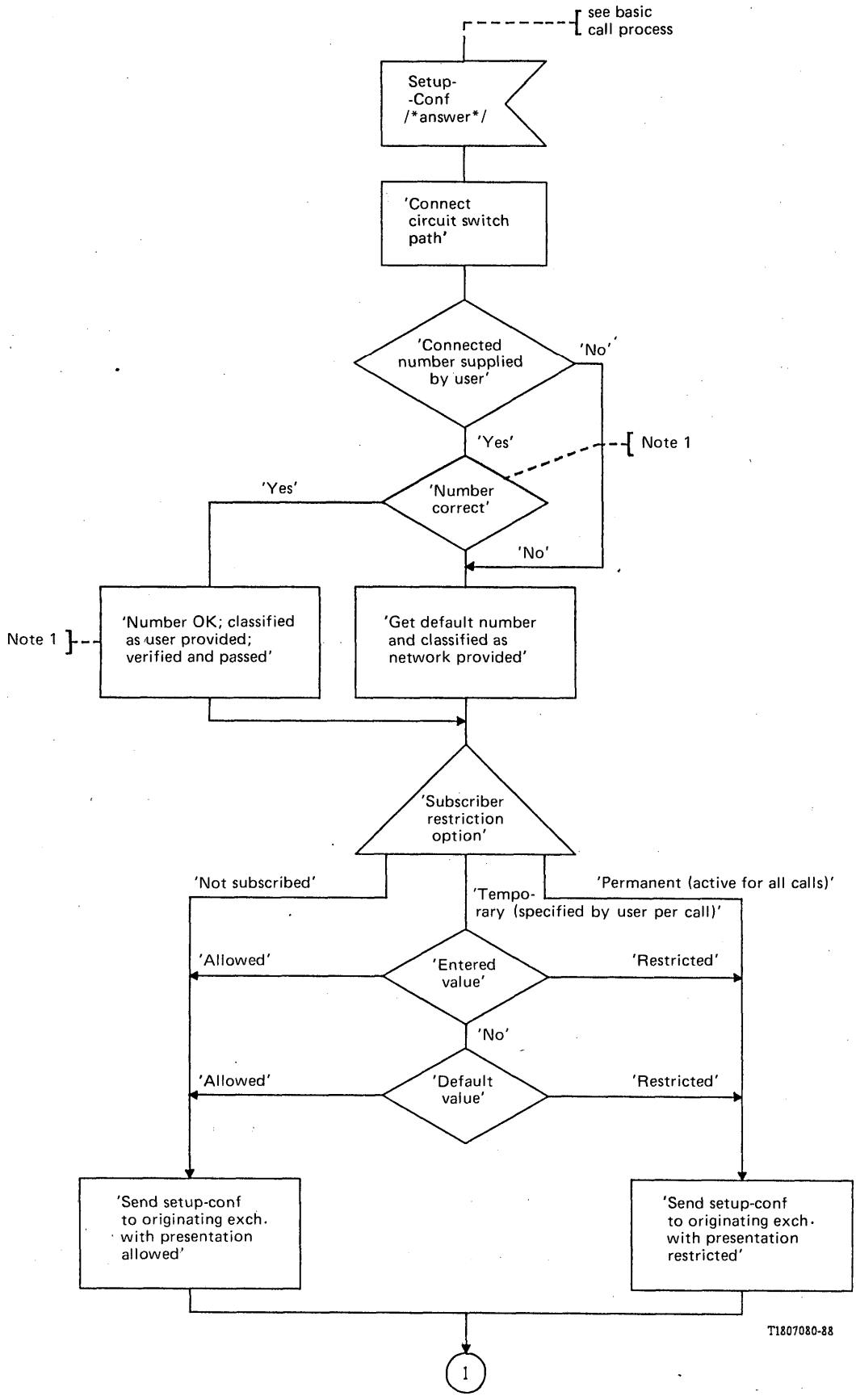
Note – When COLR is subscribed to, some network providers may not wish to send the identity of the connected customer to other network providers.

6.2.2 *Specific terminology*

None identified.

6.2.3 *Qualifications on the applicability to telecommunication services*

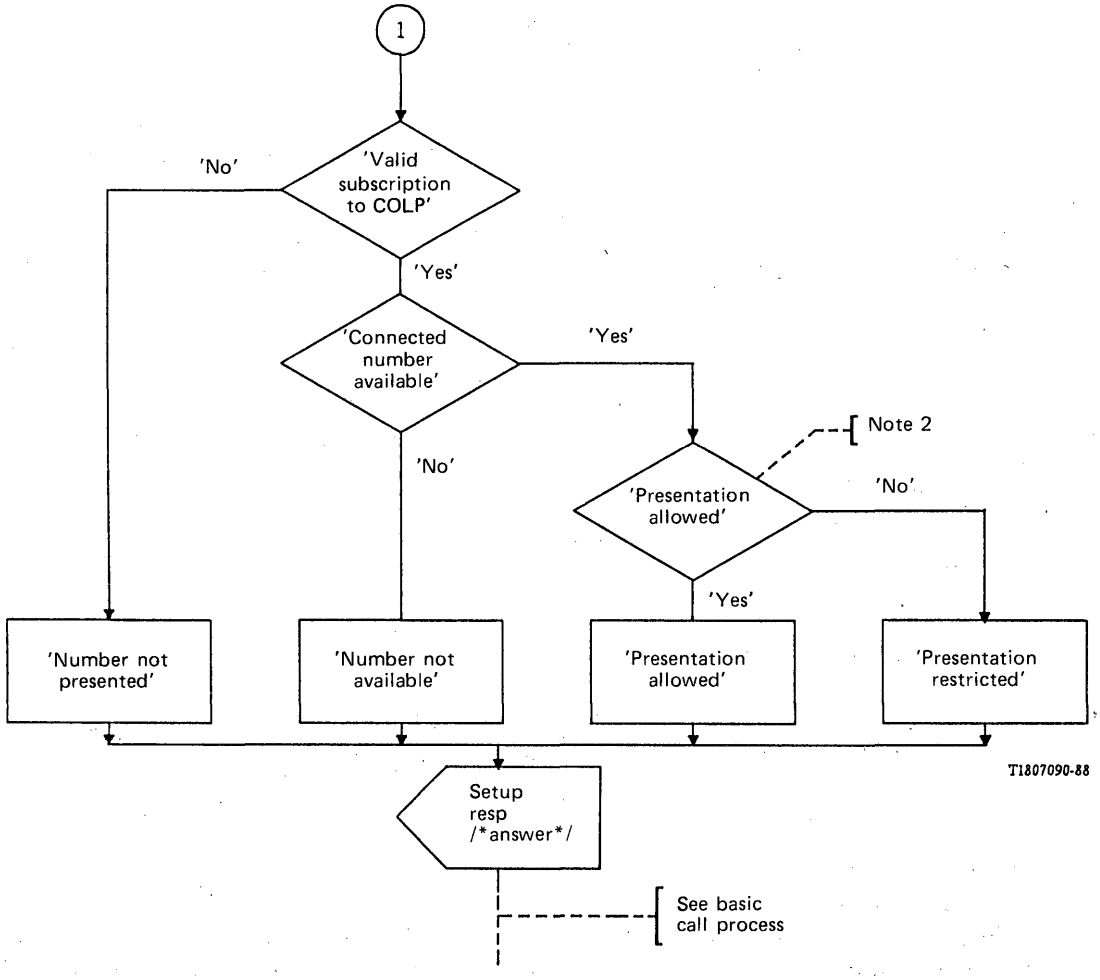
None identified, i.e. this supplementary service is applicable to all telecommunication services.



Note 1 – Examples of verification are:
– identification of the access is wrong;
– number not in range;
– insufficient number of digits;
– network destination code wrong.

FIGURE 2/I.251 (sheet 1 of 2)

Connected line identification presentation/restriction



Note 2 – Presentation may be restricted or overridden due to national regulations.

FIGURE 2/I.251 (sheet 2 of 2)

Connected line identification presentation/restriction

6.3 *Procedures*

6.3.1 *Provision/withdrawal*

COLR can be provided on a subscription basis or be generally available.

As a network provider option, COLR can be offered with several subscription options. The options apply separately to each ISDN number. Subscription options are summarized below:

Subscription option	*Values*
COLR mode	– permanent (active for all calls) – temporary (specified by user per call)
Default (only for temporary mode)	– presentation restricted – presentation not restricted

It is a network provider option to specify either or both of the above options for all subscribers, for instance, in an exchange or network.

6.3.2 *Normal procedures*

6.3.2.1 *Activation/deactivation/registration*

If subscribed to in the permanent mode, COLR is always activated. If subscribed to on a temporary basis, COLR is activated upon explicit request for the service, or on default, on a particular call and is deactivated after that call.

6.3.2.2 *Invocation and operation*

If the calling party subscribes to Connected Line Identification Presentation and the connected party has COLR activated, the calling party shall receive an indication that the connected party number is not available.

6.3.3 *Exceptional procedures*

6.3.3.1 *Activation/deactivation/registration*

No exceptional procedures identified.

6.3.3.2 *Invocation and operation*

No exceptional procedures identified.

6.3.4 *Alternative procedures*

6.3.4.1 *Activation/deactivation/registration*

No alternative procedures identified.

6.3.4.2 *Invocation and operation*

Certain countries may define categories of subscribers that have the ability to override the presentation restriction and have the connected party's ISDN number presented (e.g. the police).

The ability to have such an override option is a national matter.

When a call originates in one ISDN and terminates in another ISDN and COLR is applied, the rules and regulations of the destination network (the host network) should apply. For example, if the override category is not applicable in the originating network but it is in the destination network, a call with COLR applied can still be overridden in the destination network, whenever information on the connected line is available for this network.

6.4 *Network capabilities for charging*

This Recommendation does not cover charging principles. Future Recommendations in the D-Series are expected to contain that information.

It shall be possible to charge the subscriber accurately for the service.

6.5 *Interworking requirements*

On calls to or via non-ISDNS, it cannot be assured that a COLR indication can be carried to the originating network. As a national option the destination network shall have the possibility to restrict any information identifying the connected party from being returned to the originating network when COLR is applicable. If a network receives a connected party ISDN number without any indication of presentation allowed or restricted, the originating network (the host network) will act according to its rules and regulations.

6.6 *Interaction with other supplementary services*

6.1 *Call Waiting*

No impact, i.e. neither supplementary service affects the operation of the other supplementary service.

Assume that a call from a user C, invokes Call Waiting at user B, who has subscribed to the COLR service. User B would receive a call waiting indication but would not have his number returned when the call waiting indication is given.

6.6.2 *Call Transfer*

Assume that user A has an established call with user B and wishes to transfer this call with user B to a user C.

If user C has subscribed to COLR, then user A shall not receive the connected number when user A invokes any call transfer procedure. If user C has subscribed to COLR, then user B shall not receive the connected number during the transfer of user B to user C.

6.6.3 *Connected Line Identification Presentation*

COLR will take precedence over COLP. The only occasion when a user subscribing to COLP can take precedence over COLR is when the user is in an override category. This is a national option.

6.6.4 *Conencted Line Identification Restriction*

Not relevant.

6.6.5 *Calling Line Identification Presentation*

No impact, i.e. neither supplementary service affects the operation of the other supplementary service.

6.6.6 *Calling Line Identification Restriction*

No impact, i.e. neither supplementary service affects the operation of the other supplementary service.

6.6.7 *Closed User Group*

No impact, i.e. neither supplementary service affects the operation of the other supplementary service.

6.6.8 *Conference Call*

No impact, i.e. neither supplementary service affects the operation of the other supplementary service.

6.6.9 *Direct-Dialling-In*

No impact, i.e. neither supplementary service affects the operation of the other supplementary service.

6.6.10 *Call Diversion (i.e. Call Forwarding) services*

6.6.10.1 *Call Forwarding Busy*

When the diverted call is finally answered, no connected number will be presented to the calling party unless this party is in an override category. The latter is a national option.

6.6.10.2 *Call Forwarding No Reply*

When the diverted call is finally answered, no connected number will be presented to the calling party unless this party is in an override category. The latter is a national option.

6.6.10.3 *Call Forwarding Unconditional*

When the diverted call is finally answered, no connected number will be presented to the calling party unless this party is in an override category. The latter is a national option.

6.6.11 *Line Hunting*

No impact, i.e. neither supplementary service affects the operation of the other supplementary service.

6.6.12 *Three-Party Service*

No impact, i.e. neither supplementary service affects the operation of the other supplementary service.

6.6.13 *User-to-User Signalling*

No impact, i.e. neither supplementary service affects the operation of the other supplementary service.

6.6.14 *Multiple Subscriber Number*

No impact, i.e. neither supplementary service affects the operation of the other supplementary service.

6.6.15 *Call Hold*

No impact, i.e. neither supplementary service affects the operation of the other supplementary service.

6.16 *Advice of charge*

No impact, i.e. neither supplementary service affects the operation of the other supplementary service.

6.7 *Dynamic description*

The dynamic description for this service is shown in Figure 2/I.251.

7 I.251.7 – Malicious Call Identification

This service, having been identified, now requires further study, its description is not yet included.

8 I.251.8 – Sub-addressing

This service, having been identified, now requires further study, its description is not yet included.

Recommendation I.252

CALL OFFERING SUPPLEMENTARY SERVICES

(Melbourne, 1988)

The purpose of this Recommendation is to provide the stage 1 description of the method defined in Recommendation I.130 using the means given in Recommendation I.210.

Supplementary services are described by a prose definition and description (step 1.1) and by a dynamic description (step 1.3). The application of the attribute technique (step 1.2), as defined in Recommendation I.140, for supplementary services is for further study.

This Recommendation describes the following Call Offering supplementary services:

I.252.1 Call Transfer (CT)

I.252.2 Call Forwarding Busy (CFB)

I.252.3 Call Forwarding No Reply (CFNR)

I.252.4 Call Forwarding Unconditional (CFU)

I.252.5 Call Deflection (CD) (Note)

I.252.6 Line Hunting (LH)

Note – This service having been identified now requires further study; its description is not yet included.

1 I.252.1 – Call Transfer

1.1 *Definition*

The Call Transfer supplementary service enables a user to transfer an established (i.e. active) call to a third party. For the original call, the "served user" (see § 1.2.2) may have been either the calling or called party (i.e. the call may have been either incoming or outgoing). This service differs from the Call Diversion (i.e. Call Forwarding) supplementary services in that the latter deal only with incoming calls that have not yet reached the "fully-established" state, whereas in the case of Call Transfer an established end-to-end connection exists.

1.2 *Description*

1.2.1 *General description*

Three methods of Call Transfer are identified. One, called "Normal" Call Transfer, is described in § 1.3.2 below. The two others are described in § 1.3.4. Although the invocation of these various methods differ, the essential operation of Call Transfer is to transform the served user's established call into a new call between the other party on the established call and a third party. It should be noted that, in a Three-Party Service call, there are several stages at which the served user can effectively transfer the call. These are described in the Three-Party Service description.

1.2.2 *Specific terminology*

1.2.2.1 *Served user, other parties*

During the invocation and active phases, the service is under the control of the "served user", i.e. the one for whom the service was subscribed. This user is also referred to as "user A". Other parties associated with this service are defined as follows:

- user B is the other party in the original call (A $\longleftrightarrow$ B);
- user C is the "third party" - the other party in the subsequent call (A $\rightarrow$ C).

1.2.3 *Qualifications on the applicability to telecommunication services*

This supplementary service is considered meaningful when applied to the Telephony teleservice and the speech and 3.1 kHz audio bearer service. Furthermore, it may also be meaningful when applied to other services.

1.3 *Procedures*

1.3.1 *Provision/withdrawal*

The Call Transfer supplementary service is subscribed to by prior arrangements with the service provider. Subscription can be made for "Normal Call Transfer" and/or for either of the alternate procedures (i.e. "Single-Step Call Transfer" or "Explicit Call Transfer") offered by the service provider.

Withdrawal of the service is made by the service provider upon request by the subscriber or for service provider reasons.

1.3.2 *Normal procedures*

1.3.2.1 *Activation/deactivation/registration*

None identified.

1.3.2.2 *Invocation and operation*

The served user, user A, can transform an established call with user B into (effectively) a call from user B to a third party, user C. When the served user (user A) asks the service provider to begin the "Normal" Call Transfer, the service provider puts the already established call (with user B) on hold. User A then proceeds to establish the second call (to user C). Upon request from user A to complete the Call Transfer, the service provider would connect users B and C together while removing the connections between user A and the other two users. (The extent to which the service provider re-uses the resources from the A $\longleftrightarrow$ B and A $\rightarrow$ C calls to form the B $\rightarrow$ C call is a service provider option.)

Note – In the resulting call B $\rightarrow$ C, user C will have all the relevant characteristics of the called party, but user B will not necessarily have all the characteristics of the calling party, depending on whether user B called user A and also depending on which service or supplementary service is under consideration.

In some networks, user A can request completion of the Call Transfer either during or after the establishment of the connection to user C.

The service provider will optionally notify users B and C of the transfer and, depending on interworking conditions and the supplementary services subscribed to by users B and C, will indicate to user B the number of user C and will indicate to user C the number of user B.

1.3.3 *Exceptional procedures*

1.3.3.1 *Activation/deactivation/registration*

None identified.

1.3.3.2 *Invocation and operation*

The service request would be rejected if the user invoking the service has not subscribed to the Call Transfer service (or the requested service option). The user would be notified of the cause for rejection and the original call A ⟷ B would remain in the state it was in before the transfer request was received.

If user A's attempt to establish a connection to user C is unsuccessful, (e.g. user C is busy), user A will be so informed and will be able either to retrieve the original call A ⟷ B or to attempt a new connection (e.g. to C or to another party) (see Figure 2/I.252).

The transfer request would be rejected if the network is unsuccessful in connecting users B and C (e.g. when user C is busy, when there is network congestion, or when transfer restrictions are violated). The user would be notified of the cause for rejection and the two calls would remain in the states they were in before the request was received.

1.3.4 *Alternative procedures*

1.3.4.1 *Activation/deactivation/registration*

None identified.

1.3.4.2 *Invocation and operation*

1.3.4.2.1 *Single-Step Call Transfer*

In this procedure, the served user can transfer an established call (with user B) to another user (user C) without first establishing a call to user C. When invoking a Single-Step Call Transfer, the served user would indicate to the service provider the address of user C. The service provider would then establish a connection between users B and C, and disconnect the served user, user A, from the original call with user B. It should be noted that the service provider is not required to reinstate the call A ⟷ B if a Single-Step Call Transfer to user C fails. It is also necessary to notify user B of the progress of the establishment of the call to user C, particularly if the call A ⟷ B cannot be reinstated.

1.3.4.2.2 *Explicit Call Transfer*

In this procedure, the served user A puts the already established call (with user B) on hold and then proceeds to establish another call (to user C) or to accept an incoming call (from user C). If user A's attempt to establish a connection to user C is unsuccessful (e.g. user C is busy), user A will be so informed and will be able either to retrieve the original call A ⟷ B or to attempt a new connection (e.g. to user C or to another party) (see Figure 4/I.252).

User A then explicitly requests that the call with user B be transferred to user C. (By contrast, in the Normal Call Transfer procedure, the service provider "knows" that the two calls [A ⟷ B and A → C] are related; requesting completion of Normal Call Transfer for call A → C implicitly means "connect user C with user B".) The remainder of the procedures are identical to Normal Call Transfer (with the possible exception of the failure procedures.)

1.4 *Network capabilities for charging*

This Recommendation does not cover charging principles. Future Recommendations in the D-Series are expected to contain that information.

It shall be possible to charge the subscriber accurately for the service.

1.5 *Interworking requirements*

User B and user C may not be able to receive each other's address if one (or both) of the calls exits from the ISDN network. The different scenarios are shown in the following tables. The tables assume that B is the originator of the call to A. The network may not be able to recognize user identification if one or both of the calls requires interworking with non-ISDN network(s).

For illustrative purposes, assume that user B originates a call to user A, and user A initiates the call transfer service to connect user B to user C. The different scenarios are shown in the following tables:

i) Users A, B and C are in ISDN

Address information available to	Address of A	Address of B	Address of C
User A	–	YES	YES
User B	YES	–	YES
User C	YES	YES	–

ii) Users A and B are in ISDN. User C is in another network

Address information available to	Address of A	Address of B	Address of C
User A	–	YES	YES
User B	YES	–	YES
User C	NO	NO	–

iii) Users A and C are in ISDN. User B is in another network

Address information available to	Address of A	Address of B	Address of C
User A	–	NO	YES
User B	YES	–	NO
User C	YES	NO	–

iv) User A is in ISDN. Users B and C are in another network

Address information available to	Address of A	Address of B	Address of C
User A	–	NO	YES
User B	YES	–	NO
User C	NO	NO	–

1.6 *Interaction with other supplementary services*

1.6.1 *Call Waiting*

Assume served user A has an established call with user B and wishes to transfer user B to user C, and users A, B and C all have subscribed to the Call Waiting Service. If a call from user D is received while:

i) user A is invoking Normal Call Transfer

- If user D calls user A at any time before A requests the completion of the transfer of user B to user C, then user A shall receive a call waiting indication. When user B is transferred to user C, a B-channel would normally become idle, enabling user A to accept the waiting call.
- If user D calls user B, then user B can use normal call waiting procedures to accept the waiting call (preferably once the transfer to user C is completed). If user B had a call waiting indication while the call was established with user A, the call waiting indication shall not be affected by the transfer of user B to user C.
- If user D calls user C during the transfer process (i.e. while user C is engaged on an active call with user A), the call waiting indication shall be presented to user C. User C could then use Normal Call Waiting procedures to accept the waiting call (preferably once the call transfer is completed).

ii) user A is invoking Single-Step Call Transfer

- User A may receive a call waiting indication any time before or during the transfer invocation. Once the Single-Step Call Transfer is invoked, then user A is disconnected from user B, thus, causing a B-channel to normally become idle, enabling user A to accept the waiting call.
- User B may receive a call waiting indication any time before or during the transfer invocation. User B could then use Normal Call Waiting procedures to accept the waiting call (preferably once the transfer is completed). If the transfer is not successful (e.g. user C is busy), then user B would normally release the call, causing a B-channel to become idle and enabling user B to accept the waiting call.
- If the call from user D arrives at user C's serving office after the call from A, user C would receive a call waiting indication. The call waiting indication shall not be affected by the transfer of user B to user C. User C could then use Normal Call Waiting procedures to accept the waiting call (preferably once the transfer is completed). If the call from user D arrives before the call from user A, the call from user A will receive call waiting treatment.

iii) user A is invoking Explicit Call Transfer

- The interaction for users A, B, or C with call waiting are the same as for i) above.

1.6.2 *Call Transfer*

It shall be possible for both users (user A and user B) in a normal call, who have each subscribed to the Call Transfer Service, to simultaneously transfer the call. That is, if user A and user B are active in an established call, user A could transfer the call to a user C and user B could transfer the call to a user D. Call progress signals and other notifications will be delivered to the appropriate party at the time the signal is received. See Figure 1/I.252.

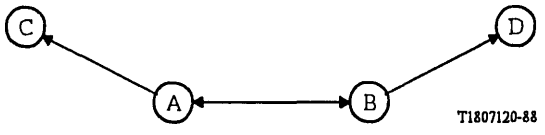


FIGURE 1/I.252

1.6.3 *Connected Line Identification Presentation (COLP)*

Assume that user A has an established call with user B and wishes to transfer this call with user B to user C. Except in the case where user C prohibits the presentation of his/her number, user C's number shall be presented:

- to user B upon the successful completion of the transfer to user C (independent of the type of transfer procedure invoked by user A) provided that user B has subscribed to COLP;
- to user A when user A is using the Normal or Explicit Call Transfer procedures and has subscribed to COLP. The reached party's number will not be presented to user A if user A invokes the Single-Step Call Transfer procedure.

Note – Number presentation may not be possible if interworking with a non-ISDN network is involved in the call transfer.

1.6.4 *Connected Line Identification Restriction (COLR)*

Assume that a user A has an established call with a user B and wishes to transfer this call with user B to a user C.

If user C has subscribed to COLR, then user A shall not receive user C's number when user A invokes any Call Transfer procedure and user B shall not receive user C's number during the transfer of user B to user C.

1.6.5 *Calling Line Identification Presentation (CLIP)*

For Normal and Explicit Call Transfers, user A shall have his number presented to user C and user B shall have his number presented to user C unless:

1) user A or B has number presentation restrictions; or
2) the call transfer process requires interworking with a non-ISDN network.

For Single-Step Call Transfer, if user C has subscribed to CLIP he shall receive the number of user B unless:

1) User B has address presentation restrictions; or
2) the call transfer process requires interworking with a non-ISDN network.

User C may also receive user A's address as a "redirecting party" unless:

1) User A has address presentation restrictions; or
2) the call transfer process requires interworking with a non-ISDN network.

1.6.6 *Calling Line Identification Restriction (CLIR)*

Assume that a user A has an established call with a user B and wishes to transfer this call with user B to a user C.

If user A has subscribed to CLIR, then user C shall not receive a calling number when user A invokes any Call Transfer procedure. If user B has subscribed to CLIR, then user C shall not receive a calling number during the transfer of user B to user C.

1.6.7 *Closed User Group (CUG)*

The intention of CUG is to allow some connections and prohibit others; call transfer must not compromise this intention.

Assume that a user A has an established call with user B and wishes to transfer this call with user B to a user C. When considering CUG requirements and restrictions, the transfer process (all three procedures) should be considered as three separate call processings:

1) when users A and B established their original connection, if user A and/or user B was a member of a CUG, then CUG requirements must have been met before the two parties were connected;

2) when user A invokes a transfer procedure, both user A and user C must meet CUG requirements before the call can be completed, if either user A or user C is a member of a CUG;

3) finally, the transfer connection of user B to user C must first meet all CUG requirements (if either user B and/or user C is a member of a CUG) before the two parties can establish communications.

The above requirements insure that CUG security is not violated. They prevent, for example, a user A who meets CUG requirements with user C from transferring a user B who does not meet CUG requirements with user C.

1.6.8 *Conference Calling*

Refer to Recommendation I.254, § 1.6.2, ineraction with Call Transfer.

1.6.9 *Direct-Dialling-In*

No impact, i.e. neither supplementary service affects the operation of the other supplementary service.

1.6.10 *Call Divertion (i.e. Call Forwarding Services)*

In general, if the served user attempts to establish a call to a party that is forwarding calls, the forwarded-to party will be alerted and may be transferred to. Specific procedures are described below.

The count for the number of forwarding "hops" should be cleared each time a call transfer occurs.

Assume that a user A has an established call with a user B and wishes to transfer this call with user B to a user C:

1.6.10.1 *Call Forwarding Busy (CFB)*

User C, which has subscribed to CFB, may be busy on another call when user A's call is received. The call from user A would then be routed to another user D. For Normal and Explicit Call Transfers, user A would, in general, be aware of the forwarding and could make a decision as to whether or not the transfer of user B should be completed to the forwarded-to user D. For Single-Step Call transfer, user B would be connected to the forwarded-to user D.

1.6.10.2 *Call Forwarding No Reply (CFNR)*

User C, who has subscribed to CFNR, may have a free access but does not answer user A's call. Upon expiration of the CFNR timer, user A's call would be routed to another user D. For Normal and Explicit Call Transfers, user A would, in general, be aware of the forwarding and could make a decision as to whether or not the transfer of user B should be completed to the forwarded-to user D. For Single-Step Call Transfer, user B would be connected to the forwarded-to user D.

1.6.10.3 *Call Forwarding Unconditional (CFU)*

If user C has subscribed to CFU, then user A's call will be routed to another user D. For Normal and Explicit Call Transfers, user A would, in general, be aware of the forwarding and could make a decision as to whether or not the transfer of user B should be completed to the forwarded-to user D. For Single-Step Call Transfer, user B would be connected to the forwarded-to user D.

1.6.11 *Line Hunting*

No impact, i.e. neither supplementary service affects the operation of the other supplementary service.

1.6.12 *Three-Party Service*

The forms of call transfer given in Table 1/I.252 are applicable to the indicated states of Three-Party Service.

TABLE 1/I.252

Three-party service state	Call transfer		
	Normal	Single-step	Explicit
Active/held	YES	NA	YES
Three-way conversation	YES [a]	NA	NA

[a] See Figure 4/I.254, three-party service dynamic description.

1.6.13 *User-to-User Signalling (UUS)*

Prior to transfer: Prior to beginning a transfer user A can employ UUS services 1, 2 and 3 normally.

During transfer: UUS services 1, 2 and 3 are only allowable between user A and user B and/or between user A and user C. User-to-user information (UUI) sent by user B will be delivered to user A, not user C. UUI cannot be transferred between users B and C during this time. The delivery of service 3 UUI cannot be guaranteed during transfer.

After completion of transfer: Only if user B and user A both request service(s) 1, 2 and/or 3, is that service(s) available for use between users B and C after the transfer is completed. If user A did not request a given service in the set-up to user C, user B will be informed that he can no longer employ that service on this call. If user A requested a particular service in the set-up to user C, but the service was not requested by user B in the initial set-up message to user A, user C will be informed at the completion of the transfer that he can no longer employ the service.

Note 1 – The procedures to be followed if transfer of charge is permitted are for further study.

Note 2 – The procedures to be followed if the number of allowable messages has been reached by any party are for further study.

1.6.14 *Multiple Subscriber Number*

No impact, i.e. neither supplementary service affects the operation of the other supplementary service.

1.6.15 *Call Hold*

Parties held by users A, B and C, before invoking a transfer process will continue to be held by the parties after the transfer process. For example, if user B places his call to user A on hold during user A's transfer of the call to user C, the resulting call from user B to user C shall remain held by user B until it is retrieved by user B. The only exception to this is the Explicit Call Transfer procedure when user A transfers user B to user C. In this case, user B will no longer be held by user A after the transfer is completed.

Special case: Assume users A and B were in an active call and user A places user B on hold, and user B places user A on hold. If user A transfers user B to user C by invoking the Explicit Call Transfer procedure, then the transfer shall take effect with the resulting call between users B and C remaining held by user B and the held call between user A to user B shall be discarded (i.e. user B cannot retrieve user A after the transfer).

1.6.16 *Advice of Charge*

Refer to Recommendation I.256, §§ 2.1.6.2, 2.2.6.2, 2.3.6.2, Interaction with Call Transfer.

1.7 *Dynamic description*

The dynamic description of this service is shown in Figure 2/I.252.

2 I.252.2 – **Call Forwarding Busy**

2.1 *Definition*

Call Forwarding Busy (CFB) permits a "served user" (see § 2.2.2) to have the network send to another number all incoming calls for the served user's ISDN number (or just those associated with a specified basic service) which meet busy at the served user's ISDN number. The served user's originating service is unaffected.

Note – In normal situations, the CFB service is provided on a per access basis. (In these situations, there is a one-to-one relationship between ISDN number and access.) However, the network may recognize multiple numbers on a single interface; in addition, it may not undertstand a complete ISDN number (e.g. DDI). In these cases, the CFB service is offered on the basis of the part of the ISDN number which the network can recognize.

2.2 *Description*

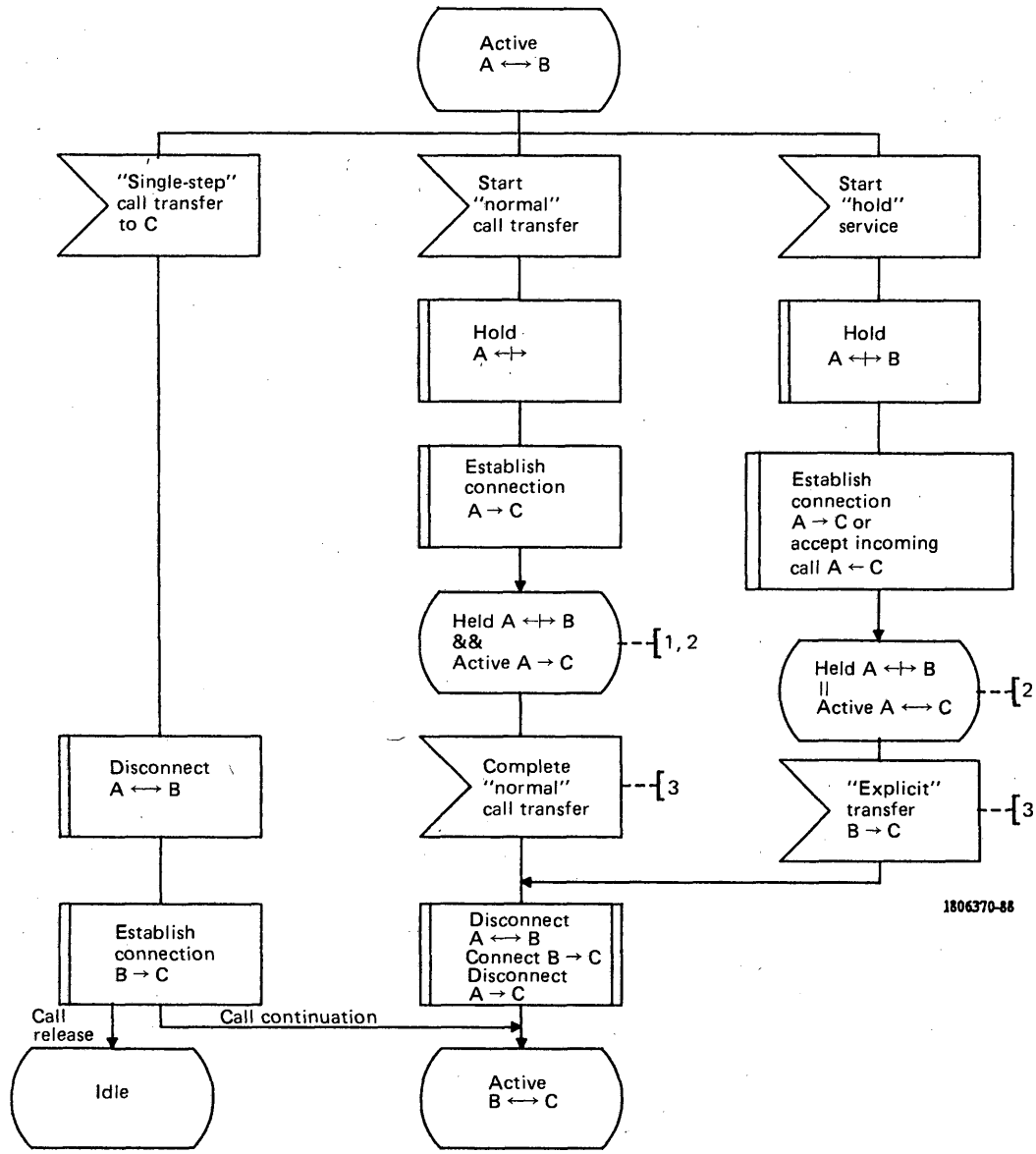
2.2.1 *General description*

For a given ISDN number, this service (including options) may be subscribed to for each basic service to which the user(s) of the number subscribes, or collectively for all the basic services to which the user(s) subscribes. Since subscription is on an ISDN number basis, the same Call Forwarding subscriptions will apply to all terminals using this number.

Note – In this service description, it is assumed that a single ISDN number is not shared across multiple interfaces. A single ISDN number may, however, be shared by multiple terminals on the same interface. Procedures permitting an ISDN number to be shared across multiple interfaces are for further study. For multiple access installations, it may be possible for the user to specify, on activation, if the service is applicable to a specific access or all accesses associated with that installation.

The served user can request a different forwarded-to number for each basic service subscription parameter value to which he has subscribed.

An indication that the CFB service is activated on a number may, as an option, be given to the user who has forwarding activated, each time an outgoing call is made. This may take the form of a special indication in the proceed response.



Note 1 – For other "paths" to and from this state, please see the Three-Party Service and Call Waiting service descriptions.

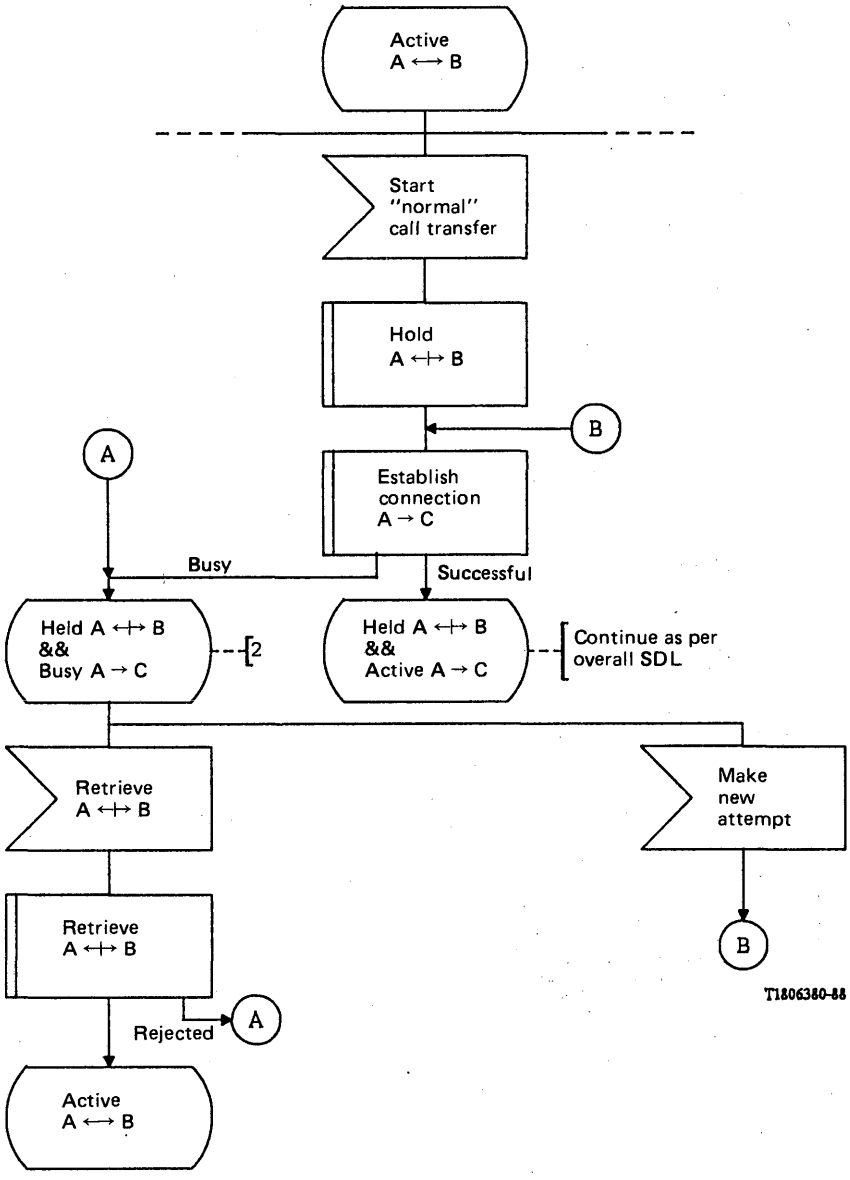
Note 2 – "&&" means service provider is aware of the relationship between the calls. "||" means the service provider is not aware of the relationship. "⟷" means the call is on hold.

