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SERIES Q: SWITCHING AND SIGNALLING

Broadband ISDN – B-ISDN application protocols for the network signalling

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Functional description of the B-ISDN user part (B-ISUP) of signalling system No. 7

ITU-T Recommendation Q.2761

(Formerly CCITT Recommendation)

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ITU-T RECOMMENDATION Q.2761

FUNCTIONAL DESCRIPTION OF THE B-ISDN USER PART (B-ISUP) OF SIGNALLING SYSTEM No. 7

Summary

This Recommendation is one of a set of Recommendations that describe the Broadband ISDN User Part. It specifies an overview of the signalling capabilities and functions required to support basic call and bearer services, additional features and supplementary services for B-ISDN applications.

The scope of the B-ISDN User Part covers international B-ISDN networks. However, the B-ISDN User Part is suitable for national applications. Most signalling procedures, information elements and message types specified for international use are also required in typical national applications.

Source

ITU-T Recommendation Q.2761 was revised by ITU-T Study Group 11 (1997-2000) and was approved under the WTSC Resolution No. 1 procedure on 3 December 1999.

FOREWORD

ITU (International Telecommunication Union) is the United Nations Specialized Agency in the field of telecommunications. The ITU Telecommunication Standardization Sector (ITU-T) is a permanent organ of the ITU. The ITU-T is responsible for studying technical, operating and tariff questions and issuing Recommendations on them with a view to standardizing telecommunications on a worldwide basis.

The World Telecommunication Standardization Conference (WTSC), which meets every four years, establishes the topics for study by the ITU-T Study Groups which, in their turn, produce Recommendations on these topics.

The approval of Recommendations by the Members of the ITU-T is covered by the procedure laid down in WTSC Resolution No. 1.

In some areas of information technology which fall within ITU-T's purview, the necessary standards are prepared on a collaborative basis with ISO and IEC.

NOTE

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

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As of the date of approval of this Recommendation, the ITU had not received notice of intellectual property, protected by patents, which may be required to implement this Recommendation. However, implementors are cautioned that this may not represent the latest information and are therefore strongly urged to consult the TSB patent database.

CONTENTS

Recommendation Q.2761

FUNCTIONAL DESCRIPTION OF THE B-ISDN USER PART (B-ISUP) OF SIGNALLING SYSTEM No. 7

(Geneva, 1999)

1 Scope

This Recommendation specifies an overview of the signalling capabilities and functions required to support basic call and bearer services and supplementary services for B-ISDN applications. The B-ISDN User Part protocol will form the basis for future capability sets of B-ISDN signalling protocols.

The B-ISDN User Part is applicable to international B-ISDN networks. At transit nodes the B-ISDN User Part supports the N-ISUP services depicted in ISUP 1997 Recommendations.

Furthermore, the B-ISDN User Part is suitable for national applications. Most signalling procedures, information elements and message types specified for international use are also required in typical national applications. Moreover, coding space has been reserved in order to allow national Administrations and recognized operating agencies to introduce network specific signalling messages and elements of information within the internationally standardized protocol structure.

Architecturally, the B-ISDN User Part can be viewed as a set of functional blocks each representative of a particular type of protocol function. This architectural separation can be seen in Figure 1. The B-ISDN User Part makes use of the services provided by the Message Transfer Part (MTP) level 3.

This Recommendation is one of a set of Recommendations that describe the Broadband ISDN User Part. Other ITU-T Recommendations in this group include:

– ITU-T Recommendation Q.2610 (1999), *Usage of course and location in B-ISDN User Part and DSS2*.

– ITU-T Recommendation Q.2650 (1999), *Interworking between Signalling System No. 7 Broadband ISDN User Part (B-ISUP) and Digital Subscriber Signalling System No. 2 (DSS2)*.

– ITU-T Recommendation Q.2660 (1999), *Interworking between Signalling System No. 7 Broadband ISDN User Part (B-ISUP) and Narrow-band ISDN User Part (N-ISUP)*.

– ITU-T Recommendation Q.2722.1 (1996), *B-ISDN User Part – Network node interface specification for point-to-multipoint call/connection control*.

– ITU-T Recommendation Q.2724.1 (1996), *B-ISDN User Part – Look-ahead without state change for the network node interface.*

– ITU-T Recommendation Q.2726.2 (1996), *B-ISDN User Part – Call priority*.