Note 3 – In some networks, User A can invoke this step before the A → C connection is completely established (e.g., during alerting).

Note 4 – Notifications are provided as described in the text.

FIGURE 2/I.252

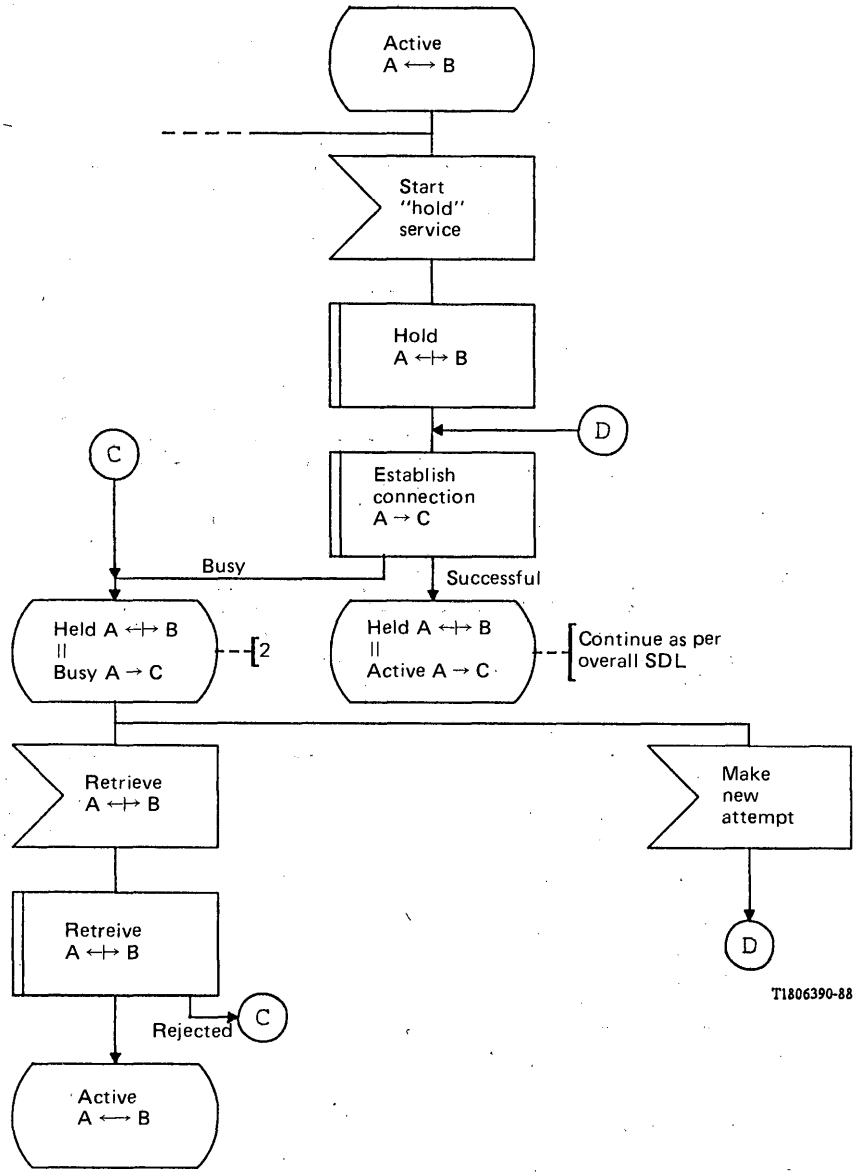
Call Transfer Service Overall SDL



Note – For Note 2, see Figure 2/I.252.

FIGURE 3/I.252

Handling of busy condition in Normal Call Transfer



Note – For Note 2, see Figure 2/I.252.

FIGURE 4/I.252

Handling of busy condition when establishing connections A → C prior to invoking Explicit Call Transfer

2.2.2 *Specific terminology*

A *served user* is a user of a particular ISDN number who is requesting that calls to his number be forwarded. This user may also be referred to as the forwarding user or the called user.

A *forwarded-to user* is a user to whom the call shall be forwarded.

2.2.3 *Qualifications on the applicability to telecommunications services*

No restrictions identified.

2.3 *Procedures*

2.3.1 *Provision/withdrawal*

CFB shall be provided after pre-arrangement with the service provider.

The service can be offered with three subscription options. Options apply separately to each basic service subscribed to on each ISDN number. For each subscription option, only one value can be selected. Subscription options are summarized below:

Subscription options	*Value*
Served user receives notification that call has been forwarded	– No – Yes, with call offering information (see § 2.3.2.2)
Calling user receives notification that his call has been forwarded	– No – Yes, with or without forwarded-to user number
Served user receives notification that CFB is currently activated	– No – Yes

2.3.2 *Normal procedures*

2.3.2.1 *Activation/deactivation/registration*

Same as for Call Forwarding Unconditional (CFU), see § 4.

2.3.2.2 *Invocation and operation*

The following illustration clarifies the CFB procedures. Assume that A calls B1, who forwards the call to B2, . . ., Bm, . . ., Bx. The final receiver of the call is C.

2.3.2.2.1 *Served user Bm's perspective*

If CFB is active and the served user is Network Determined User Busy (NDUB) or User Determined User Busy (UDUB), then an incoming call to the served user will be forwarded. In case of NDUB, the call is not offered to the served user.

In the case of UDUB, the call will have been offered to the served user. Normal call set-up information will already have been provided to the served user. When the forwarding attempt is started, the served user will receive notification that a call has been forwarded. No further notification is given.

When an incoming call is forwarded without being offered to the served user (i.e. NDUB condition), the served user, as a subscription option, may receive notification of the call forwarding (but will not be able to answer the incoming call). This notification is given as soon as the forwarding attempt is started.

This notification includes the following information (on the call that has been forwarded):

1) indication that a call has been forwarded;
2) telecommunications service information (e.g. bearer capability, higher layer compatibility);
3) user-to-user information;
4) Bm's number;
5) calling party number A (if CLIP applicable).

If multiple forwardings have occurred and the served user is authorized to receive additional information, he may also receive:

6) originally called number B1;
7) cause for original forwarding;
8) last forwarding number B (m − 1);
9) cause for last forwarding.

2.3.2.2.2 *Forwarded-to user C's perspective:*

The forwarded-to user C will receive an indication that the call has been forwarded.

As an option he may also receive:

1) originally called number B1;
2) cause for original forwarding;
3) last forwarding number Bx;
4) cause for last forwarding.

(Depending on the use of other supplementary services, the forwarded-to user C may also receive information such as the calling party A number and user-to-user signalling. See the descriptions of interactions with other supplementary services.)

2.3.2.2.3 *Calling user A's perpective:*

As a subscription option, the served user Bm can request that the calling user receive a notification that the call has been forwarded and, as an additional subscription option, that notification can include the forwarded-to number B(m+1). Transfer of the forwarded-to user number will not take place if number restrictions at the forwarded-to user exist.

2.3.3 *Exceptional procedures*

2.3.3.1 *Activation/deactivation/registration*

Same as CFU (see § 4).

2.3.3.2 *Invocation and operation*

Call forwarding applies only to subscribed basic services. Calls to an ISDN number requesting a basic service which is not subscribed to, will never be forwarded.

Within an ISDN, or tandem ISDNs, the total number of all forwardings for each call should be limited. The maximum number of such connections should be limited to a value between 3 and 5 for each call. This is to prevent infinite looping.

If the limit is reached and an attempt is made to forward the call an additional time, then the forwarded call shall be treated as follows:

If the forwarded call cannot be completed to the forwarded-to destination, then the network will clear the forwarded leg of the call. Specifically, if CFB has been invoked, and CNFR has not occurred, then the call would be cleared back towards the calling user, and the calling user would be sent a cause to indicate that the call has been forwarded but not completed (i.e. because of network congestion, invalid number, facility not available, etc.). If the forwarded call cannot be completed and if CFNR has occurred, then the call should only be cleared back as far as the CFNR exchange and the calling user will, in the case of a telephony call, continue to receive inband ringing tone.

2.3.4 *Alternative procedures*

2.3.4.1 *Activation/deactivation/registration*

None identified.

2.3.4.2 *Invocation and operation*

None identified.

2.4 *Network capabilities for charging*

This Recommendation does not cover charging principles. Future Recommendations in the D-Series are expected to contain that information.

It shall be possible to charge the subscriber accurately for the service.

2.5 *Interworking requirements*

Same as CFU (see § 4).

2.6 *Interaction with other supplementary services*

The ways in which Call Forwarding Busy interacts with other supplementary services are in general identical to the ways in which Call Forwarding Unconditional interacts with other supplementary services. Thus, if the interactions are described to be "same as CFU", the CFU text should be taken verbatim, except that the expression "Call Forwarding Unconditional" should be replaced by "Call Forwarding Busy".

2.6.1 *Call Waiting*

Calling user: same as CFU (see § 4).

Called user: No interaction. That is, if the user is not NDUB, Call Waiting will take place. If the user is NDUB, Call Forwarding Busy will take place.

Forwarded-to user: A forwarded call can invoke Call Waiting.

2.6.2 *Call Transfer*

Same as CFU (see § 4).

2.6.3 *Connected Line Identification Presentation*

Same as CFU (see § 4).

2.6.4 *Connected Line Identification Restriction*

Same as CFU.

2.6.5 *Calling Line Identification Presentation*

Same as CFU (see § 4).

2.6.6 *Connected Line Identification Restriction*

Same as CFU (see § 4).

2.6.7 *Closed User Group*

Same as CFU (see § 4).

2.6.8 *Conference Calling*

Same as CFU (see § 4).

2.6.9 *Direct-Dialling-In*

No impact, i.e. neither supplementary service affects the operation of the other supplementary service.

2.6.10 *Call Diversion (i.e. Call Forwarding) services*

2.6.10.1 *Call Forwarding Busy*

Not applicable.

2.6.10.2 *Call Forwarding No Reply*

The invocation of CFB takes precedence over CFNR.

2.6.10.3 *Call Forwarding Unconditional*

The invocation of CFU takes precedence over CFB.

2.6.11 *Line Hunting*

In general, Line Hunting takes precedence over CFB. Thus, CFB only occurs if all members of the hunt group are busy.

2.6.12 *Three-Party Service*

Refer to Recommendation I.254, § 2.6.10, interaction with CFB.

2.6.13 *User-to-User Signalling*

Same as CFU (§ 4), except that service 2 of UUS cannot be guaranteed prior to completion of the Call Forwarding Busy in case of a user-determined-busy.

2.6.14 *Multiple Subscriber Number*

No impact, i.e. neither supplementary service affects the operation of the other supplementary service.

2.6.15 *Call Hold*

No impact, i.e. neither supplementary service affects the operation of the other supplementary service.

2.6.16 *Advice of Charge*

Refer to Recommendation I.256, §§ 2.1.6.10, 2.2.6.10, 2.3.6.10, interaction with CFB.

2.7 *Dynamic description*

The dynamic description given in Figure 5/I.252 contains the descriptions of the three Call Forwarding services (CFU, CFB, and CFNR).

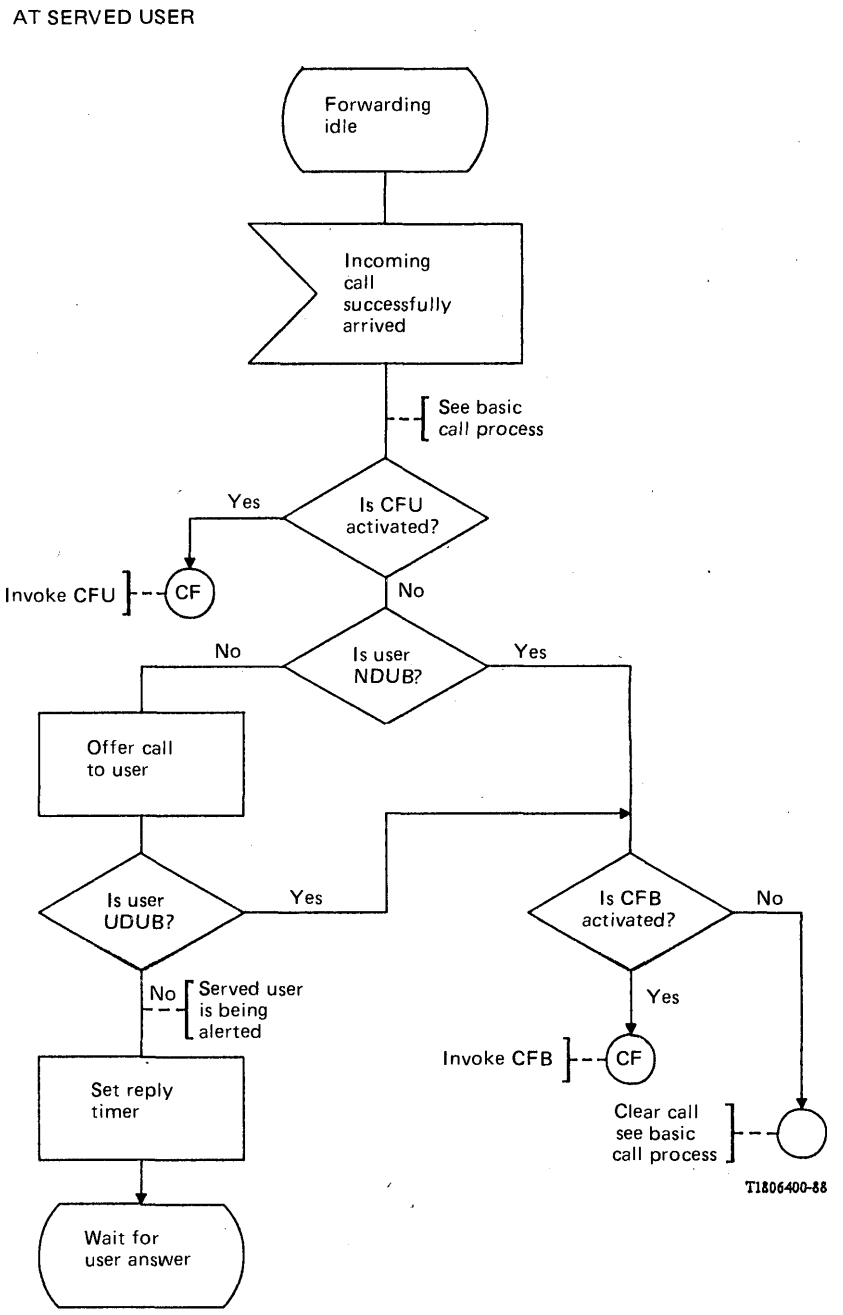


FIGURE 5/I.252 (sheet 1 of 5)

Call forwarding busy

AT SERVED USER

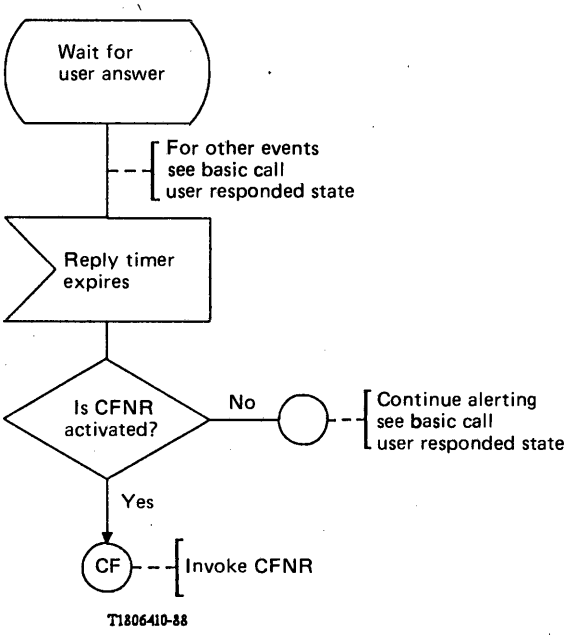


FIGURE 5/I.252 (sheet 2 of 5)

Call forwarding busy

AT SERVED USER

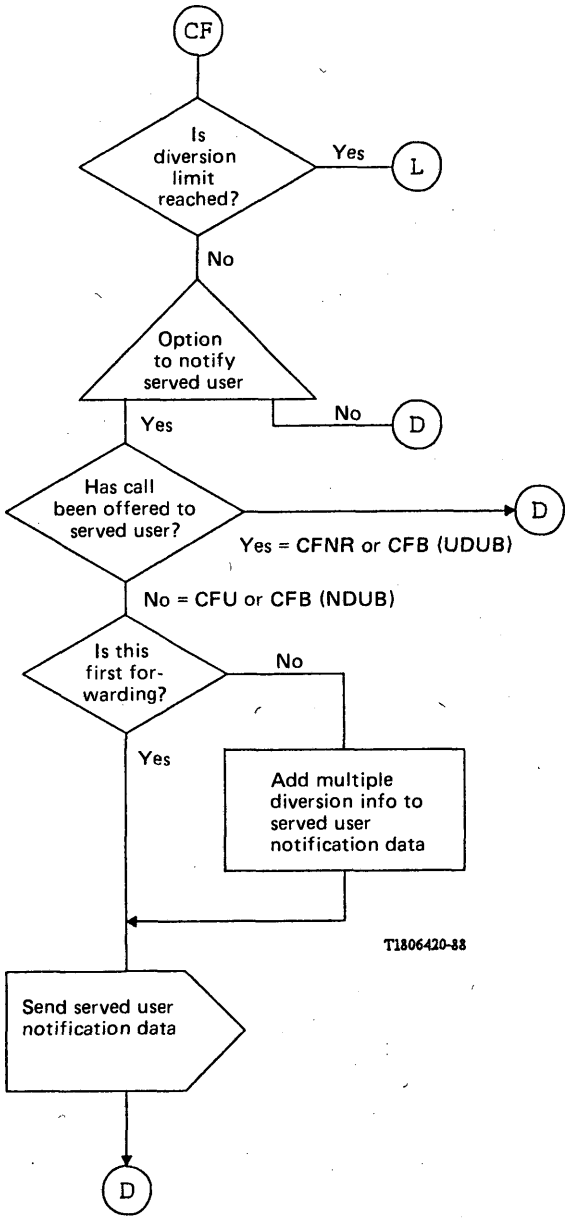


FIGURE 5/I.252 (sheet 3 of 5)

Call forwarding busy

AT SERVED USER

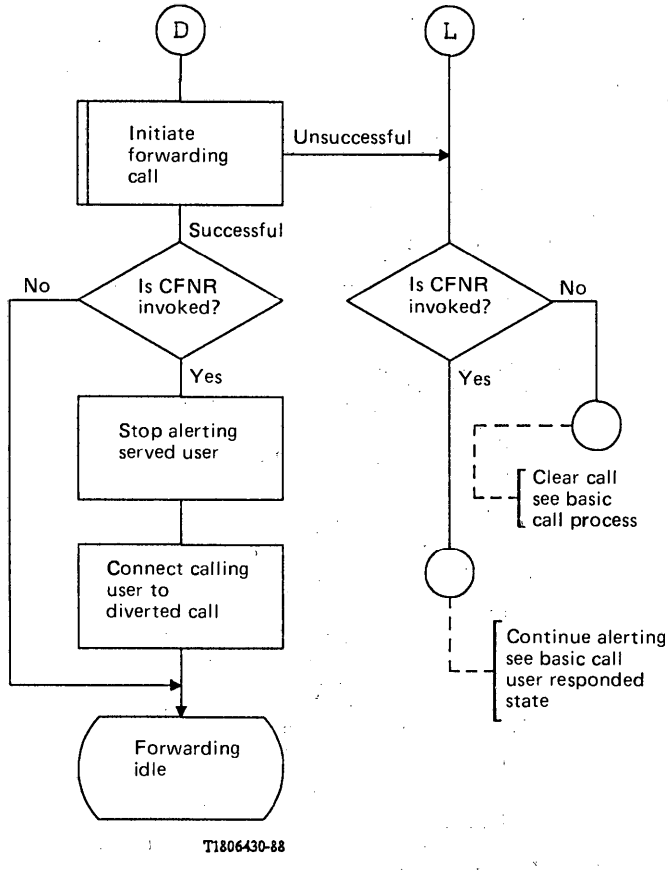
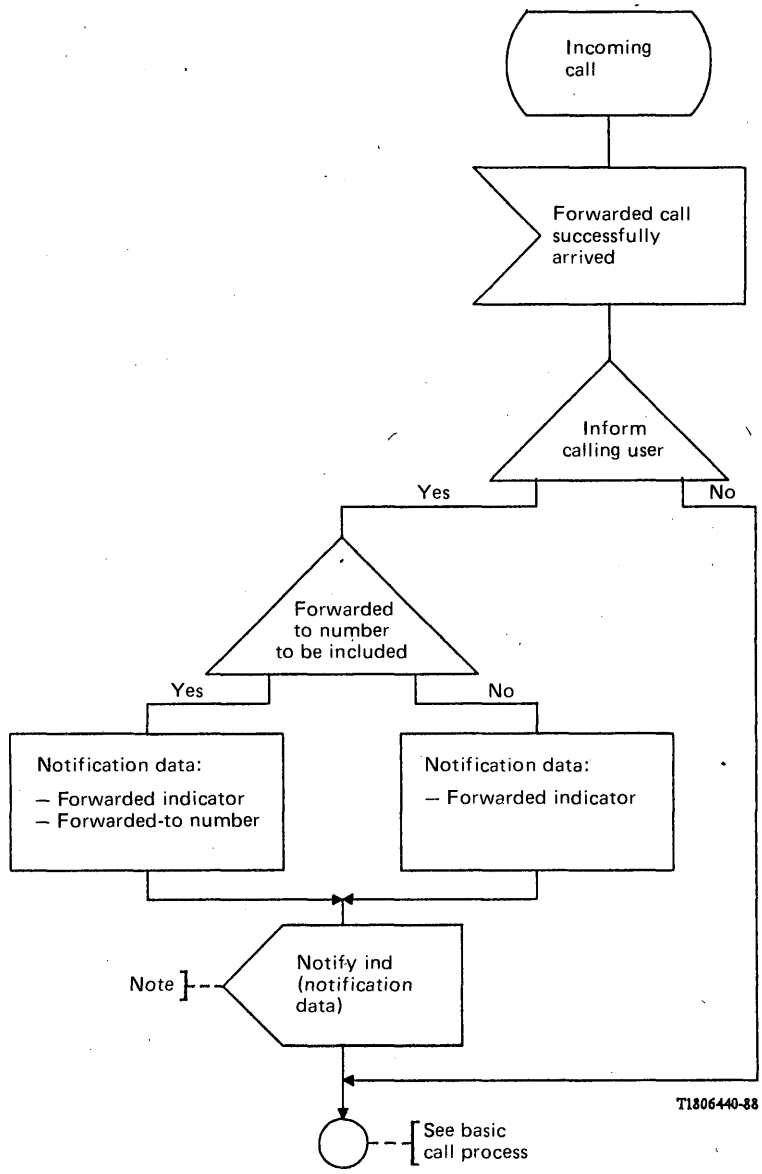


FIGURE 5/I.252 (sheet 4 of 5)

Call forwarding busy

AT FORWARDED-TO USER



Note – A notification is only sent to the calling user if the served user subscribes to the supplementary service call forwarding with address notification option. Transfer of the forwarded-to user number will not take place, if number restrictions exist at the forwarded-to user.

FIGURE 5/I.252 (sheet 5 of 5)

Call forwarding busy

3 I.252.3 – **Call Forwarding No Reply**

3.1 *Definition*

Call Forwarding No Reply (CFNR) permits a "served user" (see § 3.2.2) to have the network send to another number all incoming calls for the served user's ISDN number which meet no reply, or just those associated with a specific basic service which meet no reply. The served user's originating service is unaffected.

Note – In normal situations, the CFNR service is provided on a per access basis. (In these situations, there is a one-to-one relationship between ISDN number and access.) However, the network may recognize multiple numbers on a single interface; in addition, it may not understand a complete ISDN number (e.g. DDI). In these cases, the CFNR service is offered on the basis of the part of the ISDN number which the network can recognize.

3.2 *Definition*

3.2.1 *General description*

For a given ISDN number, this service (including options) may be subscribed to for each basic service to which the user(s) of the number subscribes, or collectively for all the basic services to which the user(s) subscribes. Since subscription is on an ISDN number basis, the same Call Forwarding subscriptions will apply to all terminals using this number.

Two conditions of CFNR are possible as follows:

1) the call is offered and no indication of a compatible terminal is received; or
2) the call is offered and an indication of a compatible terminal is received.

Only case 2) is considered here. Case 1) is for further study.

Note – In this service description, it is assumed that a single ISDN number is not shared across multiple interfaces. A single ISDN number may, however, be shared by multiple terminals on the same interface. Procedures permitting an ISDN number to be shared across multiple interfaces are for further study. For multiple access installations, it may be possible for the user to specify, on activation, if the service is applicable to a specific access or all accesses associated with that installation.

The served user can request a different forwarded-to number for each basic service subscription parameter value to which he has subscribed.

An indication that the CFNR service is activated on a number may, as an option, be given to the user who has forwarding activated, each time an outgoing call is made. This may take the form of a special indication in the proceed response.

3.2.2 *Specific terminology*

A *served user* is a user of particular ISDN number who is requesting that calls to his number be forwarded. This user may also be referred to as the forwarding user or the called user.

A forwarded-to user is a user to whom the call shall be forwarded.

3.2.3 *Qualifications on the applicability to telecommunication services*

No restrictions identified.

3.3 *Procedures*

3.3.1 *Provision/withdrawal*

CFNR shall be provided after pre-arrangement with the service provider.

The service can be offered with four subscription options. Options apply separately to each basic service subscribed to an each ISDN number. For each subscription option, only one value can be selected. Subscription options are summarized below:

Subscription options	*Value*
Served user receives notification that call has been forwarded	– No – Yes, with call offering information (see § 3.3.2.2)
Calling user receives notification that his call has been forwarded	– No – Yes, with or without forwarded-to user number
No reply condition timer	– 5-60 seconds, in steps of 5 seconds
Served user received notification that CFNR is currently activated	– No – Yes

3.3.2 *Normal procedures*

3.3.2.1 *Activation/deactivation/registration*

Same as CFU (see § 4).

3.3.2.2 *Invocation and operation*

The following illustration clarifies the CFNR procedures. Assume that A calls B1, who forwards the call to B2, . . ., Bm, . . ., Bx. The final receiver of the call is C.

3.3.2.2.1 *Served user Bm's perspective*

When CFNR is active, incoming calls will be offered to the served user. Normal call offering information is provided to the served user. If the served user does not reply within a subscribed time interval, the call will be forwarded. The served user, as a subscription option, may receive notification that a call has been forwarded. This notification is given as soon as the forwarding attempt is started. No further notification is given.

3.3.2.2.2 *Forwarded-to user C's perspective*

The forwarded-to user C will receive an indication that the call has been forwarded.

As an option he may also receive:

1) originally called number B1;
2) cause for original forwarding;
3) last forwarding number Bx;
4) cause for last forwarding.

(Depending on the use or other supplementary services, the forwarded-to user C may also receive information such as the calling party A number and user-to-user signalling. See the descriptions of interactions with other supplementary services.)

3.3.2.2.3 *Calling user A's perspective*

As a subscription option, the served user Bm can request that the calling user receive a notification that the call has been forwarded and, as an additional subscription option, that notification can include the forwarded-to number B(m + 1). Transfer of the fowarded-to user number will not take place if number restrictions at the forwarded-to user exist.

3.3.3 *Exceptional procedures*

3.3.3.1 *Activation/deactivation/registration*

Same as CFU (see § 4).

3.3.3.2 *Invocation and operation*

Call forwarding applies only to subscribed basic services. Calls to an ISDN number requesting a basic service which is not subscribed to will never be forwarded.

Within an ISDN, or tandem ISDNs, the total number of all forwardings for each call should be limited. The maximum number of such connections should be limited to a value between 3 and 5 for each call. This is to prevent infinite looping.

If the limit is reached and an attempt is made to forward the call an additional time, the forwarded call shall be treated as follows:

If the forwarded call cannot be completed to the forwarded-to destination, then the network will clear the forwarded leg of the call and the calling user will, in the case of a telephony call, continue to receive inband ringing tone. The "no reply timer" will not be restarted by the network. (Note that during the activation of CFNR, the calling user shall continue to alert the forwarding user until alerting commences at the forwarded-to user.)

3.3.4 *Alternative procedures*

3.3.4.1 *Activation/deactivation/registration*

None identified.

3.3.4.2 *Invocation and operation*

None identified.

3.4 *Network capabilities for charging*

This Recommendation does not cover charging principles. Future Recommendations in the D-series are expected to contain that information.

It shall be possible to charge the subscriber accurately for the service.

3.5 *Interworking requirements*

If a forwarded-to number is not within the ISDN, then an interworking situation is said to exist.

If a forwarded call meets an interworking situation, then an interworking indication should be sent to the calling party. Also, if the network cannot determine that the forwarded call cannot be completed (i.e. the progress of the call is provided in-band), the network shall cease alerting at the diverting termination and connect the calling user to the diverted call in order to receive these inband supervisory indications.

Note – The number of times a call has been forwarded once it has exited the Common Channel Signalling (CCS) network cannot be limited by this CCS network.

3.6 *Interaction with other supplementary services*

The ways in which Call Forwarding No Reply interacts with other supplementary services are in general identical to the ways in which Call Forwarding Unconditional interacts with other supplementary services. Thus, if the interactions are described to be "same as CFU", the CFU text should be taken verbatim, except that the expression "Call Forwarding Unconditional" should be replaced by "Call Forwarding Busy".

3.6.1 *Call Waiting*

Refer to Recommendation I.253, § 1.6.10, interaction with CFNR.

3.6.2 *Call Transfer*

Same as CFU (see § 4).

3.6.3 *Connected Line Identification Presentation*

Same as CFU (see § 4).

3.6.4 *Connected Line Identification Restriction*

Same as CFU (see § 4).

3.6.5 *Calling Line Identification Presentation*

Same as CFU (see § 4).

3.6.6 *Calling Line Identification Restriction*

Same as CFU (see § 4).

3.6.7 *Closed User Group*

Same as CFU (see § 4).

3.6.8 *Conference Calling*

Same as CFU (see § 4).

3.6.9 *Direct-Dialling-In*

No impact, i.e. neither supplementary service affects the operation of the other supplementary service.

3.6.10 *Call Diversion (i.e. Call Forwarding) services*

3.6.10.1 *Call Forwarding Busy*

The invocation of CFB takes precedence over CFNR.

3.6.10.2 *Call Forwarding No Reply*

Not applicable.

3.6.10.3 *Call Forwarding Unconditional*

The invocation of CFB takes precedence over CFNR.

3.6.11 *Line Hunting*

No impact, i.e. neither supplementary service affects the operation of the other supplementary service.

3.6.12 *Three-Party Service*

Refer to Recommendation I.254, § 2.6.10, interaction with CFNR.

3.6.13 *User-to-User Signalling*

Service 1: A CFNR subscriber who has CFNR activated should not respond by accepting or rejecting a User-to-User Service 1 request until the call is answered. If a call for which User-to-User Service 1 was requested undergoes CFNR, User-to-User Service 1 will not be extended to the forwarded-to user.

Service 2: An outgoing call which meets a called party with CFNR activated cannot use User-to-User Service 2. On CFNR, User-to-User Service 2 will not be extended to the forwarded-to user.

Service 3: A CFNR subscriber who has CFNR activated should not respond by accepting or rejecting a User-to-User Service 3 request until the call is answered. If a call which User-to-User Service 3 was requested undergoes CFNR, User-to-User Service 3 may be extended to the forwarded-to user if the forwarding party allows it.

3.6.14 *Multiple Subscriber Number*

No impact, i.e. neither supplementary service affects the operation of the other supplementary service.

3.6.15 *Call Hold*

No impact, i.e. neither supplementary service affects the operation of the other supplementary service.

3.6.16 *Advice of Charge*

Refer to Recommendation I.256, §§ 2.1.6.10, 2.2.6.10, 2.3.6.10, interaction with CFNR.

3.7 *Dynamic description*

Refer to the CFB dynamic description (which covers CFU, CFB, and CFNR) in § 2.

4 I.252.4 – Call Forwarding Unconditional

4.1 *Definition*

Call Forwarding Unconditional (CFU) permits a "served user" (see § 4.2.2) to have the network send to another number all incoming calls for the served user's ISDN number (or just those associated with a specified basic service). The served user's originating service is unaffected. If this service is activated, calls are forwarded no matter what the condition of the termination. Other Call Forwarding services provide for call forwarding based on condition e.g. Call Forwarding Busy (CFB) and Call Forwarding No Reply (CFNR).

Note – In normal situations, the CFU service is provided on a per access basis. (In these situations, there is a one-to-one relationship between ISDN number and access.) However, the network may recognize multiple numbers on a single interface; in addition, it may not understand a complete ISDN number (e.g. DDI). In these cases, the CFU service is offered on the basis of the part of the ISDN number which the network can recognize.

4.2 *Description*

4.2.1 *General description*

For a given ISDN number, this service (including options) may be subscribed to for each basic service to which the user(s) of the number subscribes, or collectively for all the basic services to which the user(s) subscribes. Since subscription is on an ISDN number basis, the same Call Forwarding subscriptions will apply to all terminals using this number.

Note – In this service description, it is assumed that a single ISDN number is not shared across multiple interfaces. A single ISDN number may, however, be shared by multiple terminals on the same interface. Procedures permitting an ISDN number to be shared across multiple interfaces are for further study. For multiple access installations, it may be possible for the user to specify, on activation, if the service is applicable to a specific access or all accesses associated with that installation.

The served user can request a different forwarded-to number for each basic service subscription parameter value to which he has subscribed.

An indication that the CFU service is activated on a number may, as an option, be given to the user who has Forwarding activated, each time an outgoing call is made. This may take the form of a special indication in the proceed response.

4.2.2 *Specific terminology*

A *served user* is a user of a particular ISDN number who is requesting that calls to his number be forwarded. This user may also be referred to as the forwarding user or the called user.

A *forwarded-to user* is a user to whom the call shall be forwarded.

4.2.3 *Qualifications on the applicability to telecommunication services*

No restrictions identified.

4.3 *Procedures*

4.3.1 *Provision/withdrawal*

CFU shall be provided after pre-arrangement with the service provider.

The service can be offered with three subscription options. Options apply separately to each basic service subscribed to on each ISDN number. For each subscription option, only one value can be selected. Subscription options are summarized below:

Subscription options	*Value*
Served user receives notification that call has been forwarded	– No – Yes, with call offering information (see § 4.3.2.2)
Calling user receives notification that his call has been forwarded	– No – Yes, with or without forwarded-to user number
Served user receives notification that CFU is currently activated	– No – Yes

4.3.2 *Normal procedures*

4..3.2.1 *Activation/deactivation/registration*

If the served user has subscribed to CFU, the served user will use the activation procedure.

To activate CFU, the served user must supply:

1) the forwarded-to number;
2) information as to whether all calls or all calls of a specified basic service should be forwarded;
3) possibly the ISDN number for which CFU should apply.

As a network option, verification of the forwarded-to number should be accomplished, if possible, before accepting the call forwarding request.

When the served user so activates CFU, the service provider will return notification of acceptance or rejection of the request (see Exceptional procedures, § 4.3.3, for a list of possible causes for rejection).

This notification will include the number of the forwarded-to user to whom the call forwarding is active. If a single number can be used by more than one terminal, activation of CFU will be possible from any terminal which uses this number. As a service option, activation/deactivation may be restricted to selected terminals (users) (e.g. by use of a password).

CFU can be deactivated in either of two ways. The user can specifically deactivate the CFU activation. The user can activate CFU for the specified basic service to another number, thus causing the previous invocation of CFU to be overridden.

4.3.2.2 *Invocation and opertion*

The following illustration clarifies the CFU procedures. Assume that A calls B1, who forwards the call to B2, . . ., Bm, . . ., Bx. The final receiver of the call is C.

4.3.2.2.1 *Served user Bm's perspective*

When CFU is active, all incoming calls will be forwarded without being offered to the served user Bm. When an incoming call is forwarded without being offered to the served user, the served user, as a subscription option, may receive notification of the call forwarding (but will not be able to answer the incoming call). This notification is given as soon as the forwarding attempt is started.

This notification includes the following information (on the call that has been forwarded):

1) indication that a call has been forwarded;
2) telecommunication service information (e.g. bearer capability, higher layer compatibility);
3) user-to-user information;
4) Bm's number;
5) calling party's number A (if CLIP applicable).

If multiple forwardings have occurred and the served user is authorized to receive additional information, he may also receive:

6) originally called number B1;
7) cause for original forwarding;
8) last forwarding number B(m – 1);
9) cause for last forwarding.

4.3.2.2.2 *Forwarded-to user C's perspective*

The forwarded-to User C will receive an indication that call has been forwarded.

As an option he may also receive:

1) originally called number B1;
2) cause for original forwarding;
3) last forwarding number Bx;
4) cause for last forwarding.

(Depending on the use of other supplementary services, the forwarded-to user C may also receive information such as the calling party A number and user-to-user signalling. See the descriptions of interactions with other supplementary services.)

4.3.2.2.3 *Calling user A's perspective*

As a subscription option, the served user Bm can request that the calling user receive a notification that the call has been forwarded and, as an additional subscription option, that notification can include the forwarded-to number B(m + 1). Transfer of the forwarded-to user number will not take place if number restrictions at the forwarded-to user exist.

4.3.3 *Exceptional procedures*

4.3.3.1 *Activation/deactivation/registration*

4.3.3.1.1 Call Forwarding Unconditional for all basic services and Call Forwarding of particular basic services cannot be activated simultaneously.

If the system cannot accept an activation request, the served user should receive a notification that Call Forwarding activation was unsuccessful. Possible causes are:

i) service not subscribed;
ii) forwarded-to invalid ISDN number;
iii) use of an operator access prefix;
iv) forwarded-to ISDN number's telecommunication services violate subscribed constraints (e.g. group restrictions);
v) forwarded-to ISDN number is of a free number within the same office (i.e. a number to which no call is chargeable);
vi) insufficient information;
vii) requested telecommunication service is not provided to the forwarded-to ISDN number;
viii) forwarded-to number is a special service code (e.g. police);
ix) forwarded-to number is served user's number.

However, the network is not required to validate information related to the forwarded-to user.

4.3.3.1.2 *Deactivation*

If the user does not specify completely which CFU request is to be deactivated (e.g. the basic service and/or the originator's number), the network will reject the deactivation request with appropriate cause.

If the network cannot accept a user's request for deactivation, the cause will be returned to the user, e.g. incorrect origination ISDN number used.

If the network deactivates CFU without the served user having requested deactivation (e.g. when an exceptional condition occurs), the served user will receive notification along with the cause.

4.3.3.2 *Invocation and operation*

Call forwarding applies only to subscribed basic services. Calls to an ISDN number requesting a basic service which is not subscribed to, will never be forwarded.

Within an ISDN, or tandem ISDNs, the total number of all forwardings for each call should be limited. The maximum number of such connections should be limited to a value between 3 and 5 for each call. This is to prevent infinite looping.

If the limit is reached and an attempt is made to forward the call an additional time, then the forwarded call shall be treated as follows:

If the forwarded call cannot be completed to the forwarded-to destination, then the network will clear the forwarded leg of the call. Specifically, if CFU has been invoked, then the call would be cleared back towards the calling user. If the call has not previously undergone CFNR, the call will be cleared all the way back to the calling user and the calling user will be informed that no user is responding. If the call has previously undergone CFNR the call will only be cleared back as far as the CFNR exchange and the calling user will, in case of a telephony call, continue to receive inband ringing tone.

4.3.4 *Alternative procedures*

4.3.4.1 *Activation/deactivation/registration*

None identified.

4.3.4.2 *Invocation and operation*

None identified.

4.4 *Network capabilities for charging*

This Recommendation does not cover charging principles. Future Recommendations in the D-Series are expected to contain that information.

It shall be possible to charge the subscriber accurately for the service.

4.5 *Interworking requirements*

If the fowarded-to number is not within the ISDN, then an interworking situation is said to exist.

If a forwarded call meets an interworking situation, then an interworking indication should be sent to the calling party.

Note – The number of times a call has been forwarded once it has exited the Common Channel Signalling (CCS) network, cannot be limited by the CCS network.

4.6 *Interaction with other supplementary services*

4.6.1 *Call Waiting*

Calling user: No impact i.e. neither supplementary service affects the operation of the other supplementary service.

Called user: If a called user has activated CFU, then execution of that forwarding condition takes precedence over Call Waiting. CFU can be activated while a call is waiting without changing the state of the waiting call.

Forwarded-to user: A forwarded call can invoke Call Waiting.

4.6.2 *Call Transfer*

4.6.2.1 *Transfer of a Forwarded Call*

Calling user: A call which has been forwarded can be transferred by the calling user.

Called user: No impact i.e. neither supplementary service affects the operation of the other supplementary service.

Forwarded-to user: A call that has been transferred will be forwarded if the transferred-to user has CFU active and the appropriate forwarding conditions are met. A call which has been forwarded can by transferred by the forwarded-to user.

4.6.2.2 *Forwarding of a Call During Transfer*

A call which is being transferred can be forwarded by the party to whom the call is being transferred.

4.6.3 *Connected Line Identification Presentation*

No impact, i.e. neither supplementary service affects the operation of the other supplementary service.

4.6.4 *Connected Line Identification Restriction*

No impact, i.e. neither supplementary service affects the operation of the other supplementary service.

4.6.5 *Calling Line Identification Presentation*

Called user: If subscribed to, the called user can receive the Calling Line Identification of all calls which have been forwarded.

Forwarded-to user: Forwarded-to users having subscribed to CLIP may receive the calling user's number. If subscribed to by the called user, the forwarded-to user may receive the called user's number when a call has been forwarded.

Forwarded-to users who have subscribed to CLIP may receive the calling user's number if the calling user has not subscribed/invoked CLIR. In addition, forwarded-to users subscribing to CLIP may also receive the original called user's number and the last forwarding user's number if neither has subscribed/invoked CLIR (e.g. if A calls B1 who forwards A to B2 who forwards A to B3 who forwards A to C, then C will receive A, B1 and B3's number, unless A, B1 and B3 have restricted delivery).

4.6.6 *Calling Line Identification Restriction*

Calling user: When the CLIR is applicable and activated, the Calling Line Identification will not be presented to the forwarded-to user unless both the forwarding and forwarded-to users are in the override category. In addition, if the forwarding user is in an override category, the calling party's number will be provided in the call offering information. The latter is a national option.

4.6.7 *Closed User Group*

CUG restrictions must be met on each leg of the call. In addition, CUG restrictions must be met end-to-end. In the case of multiple forwarding, CUG restrictions have to be met in addition at each intermediate forwarding point.

Called user/forwarded-to user: When a call is forwarded, a new check of the CUG restrictions is made at the "forwarded-to" destination. The CUG information sent to the "forwarded to" destination is the same CUG information that was sent from the originating network.

Forwarding (i.e. called) user: Call forwarding can only be activated if CUG restrictions between the forwarding user and the forwarded-to user are met.

4.6.8 *Conference Calling*

Calling user: If a conference controller attempts to establish a conference call and calls a user with call forwarding active, the forwarded-to user will be alerted and can be added to the conference.

Called user: No impact i.e. neither supplementary service affects the operation of the other supplementary service.

Forwarded-to user: A forwarded-to user can establish a conference using an existing forwarded call as one of the conference connections.

A call, which has been forwarded, can be added to an existing conference by the forwarded-to user.

4.6.9 *Direct-Dialling-In*

No impact, i.e. neither supplementary service affects the operation of the other supplementary service.

4.6.10 *Call Diversion (i.e. Call Forwarding) services*

4.6.10.1 *Call Forwarding Busy*

The invocation of CFU takes precedence over CFB.

4.6.10.2 *Call Forwarding No Reply*

The invocation of CFU takes precedence over CFNR.

4.6.10.3 *Call Forwarding Unconditional*

Not applicable.

4.6.11 *Line Hunting*

Calling user: No impact i.e. neither supplementary service affects the operation of the other supplementary service.

Called user: Call Forwarding may be assignable to all or part of the hunting group. When forwarding is only required on part of the hunting group the forwarding customer must specify, at activation, which access the service is to be invoked from. Procedures for the operation of this service in association with part of a hunt group need to be completed. In general, CFU takes precedence over Line Hunting.

Forwarded-to user: Forwarded calls will be treated as normal calls when completing to a multi-line group user.

4.6.12 *Three-Party Service*

Refer to Recommendation I.254, § 2.6.10, interaction with CFU.

4.6.13 *User-to-User Signalling (UUS)*

Call originated by a user with CFU activated: Since CFU does not affect the forwarding user's ability to make outgoing calls, a user with CFU activated can send and receive user-to-user information (UUI) in association with an ongoing call or at the set-up of a new call.

Call incoming to a user with CFU activated:

During forwarding: Any UUI which accompanies the set-up of the call will be forwarded along with the forwarded call if both the calling and forwarding (i.e. called) parties have subscribed to service 1.

After forwarding: If the calling party has requested UUS service(s) 1, 2 and/or 3 in his initial call set-up, and if the fowarding (i.e. called) party has subscribed to the same service(s), then that service (those services) will automatically be extended so that they are available for use between the calling party and the forwarded-to party. If the forwarding party does not subscribe to the same service (set of services), the calling party will be informed that he can no longer employ the service(s) on this call.

4.6.14 *Multiple Subscriber Number*

No impact, i.e. neither supplementary service affects the operation of the other supplementary service.

4.6.15 *Call Hold*

No impact, i.e. neither supplementary service affects the operation of the other supplementary service.

4.6.16 *Advice of Charge*

Refer to Recommendation I.256, §§ 2.1.6.10, 2.2.6.10, 2.3.6.10.

4.7 *Dynamic description*

Refer to CFB dynamic description (which covers CFB, CFNR and CFU) in § 2.

5 I.252.5 – **Call Deflection**

This service, having been identified, now requires further study; its description is not yet included.

6 I.252.6 – **Line Hunting**

6.1 *Definition*

Line Hunting is a supplementary service which enables incoming calls to a specific ISDN number to be distributed over a group of interfaces.

Note – Development of Line Hunting to cover the case of hunting on available ISDN numbers, or addresses, rather than on interfaces is a possible extension of the service.

6.2 *Description*

6.2.1 *General description*

The interfaces selected for Line Hunting may be contained within one node, or may encompass more than one node.

It is the responsibility of the user to provide terminals to his interfaces for effective operation of the service. The problem of terminal compatibility in the Line Hunting supplementary service is also the responsibility of the user of the service.

6.2.2 *Specific terminology*

The following specific terminology is used to describe the possible selection method:

Sequential hunting	A sequential search is conducted over the members of the group in a fixed pre-specified order
Uniform distribution	An equal distribution of calls is provided to idle members of the group

The actual algorithm for each hunting method is a network provider option.

Note – The status of an individual channel may be included in the selection criteria above.

The selection of an interface is based on the availability of information channels rather than on the NDUB status. As part of each applicable bearer service or teleservice, there is already an option specifying the maximum number of information channels which can be used on the interface for each ISDN number, all ISDN numbers or subsets of ISDN numbers.

6.2.3 *Qualifications on the applicability to telecommunication services*

This supplementary service is considered meaningful when applied to the speech and 3.1 kHz audio bearer services and to the Telephony teleservice. Furthermore, it may also be meaningful when applied to other services.

6.3 *Procedures*

6.3.1 *Provision/withdrawal*

Line Hunting is offered, with possible subscription options, as a service to the called party and applied to an ISDN number. For each subscription the following are specified:

Subscription options	*Values*
Selected Method	– Sequential – Uniform
Members	– List of 2 or more interfaces

6.3.2 *Normal procedures*

6.3.2.1 *Activation/deactivation/registration*

Line Hunting is activated on provision and deactivated on withdrawal.

6.3.2.2 *Invocation and operation*

An incoming call to an ISDN number on which Line Hunting is in operation will be offered to a specific available interface in a pre-defined manner. The selection of the specified interface may provide for a uniform distribution of calls or sequential distribution of calls.

The method of selecting the interface may be either Sequential Hunting or Uniform Distribution. The selection algorithm may include reference to the channel status.

Once an interface has been selected, normal call set-up procedures apply and Line Hunting procedures are considered complete.

Outgoing calls from a Line Hunting Group are unaffected by this service.

6.3.3 *Exceptional procedures*

6.3.3.1 *Activation/deactivation/registration*

None identified.

6.3.3.2 *Invocation and operation*

If no interface is available, the Line Hunting service is unsuccessful and a busy indication is returned to the calling subscriber.

If no compatible terminal on a selected interface responds, no further line hunting action is provided and the call is released in the normal manner.

If the offered call is rejected at an interface, the call is released with normal procedures. No further hunting is provided.

6.3.4 *Alternative procedures*

6.3.4.1 *Activation/deactivation/registration*

None identified.

6.3.4.2 *Invocation and operation*

None identified.

6.4 *Network capabilities for charging*

This Recommendation does not cover charging principles. Future Recommendations in the D-Series are expected to contain that information.

It shall be possible to charge the subscriber accurately for the service.

6.5 *Interworking requirements*

The possibility of a line hunting group including both ISDN and non-ISDN interfaces for a particular Line Hunting service should be considered. This is for futher study.

6.6 *Interaction with other supplementary services*

6.6.1 *Call Waiting*

The Call Waiting service should not be provided to a line in a hunt group.

6.6.2 *Call Transfer*

No impact, i.e. neither supplementary service affects the operation of the other supplementary service.

6.6.3 *Connected Line Identification Presentation*

No impact, i.e. neither supplementary service affects the operation of the other supplementary service.

6.6.4 *Connected Line Identification Restriction*

No impact, i.e. neither supplementary service affects the operation of the other supplementary service.

6.6.5 *Calling Line Identification Presentation*

No impact, i.e. neither supplementary service affects the operation of the other supplementary service.

6.6.6 *Calling Line Identification Restriction*

No impact, i.e. neither supplementary service affects the operation of the other supplementary service.

6.6.7 *Closed User Group*

When a free line of a Line Hunting Group has been found, any CUG restrictions must be met before the connection will be established.

6.6.8 *Conference Calling*

No impact, i.e. neither supplementary service affects the operation of the other supplementary service.

6.6.9 *Direct-Dialling-In*

No impact, i.e. neither supplementary service affects the operation of the other supplementary service.

6.6.10 *Call Diversion (i.e. Call Forwarding) services*

6.6.10.1 *Call Forwarding Busy (CFB)*

If the outcome of the Line Hunting supplementary service is unsuccessful (see § 6.3.3.2 above), CFB may be invoked.

6.6.10.2 *Call Forwarding No Reply*

No impact, i.e. neither supplementary service affects the operation of the other supplementary service.

6.6.10.3 *Call Forwarding Unconditional*

When the CUF and Line Hunting supplementary services are both subscribed to on the same ISDN number, the CFU supplementary service takes priority. Further information is contained in the CUF definition in § 4.

6.6.11 *Line Hunting*

Not relevant.

6.6.12 *Three-Party Service*

No impact, i.e. neither supplementary service affects the operation of the other supplementary service.

6.6.13 *User-to-User Signalling*

No impact, i.e. neither supplementary service affects the operation of the other supplementary service.

6.6.14 *Multiple Subscriber Number*

For further study.

6.6.15 *Call Hold*

No impact, i.e. neither supplementary service affects the operation of the other supplementary service.

6.6.16 *Advice of Charge*

No impact, i.e. neither supplementary service affects the operation of the other supplementary service.

The dynamic description of this service is contained in Figure 6/I.252.

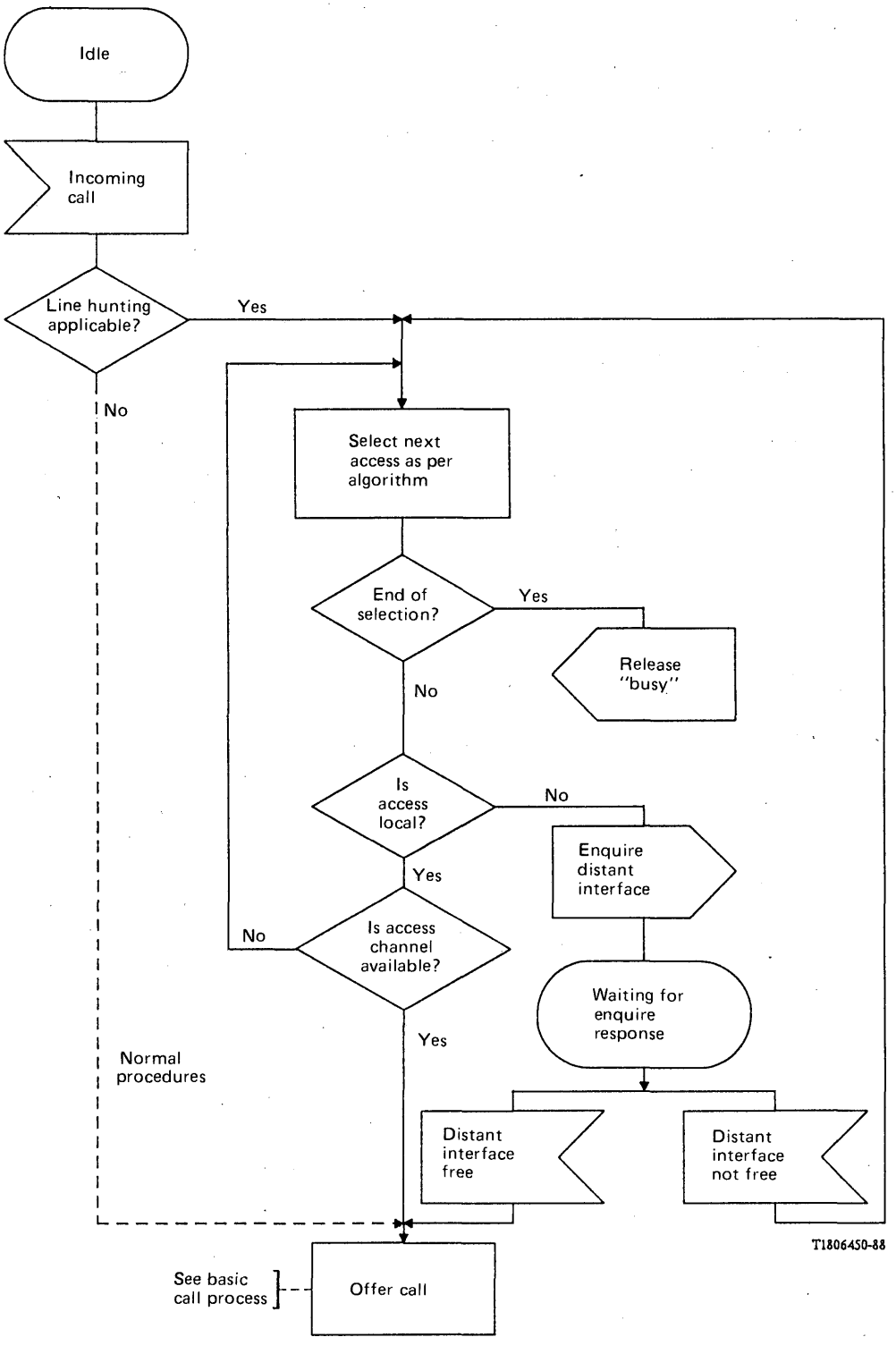


FIGURE 6/I.252

Line hunting overall SDL

Recommendation I.253

CALL COMPLETION SUPPLEMENTARY SERVICES

(Melbourne, 1988)

The purpose of this Recommendation is to provide the stage 1 description of the method defined in Recommendation I.130 using the means given in Recommendation I.210.

Supplementary services are described by a prose definition and description (step 1.1) and by a dynamic description (step 1.3). The application of the attribute technique, as defined in Recommendation I.140, for supplementary services is for futher study.

This Recommendation describes the following Call Completion supplementary services:

I.253.1 Call Waiting (CW)

I.253.2 Call Hold (HOLD)

I.253.3 Completion of calls to busy subscribers (CCBS) (Note)

Note – This service already identified needs to be further studied; its description is not yet included.

1 I.253.1 – Call Waiting

1.1 *Definition*

The Call Waiting service permits a subscriber to be notified of an incoming call (as per basic call procedures) with an indication that no interface information channel is available. The user then has the choice of accepting, rejecting or ignoring the waiting call (as per basic call procedures).

1.2 *Description*

1.2.1 *General description*

The ISDN Call Waiting service allows an out-of-band notification to subscriber B of the incoming call; this is the assumed case for this definition. In addition, as a service provider option, audible in-band indications may be provided to the channels occupied with the speech bearer service and the Telephony teleservice. Where applied, tones should be in accordance with Recommendation E.180.

The maximum number of calls that can be handled (e.g. active, held, alerting, waiting) for each ISDN number on a given interface is specified at subscription time.

1.2.2 *Specific terminology*

Throughout this definition the following terminology will be used:

Subscriber B: the subscriber who is provided by the network with the Call Waiting service on a particular interface.

User B: the user who reacts to the call waiting at B.

User C: the user who has originated a call to B which causes the Call Waiting service to be invoked.

User A: represents a user who is engaged in a call with user B (this call can be in any state).

User Response timer T1: this timer specifies the period the network will wait for a positive response, from a terminal at B, to the offered call. It is part of the basic call and has a value of a few seconds.

No Answer timer T2: this optional timer specifies the period the network will wait for a response (answer), from user B, to the offered call from user C. The value of this timer is between 0.5 and 2 minutes.

1.2.3 *Qualifications on the applicability to telecommunication services*

This supplementary service is considered meaningful when applied to the Telephony teleservice and the speech and 3.1 kHz audio bearer services. Furthermore, it may also be meaningful when applied to other services.

1.3 *Procedures*

1.3.1 *Provision/withdrawal*

Call Waiting can be provided on a subscription basis or, as a network provider option, can be generally available to all users without subscription. Call Waiting can be withdrawn for administrative reasons.

As part of each applicable bearer service or teleservice, there is an option specifying the maximum number of information channels which can be used (occupied) on the interface for each ISDN number, all ISDN numbers or subsets of ISDN numbers. Call Waiting for bearer services or teleservices occurs only when an attempt is made to exceed these limits.

As a network provider option, Call Waiting can be offered with several subscription options. The options apply separately to each ISDN number and service combination. For each subscription option, only one value can be selected. Subscription options are summarized below:

Subscription options	*Value*
Calls that can wait	– All – Others are for further study
Calling user receives notification call is waiting	– No – Yes

In addition, the following subscription options can be specified for each ISDN number, all ISDN numbers, or subsets of ISDN numbers on each interface.

Subscription options	*Value*
Maximum number of calls which can be waiting	– One – l, where $1 \leqslant l \leqslant n - m$

Note – The parameters m (maximum number of information channels) and n (maximum number of total calls present) are defined in the relevant basic service description (refer to Recommendations I.231 and I.241).

1.3.2 *Normal procedures*

1.3.2.1 *Activation/deactivation*

Subscriber B may activate and deactivate Call Waiting with an appropriate request. Whether, and if so, to what degree, activation/deactivation is supported by the network may be network dependent. If supported, then the network shall inform subscriber B (all terminals on the access) of the success, or other outcome, of this action.

1.3.2.2 *Invocation*

1.3.2.2.1 When an incoming call from user C arrives at the access of subscriber B and encounters the channels busy condition, and a network determined user busy (NDUB) condition does not result, then the Call Waiting service will be invoked and the call shall be offered to subscriber B with an indication that the channels busy condition exists.

1.3.2.3 *Operation*

1.3.2.3.1 If a response is received from a terminal at the B access, within the normal basic call period, that the user(s) is (are) being informed about the incoming call, then user C will be given an indication that the called user(s) is (are) being informed of the incoming call. In some networks this indication may also indicate that call waiting is in operation.

1.3.2.3.2 If user B requests connection to the waiting call and placement of the specified active call with user A into a held state, before the expiry of the optional No Answer timer T2, then the call between user C and user B is completed in the normal manner with any indications to user C being removed. The previously active call between user A and user B is put into the held state. User A may be given an indication that his call has been put into the held state.

Note – From this state other supplementary services, for example the Three Party Service, may be used.

1.3.2.3.3 If user B requests connection to the waiting call and termination of the specified active call with user A before the expiry of the optional No Answer timer T2, then the call between user C and user B is completed in the normal manner with any indications to user C being removed. The previously active call between user A and user B is terminated in the normal manner.

1.3.2.3.4 If user B terminates the active call with user A before the expiry of the optional No Answer timer T2, then this call shall be released in the normal manner. User B is then able to accept the waiting call from user C using normal information channel selection procedures.

1.3.2.3.5 If user B holds the active call with user A before the expiry of the optional No Answer timer T2, then this call shall be held in the normal manner. User B is then able to accept the waiting call from user C using normal information channel selection procedures.

1.3.2.3.6 If user A requests termination of the active call with user B before the expiry of the optional No Answer timer T2, then the conditions of § 1.3.2.3.4 apply.

1.3.3 *Exceptional procedures*

1.3.3.1 *Activation/deactivation/registration*

None identified.

1.3.3.2 *Invocation*

None identified.

1.3.3.3 *Operation*

1.3.3.3.1 *Incoming call from user C ignored by subscriber B*

If the optional No Answer timer T2 expires without any acceptance from subscriber B of the incoming call, then the network shall inform subscriber B that the call is no longer waiting and also inform user C that his call cannot be connected. Normal release applies to the call attempt from user C (the call is cleared indicating no response) with an appropriate indication given to user C.

1.3.3.3.2 *Incoming call from user C rejected by user B*

A rejection of the waiting call by one of the terminals on the interface of subscriber B will not stop the optional No Answer timer T2 as another terminal may subsequently accept the waiting call within the remainder of the specified period. Such a rejection may, however, cancel any indication provided to that terminal. Where rejections of a waiting call have been received from all those terminals that responded with an alerting indication before the expiry of the optional No Answer timer T2, then the network shall inform user C that his call cannot be connected. Normal release applies to the call attempt from user C with the call being cleared indicating user rejection. Subscriber B is notified that the call is no longer waiting.

1.3.3.3.3 *Release by user C within the specified period*

If calling user C informs the network, before the expiry of the optional No Answer timer T2, that he wishes to release his call attempt to subscriber B, then the network shall inform subscriber B of this situation and initiate release of the call attempt from user C.

1.3.3.3.4 *No positive response from terminals at subscriber B's interface*

If no positive response that user(s) are being informed of the waiting call is received from a terminal at subscriber B's interface during the normal call period (User Response timer T1), then the call attempt from user C shall be released by the network with user C being given the reason for the release.

1.3.3.3.5 *No resources available*

If user B accepts a call and network resources do not exist to complete the call (i.e. no information channels are available), the network will indicate an error to user B with cause "no B-channels available". The network will not clear the call but will wait for another user B indication for acceptance, until user C clears the call or the optional No Answer timer T2 expires.

1.3.4 *Alternative procedures*

1.3.4.1 *Activation/deactivation/registration*

None identified.

1.3.4.2 *Invocation and operation*

None identified.

1.4 *Network capabilities for charging*

This Recommendation does not cover charging principles. Future Recommendations in the D-Series are expected to contain that information.

It shall be possible to charge the subscriber accurately for the service.

1.5 *Interworking requirements*

1.5.1 *ISDN served user: non-ISDN calling user*

If an ISDN subscriber B receives a call from a non-ISDN calling user, the network will send the Call Waiting indication to subscriber B in the normal way.

An inband indication will be applied to channels occupied with the 3.1 kHz audio bearer service (where the call originated from the PSTN as identified by a progress indicator), only if it is destined to a number designated for inband notification by the call waiting subscriber.

1.5.2 *Non-ISDN served user: ISDN calling user*

Not applicable since a non-ISDN served user will not be able to subscribe to ISDN Call Waiting.

1.6 *Interaction with other supplementary services*

1.6.1 *Call Waiting*

Not relevant.

1.6.2 *Call Transfer*

User B, who has subscribed to both Call Waiting and Call Transfer services, cannot transfer a waiting call from user C until he first establishes a connection to user C.

Assume that user B is on an active call with user A and has received an indication of a waiting call from user C. Users A and B have Call Waiting subscribed for their accesses and user B has subscribed to the Call Transfer service. User B intends to transfer user A to user D.

- User B may receive an indication of a waiting call from user C either before or during the transfer of user A to another party. The call waiting indication may be presented regardless of the type of transfer invoked by user B (i.e. for Normal, Single Step, or Explicit transfers). When user A has been transferred, a B-channel would normally become idle, enabling the waiting call to be answered by user B.
- If user A has a call waiting indication before or during the transfer process, then upon successful completion of the transfer of user A to user D, user A shall retain the waiting call indication. User A could use normal call waiting procedures (if desired) to accept the waiting call.
- If user D receives a call waiting indication during the transfer process, e.g. while being in a call with user B, then upon successful completion of the transfer of user A to user D, user D shall retain the waiting call indication. User D could use normal call waiting procedures (if desired) to accept the waiting call.

In general, a call waiting indication may be delivered to users A or B (and to user D during the transfer process) when the called user has subscribed to the Call Waiting service.

1.6.3 *Connected Line Identification Presentation*

No impact, i.e. neither supplementary service affects the operation of the other supplementary service.

When user B uses one of the call waiting procedures to accept a waiting call (within any time limits established by the service provider), user C will be informed of the connection. The confirmation that a connection has been established may provide the connected user B's number.

1.6.4 *Connected Line Identification Restriction*

No impact, i.e. neither supplementary service affects the operation of the other supplementary service.

1.6.5 *Calling Line Identification Presentation*

No impact, i.e. neither supplementary service affects the operation of the other supplementary service.

If the user(s) at B is(are) given a call waiting indication, and has(have) subscribed to the CLIP service, then the calling user number shall be presented to the users at B at the time the call waiting indication is given.

1.6.6 *Calling Line Identification Restriction*

No impact, i.e. neither supplementary service affects the operation of the other supplementary service.

Assume a user at C, who has subscribed to the CLIR service, reaches a user(s) at B, who has subscribed to the Call Waiting service. On invocation, the user at B would receive a call waiting indication but would not receive user C's number when the call waiting indication is given.

1.6.7 *Closed User Group*

No impact, i.e. neither supplementary service affects the operation of the other supplementary service.

1.6.8 *Conference Calling*

A user at B who is active on any type of conference call may receive an indication of a waiting call.

Once a conference has been established:

i) Any party that has activated Call Waiting will be able to receive an indication of an incoming call, and could place his connection to the conference on hold to accept the waiting call.

ii) The Conference Controller could, if desired, add the party from the waiting call, by answering the waiting call and using the "add party from existing call" procedures.

1.6.9 *Direct-Dialling-In*

No impact, i.e. neither supplementary service affects the operation of the other supplementary service.

1.6.10 *Call Diversion (Call Forwarding) services*

1.6.10.1 *Call Forwarding Busy*

If user B is not NDUB, Call Waiting will take place. If user B is NDUB, CFB will take place. Therefore these services are mutually exclusive and there is no interaction.

1.6.10.2 *Call Forwarding No Reply*

If subscriber B has Call Forwarding No Reply (CFNR) activated, then a waiting call shall still be offered as described in this definition. If no answer is received to this call within the duration of the CFNR timer, then the CFNR service is invoked and the call is forwarded as per that service definition.

1.6.10.3 *Call Forwarding Unconditional*

If subscriber B has activated Call Forwarding Unconditional, then the execution of that forwarding condition takes precedence over Call Waiting. Call Forwarding Unconditional can be activated while a call is waiting without changing the state of the waiting call.

1.6.11 *Line Hunting*

The Call Waiting service should not be provided to a line in a hunt group.

1.6.12 *Three-Party Service*

A user at B who is involved in a Three-Party Service operation (with minimal Three-Party Service or active in a three-way conversation) may receive an indication of a waiting call. The procedures and restrictions for handling the waiting call are defined in the Three-Party Service description.

1.6.13 *User-to-User Signalling*

User-to-user information (UUI) (service 1) included in the call set-up message will be delivered to subscriber B with the Call Waiting indication.

UUI (service 2) sent from the calling user to the called user during the alerting phase is allowed to be sent when a point-to-point configuration exists at the called side.

If the called user subscribes to User-to-User Signalling, he may include UUI (service 1) in a rejection of a waiting call when a point-to-point configuration exists at the called side.

There is no interaction with user-to-user service 3.

1.6.14 *Multiple Subscriber Number*

No impact, i.e. neither supplementary service affects the operation of the other supplementary service.

1.6.15 *Call Hold*

When an ISDN user receives a call waiting indication the ISDN user may use the Call Hold service to hold his active call and answer the waiting call. Use of the hold service does not place a call into a waiting state.

1.6.16 *Advice of Charge*

No impact, i.e. neither supplementary service affects the operation of the other supplementary service.

1.7 *Dynamic description*

The dynamic description of this service is given in Figure 1/I.253.

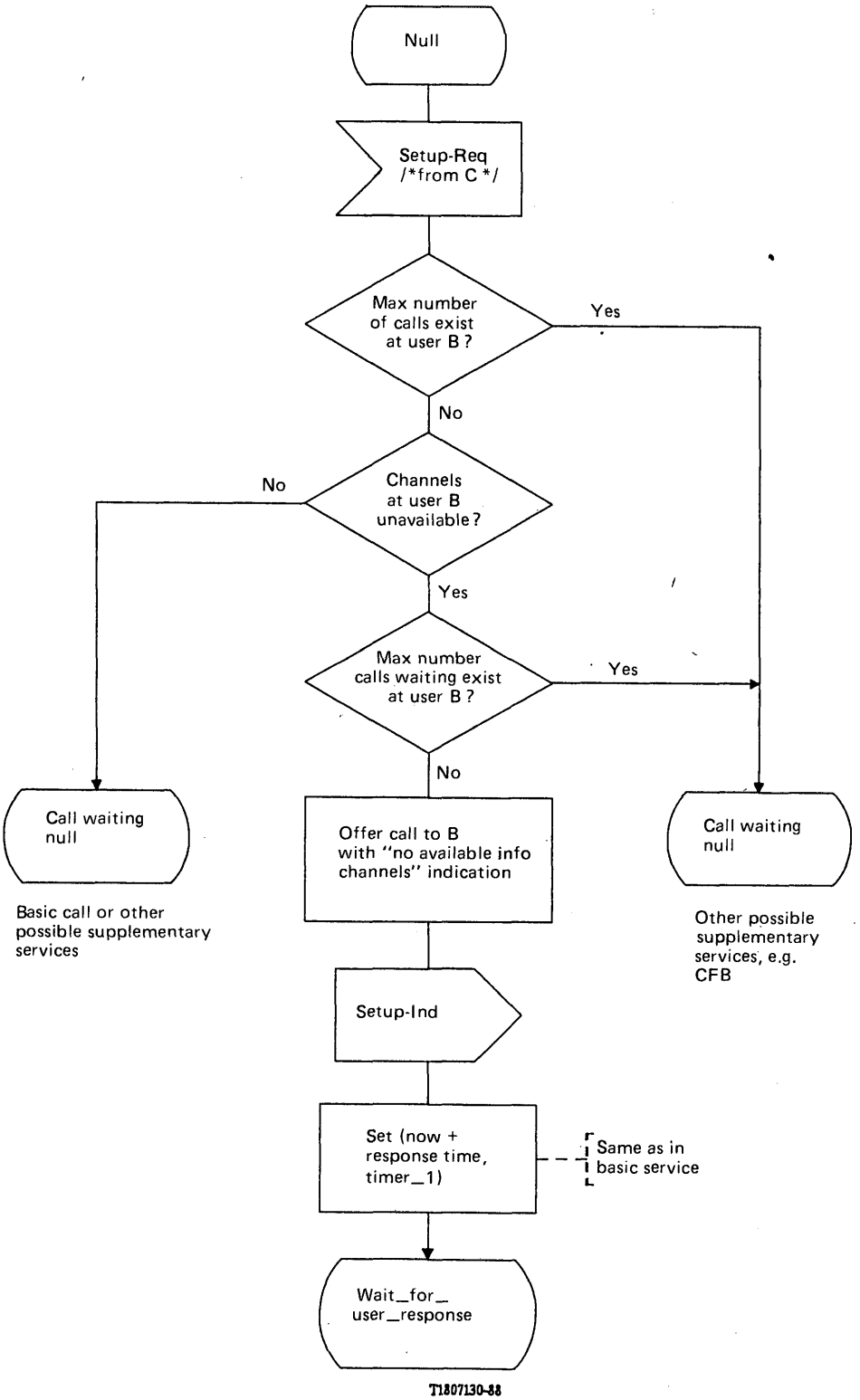


FIGURE 1/I.253 (sheet 1 of 5)

Overall SDL diagram of Call Waiting

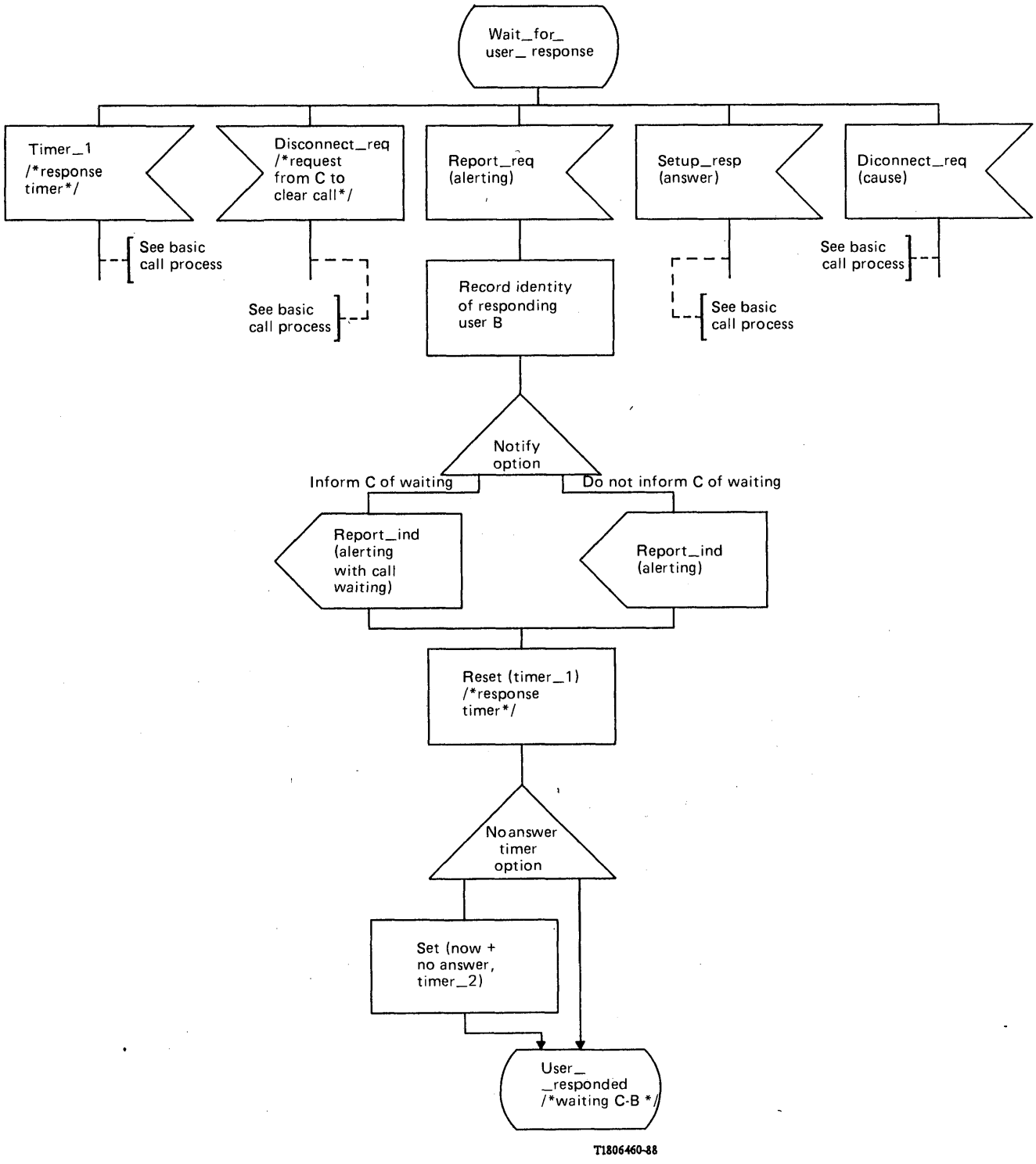


FIGURE 1/I.253 (sheet 2 of 5)