– ITU-T Recommendation Q.2726.3 (1996), *B-ISDN User Part – Network generated session identifier*.

– ITU-T Recommendation Q.2726.4 (1997), *Extensions to the B-ISDN User Part – Application generated identifiers.*

– ITU-T Recommendation Q.2730 (1999), *Signalling System No. 7 B-ISDN User Part (B-ISUP) – Supplementary services*.

– ITU-T Recommendation Q.2735.1 (1997), *Stage 3 description for community of interest supplementary services for B-ISDN using SS No. 7: Closed User Group (CUG).*

– ITU-T Recommendation Q.2762 (1999), *General functions of messages and signals of the B-ISDN User Part (B-ISUP) of Signalling System No. 7*.

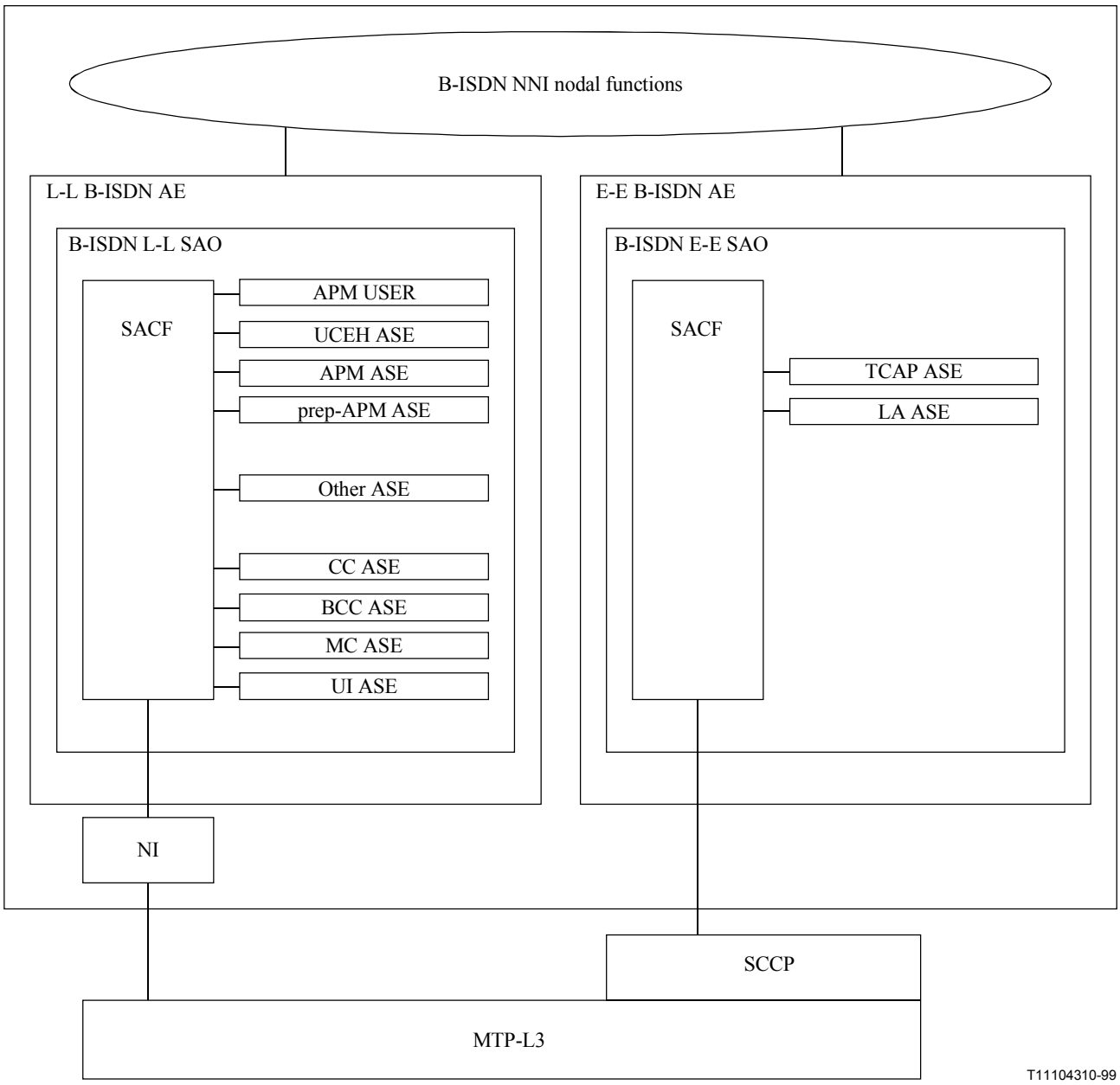
– ITU-T Recommendation Q.2763 (1999), *Signalling System No. 7 B-ISDN User Part (B-ISUP) – Formats and codes*.