Overall SDL diagram of Call Waiting

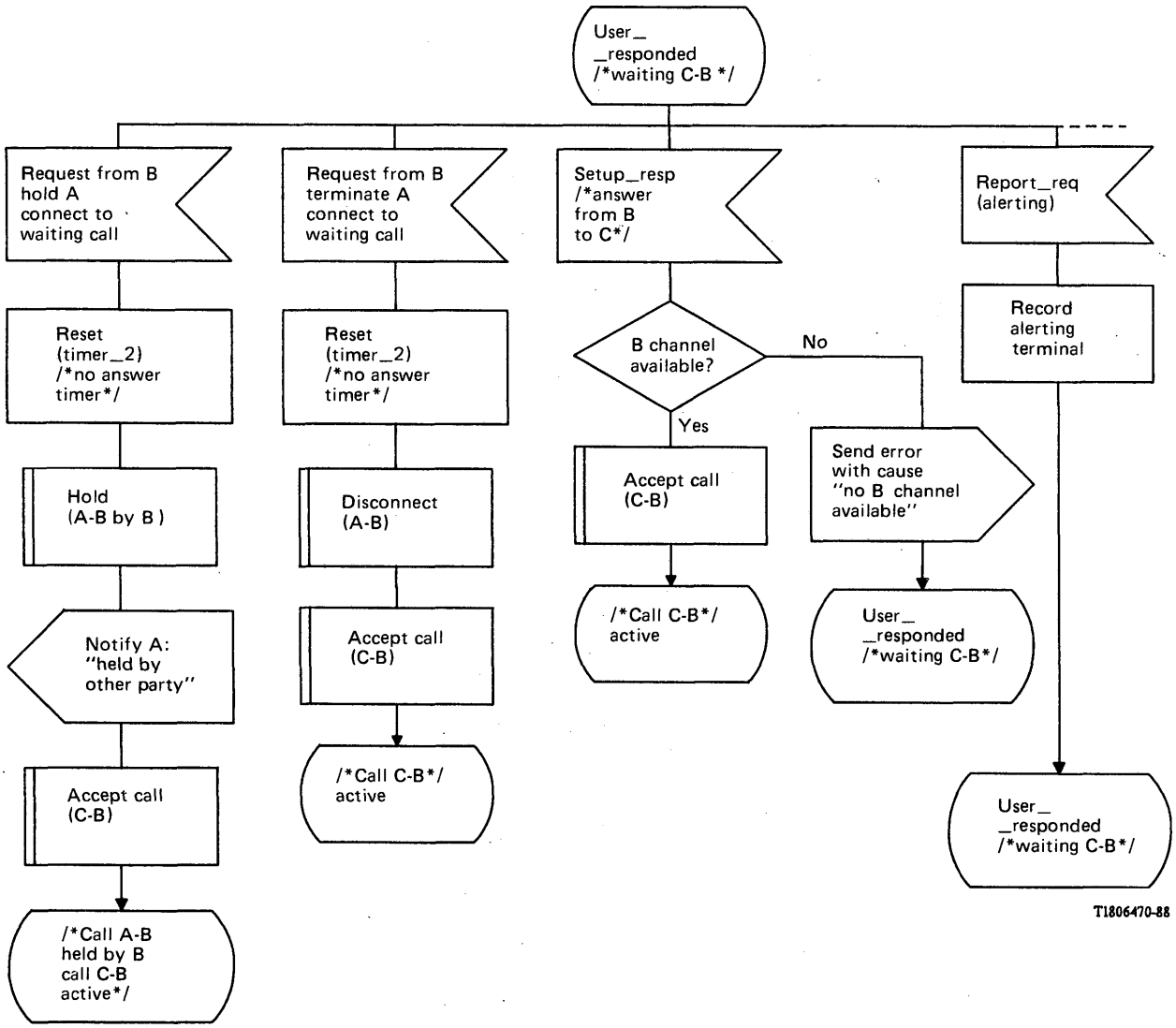


FIGURE 1/I.253 (sheet 3 of 5)

Overall SDL diagram of Call Waiting

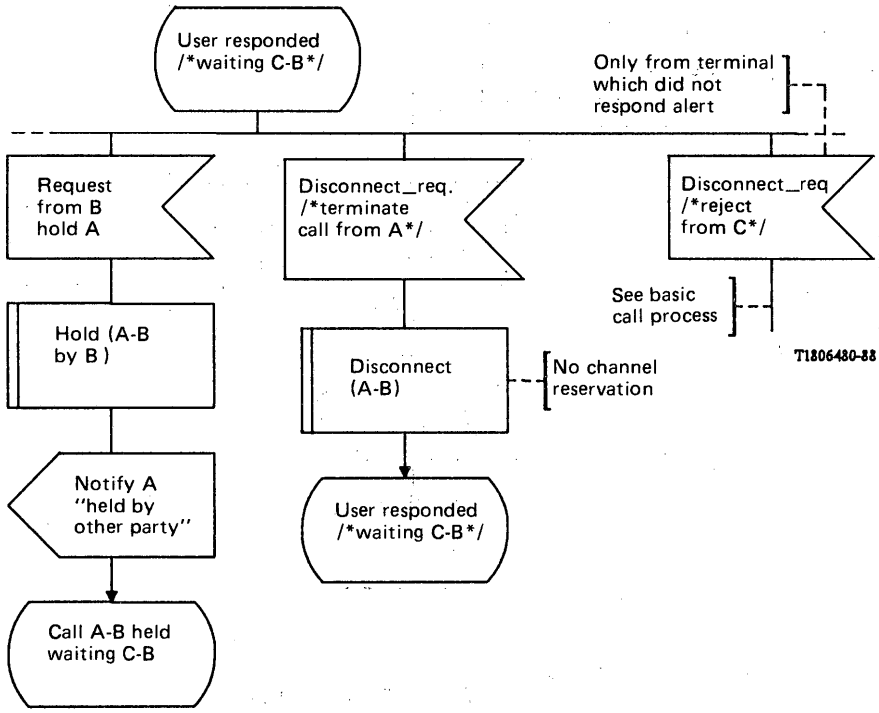


FIGURE 1/I.253 (sheet 4 of 5)

Overall SDL diagram of Call Waiting

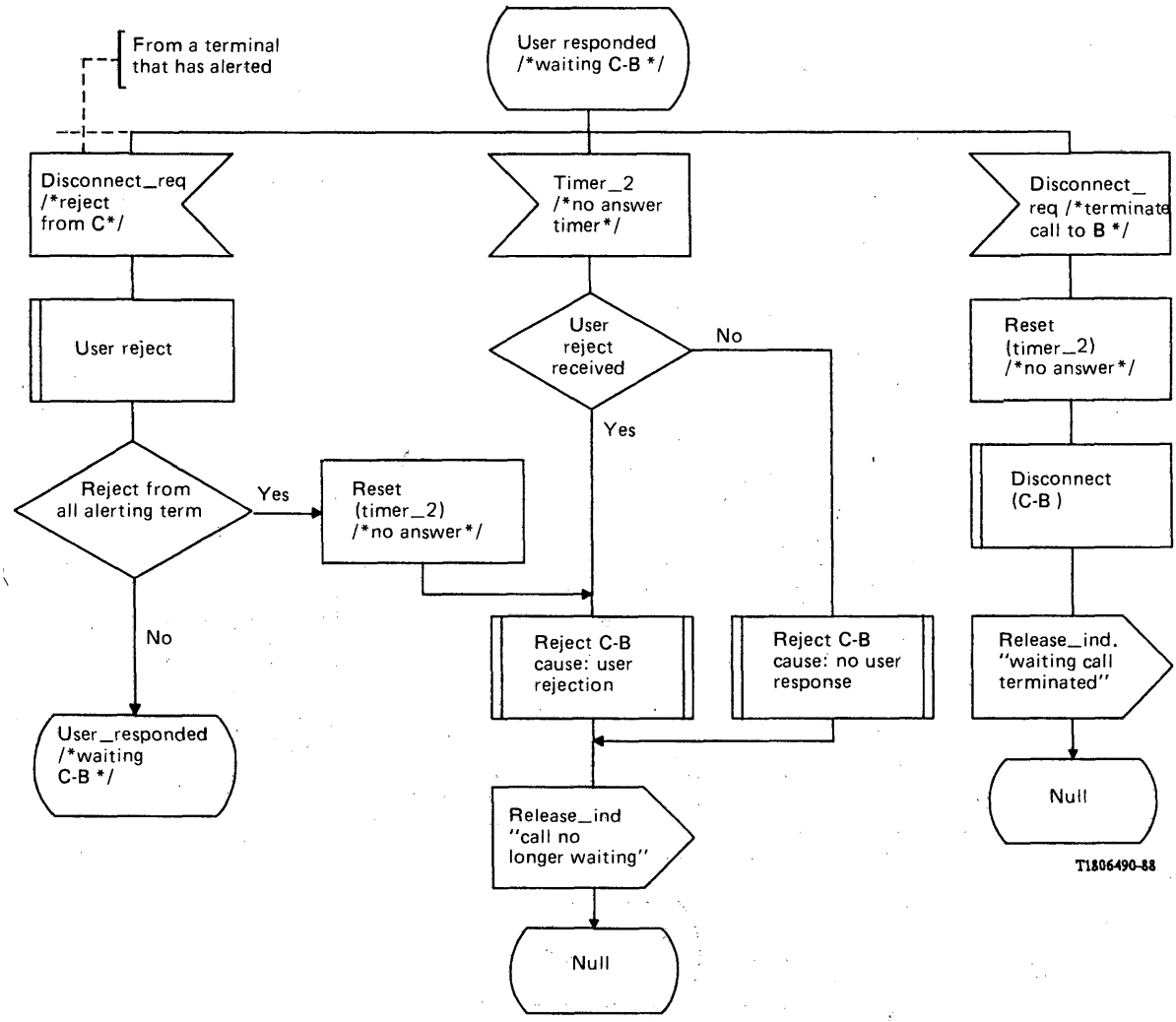


FIGURE 1/I.253 (sheet 5 of 5)

Overall SDL diagram of Call Waiting

2 I.253.2 – Call Hold

2.1 *Definition*

The Call Hold service allows a user to interrupt communications on an existing call/connection (Note 1) and then subsequently, if desired, re-establish communications. A B-channel (Note 2) may or may not be reserved after the communication is interrupted to allow the origination or possible termination of other calls. Reservation must be provided by the service provider as a user option. The Call Hold service includes the Retrieve operation which re-establishes communication on a B-channel between the served user and the held party.

Note 1 – The applicability of the hold service to a "call" versus a "connection" requires further study.

Note 2 – The applicability of this service definition to other access resources (e.g. H-channels, logical channels) for other services requires further study.

2.2 *Description*

2.2.1 *General description*

When the Call Hold service is invoked, communication on a B-channel is interrupted and the B-channel is released from use by the existing call. If reservation is subscribed to, and depending on subscription parameters, a B-channel is reserved for use by:

- the given terminal used to invoke the Call Hold service;
- a subscription time user-defined set of terminals;
- a user, defined by a directory number (Note);
- a subscription time user-defined set of directory numbers (Note), or;
- a user, identified by a Personal Identification Number (Note).

Note – Methods to define implementation are for further study.

When a user (as identified by a terminal, others for further study) places a call on hold and reservation applies, a B-channel should always be available on that user's interface so that the user may retrieve that call from hold, or set up, retrieve or connect to another call. One B-channel should be kept available for the user as long as the user:

i) has one or more calls on hold with reservation and

ii) is not currently connected to any other call.

Hence, the network should not reserve more than one B-channel for a user, regardless of how a user is defined (as identified by a terminal, others for further study).

When the served user wishes to re-establish communications, the Retrieve operation is requested. The success of the Retrieve operation depends on whether a B-channel was reserved and whether a B-channel is currently available to the served user.

2.2.2 *Specific terminology*

None identified.

2.2.3 *Qualifications on the applicability to telecommunication services*

This supplementary service is considered meaningful when applied to the Telephony teleservice and the speech and 3.1 kHz audio bearer services. Furthermore, it may also be meaningful when applied to other services.

2.3 *Procedures*

2.3.1 *Provision/withdrawal*

The type of reservation is specified at subscription time.

2.3.2 *Normal procedures*

2.3.2.1 *Activation/deactivation/registration*

None identified.

2.3.2.2 *Invocation and operation*

2.3.2.2.1 *Hold request*

The served user indicates to the service provider that the communication on the interface is to be interrupted. A call may be placed on hold:

- on the calling user's interface, by the calling user at any time after completion of dialling;
- on the called user's interface, by the called user at any time after the call has been answered and before call clearing has begun.

The communication on the interface is then interrupted. The service provider acknowledges this action, and the associated channel is made available for other uses, depending on the reservation option. As an option, the network may send a notification to the held party indicating that the call has been placed on hold.

If held call(s) are cleared for any reason, the service provider will continue to reserve a channel for the specified user(s)/terminal(s) until there are no more held calls with reservation associated with the specified user(s)/terminal(s). If at any time a call is in the held state, either party may clear the call.

2.3.2.2.2 *Retrieve request*

When the user who invoked the Call Hold service indicates that the call is to be retrieved, the service provider will re-establish communications, provided that a B-channel is available, and acknowledge to the served user and optionally to the held party that the call is now active.

The user may optionally indicate a B-channel selection parameter in the Retrieve request. The parameter may indicate:

1) any channel is acceptable;
2) specified channel is preferred; or
3) specified channel is required exclusively.

If the service provider can satisfy the request, the call will be returned to the active phase; if it cannot, the request will be rejected with the appropriate cause returned to the user.

2.3.2.2.3 *Reservation processing*

The following conditions concerning reservations against a channel apply:

1) when the call is retrieved, any reservation against a channel associated with that call should be cleared, regardless of which channel is used to retrieve the call;
2) when a call is cleared, any reservation against a channel associated with the call should be cleared;
3) when all reservations are cleared, all channels become available for use by either the network or the user.
4) When any reservation is outstanding for a given user [as identified by a terminal, a set of terminals, a DN (directory number), a set of DNs or a PIN (personal identification number)] and that user is not using a channel for an active call, then the network must consider a channel as "not free" for that user for subsequent incoming calls.

   If all channels are "not free" (busy or reserved) and a user has also subscribed to the Call Waiting service, the network would be able to offer an incoming call with an indication that "no interface information channels are available". The served user may accept that incoming call using a reserved channel.

2.3.3 *Exceptional procedures*

2.3.3.1 *Activation/deactivation/registration*

None identified.

2.3.3.2 *Invocation and operation*

2.3.3.2.1 *Hold request*

If the user tries to hold a call while not subscribed to the service or if, for some other reason, the service provider cannot hold the call, an indication will be provided to the user with the reason of failure.

2.3.3.2.2 *Retrieve request*

If the service provider cannot retrieve a previously held call, the user will be informed of the reason for failure. (For example, there may not be any channel available, or the call may be in the process of being cleared.)

2.3.4 *Alternative procedures*

None identified.

2.4 *Network capabilities for charging*

This Recommendation does not cover charging principles. Future Recommendations in the D-Series are expected to contain that information.

It shall be possible to charge the subscriber accurately for the service.

2.5 *Interworking requirements*

The operation of this feature is not affected by the nature (i.e. ISDN or non-ISDN) of the far end of the connection.

2.6 *Interactions with other supplementary services*

2.6.1 *Call Waiting*

A user may use the hold feature to hold an active call and answer an incoming call that is being given call waiting treatment.

2.6.2 *Call Transfer*

A served user may indicate to a service provider that a held call is to be transferred to another party. The transfer indication must explicitly identify the held call. A successful transfer will clear the held call from the served user's point of view. For more information, see the explicit call transfer procedure in the Call Transfer service description.

Any parties on hold to a party being transferred will continue to be on hold to that party after the transfer operation. For example, if party B, currently active or on hold to party A, is transferred to another party C by served user A, then the parties held by parties B and C before the transfer will continue to be held by those parties after the transfer.

The hold process is symmetric, i.e. both parties may place each other on hold. It is possible, therefore, for two parties that have subscribed to the Call Hold and Call Transfer services, to each place their active call on hold and to simultaneously transfer the other party. That is, if parties A and B have an active connection, party A may place the call on hold and transfer party B to another party C while at the same time party B puts his call to party A on hold and transfers party A to another party D.

2.6.3 *Connected Line Identification Presentation*

No impact, i.e. neither supplementary service affects the operation of the other supplementary service.

2.6.4 *Connected Line Identification Restriction*

No impact, i.e. neither supplementary service affects the operation of the other supplementary service.

2.6.5 *Calling Line Identification Presentation*

No impact, i.e. neither supplementary service affects the operation of the other supplementary service.

2.6.6. *Calling Line Identification Restriction*

No impact, i.e. neither supplementary service affects the operation of the other supplementary service.

2.6.7 *Closed User Group*

No impact, i.e. neither supplementary service affects the operation of the other supplementary service.

2.6.8 *Conference Calling*

Any party involved in an active conference (i.e. the conference controller or a conferee) may place the conference call on hold and later retrieve the connection to the conference. Any party placing the conference on hold may retrieve any other party it had previously placed on hold. See also the Conference Calling service description Recommendation I.254, § 1.6.15.

2.6.9 *Direct Dialling-In*

No impact, i.e. neither supplementary service affects the operation of the other supplementary service.

2.6.10 *Call Diversion (i.e. Call Forwarding) services*

2.6.10.1 *Call Forwarding Busy*

No impact, i.e. neither supplementary service affects the operation of the other supplementary service.

2.6.10.2 *Call Forwarding No Reply*

No impact, i.e. neither supplementary service affects the operation of the other supplementary service.

2.6.10.3 *Call Forwarding Unconditional*

No impact, i.e. neither supplementary service affects the operation of the other supplementary service.

2.6.11 *Line Hunting*

No impact, i.e. neither supplementary service affects the operation of the other supplementary service.

2.6.12 *Three-Party Service*

Refer to Recommendation I.254, § 2.6.15, interaction with Call Hold.

2.6.13 *User-to-User Signalling*

Any party that has placed one or more calls on hold may continue to exchange (send or receive) user-to-user information (UUI) (service 3) messages with the party(s) on hold as well as to exchange UUI (service 3) messages with an active call party. A held party that is disconnecting may receive or send UUI (service 1) messages during the clearing phase of the call.

2.6.14 *Multiple Subscriber Number*

No impact, i.e. neither supplementary service affects the operation of the other supplementary service.

2.6.15 *Call Hold*

Assume that parties A and B have both subscribed to the Call Hold service. The Hold service is unidirectional and therefore, the following is possible:

1) only party A has party B on hold;
2) only party B has party A on hold;
3) each party has the other party on hold.

2.6.16 *Advice of Charge*

No impact, i.e. neither supplementary service affects the operation of the other supplementary service.

2.7 *Dynamic description*

The dynamic description of this service is given in Figure 2/I.253.

3 I.253.3 – Completion of Calls to Busy Subscribers

This service, already identified, needs to be further studied; its description is not yet included.

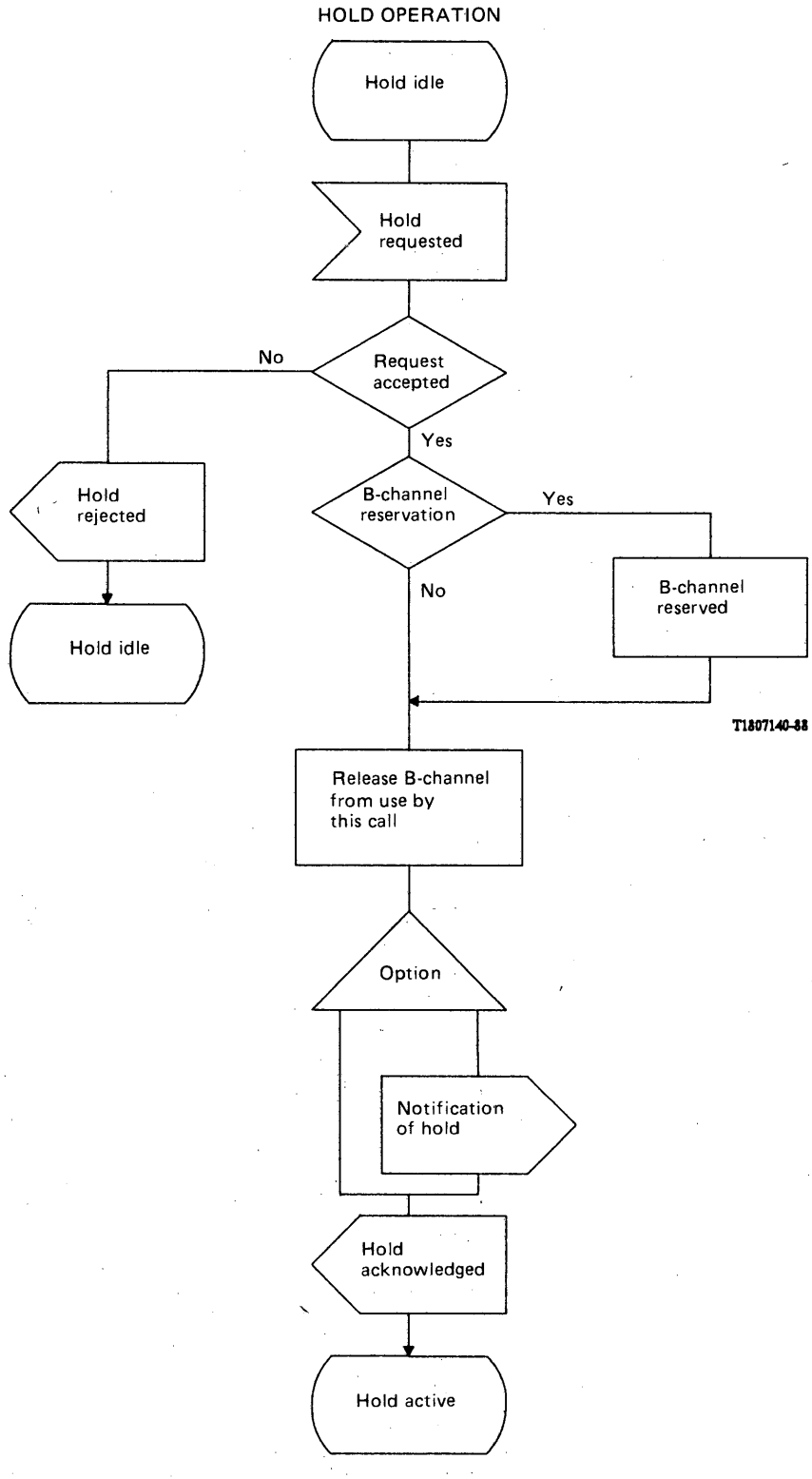


FIGURE 2/I.253 (sheet 1 of 2)

Overall SDL diagram of Call Hold

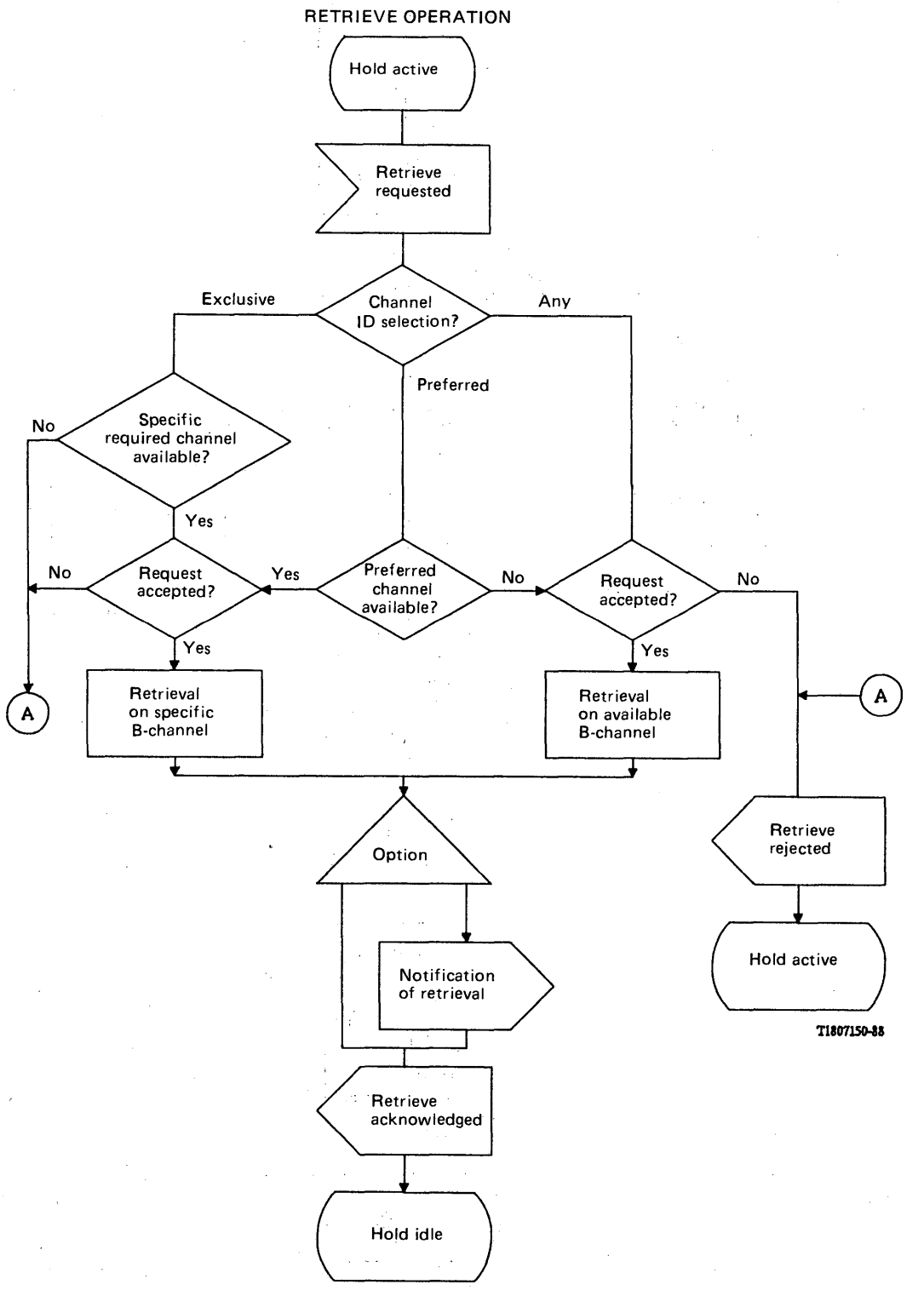


FIGURE 2/I.253 (sheet 2 of 2)

Overall SDL diagram of Call Hold

Recommendation I.254

MULTIPARTY SUPPLEMENTARY SERVICES

(Melbourne, 1988)

The purpose of this Recommendation is to provide the stage 1 description of the method defined in Recommendation I.130 using the means given in Recommendation I.210.

Supplementary services are described by a prose definition and description (step 1.1) and by a dynamic description (step 1.3). The application of the attribute technique (step 1.2), as defined in Recommendation I.140, for supplementary services is for further study.

This Recommendation describes the following Multiparty Supplementary Services:

I.254.1 Conference Calling (CONF)

I.254.2 Three-Party Service (3PTY)

1 I.254.1 – Conference Calling Service Description

1.1 *Definition*

Conference Calling is an ISDN supplementary service which allows a user to communicate simultaneously with multiple parties, which may also communicate among themselves. This description deals primarily with the establishment and manipulation of the connections used to form a conference call and is therefore expected to be applicable to many types of conference calls (e.g. voice, data, video, multi-media). Although provision is made for specifying the conference type, it is recognized that the control of conferencing functions (especially for those other than speech) is beyond the scope of this Recommendation.

This Recommendation describes the operation of the "Add-on" Conference Calling service only. Other forms of Conference Calling (e.g. "Meet-me") are not described.

1.2 *Description*

1.2.1 *General description*

When Conference Calling is invoked, conference resources (e.g. a "bridge") are allocated to the served user, and any calls indicated by the service request are added to the conference. Once a conference is active, parties may be added, dropped, isolated (i.e. prevented from communicating with the conference), reattached, or split (i.e. removed from the conference but remain connected to the conference controller). The controller can place his connection to the conference on hold, retrieve the conference, end the conference, or disconnect himself from the conference.

1.2.2 *Specific terminology*

1.2.2.1 *Served user, conference controller, conferees, parties*

During the invocation phase, the service is under the control of the "served user", i.e. the one for whom the service was subscribed or, in those cases where subscription is not required, the one who invokes the service. Once the conference is in the active state, the service is under the control of the "conference controller" who, in most cases, is the served user but could be a party other than the served user if transfer of control has occurred (an anticipated future extension to this service). Any party other than the conference controller is called a "conferee". All participants in the conference call are considered "parties".

1.2.2.2 *Call ID, Party ID, Connection ID*

Call ID: the served user's (controller's) reference to a call of which he is a party. Examples:

1) the conference call itself,
2) a call which is to be added to the conference,
3) a call which is formed by splitting a party from the conference.

Party ID: the served user's (or controller's) reference to a particular party within the context of a call.

Connection ID: the served user's (or controller's) reference to a particular connection (to a particular party) within the context of a call.

Observe that multiple parties may be associated with a given call, e.g. a conference call. Moreover, there can be multiple connections associated with a single party, e.g. a simultaneous voice and video call.

Note – This service description assumes that there exists only one connection to a given party. Procedures to allow for multiple connection (e.g. multi-media conference calls) to a given party are anticipated future extensions.

1.2.2.3 *Conference states*

Conference Idle: the state prior to the reception of a "conference invocation request", or after a particular conference has ended.

Conference Active: the state in which conference resources have been allocated to the specified conference and at least one party has a connection to the conference. That connection could be either active or held.

Conference Floating: the state in which the conference is active but without a controller. This state is possible when two or more conferees exist on an active conference and the controller successfully disconnects himself (see Figure 1/I.254, sheet 7).

1.2.3 *Qualification on the applicability to telecommunication services*

This supplementary service is considered meaningful when applied to the Telephony teleservice and the speech and 3.1 kHz audio bearer services. Furthermore, it may also be meaningful when applied to other services.

1.3 *Procedures*

1.3.1 *Provision/withdrawal*

The Conference Calling supplementary service may be subscribed to by prior arrangements with the service provider. The subscription parameters include the maximum (and, if different, the default) number of conferees allowed in a conference call.

Note – The default will usually be three, but may be six (or some other number).

If the served user has subscribed to more than one size conference service and wishes to establish a conference of a size other than the default size, the served user must request the properly-sized conference before any parties are added to the conference.

Withdrawal of the service is made by the service provider upon request by the subscriber or for service provider reasons.

1.3.2 *Normal procedures*

1.3.2.1 *Activation/deactivation/registration*

None identified.

1.3.2.2 *Invocation and operation*

1.3.2.2.1 *Beginning the conference call* (see Figure 1/I.254, Sheets 1 and 2)

Invocation parameters:

The Conference Calling service must be invoked by the served user. The invocation request must include the "root" Call ID, i.e. the Call ID by which the served user (or controller) will refer to the conference call itself. This Call ID may be either a new Call ID or the Call ID of an existing call which is to be used to form the conference.

The invocation request may include the following additional information:

- Conference size: the intended maximum number of parties for the conference (if different from the default).
- Existing call/party information (Call IDs/Party IDs/disposition of related B-channel connections): in order to initially include one or more parties from an existing call in the conference, the invocation request must include the Call ID, and optionally the Party ID and information as to how the B-channel associated with that call is to be handled.
- New party information (called party address, other "set-up" information): in order to initially include a party for which there is no existing call, the invocation request must include the desired party's address, and optionally other information information contained in a normal call request.

  Note – Some information which is mandatory in a normal call request (e.g. "bearer capability") can be inferred (e.g. from the conference type) and and hence may not be mandatory here.
- Connection request: either active or held. This request defines the served user's initial connection to the conference. Possible values follow:

  Active state specified:

  i) Specific B-channel: a specified preferred/exclusive B-channel shall be used to immediately establish a connection to the conference.

  ii) Any available B-channel may be used.

  Held state specified:

  i) Reserved B-channel: a B-channel is to be reserved for (later) connection to the conference.

  ii) No reserved B-channel: in this case no B-channel is allocated or reserved; the served user may have to free up a B-channel later when participation in the conference is desired.
- Conference type: in general, the bearer capability compatibility check during context arbitration can be used to infer the type of conference required. It is assumed to be "speech". Other conference types may require special bridging facilities and/or higher layer control.
- Conference bridge location: it should be possible to request the conference bridge to be at a specified location, e.g. close to some grouping of conferees. Procedures for remote location of conference bridge facilities are anticipated future extensions.

Defaults for invocation parameters

If any of the information described above is not included in the invocation request, the following defaults will occur:

- Conference size: the size defaults to the subscribed default conference size specified at subscription time (if the served user specified a default conference size at subscription time) or the subscribed maximum conference size (if a default conference size was not specified), or the default conference size specified by the service provider (if the served user did not subscribe to the service).
- Existing call/party information:

  i) Call IDs: if no Call ID other than the root Call ID is specified, no existing calls will be initially included in the conference.

  ii) Party IDs: if not specified, each party (other than the served user) of the indicated Call ID(s) will be initially included in the conference.

  iii) Disposition of related B-channel connections: if disposition information is not included, the related B-channel connections will be deallocated, unless the service provider chooses to use them for connection of the served user to the conference call (e.g. in a multi-media conference).
- New party information:

  i) Called party address: if not specified, no new parties will be initially included in the conference.

  ii) Other "set-up" information: for further study.

- Connection request: if no connection information is included, it is assumed that the served user wishes to be initially connected to the conference in the active state and any available B-channel may be used.

  i) If the served user indicates that he wishes to be connected to the conference in the active state but does not indicate "specific B-channel" or "any available B-channel", it is assumed that any available B-channel may be used.

  ii) If the served user indicates that he wishes his resulting connection to the conference to be in the held state, but does not indicate "reserved B-channel" nor "no reserved", it is assumed that a B-channel is to be reserved for (later) connection to the conference.

- Conference type: if not specified, the service provider will attempt to derive the appropriate conference type from the bearer capabilities of the call(s) involved. If no calls are known by the service provider to be involved in the call, the default conference type shall be "speech".
- Conference bridge location: if not specified, the service provider will attempt to place the conference bridge(s) in the most appropriate location, considering the call(s) known by the service provider to be involved at the time the request is made.

Procedures

When a conference request is made, a conference call is set up.

When the service provider receives the request to allocate resources for the conference call, it checks to see that the requested conference can be established. This procedure is termed "context arbitration". Context arbitration includes a bearer capability compatibility check, a supplementary services compatibility check, a check to see that the state of each connection to be added is acceptable, and a check for the availability of conference/network resources. Upon successful completion of the context arbitration, the resources needed are allocated.

If the conference request is successful, all existing appropriate call(s) referenced in the conference request are added to the conference.

Note – Adding parties from an existing call may not be successful in all cases due to remote bridging and rerouting limitations.

Upon successful joining of the specified parties to the conference, any unused B-channels are deallocated and any single party calls are released.

The service provider checks the conference request for additional information (optional parameters). For those optional parameters not included in the conference request, the default values will be used. In addition, if the connection request parameter is not included and no additional parties are indicated (i.e. m = 0, n = 0) the service provider will prompt the served user for further actions.

1) Prompting procedures detected: if the number of referenced existing calls (other than the root Call ID) in the conference request is zero and the controller connection request is not included, then the conference is put on hold from the served user's point of view and the served user is prompted for further actions (i.e. the add-party procedure is automatically started).

2) No prompting procedures detected: if the number of referenced existing calls (other than the root Call ID) in the conference request is larger than zero, or if the controller connection request is specified, the referenced calls are automatically connected to the conference, which is now in an active state. The served user's connection to the conference will also be active unless the controller has indicated that his connection to the conference should be held.

   The decision to put the conference on hold or not (from the served user's point of view) is based on the information received in the Conference request, independent of the number of referenced existing calls.

1.3.2.2.2 *Managing individual parties* (see Figure 1/I.254, Sheets 2 and 3)

When managing a party, the controller needs to specify the pair Call ID/Party ID. If no party(s) is specified, the service provider will typically assume that the request applies to all parties associated with the indicated Call ID. (Exception: if Party ID is not specified in the drop party command, the last party added to conference is dropped.)

In the active state of the conference, the conference controller has the following options for managing parties in association with a conference:

Add new party

The conference controller can request that a new party be added to an existing conference call using procedures analogous to those used to start the conference call.

Upon a request for the addition of a new party, the conference controller automatically puts the conference on hold. The service provider checks the Add Party request for additional information, i.e. whether or not the conference controller is to keep the conference on hold after the addition of a new party. If no information is received, the service provider will use the service default value.

When on hold, the conference controller can either indicate the address of a new party or indicate a Call ID of an already existing call. (See Figure 1/I.254, Sheet 2.)

a) New call: the service provider will establish a connection with the new party indicated by the address provided by the controller. Upon call establishment, the controller will be connected to this new active call. (If call establishment fails or if the active call is disconnected, the controller may or may not return to the active conference based on the connection request parameter within the Add Party request).

   Note – By establishing this connection via the conference bridge, the service provider may avoid problems associated with remote bridging and rerouting.

b) Existing call: if a Call ID exists, the controller indicates a call Call ID to be added directly to the conference. The party (parties) on the indicated call are immediately joined to the conference.

   If a Party ID is given in conjunction with the Call ID, then the specified party is split from the specified call and added to the conference. If no Party ID is given then all parties on the specified call are added to the conference.

   Note – Adding parties from an existing call may not be successful in all cases due to remote bridging and rerouting limitations.

Drop party

The conference controller can request that a specified party be disconnected from the conference and the conference controller's association with that party be eliminated completely. If no Party ID is specified, it is assumed that the last party (if identifiable) added to the conference should be dropped. After the party is dropped, if there are no other conferees (a conferee being a party *other* than the conference controller), then the conference remains in the Conference Active state (with only the conference controller attached). If, after the party is dropped, there is only one other conferee, then the service provider could, at its option, form an "ordinary" two-party call and release the conference resources, or remain in the Conference Active state (with only the conference controller and the one conferee attached). (See Figure 1/I.254, Sheet 3.)

Split party

The conference controller can request that a specified party be removed from the conference but remain connected to the conference controller. Execution of this request requires that the network establish a new Call ID for the call between the conference controller and the specified party, since that party is no longer associated with the conference call. Two parameters must appear in the Split Party request:

1) Call ID (conference call), and
2) Party ID (specified party).

The Split Party request will put the controller's connection to the conference in the held state and the controller's connection to the specified party in the active state (see Figure 1/I.254, Sheet 3).

Isolate party

The conference controller can request that a specified party be prevented from communicating with the conference but not removed from it. This does not affect the state (e.g. active or held) of the specified party's access channels (e.g. B-channels) which are nominally under the control of the specified party. (See Figure 1/I.254, Sheet 3.)

Reattach party

The conference controller can request that the specified party be reattached to the conference. Successful execution of this command permits a previously isolated party to again converse with all other parties that are connected to the conference. (See Figure 1/I.254, Sheet 3.)

1.3.2.2.3 *Managing the conference* (see Figure 1/I.251, Sheets 4 and 5)

In addition to the foregoing, the conference controller can manage the complete conference in any of the following ways:

Hold conference: the conference controller can request that his own connection to the conference be held, using procedures as described in the Call Hold service. Successful execution of this command retains the existing state of conferees in relation to the conference, i.e. those who could communicate with each other can still do so and those who were in an isolated state remain in that state. (See Figure 1/I.254, Sheet 4.)

Retrieve conference: the conference controller can request that a conference controller's connection to the conference be retrieved (see hold conference description above). Successful execution of this command retains the existing state of conferees, i.e. those who could communicate with each other can still do so between themselves as well as the conference controller, and those who were in an isolated state remain in that state. (See Figure 1/I.254, Sheet 4.)

Interrogate: it is an anticipated future extension that the conference controller will be able to request the current status of the conference call (i.e. number of parties, identification of parties, etc.) from the service provider. Information content and procedures for the interrogate request are, as yet, undefined. (See Figure 1/I.254, Sheet 4.)

Disconnect: a Disconnect request from the controller will disconnect the controller from the conference, and may, in some cases, result in ending the conference. From the controller's perspective, this disconnect procedure is identical to that outlined in the Basic Call service description.

If:

a) the number of conferees is greater than or equal to 2; and

b) the Conference Floating option is subscribed to; and

c) Floating conditions (e.g. charging) are satisfied;

then the conference goes to the Floating state. Otherwise the conference ends (see End conference). This procedure differs from the disconnect controller procedure in that the normal disconnect procedure can result in either the Conference Active or Conference Idle state. When Conference Floating cannot be performed, instead of notifying the controller, disconnect processing continues with the release of conference resources. (See Figure 1/I.254, Sheet 5.)

Disconnect controller: the controller can request that he be disconnected from the conference. If the number of parties is greater than or equal to 3 and if the controller has subscribed to the Conference Floating option, and provided charging or other restrictions are not violated, the connection of the controller will be cleared and the conference will proceed to the Floating state (i.e. the remaining conferees may continue to communicate). Otherwise, the controller will be notified that the Disconnect Controller request is denied and the conference will remain active with the controller still connected.

The remaining parties will stay on the conference without a controller until less than two conferees exist on the conference. In a conference without a controller, conferees can only hold, retrieve or drop their own connections.

If one or two parties (including the controller) exist on the conference at the time disconnect is requested, the controller will be notified that the Disconnect request is denied and the conference will remain active with the controller still connected. (See Figure 1/I.254, Sheet 5.)

End conference: the conference controller can request that the conference be terminated, i.e.

1) that every party associated with a particular conference be disconnected,

2) that all conference resources be de-allocated, and

3) that all knowledge of the conference call, including the Call ID, be removed. (See Figure 1/I.254, Sheet 5.)

Note – While Disconnect Controller and End Conference provide useful unambiguous functions, it is recommended that all terminals include the Disconnect function, and that this be the request that is sent in response to the normal user action (e.g. hanging up the telephone). This will avoid the problem which arises if the controller "hangs up" and leaves the terminal before receiving notification that a Disconnect Controller request cannot be accomplished. The Disconnect request would allow processing to continue at this point and the conference would be ended.

1.3.2.2.4 *Possible actions by conferees* (See Figure 1/I.254, Sheet 6)

In the active state of the conference, the conference can:

Hold/retrieve: put his connection to the conference on hold and later retrieve it. (See Figure 1/I.254, Sheet 6.)

Disconnect from the conference: the procedures here are nominally the same as those that occur after a conferee has been dropped from a conference by the conference controller. (See Figure 1/I.254, Sheet 6).

Indication of the above actions by any conferee should be provided to the conference controller. Whether conferees also receive indications as to the actions of other conferees is for further study.

1.3.3 *Exceptional procedures*

1.3.3.1 *Activation/deactivation/registration*

None identified.

1.3.3.2 *Invocation and operation*

1.3.3.2.1 *Beginning the conference call*

If a user tries to invoke Conference Calling and the service provider cannot comply with that request, the service provider will deny the request and explain the reason for denial. Possible reasons for non-compliance are:

- service not subscribed;
- resources cannot be allocated;
- served user (or intended conferee) restrictions not met;
- context arbitration check failed;
- more than one party in an alerting state.

If multiple conferees are specified in the conference request and if the context arbitration failed for only a subset of the intended conferees, the service provider has the option of permitting the subset of conferees which passed the context arbitration to form the initial conference call. If this is not permitted, the failure of any of the requested parties to pass the context arbitration check causes the conference request to be denied.

1.3.3.2.2 *Managing individual parties*

Add new party: if the service provider cannot satisfy an Add New Party request (e.g. if the conference call has been cleared or if the maximum number of conferees allowed has already been reached) the conference controller will receive indication that the request is denied, with the reason for failure.

Note – It is an anticipated future extension to allow for conference re-sizing when there is an attempt to exceed the maximum conference size allowed.

Failure to pass any of the checks associated with the context arbitration results in the return of a failure message to the conference controller with appropriate cause(s).

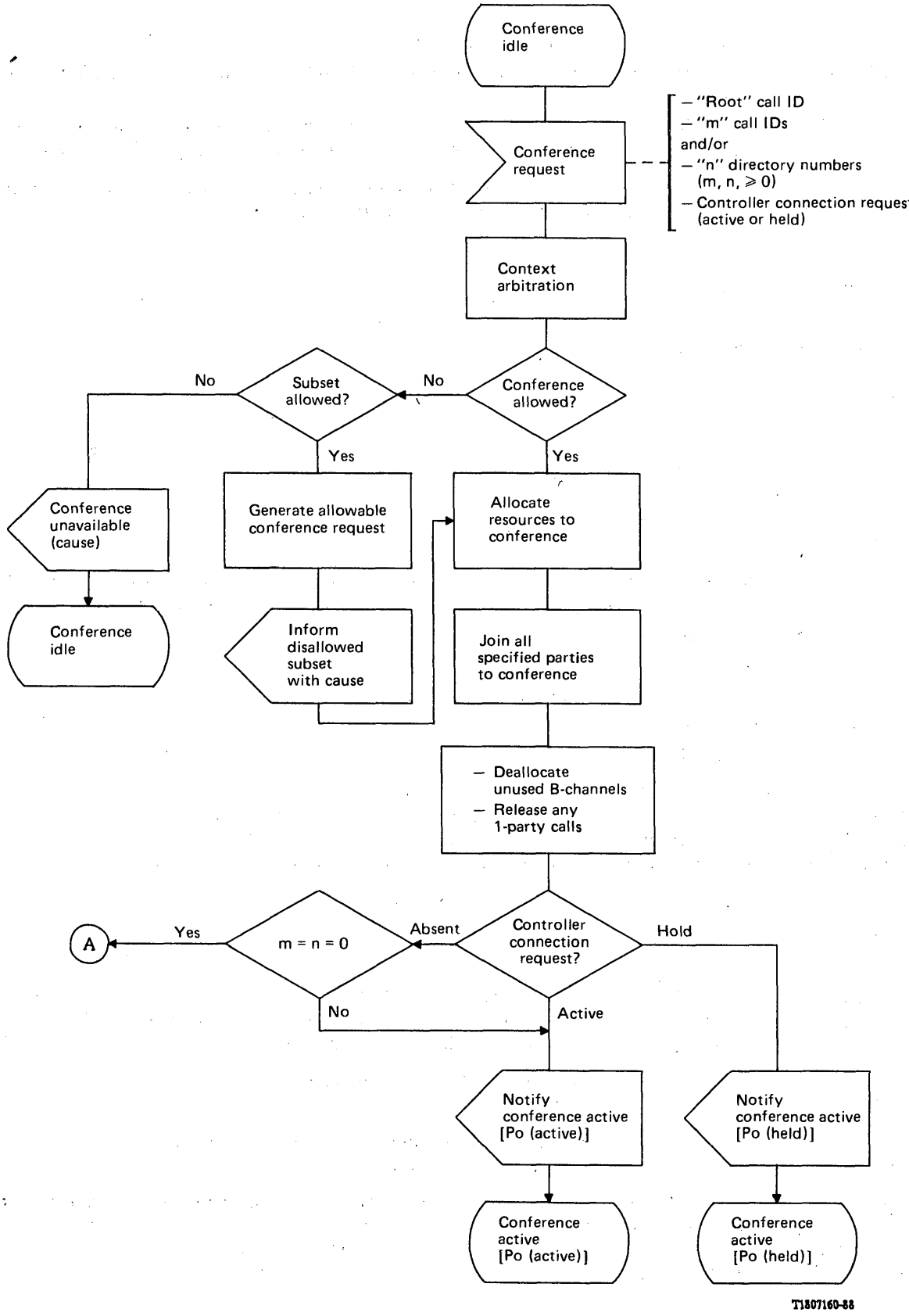
Split isolate party: if no Party ID is included in a Split Party or Isolate Party request, notification of failure is returned to the conference controller. If the controller sends an Isolate Party request concerning a party which is already isolated, or a Re-attach Party request concerning a party which is already attached, the network will ignore the request.

1.3.3.2.3 *Managing the conference*

No exceptional procedures identified.

1.3.4 *Alternative procedures*

None identified.



Note – Indication of change in state (i.e., held, disconnect, etc.) of the conferee should be provided to the conference controller.

FIGURE 1/I.254 (sheet 1 of 7)

Conference calling

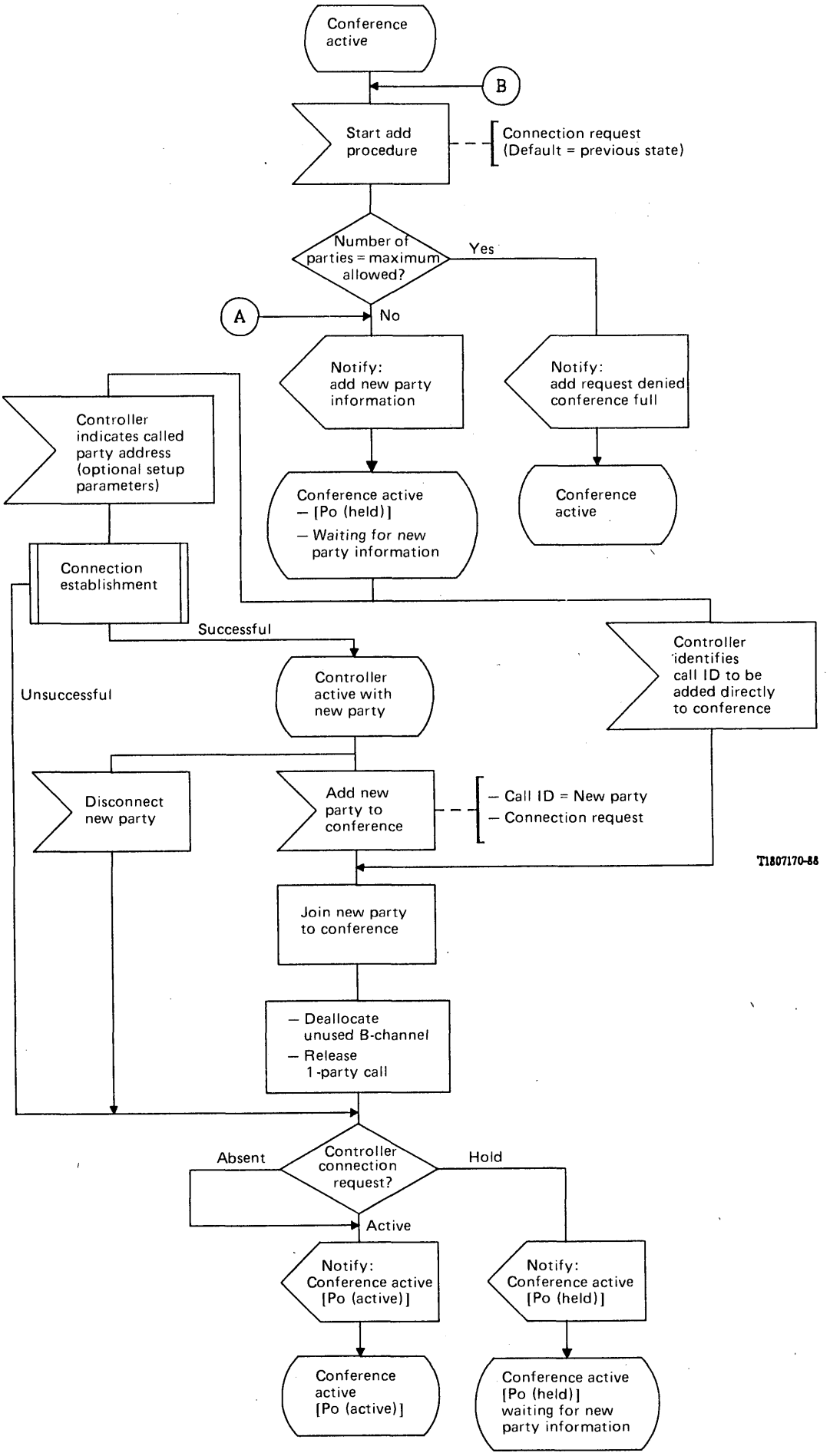
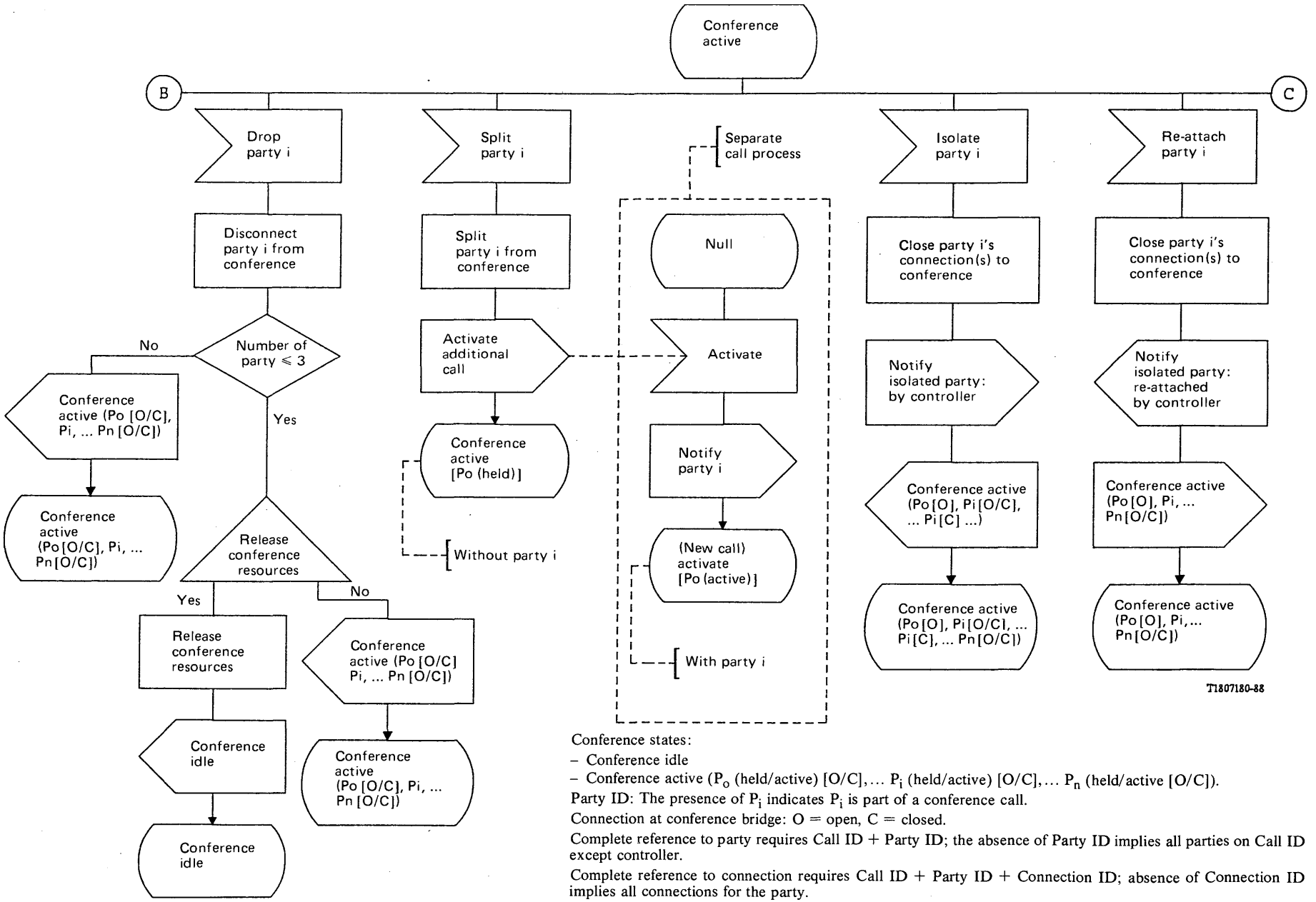


FIGURE 1/I.254 (sheet 2 of 7)

Conference calling



Conference states:

– Conference idle

– Conference active (P_o (held/active) [O/C],... P_i (held/active) [O/C],... P_n (held/active [O/C]).

Party ID: The presence of P_i indicates P_i is part of a conference call.

Connection at conference bridge: O = open, C = closed.

Complete reference to party requires Call ID + Party ID; the absence of Party ID implies all parties on Call ID except controller.

Complete reference to connection requires Call ID + Party ID + Connection ID; absence of Connection ID implies all connections for the party.

FIGURE 1/I.254 (sheet 3 of 7)

Conference calling

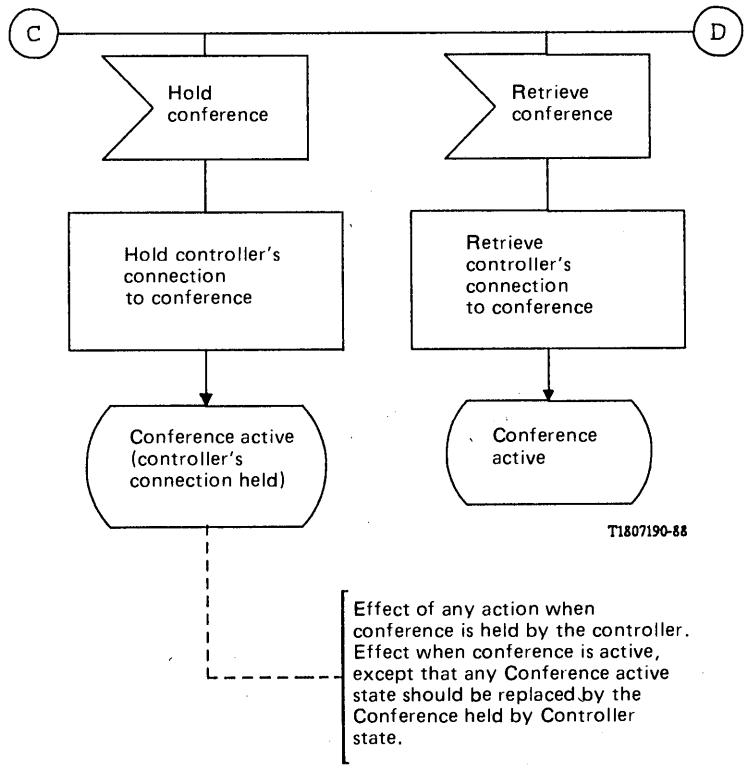


FIGURE 1/I.254 (sheet 4 of 7)

Conference calling

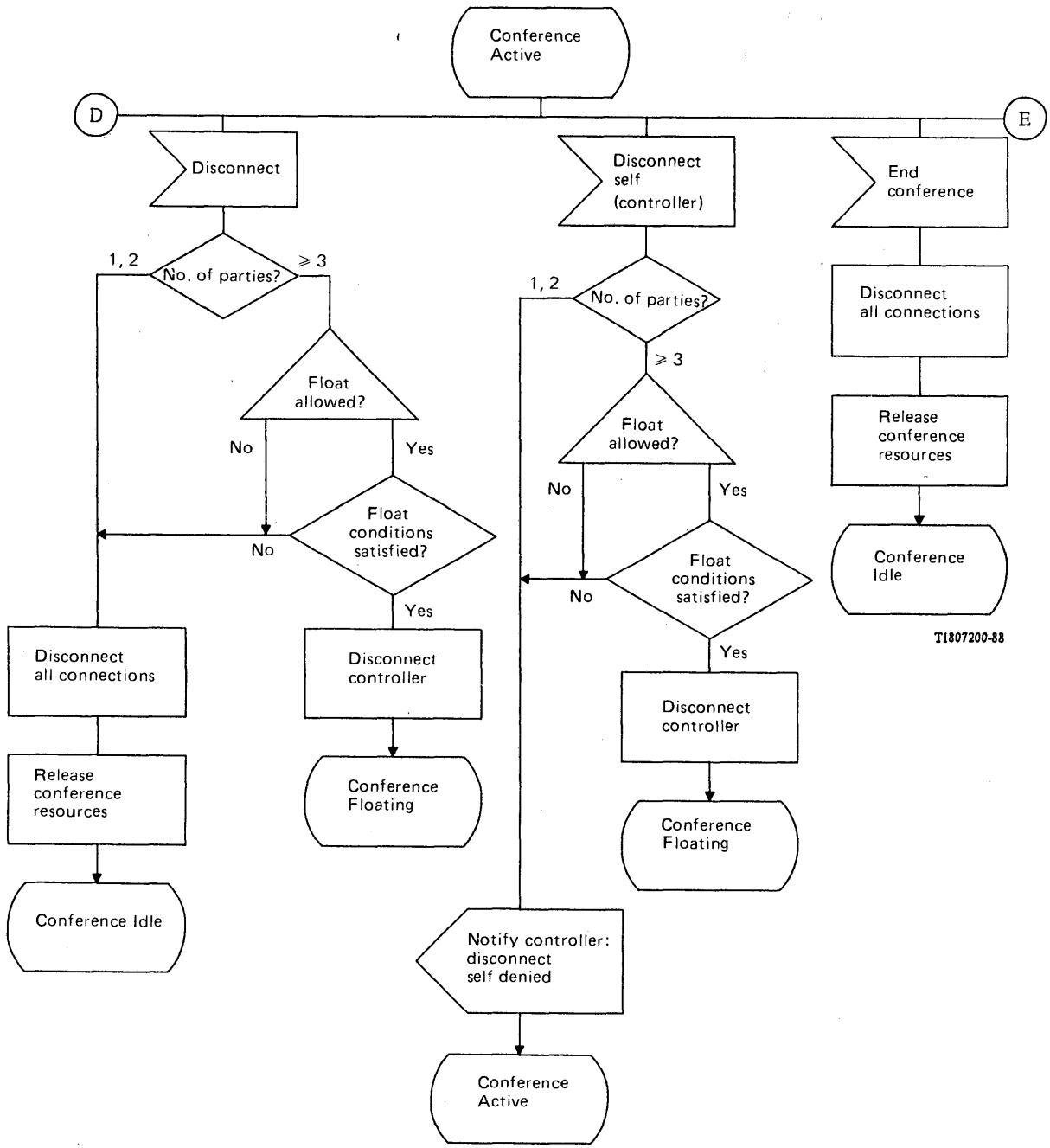


FIGURE 1/I.254 (sheet 5 of 7)

Conference calling

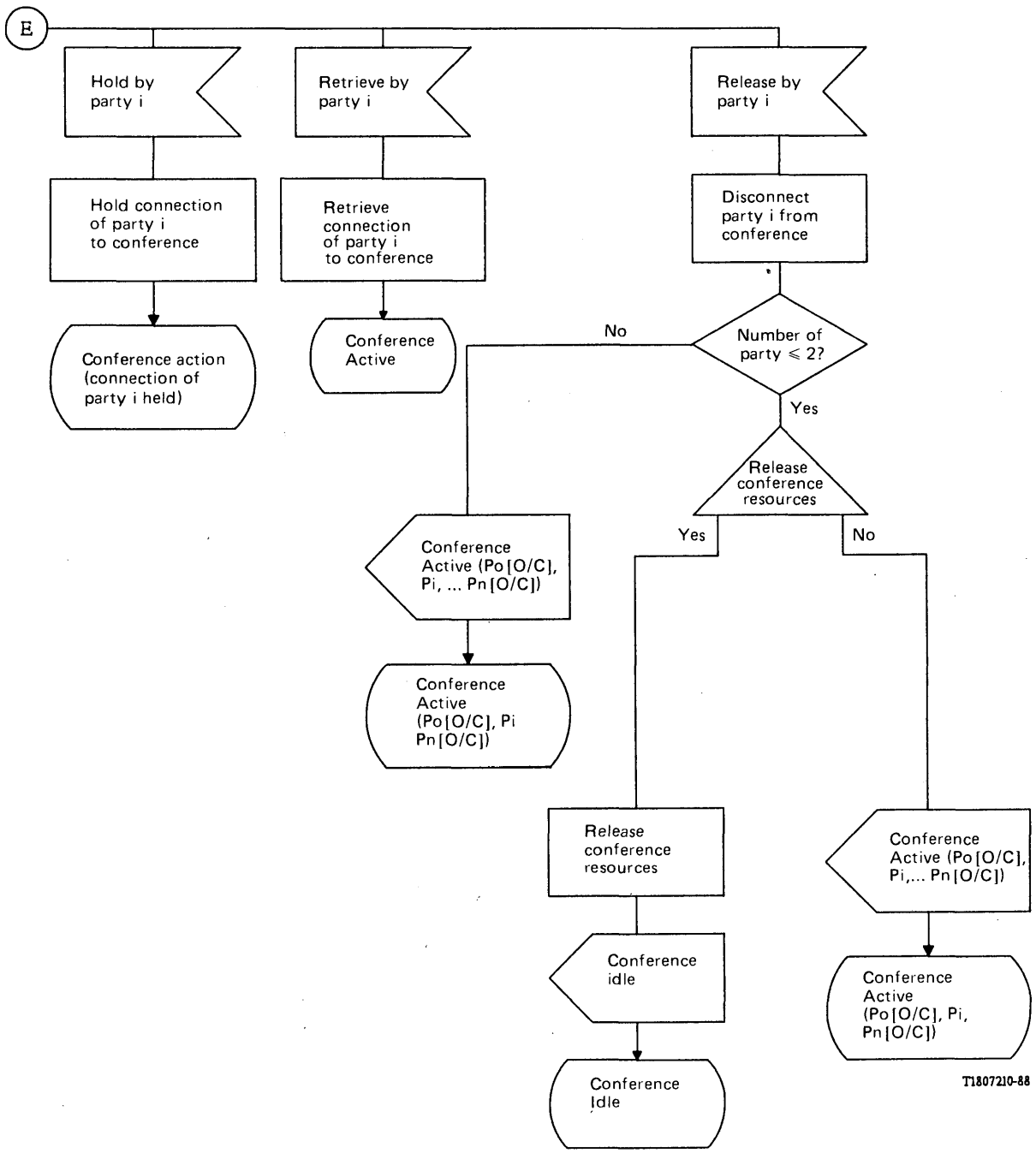


FIGURE 1/I.254 (sheet 6 of 7)

Conference calling

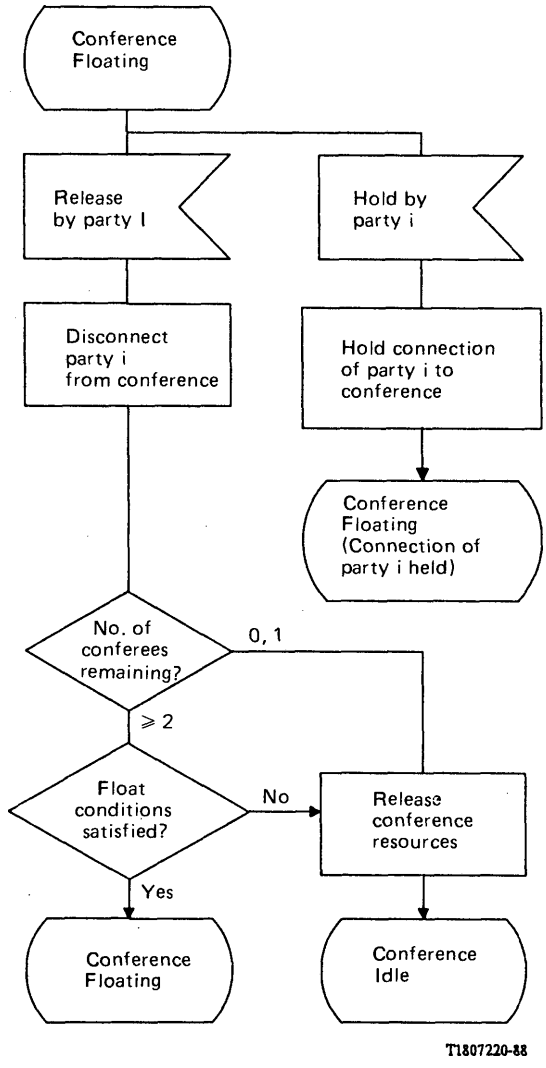


FIGURE 1/I.254 (sheet 7 of 7)

Conference calling

1.4 *Network capabilities for charging*

This Recommendation does not cover charging principles. Future Recommendations in the D-Series are expected to contain that information.

It shall be possible to charge the subscriber accurately for the service.

1.5 *Interworking requirements*

None identified.

1.6 *Interactions with other supplementary services*

1.6.1 *Call Waiting*

Once a conference has been established of which the parties have subscribed to the Call Waiting service:

i) any party that has activated Call Waiting will be able to receive an indication of an incoming call, and could place the conference on hold to accept the waiting call;

ii) the conference controller may, if desired, add the party from the waiting call by answering the waiting call and using the "add party from existing call" procedures.

Note – If either the conference controller or a conferee has accepted a waiting call and has subscribed to either (minimal) Three-Party service or Call Hold service, then this party could alternate between the waiting call and the conference.

1.6.2 *Call Transfer*

Conference controller

A conference controller may transfer the conference to a party not in the conference, but "control" cannot be transferred [Figure 2/I.254, case a)]. The transfer of control of a conference to another party in the conference is an anticipated future extension [Figure 2/I.254, case b)] not yet included in this service description. A conference controller may disconnect himself from the conference [Figure 2/I.254, case c)] which may result in the conference entering a Floating state (see § 1.3.2.2.3).

Conferee

A conferee should be able to transfer his connection to the conference [Figure 2/I.254, case d)] to another party. Only the "normal" and "explicit" forms of transfer should be used, and the Complete Transfer request should only be made after the call to the other party has reached the active state. (This is to prevent call progress signals from disrupting the conference.) The identity of the new party, if available and unrestricted, should be given to the conference controller.

Any party

Any party in a conference may transfer calls, or receive transferred calls, that are independent from the conference. A conference controller can add a call transferred to him using the "add party from existing call" procedure [Figure 2/I.254, case e)] (see § 1.3.2.2.2).

A conference controller can "transfer" a call to a conference [Figure 2/I.254, case f)]. (This is functionally similar to the case shown in Figure 2/I.254, case a).) A conferee may explicitly transfer an incoming call that has reached the active state to a conference [Figure 2/I.254, case f)], but this results in the conferee being disconnected from the conference, as shown in Figure 2/I.254, case d); it is not a form of "add party".

Any party in a conference may place the conference on hold, and explicity transfer another party that is being held. For example, user A is active in a conference call and also has a party B on hold (B is thus not part of the conference). User A may place the conference on hold and "explicitly" transfer party B to another party.

Calls may be transferred to any party of a conference while that party has the conference on hold. A conferee receiving a transferred call would not be able to add the transferred party to the conference. A conference controller receiving a transferred party would be able to use the "add party from existing call" procedure to add this new party to the conference.

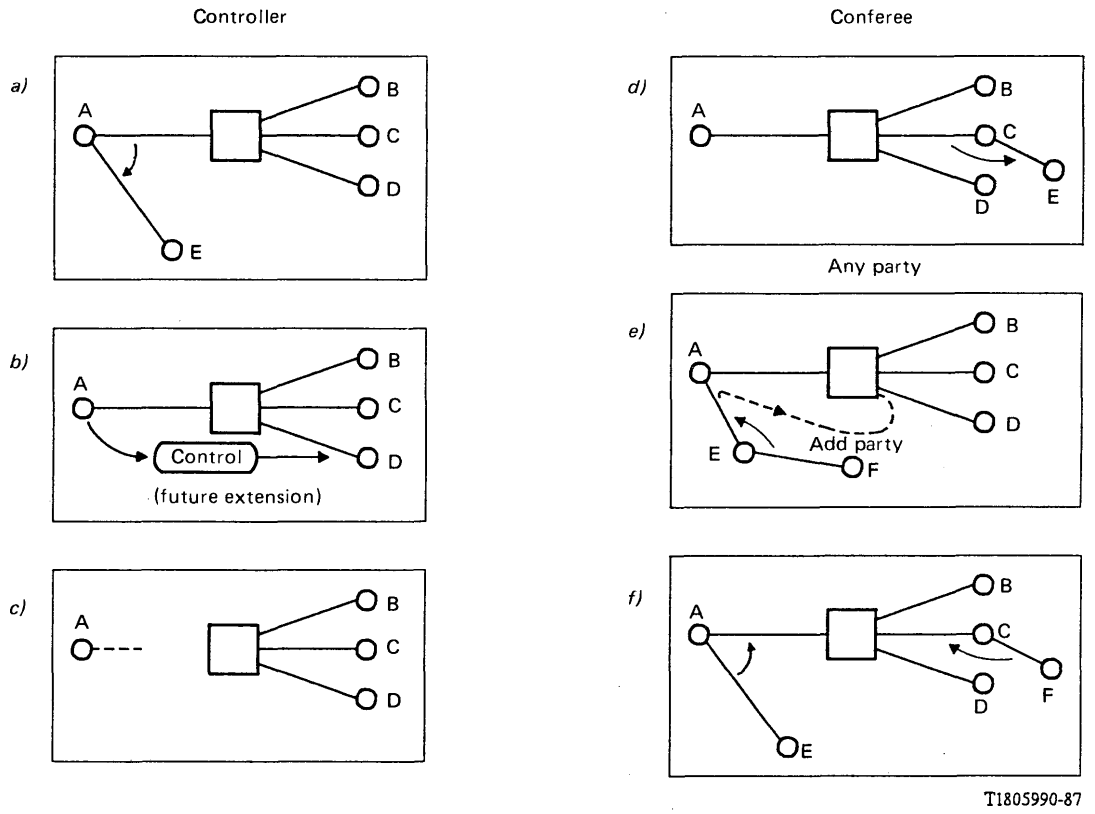


FIGURE 2/I.254

Interaction of conference calling service with call transfer

1.6.3 *Connected Line Identification Presentation*

A conference controller who has also subscribed to COLP should be presented the connected party's number when the party is either part of the initial activation of the conference or is added as a new conferee to an existing conference. Conferees in an existing conference who have subscribed to COLP will not receive a new party's number whenever a conference controller adds a new party to the conference.

1.6.4 *Connected Line Identification Restriction*

No impact, i.e. neither supplementary service affects the operation of the other supplementary service.

1.6.5 *Calling Line Identification Presentation*

Any party that has subscribed to CLIP will receive the address of the conference controller when:

- the party is to be included as a "new party" during the invocation of a conference call, or
- the party is being added to an existing conference call.

1.6.6 *Calling Line Identification Restriction*

No impact, i.e. neither supplementary service affects the operation of the other supplementary service.

1.6.7 *Closed User Group*

The conference controller and all conferees must belong to the same CUG. When establishing the conference initially, or when adding a new conferee, CUG restrictions must be checked and met for all parties on the conference call before the (new) party is allowed to enter the conference.

1.6.8 *Conference Calling*

A conferee may be connected to more than one conference if he has also subscribed to the Hold service. The conferee could switch between the conferences by placing one conference on hold and retrieving the other conference. (See also § 6.12 for the interaction with Three Party Service).

1.6.9 *Direct Dialling-In*

No impact, i.e. neither supplementary service affects the operation of the other supplementary service.

1.6.10 *Call Diversion (Call Forwarding) services*

A call which has been diverted can be added to a conference by the conference controller or be part of a new conference when initially invoked by the served user.

1.6.10.1 *Call Forwarding Busy*

See § 1.6.10 above.

1.6.10.2 *Call Forwarding No Reply*

See § 1.6.10 above.

1.6.10.3 *Call Forwarding Unconditional*

See § 1.6.10 above.

1.6.11 *Line Hunting*

No impact, i.e. neither supplementary service affects the operation of the other supplementary service.

1.6.12 *Three-Party Service* (see Figure 3/I.254)

It should be possible for a conference controller who has also subscribed to (minimal) Three-Party Service to participate in two conferences, and alternate between them [Figure 3/I.254, case a)]. It should not be possible to use (full) Three-Party Service to join the two conferences [Figure 3/I.254, case b)]. Procedures for joining conferences via normal "add party" functions are described in the text.

It should be possible for a conferee who has also subscribed to (minimal) Three-Party Service to participate both in the conference and in another call (which may or may not be a conference) and alternate between them [Figure 3/I.254, case c)]. It is highly undesirable, and may, in some networks, be prohibited, for the conferee to use (full) Three-Party Service to bridge the conference and the other call [Figure 3/I.254, case d)]. This is due to the reduced control the conference controller would have regarding the party(ies) on the other call. Example: a conference controller request to drop the conferee that invoked Three-Party Service would drop the conference connection to all of the parties on that three-way call [Figure 3/I.254, case e)] but would not, in fact, disconnect any of them; they would remain active with party C.

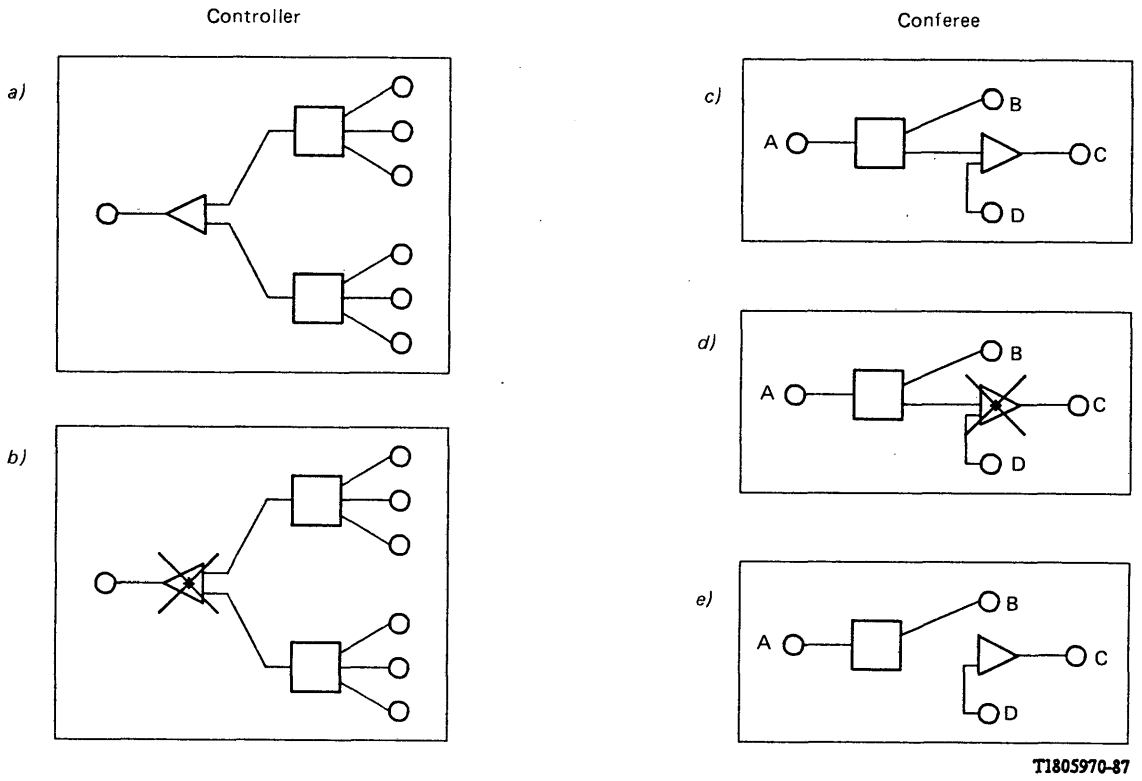


FIGURE 3/I.254

Interaction of conference calling service with Three-Party Service

1.6.13 *User-to-User Signalling*

The conference controller will be able to send user-to-user information (UUI) (service 3) to any conferee on a conference call individually, and in some networks optionally broadcast messages to all conferees. (This assumes that each conferee can be uniquely identified.) UUI can be received by the conference controller from any of the conferees. While adding a new party to the conference, the conference controller can send and receive UUI (services 1, 2 and 3) from the new party until the new party is added to the conference.

A conferee may send and receive UUI (service 3 and service 1 during call clearing phase) from the conference controller. UUI cannot be sent between the conferees in association with the conference call (although any two parties, if subscribed, could send non-call associated UUI to each other.) A conferee's ability to send broadcast messages (under the control of the conference controller) to all parties, is for further study. A conferee may send UUI (service 1) to the conference controller only during the call clearing phase.

1.6.14 *Multiple Subscriber Number*

No impact, i.e. neither supplementary service affects the operation of the other supplementary service.