– ITU-T Recommendation Q.2764 (1999), *Signalling System No. 7 B-ISDN User Part (B-ISUP) – Basic call procedures*.

– ITU-T Recommendation Q.2765 (1999), *Signalling System No. 7 B-ISDN User Part (B-ISUP) – Application transport mechanism (APM)*.

– ITU-T Recommendation Q.2766.1 (1998), *Switched virtual path capability*.

– ITU-T Recommendation Q.2767.1 (1998), *Soft PVC capability*.



APM	Application Transport Mechanism
ASE	Application Service Element
BCC	Bearer Connection Control
CC	Connection Control
E-E	Edge-to-Edge
LA	Look-Ahead
L-L	Link-to-Link
MC	Maintenance Control
MTP	Message Transfer Part
NI	Network Interface
Other	e.g. Supplementary Services
SACF	Single Association Control Function
SAO	Single Association Object
SCCP	Signalling Connection Control Part
TCAP	Transaction Capabilities
UCEH	Unrecognized Context & Error Handling
UI	Unrecognized Information

Figure 1/Q.2761 – Overview of functional architecture

2 References

The following ITU-T Recommendations and other references contain provisions which, through reference in this text, constitute provisions of this Recommendation. At the time of publication, the editions indicated were valid. All Recommendations and other references are subject to revision; all users of this Recommendation are therefore encouraged to investigate the possibility of applying the most recent edition of the Recommendations and other references listed below. A list of the currently valid ITU-T Recommendations is regularly published.

[1] ITU-T Recommendation I.413 (1993), *B-ISDN user-network interface*.

[2] ITU-T Recommendation Q.2931 (1995), *Digital Subscriber Signalling System No. 2 (DSS2) – User-Network Interface (UNI) layer 3 specification for basic call/connection control.*

[3] ITU-T Recommendation Q.2762 (1999), *General functions of messages and signals of the B-ISDN User Part (B-ISUP) of Signalling System No. 7.*

[4] ITU-T Recommendation Q.2763 (1999), *Signalling System No. 7 B-ISDN User Part (B-ISUP) – Formats and codes.*

[5] ITU-T Recommendation Q.2764 (1999), *Signalling System No. 7 B-ISDN User Part (B-ISUP) – Basic call procedures.*

[6] ITU-T Recommendation Q.2730 (1999), *Signalling System No. 7 B-ISDN User Part (B-ISUP) – Supplementary services.*

[7] ITU-T Recommendation Q.2660 (1999), *Interworking between Signalling System No. 7 Broadband ISDN User Part (B-ISUP) and Narrow–band ISDN User Part (N-ISUP).*

[8] ITU-T Recommendation Q.2650 (1999), *Broadband ISDN interworking between Signalling System No. 7 Broadband ISDN User Part (B-ISUP) and Digital Subscriber Signalling System No. 2 (DSS2).*

[9] ITU-T Recommendation Q.2610 (1999), *Broadband Integrated Services Digital Network (B-ISDN) – Usage of course and location in B-ISDN User Part and DSS2.*

[10] ITU-T Recommendation Q.761 (1999), *Signalling System No. 7 – ISDN user part functional description.*

[11] ITU-T Recommendation Q.762 (1999), *Signalling System No. 7 – ISDN user part general functions of messages and signals.*

[12] ITU-T Recommendation Q.763 (1997), *Signalling System No. 7 – ISDN user part formats and codes.*

[13] ITU-T Recommendation Q.764 (1999), *Signalling System No. 7 – ISDN user part signalling procedures.*

[14] ITU-T Recommendation Q.701 (1993), *Functional description of the Message Transfer Part (MTP) of Signalling System No. 7.*