1.6.15 *Call Hold*

When establishing a conference, the served user may identify any party(s) it has on hold to become a conferee(s) in the conference call being established. Similarly, a conference controller may add any party he has on hold to an active conference.

A party (A) in a conference may place the conference on hold and retrieve some other party that party A has on hold. Party A may then place this call on hold to retrieve the conference call.

Assuming subscription to both the Conference Calling and Call Hold services, a party may:

i) be a conference controller of two or more conferences. The conference controller switches conferences by putting the active conference on hold and then retrieving another conference;

ii) be a conference controller of one conference and a conferee of another conference(s). The party may switch between conferences by putting the active conference on hold and then retrieving another conference.

1.6.16 *Advice of Charge*

No impact, i.e. neither supplementary service affects the operation of the other supplementary service.

1.7 *Dynamic description*

The dynamic description of this service is shown in Figure 1/I.254, Sheets 1 to 7.

2 I.254.2 – **Three Party Service**

2.1 *Definition*

The Three-Party Service enables a user who is active on a call to hold that call, make an additional call to a third party, switch from one call to the other as required (privacy being provided between the two calls), and/or release one call and return to the other. Optionally, the served user could subscribe to an ability to join the two calls together into a three-way conversation. (Relationships between this service and the Call Transfer supplementary service are indicated throughout the text and Figure 4/I.254).

2.2 *Description*

2.2.1 *General description*

Three-Party Service provides a user with flexibility in handling up to two (initially-) independent calls. Different forms of the service exist which allow the user to control these calls. The various forms of Three-Party Service are given in Table 1/I.254.

In principle, all participants in a Three-Party Service call should be informed about the state of their calls whenever necessary.

TABLE 1/X.254

Form of service	– Hold existing call – Make call to 3rd party – Alternate between parties	Form common path between all three parties
Minimal service	Yes	No
Full three-party service	Yes	Yes

2.2.2 *Specific terminology*

Call ID: the served user's reference to a call of which he is a party. Examples:

1) the call to user B (or user C) prior to its being used to form a three-way conversation;
2) the three-way conversation, once it is formed.

Served user: during the invocation and active phases, the service is under the control of the "served user", i.e. the one for whom the service was subscribed. This user is also referred to as "user A".

User B: The other party in the original call (A $\longleftrightarrow$ B).

User C: The "third party" – the other party in the second (e.g. enquiry) call (A $\rightarrow$ C).

(For the original call, the served user may have been either the calling or called party (i.e. it may have been either an incoming or outgoing call)).

2.2.3 *Qualifications on the applicability to telecommunication services*

This supplementary service is considered meaningful when applied to the Telephony teleservice and the speech and 3.1 kHz audio bearer services. Furthermore, it may also be meaningful when applied to other services.

2.3 *Procedures*

2.3.1 *Provision/withdrawal*

The Three-Party supplementary service is subscribed to by prior arrangements with the service provider. Subscription can be made for the Minimal Service or the Full Three-Party Service.

Withdrawal of the service is made by the service provider upon request by the subscriber or for service provider reasons.

2.3.2 *Normal procedures*

2.3.2.1 *Activation/deactivation/registration*

None identified.

2.3.2.2 *Invocation and operation*

2.3.2.2.1 *Beginning Three-Party Service* (see Figure 4/I.254, Sheet 1)

The served user, user A, who has an existing active call with user B, asks the service provider to begin the Three-Party Service. The service provider puts the existing call on hold. User A then proceeds to establish the second call (to user C).

Note – The same actions take place when the served user asks the service provider to start the "normal" Call Transfer service (see Call Transfer service description). Conceivably, a similar "Held && Active" service state (see Figure 2/I.252) could be attained as a result of accepting an incoming call in such a way that the service provider knew to associate that incoming call with the existing call and, hence, put the existing call on hold (see Call Waiting service description for one such possibility).

2.3.2.2.2 *Managing two associated calls – one held one active* (see Figure 4/I.254, Sheets 1 and 2)

Served user:

Once the call to the third party reaches the alerting state, the served user can:

i) alternate from one call to the other as required (possibly several times), privacy being provided between the two calls;

   Note – The exact interactions between the served user and the service provider depend somewhat on the information and control capabilities available to the user from his terminal. Compare the two methods of alternating between calls given in Figure 4/I.254 under "Alternate" vs. "Return to B(C)".

ii) Disconnect the active party (e.g. user C), whereupon the service provider would notify (see Note) the served user that the other party (e.g. user B) is still held and wait for one of the following events:

- a request from the served user that the held party be retrieved;
- a request from held party to disconnect.

If neither event occurs within a brief time interval, the service provider will disconnect the held party.

Note – This would be a "high priority notify", i.e. one capable of gaining the served user's attention if he were away from the terminal. Ringing is an example of this.

iii) Disconnect the held party (e.g. user B)

Note – Disconnecting a held party without previously retrieving it is considered undesirable for a "human-to-human" call but may be useful in other cases;

or, if subscribed for:

iv) request the service provider to begin a three-way conversation (see managing an active three-way conversation below).

Note – In some networks, the served user can invoke this step only after the call to the third party reaches the active state.

Active party

If the active party disconnects, the service provider would notify the served user that the other party (e.g. user B) is still held and wait for one of the following events:

- a request from the served user that the held party be retrieved;
- a request from the held party to disconnect.

If neither event occurs within a brief time interval, the service provider will disconnect the held party.

Held party

If the held party disconnects, the service provider will clear that connection, resulting in a simple active call between the served user and the currently-active user.

2.3.2.2.3 *Managing an active three-way conversation* (See Figure 4/I.254, Sheet 3)

Note – The extent to which the service provider re-uses the existing resources (e.g. a bridge) to form the resulting, simple call is a service provider option.

Served user

During an active three-way conversation, the served user can request that the service provider:

i) end the three-way conversation;

Note – Signalling procedures for disconnecting a multi-connection call are not yet defined.

ii) disconnect himself from the three-way conversation. Since the served user is also the controller (and normally the one that is charged for the call), this shall result in the entire three-way call being cleared.

Note – An anticipated future extension to this service and the Call Transfer service is the ability to negotiate charging and control responsibilities, thus permitting the call to continue after the served user has disconnected (See Figure 4/I.254: call transfer from Active Three-Way Conversation state).

iii) explicitly disconnect one of the other parties which would result in a simple active call between the served user and the remaining other party;

iv) place his connection into the conversation on hold (and, typically, later retrieve it).

Note – While the served user is held, the other parties (B and C) may continue to communicate.

v) split off one of the parties in order to have a private communication with that party. This results in that party being split off from the conversation, the connection between the served user and the other party on the three-way call being placed on hold, and the connection between the served user and the designated party being active.

Other party (B or C)

Either of the other parties (users B or C) can ask the service provider to:

i) release it from the three-way conversation which results in a simple active call between the served user and the remaining party;

ii) place its connection to the three-way conversation on hold (and, typically, later retrieve it);

Note – While the served user is held, the other parties (i.e. served user and remaining party) may continue to communicate.

2.3.3 *Exceptional procedures*

2.3.3.1 *Activation/deactivation/registration*

None identified.

2.3.3.2 *Invocation and operation*

None identified.

2.3.4 *Alternative procedures*

2.3.4.1 *Activation/deactivation/registration*

None identified.

2.3.4.2 *Invocation and operation*

None identified, except for the point made above regarding variations due to different terminal capabilities.

2.4 *Network capabilities for charging*

This Recommendation does not cover charging principles. Future Recommendations in the D-Series are expected to contain that information.

It shall be possible to charge the subscriber accurately for the service.

2.5 *Interworking Requirements*

None identified.

2.6 *Interaction with other supplementary services*

2.6.1 *Call Waiting*

Assume that users A, B and C have subscribed to the Call Waiting service, then:

- if a call waiting indication was presented to user A and/or user B either before or during the Three-party-Service invocation, then the call waiting indication would still be present after the Three-Party Service is active. While the Three-Party Service is active, the party with the waiting call may put his active call on hold to accept the waiting call;
- a call waiting indication may be presented to any party involved in a Three-Party Service call, and that party:
  1) may be active in a two-party call (A-B or A-C),
  2) may be on hold (B during A-C, C during A-B),
  3) may be active in a three-way conversation, or
  4) may have his connection to the three-way conversation on hold;
- it may be desirable to include a capability of accepting an incoming call as part of Three-Party Service. Currently a user could alternate between the first call and the second (waiting or answered) call by combining hold and retrieve requests. A user could also join the second (waiting or active) call to the first call by invoking a three- (or more) party conference call.

2.6.2 *Call Transfer*

Call Transfer can be invoked in either the Held A ⟷ B(C) && Active A → C(B) state (see Figure 2/I.252 for Call Transfer service) or the Active Three-Way Conversation state (see Figure 5/I.254, call transfer from Active Three-Way Conversation state).

2.6.3 *Connected Line Identification Presentation*

No impact supplementary service affects the operation of the other supplementary service.

2.6.4 *Connected Line Identification Presentation*

No impact, i.e. neither supplementary service affects the operation of the other supplementary service.

2.6.5 *Calling Line Identification Presentation*

No impact, i.e. neither supplementary service affects the operation of the other supplementary service.

2.6.6 *Calling Line Identification Restriction*

No impact, i.e. neither supplementary service affects the operation of the other supplementary service.

2.6.7 *Closed User Group*

Assume that a user A, who has subscribed to the Three-Party Service, has an established call with user B and wishes to create a three-party call by including a user C (either a minimum Three-Party Service or a three-way conversation).

When user A invokes the Three-Party Service and places a call to user C, the service provider shall check that all CUG conditions are met between users A and C but is *not* required to check CUG conditions between users B and C at this point since user A may wish to only have a minimal Three-Party Service call.

If any of the parties to be involved in the three-party call are also a CUG member, then CUG conditions must be met by all of the parties before a three-way conversation can be formed.

2.6.8 *Conference Calling*

A served user who has invoked Three-Party Service to create a three-way conversation may convert the three-way conversation to a conference call by invoking the Conference Calling Service and identifying the Party IDs of the currently existing other two parties as part of the conference invocation. This requires that the served user of the Three-Party Service has also subscribed to the Conference Calling service. For other interactions, see § 1.6.12.

2.6.9 *Direct Dialling-In*

No impact, i.e. neither supplementary service affects the operation of the other supplementary service.

2.6.10 *Call Diversion (Call Forwarding) services*

If the served user attempts to establish the second call to a user C who has Call Forwarding activated, and the appropriate forwarding conditions are met, the forwarding-to user will be alerted and treated in all other respects as if the call had been placed to him.

2.6.11 *Line Hunting*

No impact, i.e. neither supplementary service affects the operation of the other supplementary service.

2.6.12 *Three-Party Service*

The served user (A) may treat a Three-Party Service call that has reached the Three-Way Conversation service state as an "existing call" upon which the minimal Three-Party Service may be invoked. That is, if the served user A is in a three-way conversation with parties B and C and invokes (minimal) Three-Party Service on it, the service provider will place the served user's connection to the conversation on hold (with channel reservation) and allow the served user to establish a call to another party (D). Once the call to user D reaches the alerting state, any of the procedures in § 2.3.2.2.2 may be used to manage the call to party D and the "three-way conversation" call.

2.6.13 *User-to-User Signalling*

While adding the third party (user C) to the three-party service, the served user (user A) can send and receive UUI (services 1, 2 and 3) from the new party until the new party is added to a three-way conversation.

The served user will be able to send and receive UUI (service 3) to both remote parties (users B and C) on a three-way conversation individually and in some networks optionally broadcast UUI (service 3) messages to both parties (see Note). UUI (service 3) cannot be sent between remote parties (users B and C) in association with the three-way conversation.

Note – This assumes that each party can be uniquely identified.

2.6.14 *Multiple Subscriber Number*

No impact, i.e. neither supplementary service affects the operation of the other supplementary service.

2.6.15 *Call Hold*

A served user who has all of his parties on hold would not be able to invoke the Three-Party Service, since he is not active on any given call.

A served user A engaged in an active call to a user B shall be able to invoke the Three-Party Service (if subscribed to) to a user C already on hold to served user A. This will allow served user A to create a three-way conversation with user B and previously held user C.

Any party involved in a Three-Party Service call (either minimum service or a three-way conversation) will be able to put the Three-Party Service call on hold. Once a party puts a Three-Party Service call on hold, that party may retrieve any other call it has previously held.

For any party involved in a three-party call which has also subscribed to the hold service without channel reservation, that party may place the Three-Party Service on hold and

1) initiate a new call;
2) receive a call (e.g. to process a Call Waiting request); or
3) complete a call to a new free party that previously was busy and for which the Completion of Calls to Busy Subscribers (CCBS) had been invoked (see Note).

Note – The Completion of Calls to Busy Subscribers supplementary service needs further study.

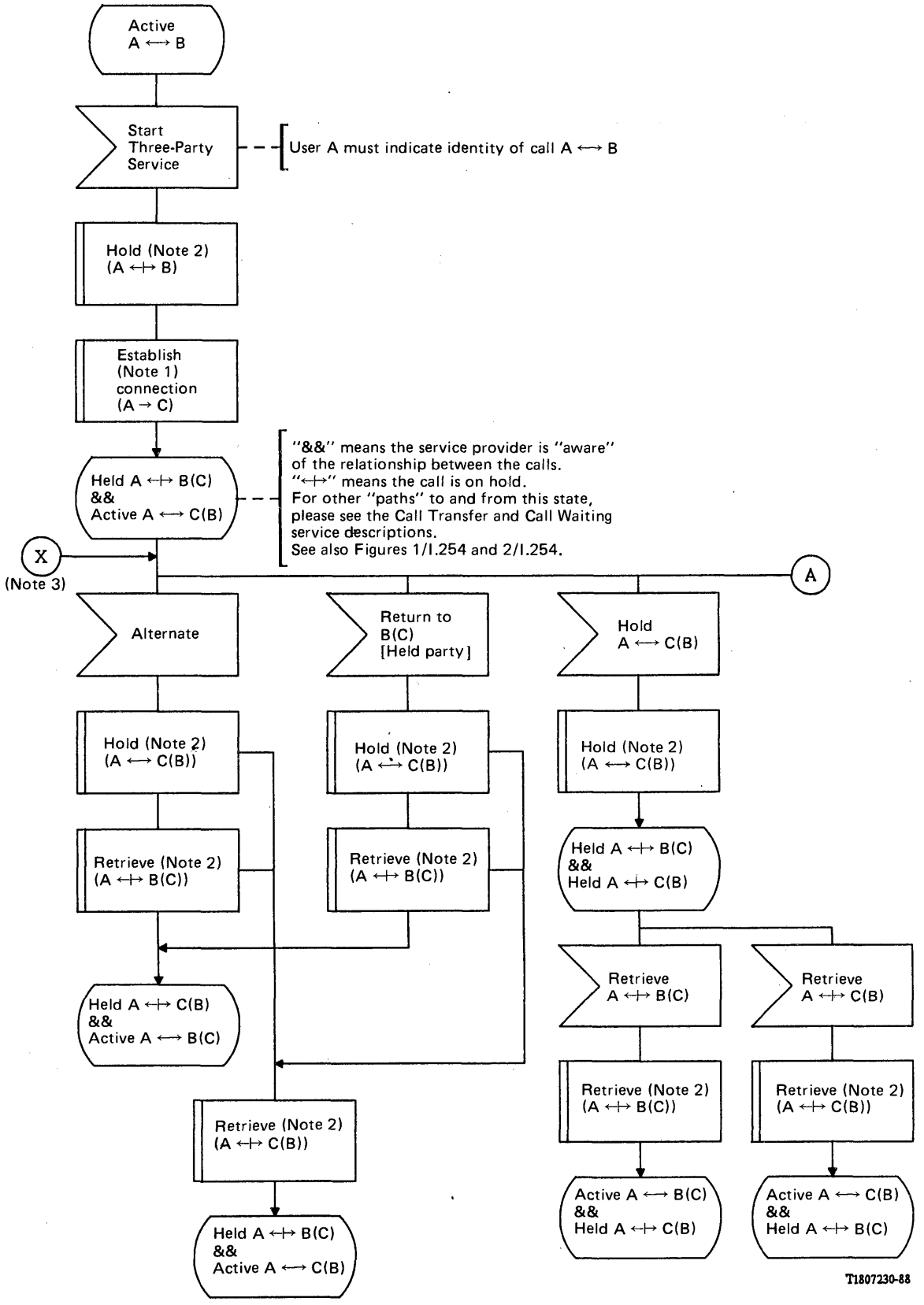
The Call Hold service allows a user to switch (by hold and retrieve) between "parties" where a party may be a single user, a three-way conversation, or a conference call. Thus, a party in a three-way conversation may switch between the three-way conversation and another "party" hold, the "party" being a single user, another three-party call or a conference call.

2.6.16 *Advice of Charge*

No impact, i.e. neither supplementary service affects the operation of the other supplementary services.

2.7 *Dynamic description*

The dynamic description of this service is shown in Figure 4/I.254.



Note 1 – The information sent to the involved parties is described in the Basic Call service description.

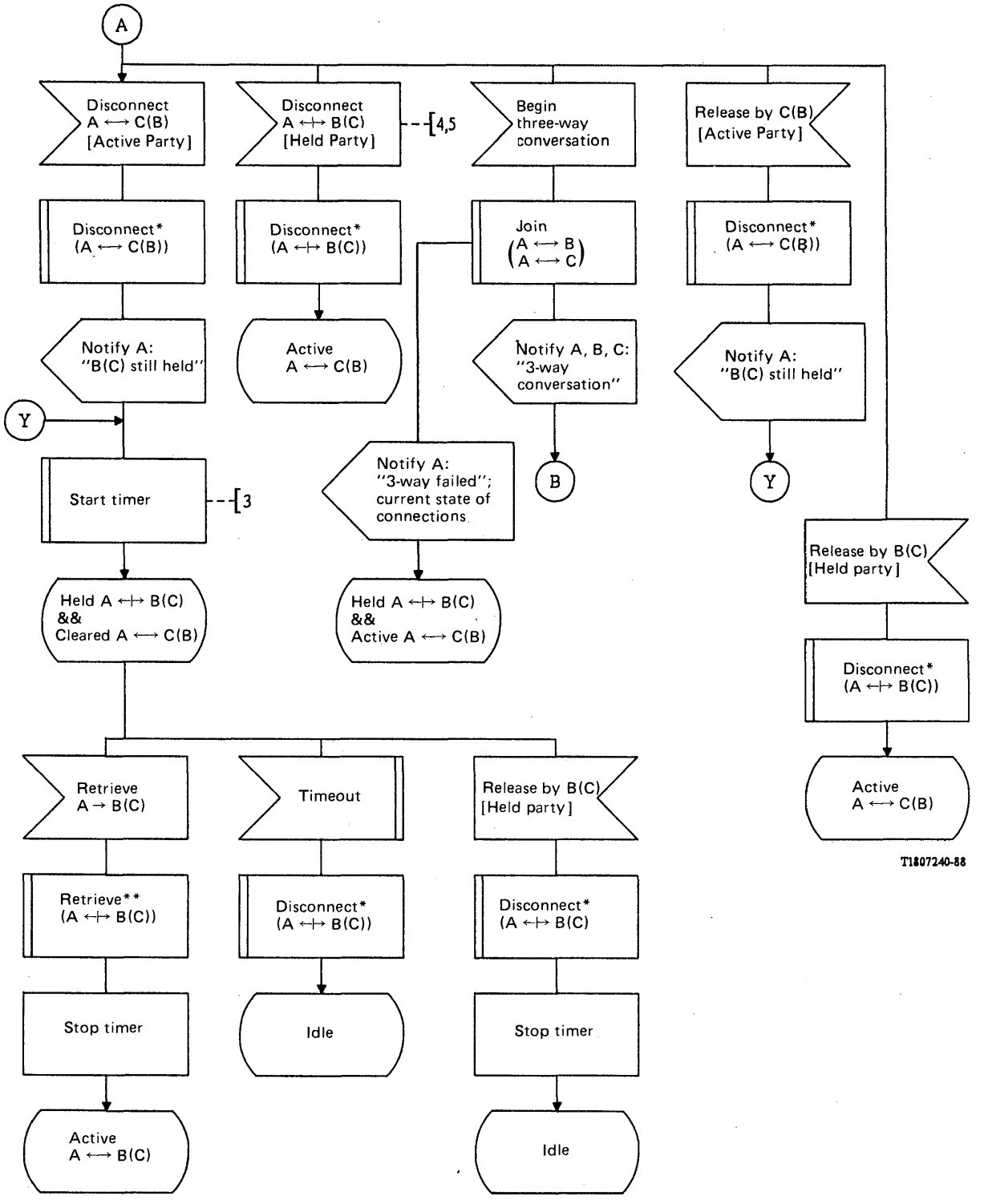
Note 2 – The information sent to the involved parties is described in the Call Hold service description.

Note 3 – From Figure 6/I.254.

Note 4 – Handling of busy condition in Three-Party Service is given in Figure 7/I.254.

FIGURE 4/I.254 (sheet 1 of 3)

Three-Party Service overall SDL



* See Note 1 on sheet 1.
** See Note 2 on sheet 1.

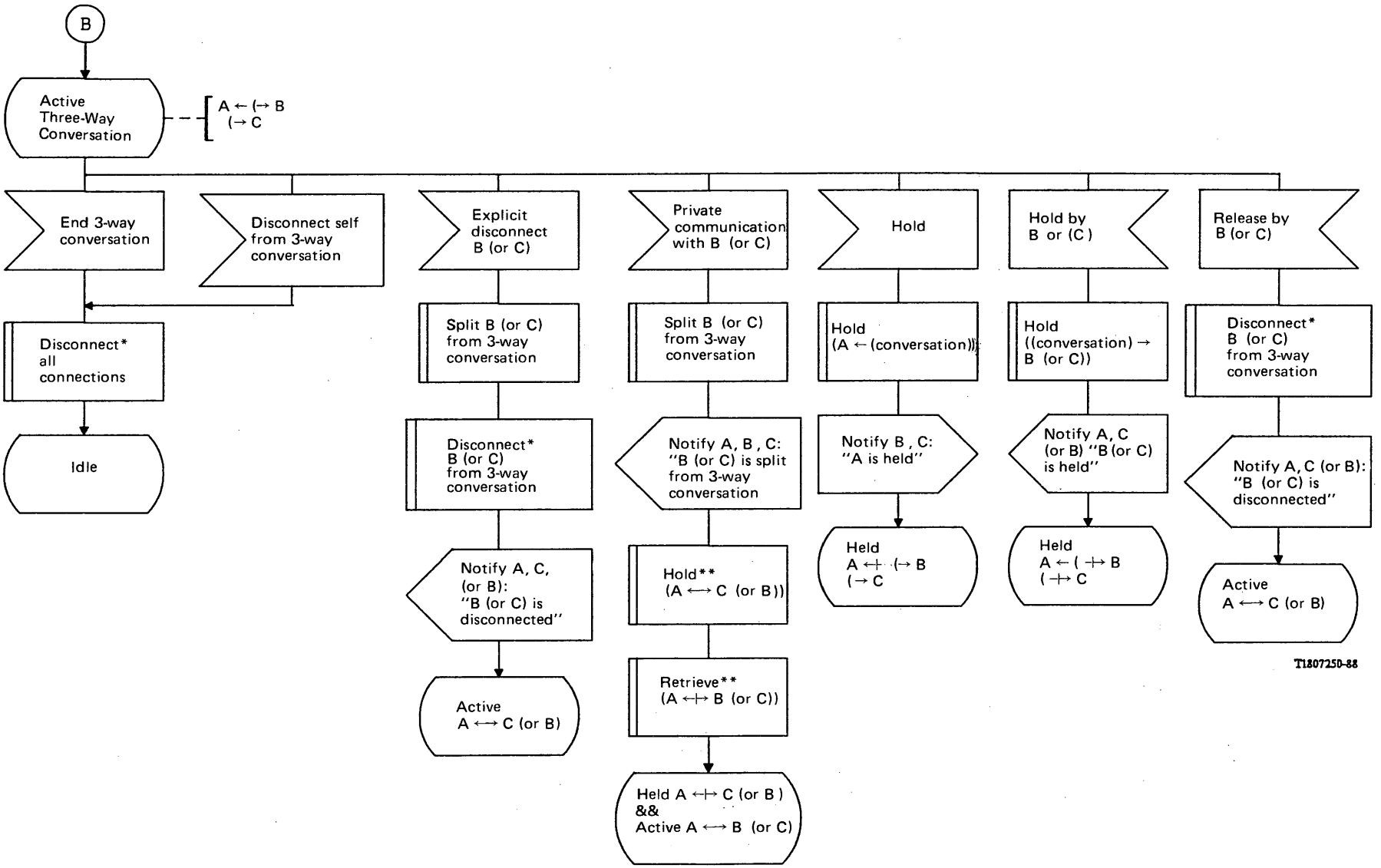
Note 3 – Timer values in the range of 5-10 seconds seem reasonable.

Note 4 – Discourteous for "human-to-human" call; may be useful otherwise.

Note 5 – Signalling procedures do not yet exist for disconnecting a held party.

FIGURE 4/I.254 (sheet 2 of 3)

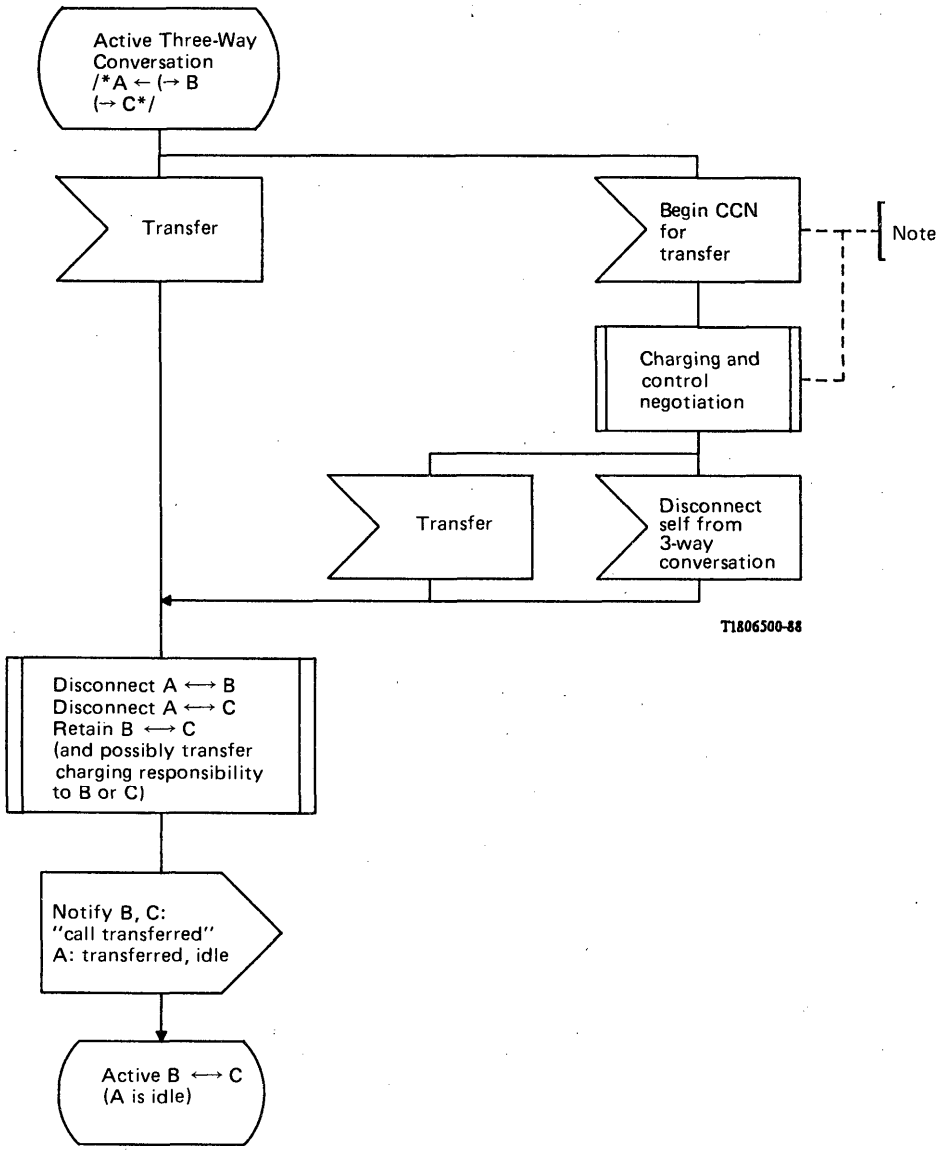
Three-Party Service overall SDL



* See Note 1 on sheet 1.
** See Note 2 on sheet 1.

FIGURE 4/I.254 (sheet 3 of 3)

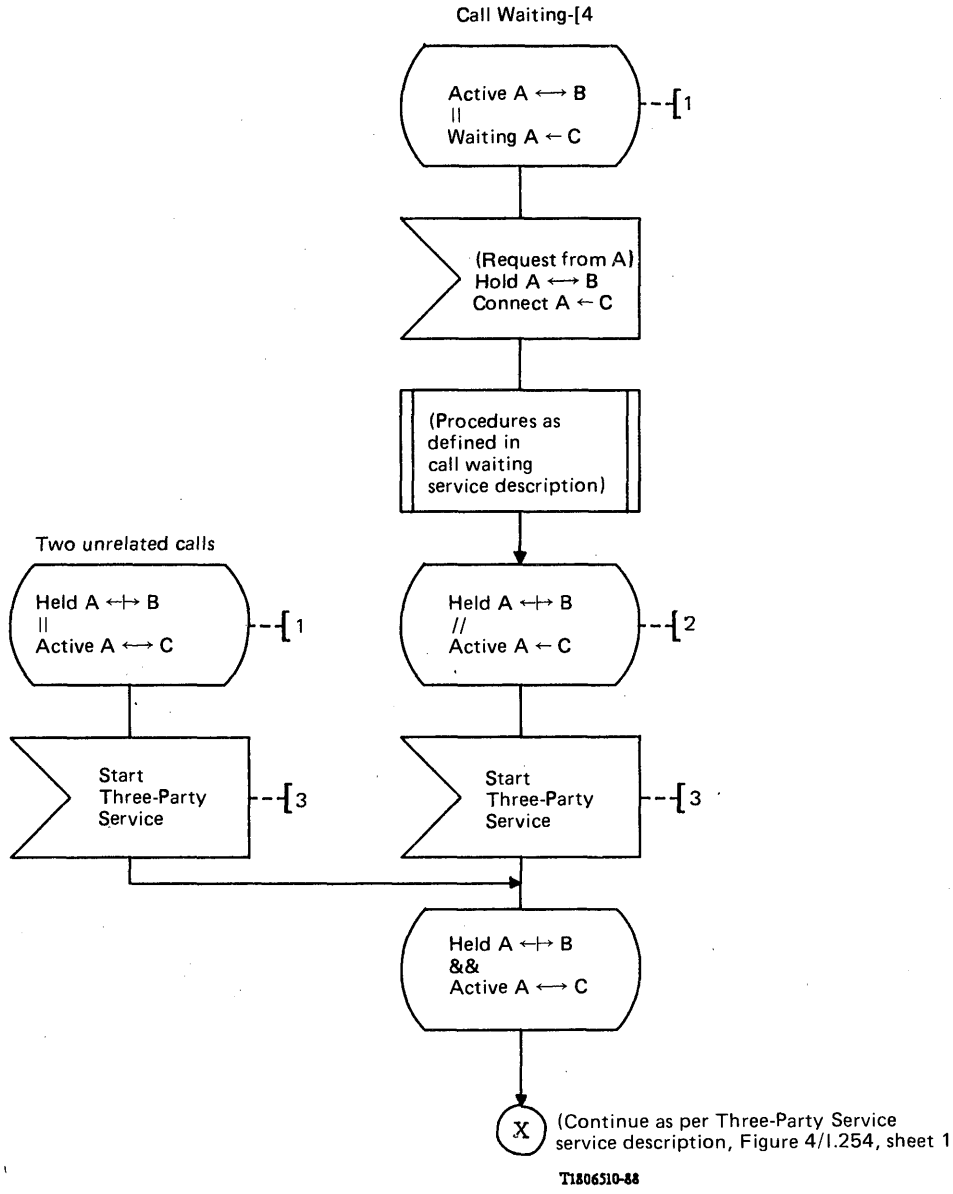
Three-Party Service overall SDL



Note – These procedures require further study.

FIGURE 5/I.254

Call transfer from Active Three-Way Conversation state



Note 1 – "//" means service provider is not aware of the relationship between the two calls.

Note 2 – "//" means service provider may be aware of a relationship between the two calls, but is not as "strong" a relationship as the "&&" relationship needed for Three-Party Service.

Note 3 – User A must indicate identities of A ←|→ B and A ← C.

Note 4 – Nomenclature used here is different from that used in Call Waiting service description, but is functionally equivalent.

FIGURE 6/I.254

Invoking Three-Party Service using a waiting call or using two unrelated calls

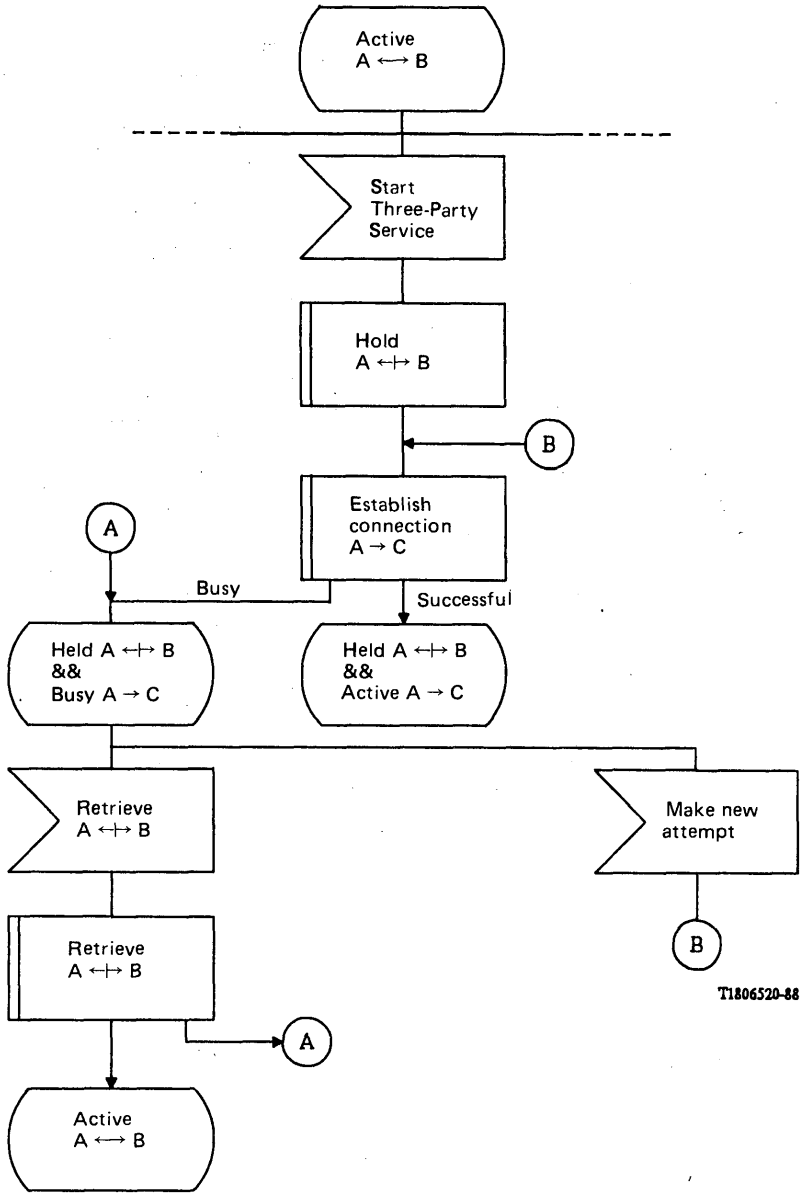


FIGURE 7/I.254

Handling of busy condition in Three-Party Service

COMMUNITY OF INTEREST SUPPLEMENTARY SERVICES

(Melbourne, 1988)

The purpose of this Recommendation is to provide the stage 1 description of the method defined in Recommendation I.130 using the means given in Recommendation I.210.

Supplementary services are described by a prose definition and description (step 1.1) and by a dynamic description (step 1.3). The application of the attribute technique (ste 1.2), as defined in Recommendation I.140, for supplementary services is for further study.

This Recommendation describes the following Community of Interest supplementary services:

1.255.1 Closed User Group (CUG)

1.255.2 Private Numbering Plan (PNP) (Note)

Note – This service having been identified, now requires further study; its description is not yet included.

1 I.255.1 – Closed User Group

1.1 *Definition*

The supplementary service Closed User Group (CUG) enables users to form groups, to and from which access is restricted. A specific user may be a member of one or more CUGs. Members of a specific CUG can communicate among themselves but not, in general, with users outside the group. Specific CUG members can have additional capabilities that allow them to originate calls outside the group, and/or to receive calls from outside the group. Specific CUG members can have additional restrictions that prevent them from originating calls to other members of the CUG, or from receiving calls from other members of the CUG.

Note – When defining the ISDN networking service, its relationship with CUG needs to be studied.

1.2 *Description*

1.2.1 *General description*

A CUG is a group of users who may be members of one or several public networks; each ISDN member of a CUG is identified by an ISDN number.

A CUG may be defined independently of any basic service, or in relation with one, or a number of basic services.

Note – In the case of ISPBXs some Administrations will accept ISPBX extensions as CUG members. Other Administrations will consider the whole ISPBX as a CUG member. In the former case, it is possible for an ISPBX to establish relations between subsets of its users and public CUGs, but this is not perceived at the user-network interface.

1.2.1.1 *Access arrangements*

A user may be a member of several CUGs. Each service provider may define the maximum number of CUGs which can be allocated to an individual subscriber. When subscribed to at least one CUG, a user may subscribe to one of the following access arrangements (*Note* – This information is held by the provider of the service):

- Closed User Group (c);
- Closed User Group with incoming access (c+i);
- Closed User Group with outgoing access (c+o);
- Closed User Group with incoming and outgoing access (c+i+o).

A user may subscribe to one of two additional access restrictions within each particular CUG:

- incoming calls barred within a CUG (icb);
- outgoing calls barred within a CUG (ocb).

All of these cases are illustrated in Figure 1/I.255.

1.2.1.1.1 *CUG only capabilities*

The user may make calls to, and receive calls from, members of those CUGs of which the user is a member (see case 1 in Figure 1/I.255).

An exception to this is when either incoming calls barred within the CUG or outgoing calls barred within the CUG applies.

a) *Incoming calls barred within the CUG:* this access restriction means that a CUG-user is prohibited from receiving calls from users subscribed to the same CUG. This access restriction is given per CUG-user and CUG (see case 2 in Figure 2/I.255).

b) *Outgoing calls barred within the CUG:* this access restriction means that a CUG-user is prohibited from making calls to users subscribed to the same CUG. This access restriction is given per CUG user and CUG (see case 3 in Figure 1/I.255).