[15] CCITT Recommendation Q.702 (1988), *Signalling data link.*

[16] ITU-T Recommendation Q.703 (1996), *Signalling link.*

[17] ITU-T Recommendation Q.704 (1996), *Signalling network functions and messages.*

[18] ITU-T Recommendation Q.2100 (1994), *B-ISDN ATM adaptation layer (SAAL) – Overview description.*

[19] ITU-T Recommendation Q.2110 (1994), *B-ISDN ATM adaptation layer – Service Specific Connection Oriented Protocol (SSCOP) specification.*

[20] ITU-T Recommendation Q.2140 (1995), *B-ISDN ATM adaptation layer – Service Specific Coordination Function for signalling at the Network Node Interface (SSCF at NNI).*

[21] ITU-T Recommendation Q.1400 (1993), *Architecture framework for the development of signalling and OA&M protocols using OSI concepts.*

[22] ITU-T Recommendation I.150 (2000), *B-ISDN asynchronous transfer mode functional characteristics.*

[23] ITU-T Recommendation I.361 (1999), *B-ISDN ATM layer specification.*

[24] ITU-T Recommendation I.362 (1993), *B-ISDN ATM Adaptation Layer (AAL) functional description.* (Withdrawn in 06/1997.)

[25] ITU-T Recommendation I.363 (1993), *B-ISDN ATM Adaptation Layer (AAL) specification.*

[26] ITU-T Recommendation I.371 (2000), *Traffic control and congestion control in B-ISDN.*

[27] ITU-T Recommendation I.610 (1999), *B-ISDN operation and maintenance principles and functions.*

[28] ITU-T Recommendation E.164/I.331 (1997), *The international public telecommunication numbering plan*.

[29] ITU-T Recommendation Q.2010 (1995), *Broadband integrated services digital network overview – Signalling capacity set 1, release 1.*

[30] ITU-T Recommendation E.191 (2000), *B-ISDN addressing.*

[31] ITU-T Recommendation Q.1218 (1995), *Interface Recommendation for intelligent network CS-1*.

[32] ITU-T Recommendation Q.2722.1 (1996), *B-ISDN user part – Network node interface specification for point-to-multipoint call/connection control.*

[33] ITU-T Recommendation Q.2724.1 (1996), *B-ISDN User Part – Look-ahead without state change for the network Node Interface.*

[34] ITU-T Recommendation Q.2726.2 (1996), *B-ISDN User Part – Call priority.*

[35] ITU-T Recommendation Q.2726.3 (1996), *B-ISDN User Part – Network generated session identifier.*

[36] ITU-T Recommendation Q.2726.4 (1997), *Extensions to the B-ISDN User Part – Application generated identifiers.*

[37] ITU-T Recommendation Q.2735.1 (1997), *Stage 3 description for community of interest supplementary services for B-ISDN using SS No. 7: Closed User Group (CUG).*

[38] ITU-T Recommendation Q.2766.1 (1998), *Switched virtual path capability.*

[39] ITU-T Recommendation Q.2767.1 (1998), *Soft PVC capability.*

[40] ITU-T Recommendation Q.2210 (1996), *Message transfer part level 3 functions and messages using the services of ITU-T Recommendation Q.2140.*

[41] ITU-T Recommendation Q.2765 (1999), *Signalling System No. 7 B-ISDN User Part (B-ISUP) – Application transport mechanism (APM).*

[42] ITU-T Recommendation I.356 (2000), *B-ISDN ATM layer cell transfer performance.*

[43] ITU-T Recommendation Q.730 (1999), *ISDN user part supplementary services.*

[44] ITU-T Recommendation Q.731.1 (1996), *Stage 3 description for number identification supplementary services using Signalling System No. 7 – Direct-Dialling-In (DDI).*

[45] ITU-T Recommendation Q.731.3 (1993), *Stage 3 description for number identification supplementary services using Signalling System No. 7 – Calling Line Identification Presentation (CLIP).*

[46] ITU-T Recommendation Q.731.4 (1993), *Stage 3 description for number identification supplementary services using Signalling System No. 7 – Calling Line Identification Restriction (CLIR).*

[47] ITU-T Recommendation Q.731.5 (1993), *Stage 3 description for number identification supplementary services using Signalling System No. 7 – Connected Line Identification Presentation (COLP).*