The network shall provide a preferential CUG option whereby one of the user's CUGs (or the only one if a single CUG applies) is used as a preferential CUG. If the user sets up a call with no CUG facility request, the network assumes that the preferential CUG is requested (i.e. preferential CUG is the default).

1.2.1.1.2 *CUG with outgoing access*

The user may make and receive calls in the same way, with the same exception as in § 1.2.1.1.1. In addition, this user can make calls to all other non-CUG users, and to those other CUG users who allow incoming access. Incoming calls are only allowed from members of the user's CUG(s). (See cases 4, 5, and 6 in Figure 1/I.255.)

1.2.1.1.3 *CUG with incoming access*

The user may make and receive calls in the same way, with the same exceptions as in § 1.2.1.1.1. In addition, this user may receive calls from any non-CUG user and also from other CUG users who have outgoing access. Outgoing calls are only allowed to members of the user's CUG(s). (See cases 7, 8, and 9 in Figure 1/I.255.)

1.2.1.1.4 *CUG with incoming and outgoing access*

The outgoing access and incoming access can be offered simultaneously to the user by the service provider.

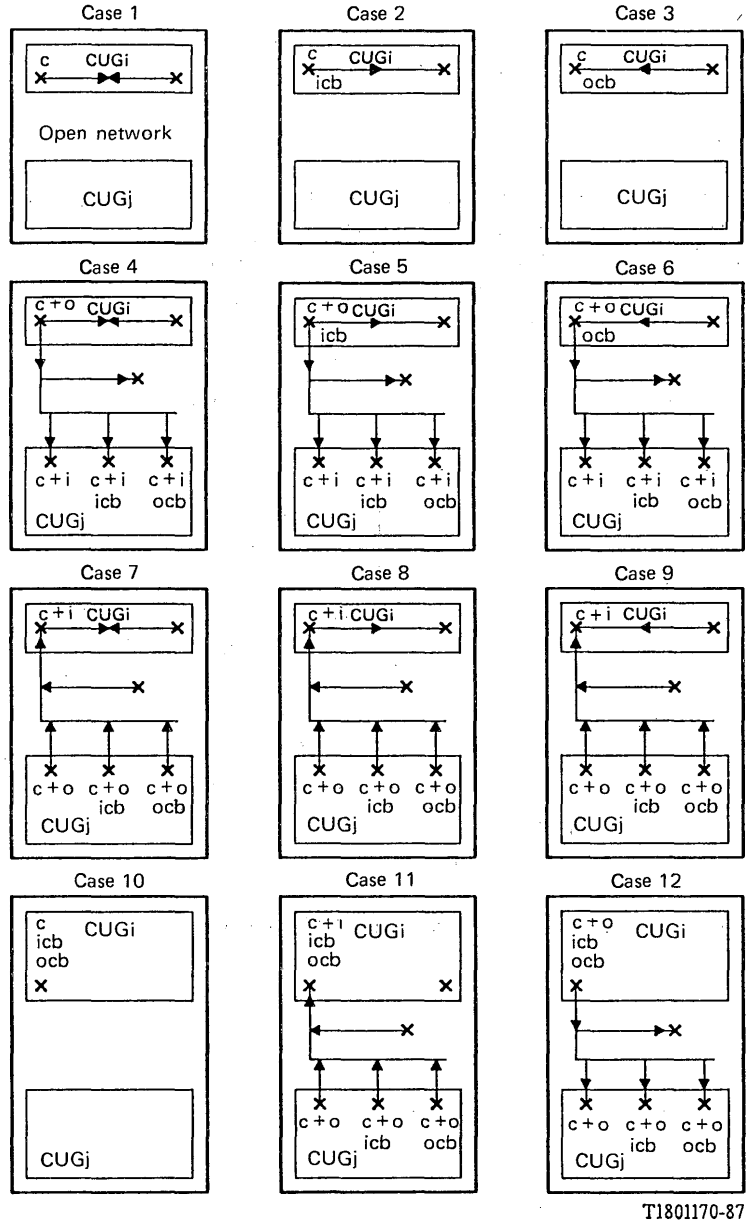
1.2.1.2 *Interaction between the options "Preferential CUG" and "Outgoing Access"*

Both options imply that no subscriber procedures are needed to invoke either of them when placing a call. When a user subscribes to both options, the service provider does not know which option the user is invoking, if no additional subscriber procedures are used when placing the call.

Three ways of operating are recommended:

1) The user has to indicate if a call is intended to be an outgoing access call. If no information (CUG request or Outgoing Call request) is given, the preferential CUG is assumed;
2) The combination of the options is not allowed, i.e. a user cannot have both options allocated at the same time;
3) The caller may make a call and the network will route the call with the preferential CUG and an Outgoing Access request. The call will therefore be connected if the called number is a member of the preferential CUG or is a member of a different CUG and has incoming access, or is a non-CUG user.

The choice of operation is a national option.



c CUG
c+o CUG outoing access
c+i CUG with incoming access
icb incoming calls barred within CUG
ocb outgoing calls barred within CUG

FIGURE 1/I.255

Access arrangements in CUG

1.2.2 *Specific terminology*

None.

1.2.3 *Qualifications on the applicability to telecommunication services*

None identified.

1.3 *Procedures*

1.3.1 *Provision/withdrawal*

The CUG service is provided on a subscription basis. As a network provider option, CUG can be offered with several subscription options. The subscriber options may apply separately to each ISDN number and basic service, or apply to a particular ISDN number for a set of basic services.

Basic service	*Value*
Closed User Groups	– List of one or more CUGs
Subscription option	
Preferential CUG	– None designated (see Note) – CUG value
Type of inter-CUG access (in/out of CUG)	– None – Outgoing access – Incoming access – Outgoing and incoming access
Intra-CUG restrictions	– None – Incoming (terminating) calls barred – Outgoing (originating) calls barred

Note – The user must always specify a preferential CUG when the type of inter-CUG access option is set to none.

1.3.2 *Normal procedures*

1.3.2.1 *Activation/deactivation/registration*

Not required.

1.3.2.2 *Invocation and operation*

Normal call set-up procedures will apply to all CUG calls. In addition, the network shall carry out internal checks to determine whether or not the particular call is allowed between the two parties concerned.

1.3.2.2.1 *Outgoing (originating) calls*

At the time of call set-up the user specifies a CUG index to indicate that a service to a particular CUG is requested. The user, includes a request for a CUG service and the relevant CUG index in the setting up of the call. The CUG indices are allocated by prior arrangements with the service provider. Withdrawal of the CUG service, or indices will be an action of the service provider at the request of the user or due to service provider reasons.

When requesting outgoing access capability, the user makes a normal call.

If the user sets up a call without requesting the CUG service and the user has a preferential CUG, the network assumes that the preferential CUG is requested.

The choice of preferential CUG will only be alterable by service provider action.

1.3.2.2.2 *Incoming (terminating) calls*

An incoming call from another CUG member will be indicated to the called CUG user with a CUG indication and the appropriate CUG index.

An incoming call from a non-CUG user, assuming that the called CUG user has incoming access allowed, will contain no CUG related information in the call offering message.

An incoming call from a CUG user using outgoing access, to a CUG user subscribed to a different CUG but with incoming access, will contain no CUG related information in the call offering message.

1.3.3 *Exceptional procedures*

1.3.3.1 *Activation/deactivation/registration*

None identified.

1.3.3.2 *Invocation and operation*

Upon receipt of a request for CUG service the network shall check its validity in conjunction with the access capabilities contained in the user profile. If a non-valid request is received or the checks cannot be performed, then the network shall reject the call and return an appropriate indication to the calling user.

If, due to an interworking situation, signalling in the network is not able to carry the information required to provide the service, the call attempt is terminated and an appropriate cause is given to the calling user.

1.3.4 *Alternative procedures*

1.3.4.1 *Activation/deactivation/registration*

None identified.

1.3.4.2 *Invocation and operation*

None identified.

1.4 *Network capabilities for charging*

This Recommendation does not cover charging principles. Future Recommendations in the D-Series are expected to contain that information.

It shall be possible to charge the subscriber accurately for the service.

1.5 *Interworking requirements*

A CUG may span over several networks. In this case the responsibility for the management of this CUG is in one of these networks; in addition there is a need for a CUG identification mechanism that would be accepted by all of the encompassed networks. One such mechanism presently exists for CUGs spanning over data networks having X.121 as the numbering plan (see Recommendation X.180 Administrative Arrangements for International Closed User Groups). An equivalent mechanism should be defined for CUGs on networks using the E.164 numbering plan, or on networks which do not use the same numbering plan.

1.6 *Interaction with other supplementary services*

The intention of CUG is to allow some connections and prohibit others. No supplementary service interaction should be allowed which could compromise this intention.

1.6.1 *Call Waiting*

No impact, i.e. neither supplementary service affects the operation of the other supplementary service.

1.6.2 *Call Transfer*

The CUG-restrictions must be met:

- between the calling/called party and the transferring party,
- between the transferring party and the transferred-to-party,
- between the calling/called party and the transferred-to-party.

If, and only if, all the above statements are fulfilled, the transfer of the call is allowed.

1.6.3 *Connected Line Identification Presentation*

No impact, i.e. neither supplementary service affects the operation of the other supplementary service.

1.6.4 *Connected Line Identification Restriction*

No impact, i.e. neither supplementary service affects the operation of the other supplementary service.

1.6.5 *Calling Line Identification Presentation*

No impact, i.e. neither supplementary service affects the operation of the other supplementary service.

1.6.6 *Calling Line Identification Restriction*

It is an option to allow invocation of CLIR in connection with a CUG call.

1.6.7 *Closed User Group*

Not applicable.

1.6.8 *Conference Calling*

All conferees must belong to the same CUG. When adding a new conferee, the CUG-restrictions must be checked before the new conferee is allowed to enter the conference.

1.6.9 *Direct Dialling-In*

No impact, i.e. neither supplementary service affects the operation of the other supplementary service.

1.6.10 *Call Diversion (Call Forwarding) services*

1.6.10.1 *Call Forwarding Busy*

See Call Forwarding Busy interaction with CUG in Recommendation I.252, § 2.

1.6.10.2 *Call Forwarding No Reply*

See Call Forwarding No Reply interaction with CUG in Recommendation I.252, § 3.

1.6.10.3 *Call Forwarding Unconditional*

See Call Forwarding Unconditional interaction with CUG in Recommendation I.252, § 4.

1.6.11 *Line Hunting*

When a free line of a hunting group has been found, any CUG condition must be met before the connection will be established.

1.6.12 *Three Party Service*

See Three Party Service interaction with Closed User Group in Recommendation I.254, § 2.

1.6.13 *User-to-User Signalling*

No impact, i.e. neither supplementary service affects the operation of the other supplementary service.

1.6.14 *Multiple Subscriber Number*

For further study.

1.6.15 *Call Hold*

No impact, i.e. neither supplementary service affects the operation of the other supplementary service.

1.6.16 *Advice of Charge*

No impact, i.e. neither supplementary service affects the operation of the other supplementary service.

1.7 *Dynamic description*

The dynamic description of this service is shown in Figure 2/I.255.1.

2 I.255.2 – Private Numbering Plan

This service, already identified, needs further study; its description is not yet included.

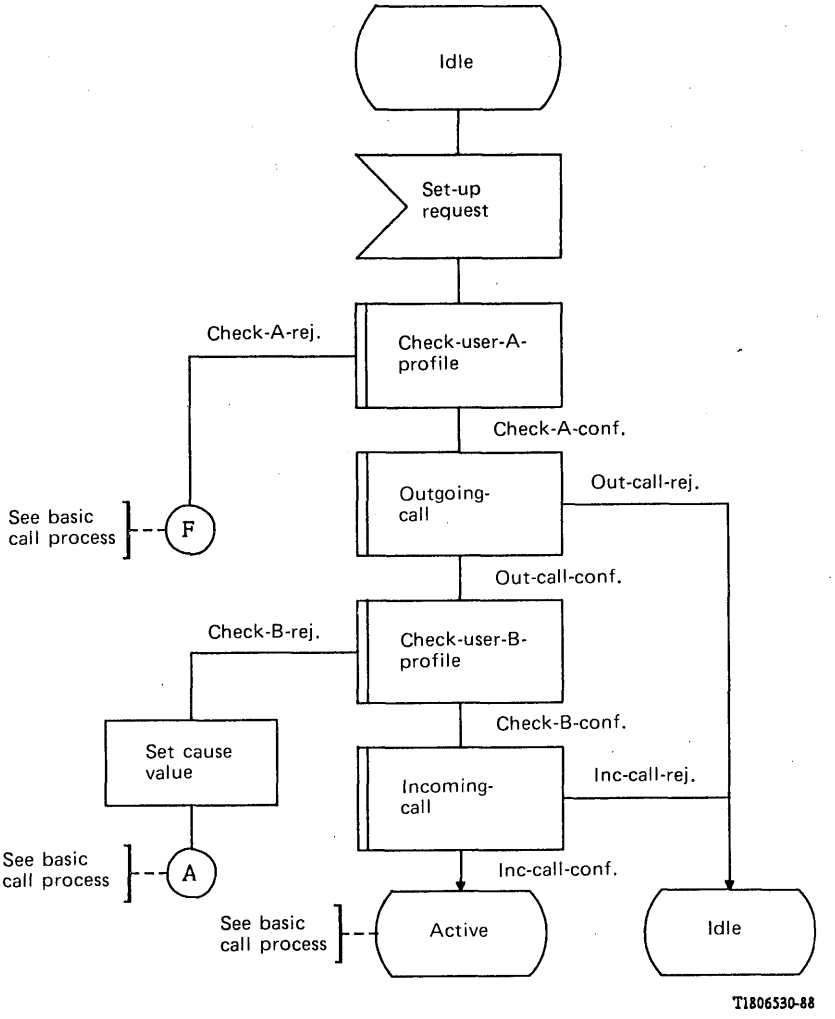


FIGURE 2/I.255 (sheet 1 of 4)

Closed User Group

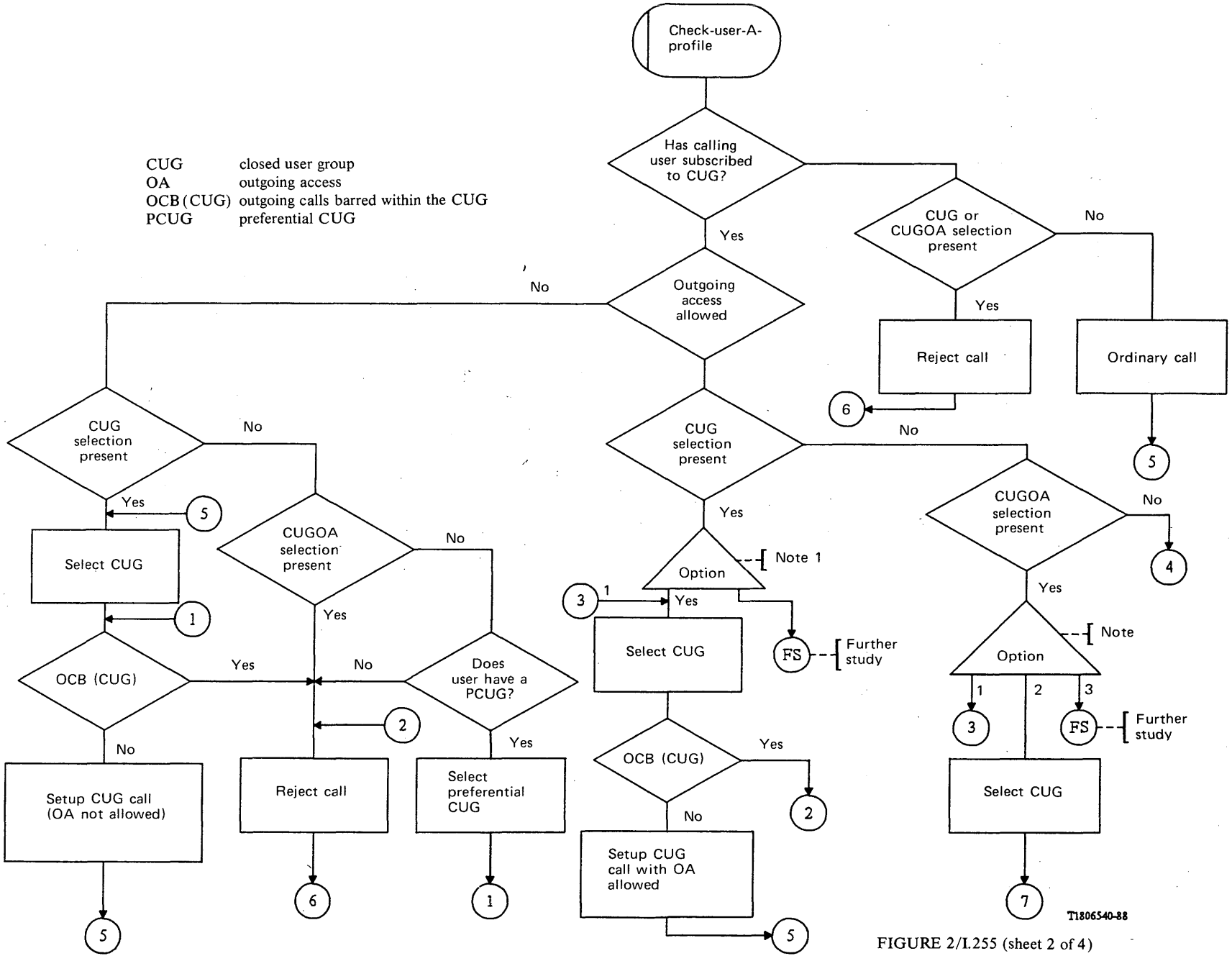


FIGURE 2/I.255 (sheet 2 of 4)

Closed User Group

Note – The option 2 applies for PDN networks and is for further study.

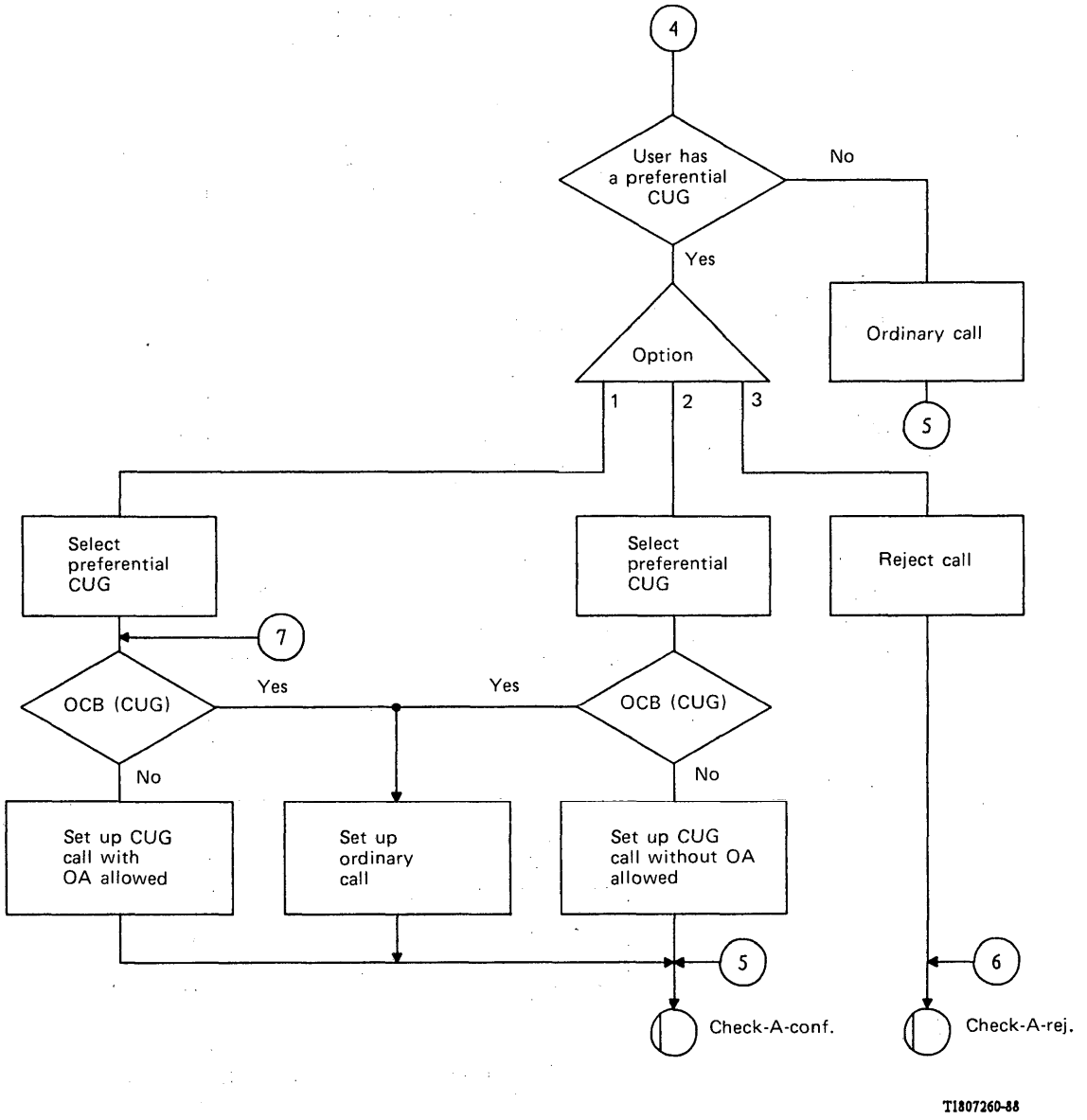
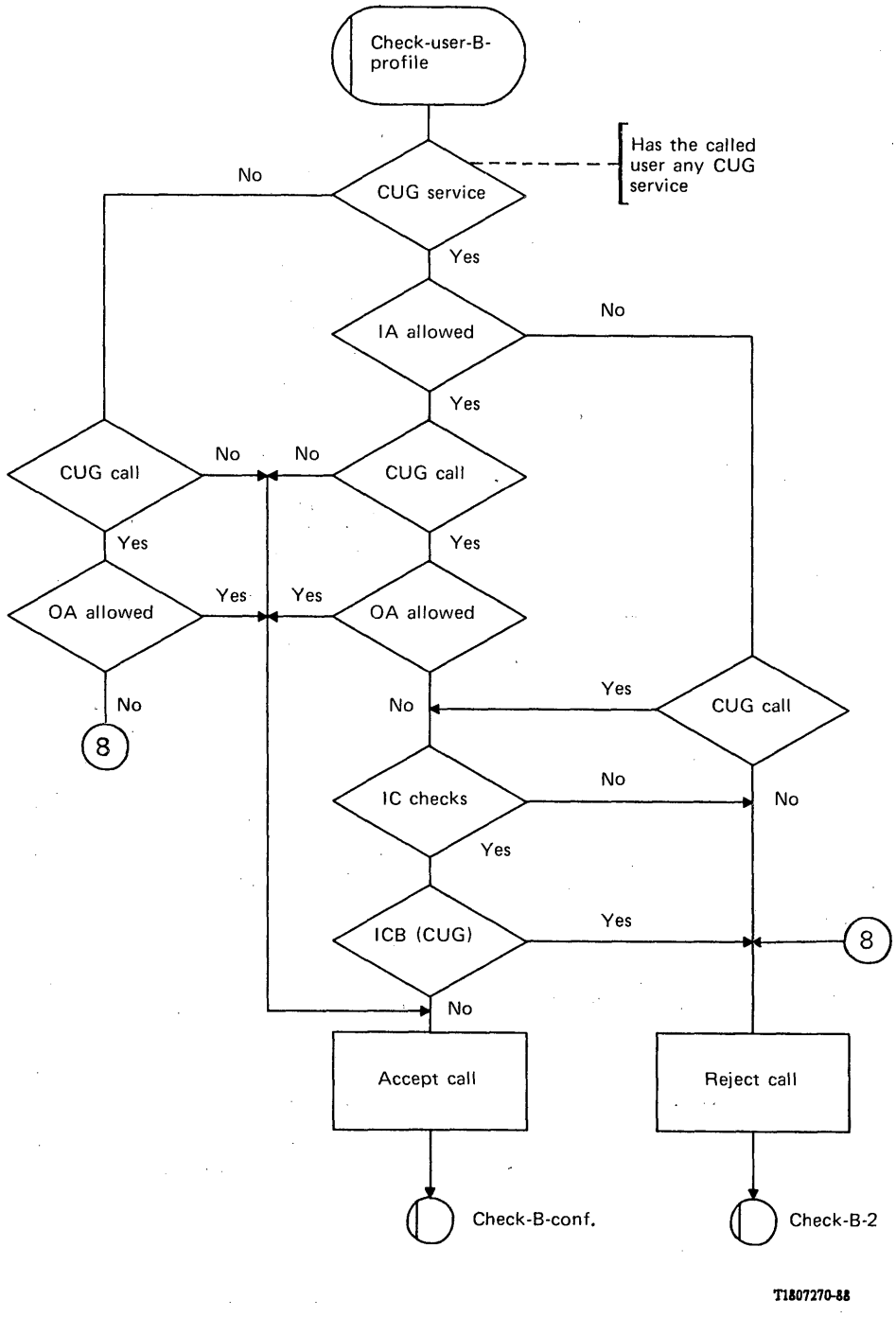


FIGURE 2/I.255 (sheet 3 of 4)

Closed User Group



IA incoming access
OA outgoing access
IC interlock code
ICB (CUG) incoming calls barred within the CUG

FIGURE 2/I.255 (sheet 4 of 4)

Closed User Group

CHARGING SUPPLEMENTARY SERVICES

(Melbourne, 1988)

The purpose of this Recommendation is to provide the stage 1 description of the technique defined in Recommendation I.130 using the means given in Recommendation I.210.

Supplementary services are described by a prose definition and description (step 1.1) and by a dynamic description (setp 1.3). The application of the attribute technique (step 1.2), as defined in Recommendation I.140, for supplementary services is for further study.

This Recommendation describes the following Charging supplementary services:

I.256.1 Credit Card Calling (CRED) (Note)

I.256.2 Advice of Charge (AOC)

I.256.3 Reverse Charging (REV) (Note)

1 I.256.1 – **Credit Card Calling**

This service, already identified, needs further study; its description is not yet included.

2 I.256.2 – **Advice of Charge**

Advice of Charge is a service allowing the user paying for a call to be informed of usage-based charging information. This service is not meant to replace the charge metering inside the network which is considered to be correct in all cases.

Advice of Charge may be of one or more of the following types:

- charging information at the end of the call (described in § 2.1)
- charging information during a call (described in § 2.2)
- charging information at call set-up time (described in § 2.3).

2.1 *Charging information at the end of the call*

2.1.1 *Definition*

The possibility for a user to receive charging information for a call when the call is released.

2.1.2 *Description*

2.1.2.1 *General description*

This type of Advice of Charge service provides a user with charging information for a call when the call is released. The charging information may consist of a number of elements such as:

a) type of Advice of Charge
   - charging at the end of a call

b) type of charging
   - free of charge
   - information on charged amount
     - number of charging units used
     - charge used
     - duration used
     - volume used
     - number of times used (Note)

       Note – Number of times should be used, for example, to charge a certain number of invocations of a supplementary service.

- information on charging rate
  - price per time unit and number of time units
  - price per volume unit and number of volume units
  - price per number of times unit and number of *number of times* units
  - duration per charging unit and number of charging units
  - volume per charging unit and number of charging units
  - *number of times* units per charging unit and number of charging units

c) usage charging element
- registration
- call attempt
- invocation
- duration
- volume
- network processing

d) billing identification
- normal charging
- reverse charging
- credit card charging

The selection of these values is a national matter.

2.1.2.2 *Specific terminology*

None identified.

2.1.2.3 *Qualifications on the applicability to telecommunication services*

This supplementary service is applicable to all telecommunication services.

2.1.3 *Procedures*

2.1.3.1 *Provision/withdrawal*

Charging information at the end of a call can be provided on a subscription basis or be generally available. Withdrawal can be at subscriber request or for administrative reasons.

2.1.3.2 *Normal procedures*

2.1.3.2.1 *Activation/deactivation/registration*

The service is activated/deactivated by the network, and no user procedures for activation/deactivation is needed. When the service is activated, it stays active for calls.

2.1.3.2.2 *Invocation and operation*

The service may be requested on a per call basis or it may be active for all calls. The charging information is provided by the local exchange at call clearing time. The charging information is transferred to the user in the charge advice information element within a call control message clearing the call.

2.1.3.3 *Exceptional procedures*

2.1.3.3.1 *Activation/deactivation/registration*

Not applicable.

2.1.3.3.2 *Invocation and operation*

If the charging information related to a call is not available at call clearing, the reason should be indicated to the user.

2.1.3.4 *Alternative procedures*

None identified.

2.1.4 *Network capabilities for charging*

This Recommendation does not cover charging principles. Future Recommendations in the D-Series are expected to contain that information.

It shall be possible to charge the subscriber accurately for the service.

2.1.5 *Interworking requirements*

This service should be supported across the internetwork interface between ISDNs. Other interworking cases are left for further study.

2.1.6 *Interactions with other supplementary services*

2.1.6.1 *Call Waiting*

No impact i.e. neither supplementary service affects the operation of the other supplementary service.

2.1.6.2 *Call Transfer*

Original calling user: no impact.

Transferring user: when a call is transferred and the transferring user is charged for the transferred part of the call, the charging information may be sent to the transferring user when the call is cleared, if the transferring user has subscribed to Advice of Charge supplementary service.

2.1.6.3 *Connected Line Identification Presentation*

No impact, i.e. neither supplementary service affects the operation of the other supplementary service.

2.1.6.4 *Connected Line Identification Restriction*

No impact, i.e. neither supplementary service affects the operation of the other supplementary service.

2.1.6.5 *Calling Line Identification Presentation*

No impact, i.e. neither supplementary service affects the operation of the other supplementary service.

2.1.6.6 *Calling Line Identification Restriction*

No impact, i.e. neither supplementary service affects the operation of the other supplementary service.

2.1.6.7 *Closed User Group*

No impact, i.e. neither supplementary service affects the operation of the other supplementary service.

2.1.6.8 *Conference Calling*

When the user has made a conference call, the overall charge for the conference call may be included in the charge advice information element.

Charges for the use of the conference bridge: this charging information may be sent to the conference controller. However, in some networks no charging information can be given in this case, e.g. due to off-line processing of the charges.

2.1.6.9 *Direct Dialling-In*

No impact, i.e. neither supplementary service affects the operation of the other supplementary service.

2.1.6.10 *Call Diversion (Call Forwarding) services*

2.1.6.10.1 *Call Forwarding Busy*

Original calling user: no impact.

Forwarding user: when a call is forwarded and the forwarding user is charged for the forwarded part of the call, the charging information may be transferred to the forwarding user when the call is cleared if the forwarding user has subscribed to the Advice of Charge supplementary service.

2.1.6.10.2 *Call Forwarding No Reply*

Original calling user: no impact.

Forwarding user: when a call is forwarded and the forwarding user is charged for the forwarded part of the call, the charging information may be transferred to the forwarding user when the call is cleared, if the forwarding user has subscribed to the Advice of Charge supplementary service.

2.1.6.10.3 *Call Forwarding Unconditional*

Original calling user: no impact.

Forwarding user: when a call is forwarded and the forwarding user is charged for the forwarded part of the call, the charging information may be transferred to the forwarding user when the call is cleared, if the forwarding user has subscribed to the Advice of Charge supplementary service.

2.1.6.11 *Line Hunting*

No impact, i.e. neither supplementary service affects the operation of the other supplementary service.

2.1.6.12 *Three-Party Service*

When the user has made an enquiry call or a three-party conference call, the overall charge for the call may be indicated in the charge advice information element.

Charges for the use of the three-party bridge: this charging information may be sent to the served user. However, in some networks no charging information can be given in this case, e.g. due to off-line processing of the charges.

2.1.6.13 *User-to-User Signalling*

No information concerning charges for user-to-user information will be given.

2.1.6.14 *Multiple Subscriber Number*

No impact, i.e. neither supplementary service affects the operation of the other supplementary service.

2.1.6.15 *Call Hold*

No impact, i.e. neither supplementary service affects the operation of the other supplementary service.

2.1.6.16 *Advice of Charge*

Not applicable.

2.1.7 *Dynamic description*

The dynamic description of this type of Advice of Charge service is shown in Figure 1/I.256.

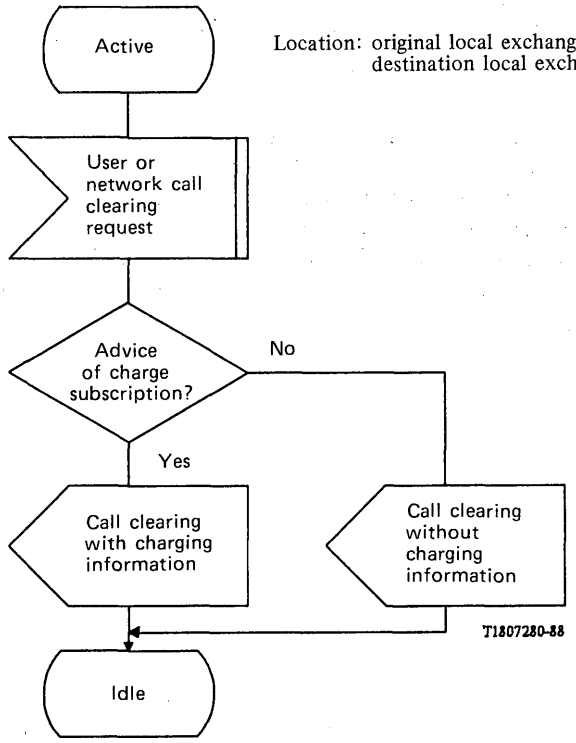


FIGURE 1/I.256

Charging information at the end of the call

2.2 *Charging information during a call*

2.2.1 *Definition*

The possibility for a user to receive charging information for a call during the active phase of the call.

2.2.2 *Description*

2.2.2.1 *General description*

This type of Advice of Charge provides the user with information that may be either incremental or cumulative and will be sent automatically or on request. The charging information may consist of a number of information elements such as:

a) type of Advice of Charge
   - incremental charging during a call, or
   - cumulative charging during a call

b) type of charging
   - free of charge
   - information charged amount
     - number of charging units used
     - charge used
     - duration used
     - volume used
     - number of times used (Note)

       Note – Number of times should be used, for example, to charge a certain number of invocations of a supplementary service.
   - information charging rate
     - price per time unit and number of time units
     - price per volume unit and number of volume units
     - price per number of times unit and number of *number of times* units
     - duration per charging unit and number of charging units
     - volume per charging unit and number of charging units
     - *number of times* units per charging unit and number of charging units

c) usage charging element
   - registration
   - call attempt
   - invocation
   - duration
   - volume
   - network processing

d) billing identification
   - normal charging
   - reverse charging
   - credit card charging

2.2.2.2 *Specific terminology*

Not applicable.

2.2.2.3 *Qualifications on the applicability to telecommunication services*

This supplementary service is applicable to all telecommunication services.

2.2.3 *Procedures*

2.2.3.1 *Provision/withdrawal*

Charging information during a call is provided on a subscription basis. Withdrawal can be at subscriber request or for administrative reasons.

2.2.3.2 *Normal procedures*

2.2.3.2.1 *Activation/deactivation/registration*

The service is activated/deactivated by the network, and no user procedures for activation/deactivation is needed. When the service is activated, it stays active for all calls.

2.2.3.2.2 *Invocation and operation*

The service may be requested on a per call basis or it may be active for all calls. The charging information is provided by the local exchange and is transferred to the user in an appropriate message each time N charging units have been added. N is a number between one and N_{max}, where N is a number specific to the network. The number of charging information units sent to the user may be limited to X units per minute. The value of X is a number specific to the network. If the charging information is provided only on request, the user must send an appropriate request to the network, which will then transfer the information in the Advice of Charge information element.

When the call is released:

- the remaining number of charging units, since the last transfer of charging information, is sent to the user in one of the call control messages clearing the call (incremental); or
- the overall charge for the call is sent to the user in one of the call control messages clearing the call (cumulative).

2.2.3.3 *Exceptional procedures*

2.2.3.3.1 *Activation/deactivation/registration*

Not applicable.

2.2.3.3.2 *Invocation and operation*

If the charging information related to a call is not available during the call, the reason should be indicated to the user.

2.2.3.4 *Alternative procedures*

None identified.

2.2.4 *Network capabilities for charging*

This Recommendation does not cover charging principles. Future Recommendations in the D-Series are expected to contain that information.

It shall be possible to charge the subscriber accurately for the service.

2.2.5 *Interworking requirements*

This service should be supported across the internetwork interface between ISDNs. Other interworking cases are left for further study.

2.2.6 *Interactions with other supplementary services*

2.2.6.1 *Call Waiting*

No impact, i.e. neither supplementary service affects the operation of the other supplementary service.

2.2.6.2 *Call Transfer*

Original calling user: no impact.

Transferring user: when a call is transferred and the transferring user is charged for the transferred part of the call, no charging information will be sent to the transferring user.

2.2.6.3 *Connected Line Identification Presentation*

No impact, i.e. neither supplementary service affects the operation of the other supplementary service.

2.2.6.4 *Connected Line Identification Restriction*

No impact, i.e. neither supplementary service affects the operation of the other supplementary service.

2.2.6.5 *Calling Line Identification Presentation*

No impact, i.e. neither supplementary service affects the operation of the other supplementary service.

2.2.6.6 *Calling Line Identification Restriction*

No impact, i.e. neither supplementary service affects the operation of the other supplementary service.

2.2.6.7 *Closed User Group*

No impact, i.e. neither supplementary service affects the operation of the other supplementary service.

2.2.6.8 *Conference Calling*

Charges for the different connections to the conference bridge: no interaction.

Charges for the use of the conference bridge: this charging information may be sent to the conference controller. However, in some networks no charging information can be given in this case, e.g. due to off-line processing of the charges.

2.2.6.9 *Direct Dialling-In*

No impact, i.e. neither supplementary service affects the operation of the other supplementary service.

2.2.6.10 *Call Diversion (Call Forwarding) services*

2.2.6.10.1 *Call Forwarding Busy*

Original calling user: no impact.

Forwarding user: when a call is forwarded and the forwarding user is charged for the forwarded part of the call, the charging information may be transferred to the forwarding user when the call is cleared, if the forwarding user has subscribed to the Advice of Charge supplementary service.

2.2.6.10.2 *Call Forwarding No Reply*

Original calling user: no impact.

Forwarding user: when a call is forwarded and the forwarding user is charged for the forwarded part of the call, the charging information may be transferred to the forwarding user when the call is cleared, if the forwarding user has subscribed to the Advice of Charge supplementary service.

2.2.6.10.3 *Call Forwarding Unconditional*

Original calling user: no impact.

Forwarding user: when a call is forwarded and the forwarding user is charged for the forwarded part of the call, the charging information may be transferred to the forwarding user when the call is cleared, if the forwarding user has subscribed to the Advice of Charge supplementary service.

2.2.6.11 *Line Hunting*

No impact, i.e. neither supplementary service affects the operation of the other supplementary service.

2.2.6.12 *Three-Party Service*

Charges for the different connections within the service: no interaction.

Charges for the use of the three-party bridge: this charging information may be sent to the served user. However, in some networks no charging information can be given in this case, e.g. due to off-line processing of the charges.

2.2.6.13 *User-to-User Signalling*

No information concerning charges for user-to-user information will be given.

2.2.6.14 *Multiple Subscriber Number*

No impact, i.e. neither supplementary service affects the operation of the other supplementary service.

2.2.6.15 *Call Hold*

No impact, i.e. neither supplementary service affects the operation of the other supplementary service.

2.2.6.16 *Advice of Charge*

Not applicable.

2.2.7 *Dynamic description*

The dynamic description of this service is shown in Figure 2/I.256 to 6/I.256.

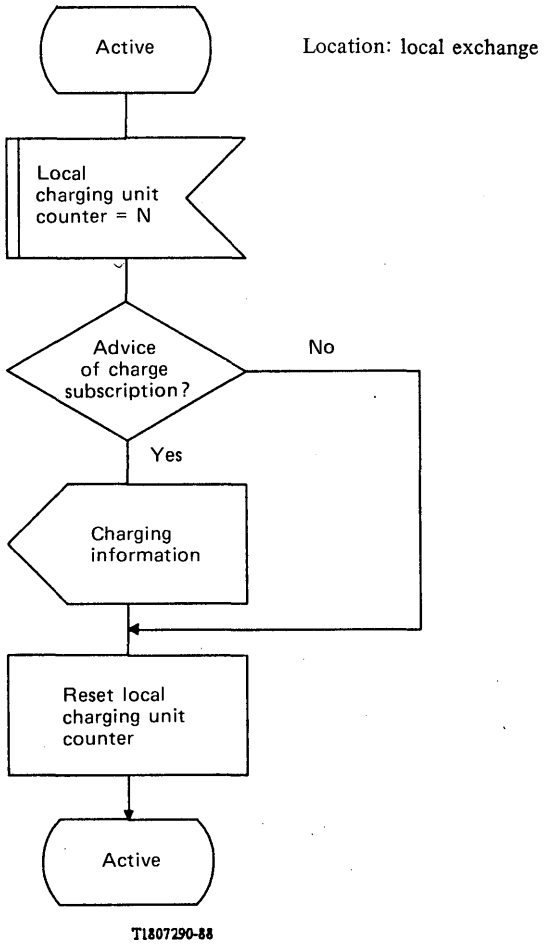


FIGURE 2/I.256

Charging information — incremental information during a call

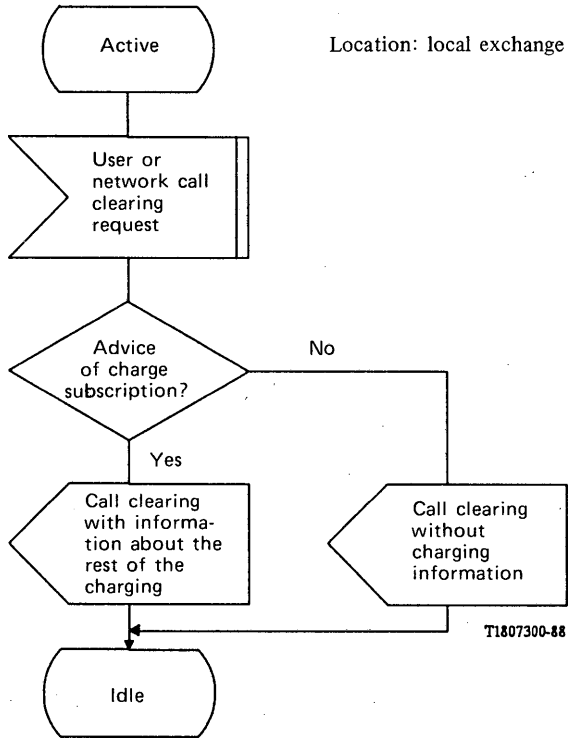


FIGURE 3/I.256

Charging information — incremental information at call clearing

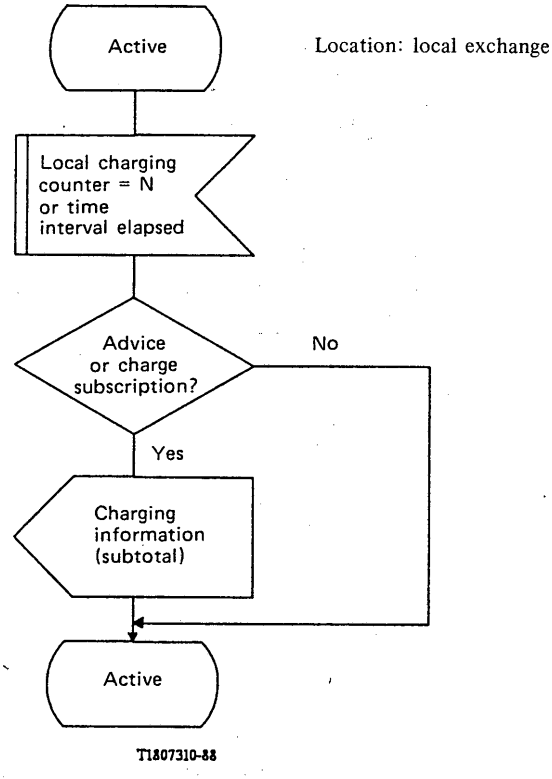


FIGURE 4/I.256

Charging information — cumulative information during a call

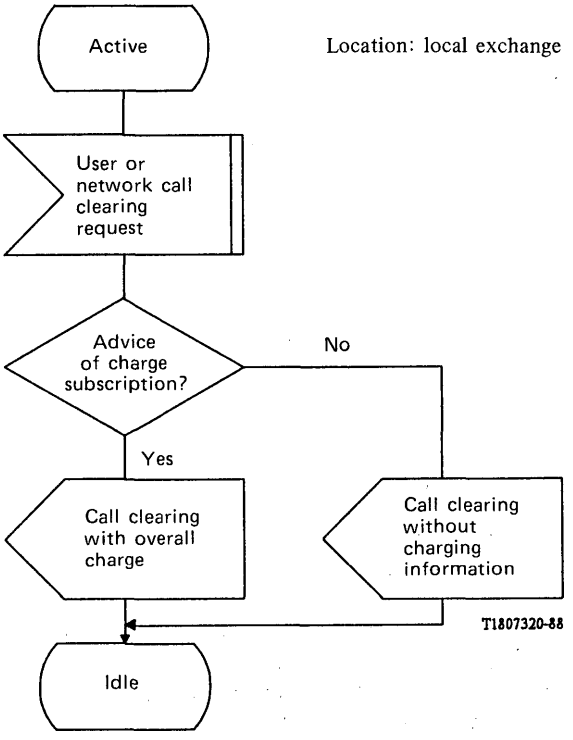


FIGURE 5/I.256

Charging information — cumulative information at call clearing

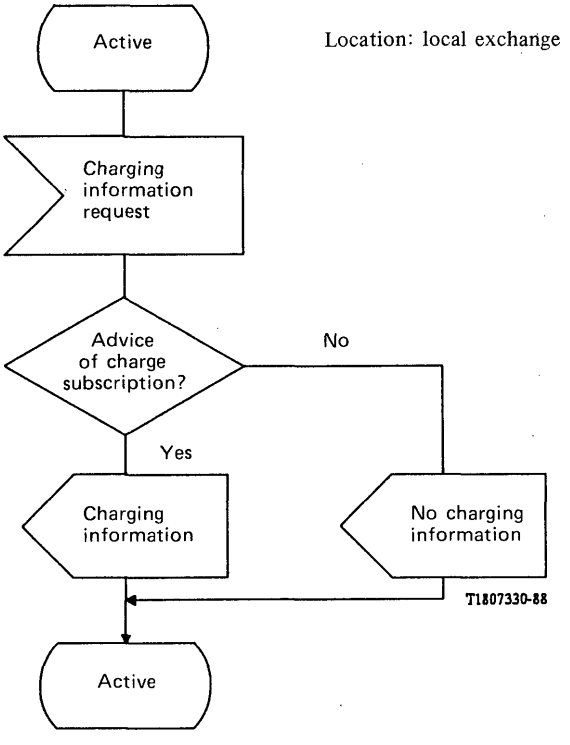


FIGURE 6/I.256

Charging information — request for charging information during a call

2.3 *Charging information at call set-up time*

2.3.1 *Definition*

The possibility for a user to receive information about the charging rates at call set-up time and possible change of charging rates during the call.

2.3.2 *Description*

2.3.2.1 *General description*

This type of Advice of Charge provides the user with the possibility to receive information about the charging rates at call establishment. In addition the user will be informed if a change in charging rates takes place during the call. The charging information may consist of a number of elements such as:

a) type of Advice of Charge
   - charging rate information

b) type of charging
   - free of charge
   - information on charging rate
     - price per time unit and number of time units
     - price per volume unit and number of volume units
     - price per number of times unit and number of *number of times* units
     - duration per charging unit and number of charging units
     - volume per charging unit and number of charging units
     - *number of times* units per charging unit and number of charging units

c) usage charging element
   - registration
   - call attempt
   - invocation
   - duration
   - volume
   - network processing

d) billing identification
   - normal charging
   - reverse charging
   - credit card charging

2.3.2.2 *Specific terminology*

Not applicable.

2.3.2.3 *Qualifications on the applicability to telecommunication services*

This supplementary service is applicable to all telecommunication services.

2.3.3 *Procedures*

2.3.3.1 *Provision/withdrawal*

The possibility to receive information about the charging rates is provided on a subscription basis or may be generally available.

2.3.3.2 *Normal procedures*

2.3.3.2.1 *Activation/deactivation/registration*

The service is activated by the network, and no user procedures for activation/deactivation is needed. When the service is activated, it stays active for all calls.

2.3.3.2.2 *Invocation and operation*

The service may be requested on a per call basis or it may be active for all calls. The charging information is provided by the network during the call establishment phase or, at the latest, at call connection. The information is transferred to the user in the charge advice information element in the call control message.

When there is a change in the charging interval during the call, the network sends information about the new charging interval. This information is sent in the Advice of Charge information element.

2.3.3.3 *Exceptional procedures*

2.3.3.3.1 *Activation/deactivation/registration*

Not applicable.

2.3.3.3.2 *Invocation and operation*

If the charging information related to a call is not available, the reason should be indicated to the user.

2.3.3.4 *Alternative procedures*

None identified.

2.3.4 *Network capabilities for charging*

This Recommendation does not cover charging principles. Future Recommendations in the D-Series are expected to contain that information.

It shall be possible to charge the subscriber accurately for the service.

2.3.5 *Interworking requirements*

This service should be supported across the internetwork interface between ISDNs.

2.3.6 *Interaction with other supplementary services*

2.3.6.1 *Call Waiting*

No impact i.e. neither supplementary service affects the operation of the other supplementary service.

2.3.6.2 *Call Transfer*

Original calling user: no impact.

Transferring user: charging information may be sent to the transferring user at the time he establishes the call to the transferred-to party and when the resulting call is established. This is to inform the transferring user of the charges he will continue to be responsible for.

2.3.6.3 *Connected Line Identification Presentation*

No impact, i.e. neither supplementary service affects the operation of the other supplementary service.

2.3.6.4 *Connected Line Identification Restriction*

No impact, i.e. neither supplementary service affects the operation of the other supplementary service.

2.3.6.5 *Calling Line Identification Presentation*

No impact, i.e. neither supplementary service affects the operation of the other supplementary service.

2.3.6.6 *Calling Line Identification Restriction*

No impact, i.e. neither supplementary service affects the operation of the other supplementary service.

2.3.6.7 *Closed User Group*

No impact, i.e. neither supplementary service affects the operation of the other supplementary service.

2.3.6.8 *Conference Calling*

The user should be informed about the charging rate for each leg of the conference call.

Charges for the user of the conference bridge: this charging information may be sent to the conference controller. However, in some networks no charging information can be given in this case.

2.3.6.9 *Direct Dialling-In*

No impact i.e. neither supplementary service affects the operation of the other supplementary service.

2.3.6.10 *Call Diversion (Call Forwarding) services*

2.3.6.10.1 *Call Forwarding Busy*

No impact, i.e. neither supplementary service affects the operation of the other supplementary service.

2.3.6.10.2 *Call Forwarding No Reply*

No impact, i.e. neither supplementary service affects the operation of the other supplementary service.

2.3.6.10.3 *Call Forwarding Unconditional*

No impact, i.e. neither supplementary service affects the operation of the other supplementary service.

2.3.6.11 *Line Hunting*

No impact, i.e. neither supplementary service affects the operation of the other supplementary service.

2.3.6.12 *Three-Party Service*

The user should be informed about the charging rate for each leg of the call.

Charges for the use of the three-party bridge: this charging information may be sent to the conference controller. However, in some networks no charging information can be given in this case.

2.3.6.13 *User-to-User Signalling*

No information concerning charges for user-to-user information will be given.

2.3.6.14 *Multiple Subscriber Number*

No impact, i.e. neither supplementary service affects the operation of the other supplementary service.

2.3.6.15 *Call Hold*

No impact, i.e. neither supplementary service affects the operation of the other supplementary service.

2.3.6.16 *Advice of Charge*

Not applicable.

2.3.7 *Dynamic description*

The dynamic description of this type of Advice of Charge is shown in Figures 7/I.256 and 8/I.256.

3 I.256.3 – **Reverse charging**

This service, already identified, needs further study; its description is not yet included.

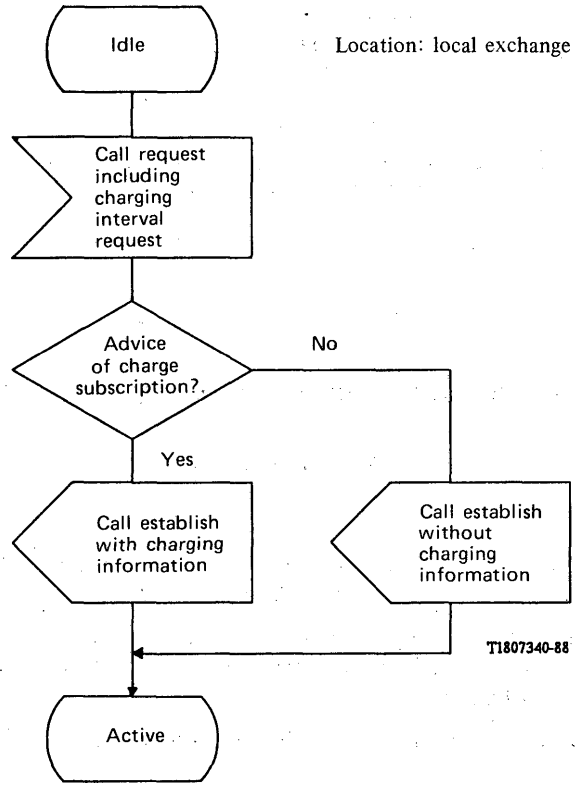


FIGURE 7/I.256

Charging information — charging interval request at call set-up time

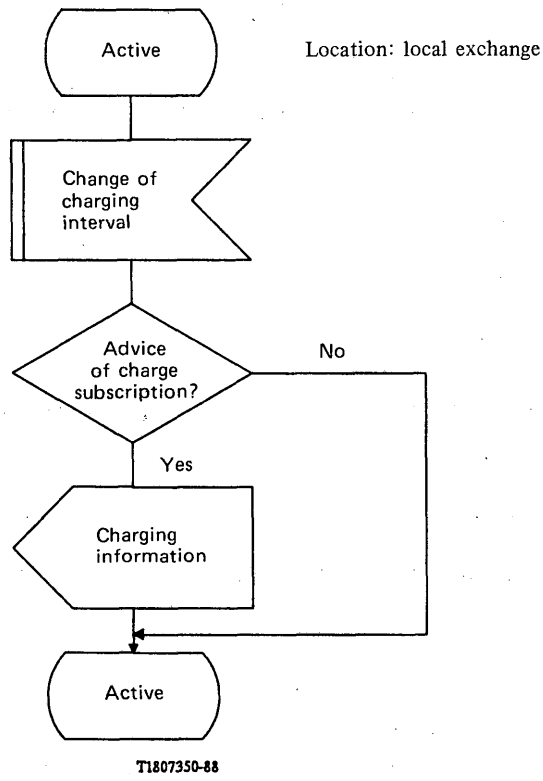


FIGURE 8/I.256

Charging information — change of charging interval at the active phase of a call

Recommendation I.257

ADDITIONAL INFORMATION TRANSFER

(Melbourne, 1988)

The purpose of this Recommendation is to provide the stage 1 description of the method defined in Recommendation I.130 using the means given in Recommendation I.210.

Supplementary services are described by a prose definition and description (step 1.1) and by a dynamic description (step 1.3). The application of the attribute technique (step 1.2), as defined in Recommendation I.140, for supplementary technique is for further study.

This Recommendation describes the following additional information transfer supplementary service.

1 I.257.1 – User-to-User Signalling (UUS)

1.1 *Definition*

The User-to-User Signalling (UUS) supplementary service allows an ISDN user to send/receive a limited amount of information to/from another ISDN user over the signalling channel in association with a call to the other ISDN user.

Note – These procedures are applicable to User-to-User Information (UUI) transfer in association with a circuit-switched telecommunication service only. Procedures to permit UUI transfer in association with other types of calls (e.g. packet bearer services) need to be investigated.

1.2 *Description*

1.2.1 *General description*

User-to-User Signalling (UUS) allows the user to send/receive a limited amount of user generated information to/from another user-network interface. This information is passed transparently (i.e. without modification of contents) through the network. Normally, the network will not interpret or act upon this information.

Services 1, 2, and 3 allow the transmission of 128 octets per message as a maximum.

Note – During an interim period of time, some networks may support 32 octets on one or more of the services. After this period, 32 octets will always be supported. Restrictions may apply to calls requesting UUI of more than 32 octets. Limitations are also placed on the amount of information a user is permitted to transfer in a given time period (e.g. limitations can be placed on the number of messages transmitted or on the throughput).

The user can transfer UUI in different phases of the call depending on the service(s) to which the user subscribes. These are:

- *Service 1*: the transfer of UUI during the set-up and clearing phases of a call, with UUI embedded within call control messages;
- *Service 2*: the transfer of UUI during the set-up phase of call, transferred independently of call control messages. From the sender's point of view UUI is sent prior to the active phase of the call (i.e. prior to the acceptance of the call at the distant exchange). This same UUI may, as a service provider option, be received by the terminating exchange and delivered to the user during the active phase of the call;
- *Service 3*: the transfer of UUI during the active phase of a call, transferred independently of call control messages.

In a point-to-multipoint arrangement at the called party the following Service 1 UUI transfer is allowed:

- in the forward direction: UUI will only be accepted if it is contained in either the initial set-up or the first clearing message. In the case of premature clearing, UUI will be delivered to terminals which have at this point in time already acknowledged the call;
- in the backward direction: UUI will only be accepted by the network at the called interface from a terminal which is selected (see Note). This means that a terminal in a multipoint configuration at the called interface is not allowed to send UUI Service 1 information with the alerting indication to the calling party;
- if the call never reaches the active phase (e.g. in case of call rejection), and if multiple responses are received, only one UUI which was sent from the called party will be transferred to the calling party.

Note – A selected terminal is the terminal behind the called interface that the service provider considers or elects as the terminal to be in the active phase of a call.

Preferably, UUS Service 2 should be used in point-to-point configurations. In a multipoint configuration, Service 2 may, from a user's perspective, lead to an incorrect view of the service.

1.2.2 *Specific terminology*

None identified.

1.2.3 *Qualification on the applicability to telecommunication services*

Restrictions can only be identified for telecommunication services which are based on the X.31 packet mode bearer services and their future enhancement.

1.3 *Procedures*

1.3.1 *Provision/withdrawal*

Services 1, 2 and 3 must be subscribed to by the calling user to whom billing will apply. Whether these component services are offered to the user as separate supplementary services or in any particular combination is a service provider option.

1.3.2 *Normal procedures*

1.3.2.1 *Activation/deactivation/registration*

UUS Services 1 and 2, must be requested by the calling user a the set-up of the call if UUI transfer is desired in either direction. Service 3 may be requested by the calling or, as a service provider option, by the called user at call set-up or during the set-up or active state of the call.

Note – Depending on the network connection selected at call set-up, the request for Service 3 during the set-up or active phase of the call may fail.

Once a UUS service is activated (see Note), the network will accept UUI in both directions according to the subscription of the calling user.

Note – Activation means request of UUS. Invocation means submission of UUI.

Services 2 and 3 must be explicitly requested. Service 1 may be explicitly or implicitly requested. The service is implicitly requested when UUI is included in the call request (i.e. the service is requested at the same time it is invoked).

On a per call basis the calling user should be able to specify the desired UUS service(s) according to the service options offered by the service provider.

As an option, at call set-up, users whould be able to specify whether the requested UUS service is required for the call, i.e. if the call should be completed or not if UUI cannot be passed. If the UUI-required indication is given by the user, the call will not be completed if UUI cannot be passed to the destination user. If the UUI-required indication is not given by the user, the call will be completed even if UUI cannot be passed. If UUS Service 3 is requested during the call it cannot be requested as 'UUI required'.

For Services 2 and 3 the network will confirm the UUS service request. This confirmation is preceeded by an end-to-end check by the network for service availability.

For Services 2 and 3 the network should interrogate the destination user concerning service availability. No response from the destination user is taken as a rejection of the UUS request by the network. The network should explicitly indicate to the origination user whether the requested service(s) has been (are) successfully activated or not. In the case of unsuccessful activation, the network should indicate whether or not the condition is due to unavailability of the destination user (see § 1.3.3).

Note – The terms "originating" and "destination" refer to the origination or destination of the UUS request.

When Service 1 is explicitly requested, the network will inform the destination user of the request. The destination user should accept or reject the activation as described for Services 2 and 3.

1.3.2.2 *Invocation and operation*

A user wishing to send UUI will be informed by the network as part of normal call establishment if there is not sufficient signalling connectivity to allow the transfer of UUI. Confirmation of delivery is not provided by the network. The network does not expect any confirmation of UUI acceptance from the destination.

1.3.2.2.1 *Service 1*

If authorized, an ISDN user may transfer a limited amount of user-generated information when initiating, accepting, rejecting, or clearing a call.

It is possible for a calling user to request UUI transfer with a call set-up and to terminate the call before a connection is established.

1.3.2.2.2 *Service 2*

Any time after the explicit confirmation of the UUS service request is received from the network, an ISDN user may transfer a limited amount of user-generated information (two messages in each direction) to the other user involved in the call.

1.3.2.2.3 *Service 3*

If explicit confirmation of the USS service request has been received from the network, an ISDN user may, during the active phase of a call, transfer a limited amount of user-generated information to the other user on the call.

1.3.3 *Exceptional procedures*

1.3.3.1 *Activation/deactivation/registration*

If the network cannot accept a request for UUI transfer, notification with cause will be returned to the served user. Possible reasons for rejection are:

1) service not subscribed to;
2) calling or called user is not an ISDN user;
3) protocol error;
4) necessary inter-office signalling connectivity does not exist between sending and receiving users;
5) user constraints prohibit activation/invocation of service between calling and called users (e.g. CUG);
6) network congestion.

Note – If UUI contained in a set-up message cannot be transferred for reasons 2) or 5) notification will not be provided until after the network has received a response to the set-up message, since the network does not know *a priori* whether UUI can be transferred or not.

When the invocation of Services 2 or 3 is not understood by the service provider or by the called user, no explicit rejection is sent to the calling user. This lack of acknowledgement must be interpreted as a rejection.

1.3.3.2 *Invocation and operation*

The user may not be able to interpret incoming UUI. In such a situation, the user should discard this information without disrupting normal call handling. No specific signalling is provided by the network to accommodate this situation.

UUI sent near or at the end of a call may not reach its destination, e.g. if the called party initiates disconnection procedures prior to the arrival of the UUI. At all other times, however, the network offers high probability that messages will be delivered correctly.

Under circumstances of network congestion or failure, the network may discard Service 2 and Service 3 UUI. Users desiring to have confirmed UUI delivery must employ their own end-to-end protocols (i.e. acknowledgement of receipt by another UUI).

In case of excessive UUI length, no truncation is performed by the service provider. UUI information is discarded and the user will be informed.

1.3.4 *Alternative procedures*

1.3.4.1 *Activation/deactivation/registration*

None identified.

1.3.4.2 *Invocation and operation*

None identified.

1.4 *Network capabilities for charging*

This Recommendation does not cover charging principles. Future Recommendations in the D-Series are expected to contain that information.

It shall be possible to charge the subscriber accurately for the service.

1.5 *Interworking requirements*

UUI can be delivered only when both users are ISDN subscribers or when a non-ISDN network provides a means of conveying the UUI.

1.6 *Interaction with other supplementary services*

1.6.1 *Call Waiting*

Calling user: any UUI included in the call set-up message will be delivered with the call waiting indication. UUI can be sent by the calling user to the called user during the call alerting period.

Called user: if a Call Waiting user also uses UUI, he can include UUI with the rejection of the call. UUI can be sent by the called user to the calling user during the call alerting period.

Note – See § 1.2 for restrictions on point-to-multipoint arrangements.

1.6.2 *Call Transfer*

See Call Transfer interaction with User-to-User Signalling in Rec. I.252, § 1.

1.6.3 *Connected Line Identification Presentation*

No impact, i.e. neither supplementary service affects the operation of the other supplementary service.

1.6.4 *Connected Line Identification Restriction*

No impact, i.e. neither supplementary service affects the operation of the other supplementary service.

1.6.5 *Calling Line Identification Presentation*

No impact, i.e. neither supplementary service affects the operation of the other supplementary service.

1.6.6 *Calling Line Identification Restriction*

No impact, i.e. neither supplementary service affects the operation of the other supplementary service.

1.6.7 *Closed User Group*

No impact, i.e. neither supplementary service affects the operation of the other supplementary service.

1.6.8 *Conference Calling*

See Conference Calling interaction with User-to-User Signalling, Rec. I.254, § 1.

1.6.9 *Direct Dialling-In*

No impact, i.e. neither supplementary service affects the operation of the other supplementary service.

1.6.10 *Call Diversion (Call Forwarding) services*

1.6.10.1 *Call Forwarding Busy*

See Call Forwarding Busy interaction with User-to-User Signalling, Rec. I.252, § 2.

1.6.10.2 *Call Forwarding No Reply*

See Call Forwarding No Reply interaction with User-to-User Signalling, Rec. I.252, § 3.

1.6.10.3 *Call Forwarding Unconditional*

See Call Forwarding Unconditional interaction with User-to-User Signalling, Rec. I.252, § 4.

1.6.11 *Line Hunting*

No impact, i.e. neither supplementary service affects the operation of the other supplementary service.

1.6.12 *Three-Party service*

See Three-Party service interaction with UUS, Rec. I.254, § 2.

1.6.13 *User-to-User Signalling*

Not applicable.

1.6.14 *Multiple Subscriber Number*

No impact, i.e. neither supplementary service affects the operation of the other supplementary service.

1.6.15 *Call Hold*

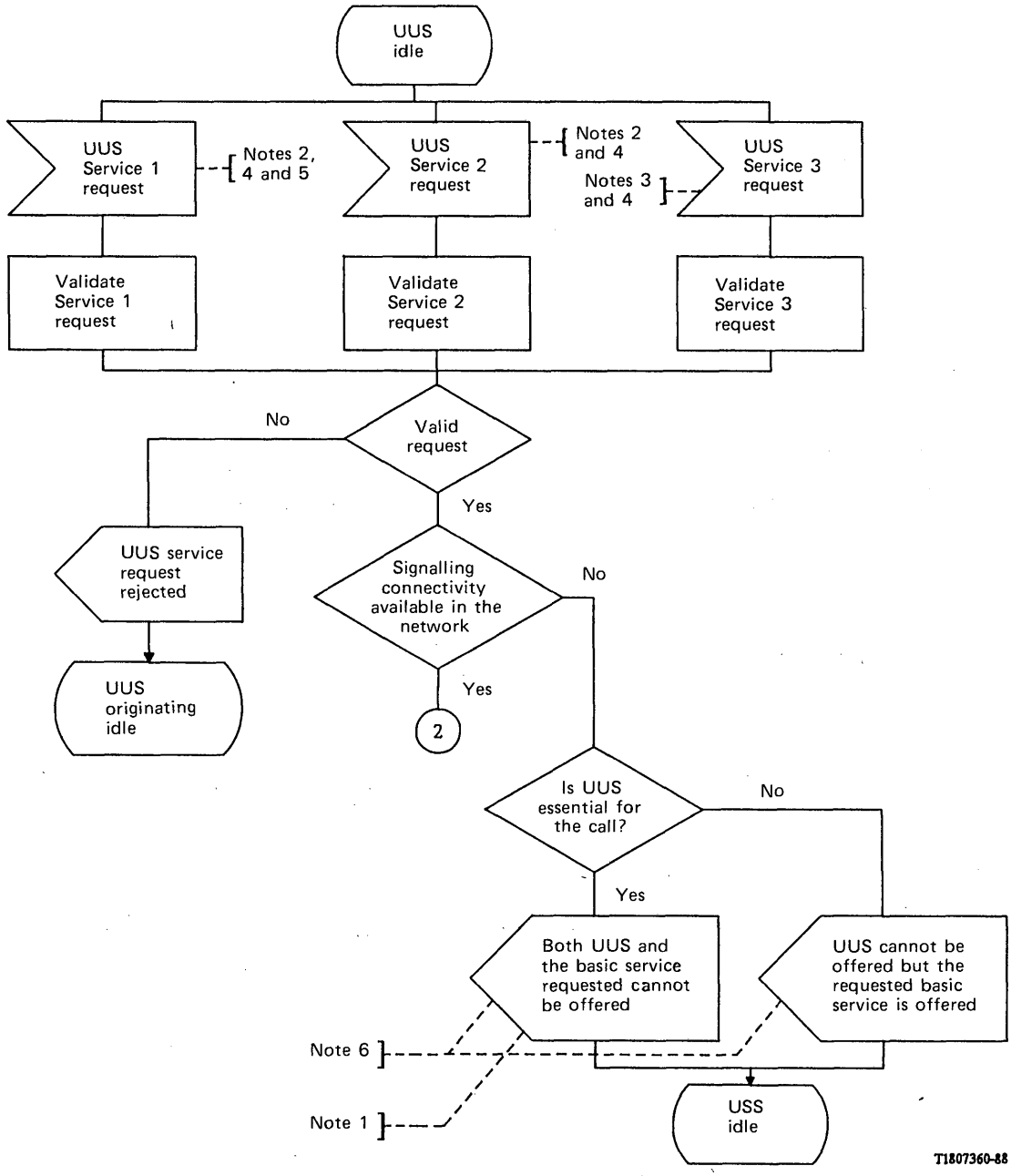
See Call Hold interaction with User-to-User Signalling, Rec. I.253, § 2.

1.6.16 *Advice of Charge*

See Advice of Charge interaction with User-to-User Signalling, Rec. I.256, § 2.

1.7 *Dynamic description*

The dynamic description of this service is shown in Figure 1/I.257.



Note 1 – The call is cleared.

Note 2 – This service must be requested at call set-up by the calling user.

Note 3 – This Service 3 may be requested at call set-up or during the active phase of the call by the calling user and during the active phase of the call by the called user.

Note 4 – As an option, at call set-up, users should be able to specify whether the requested UUS service is essential or non-essential for the call.

Note 5 – Service 1 may be explicitly or implicitly requested.

Note 6 – The reasons for rejections are given in § 1.3.3.

FIGURE 1/I.257 (sheet 1 of 3)

User-to-User Signalling

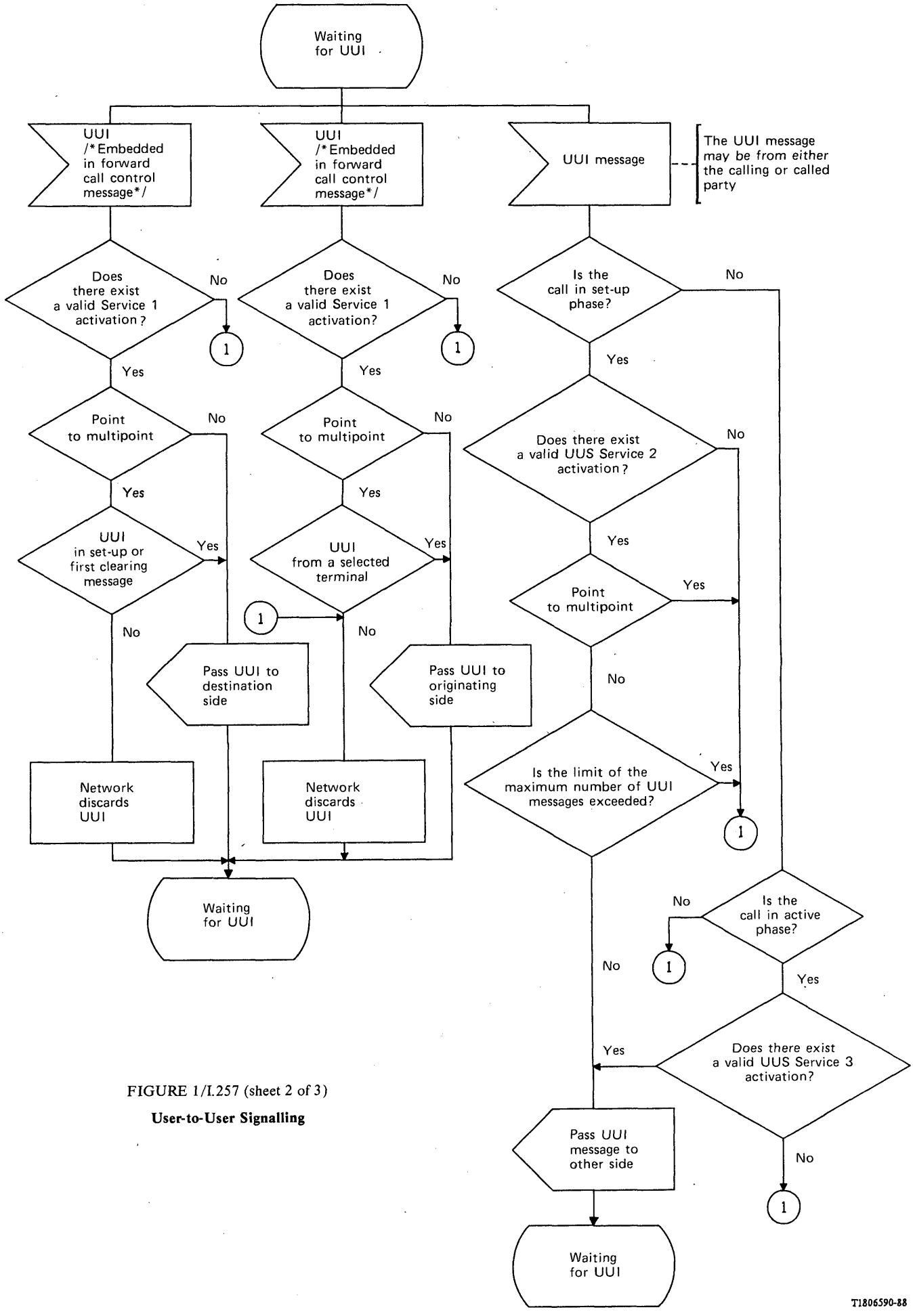
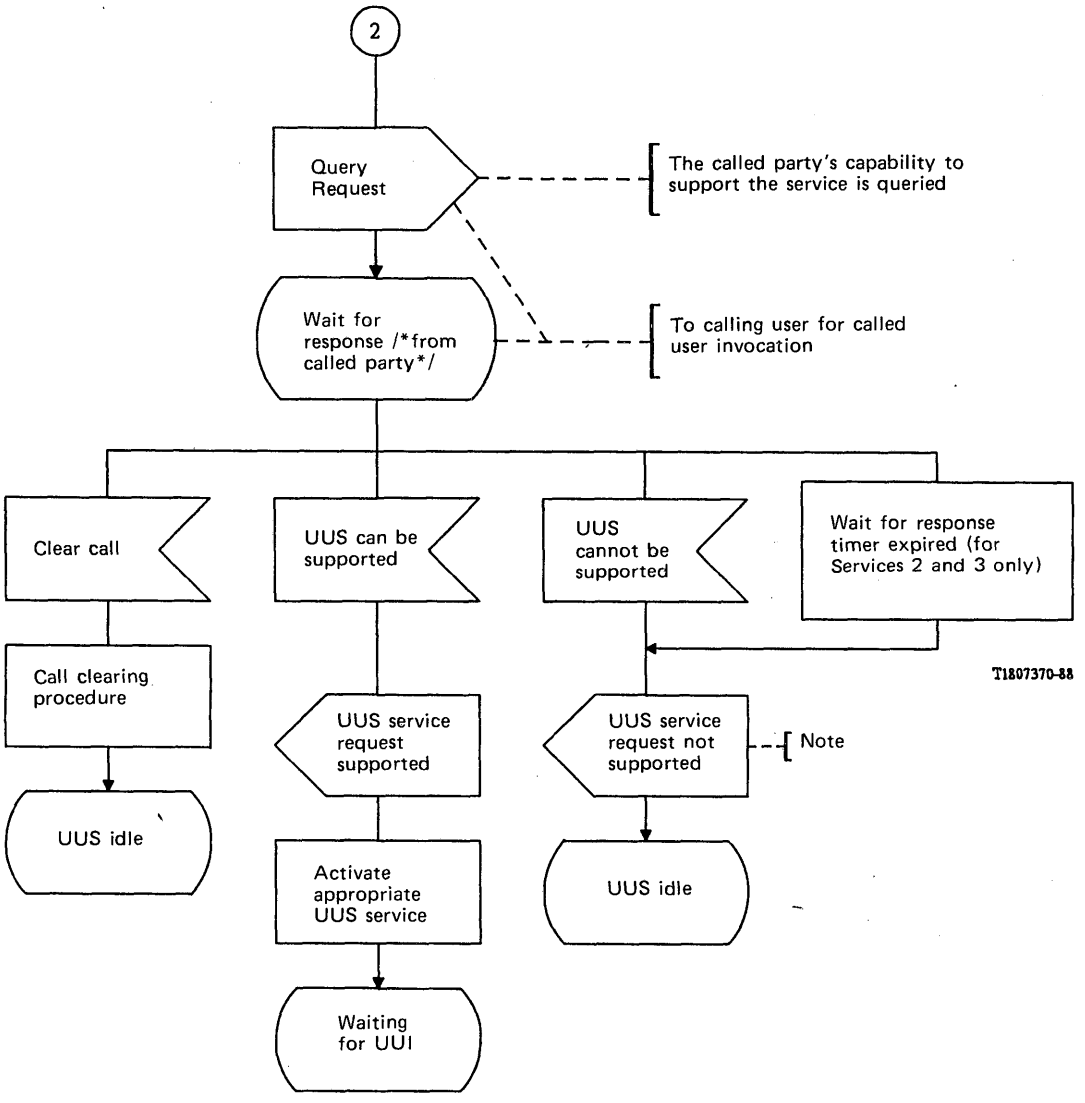


FIGURE 1/I.257 (sheet 2 of 3)

User-to-User Signalling



Note – The reasons for rejections are given in § 1.3.3.

FIGURE 1/I.257 (sheet 3 of 3)

User-to-User Signalling

ISBN 92-61-03371-7