[48] ITU-T Recommendation Q.731.6 (1993), *Stage 3 description for number identification supplementary services using Signalling System No. 7 – Connected Line Identification Restriction (COLR).*

[49] ITU-T Recommendation Q.735.1 (1993), *Stage 3 description for community of interest supplementary services using Signalling System No. 7 – Closed User Group (CUG).*

[50] ITU-T Recommendation Q.737.1 (1997), *Stage 3 description for additional information transfer supplementary services using Signalling System No. 7 – User-to-User Signalling (UUS).*

[51] ITU-T Recommendation Q.765 (2000), *Signalling System No. 7 – Application transport Mechanism.*

3 Relationships to other Recommendations

The B-ISDN User Part protocol that supports ATM call and bearer services is described in Recommendations Q.2761 to Q.2764. A general description of B-ISDN User Part signals and messages is provided in Recommendation Q.2762. Message formats and message field codings are defined in Recommendation Q.2763, while the signalling procedures are described in Recommendation Q.2764. Exceptions against Recommendations Q.730, Q.731, Q.735 and Q.737 are provided in Recommendations Q.2730 and Q.2735.1 to provide for supplementary services. Requirements for interworking between N-ISDN User Part and the B-ISDN User Part are provided in Recommendation Q.2660.

Numbering requirements are described in Recommendation E.191. It is assumed that the B-ISDN supports the international numbering plan defined for the ISDN and provides a switched service between B-ISDN terminals or between B-ISDN terminals and terminals being connected to the public switched telephone network, or the ISDN network. In addition, ATM End System Address(es) (AESA) for addressing and routing are supported.

Requirements on exchange capabilities for the support of the B-ISDN User Part are described in the Q.2500-series Recommendations.

Requirements or functions for interworking between the B-ISDN User Part and Recommendation Q.2931 are included in Recommendation Q.2650. Use of the cause parameter is described in Recommendations Q.850 and Q.2610.

See 5.4 for additional Recommendations that provide enhanced capabilities to the basic B-ISDN call and bearer services. Recommendations Q.2761 to Q.2764 have incorporated the Recommendations concerning additional traffic parameters, negotiation of traffic characteristics during the call setup phase, modification of traffic characteristics during the active phase of a call, ATM End System Address (AESA) of calling, called, and connected party and Frame Relay.

4 Abbreviations

This Recommendation uses the following abbreviations:

3PTY	Three-Party Service
AAL	ATM Adaptation Layer
ABR	Available Bit Rate
ABT	ATM Block Transfer
AE	Application Entity
AESA	ATM End System Address
ASE	Application Service Element
ATC	ATM Transfer Capability
ATM	Asynchronous Transfer Mode
B-ISDN	Broadband Integrated Services Digital Network
B-ISUP	Broadband Integrated Services Digital Network User Part
BC	Bearer Control
BCC	Bearer Connection Control
BCOB-A	Broadband Connection Oriented Bearer – Sub-category A
BCOB-C	Broadband Connection Oriented Bearer – Sub-category C
BCOB-X	Broadband Connection Oriented Bearer – Sub-category X
CC	Call Control
CCBS	Completion of Calls to Busy Subscriber
CD	Call Deflection
CDVT	Cell Delay Variation Tolerance
CF	Call Forwarding
COLP/COLR	Connected Line Identification Presentation/Restriction
CONF	Conference Calling
CS	B-ISDN Signalling Capability Set
CTM	Call Transfer Message
CUG	Closed User Group
CW	Call Waiting
DBR	Deterministic Bit Rate
DDI	Direct-Dialling-In
DPC	Destination Point Code
HOLD	Call Hold
IAM	Initial Address Message
IN	Intelligent Network
ITU-T	International Telecommunication Union – Telecommunication Standardization Sector

L-L	Link-to-Link
MC	Maintenance Control
MCID	Malicious Call Identification
MLPP	Multi-level Precedence and Preemption
MSN	Multiple Subscriber Number
MTP	Message Transfer Part
NI	Network Interface
NSAP	Network Service Access Point
OPC	Originating Point Code
SACF	Single Association Control Function
SAO	Single Association Object
SBR	Statistical Bit Rate
SCCP	Signalling Connection Control Part
SIO	Service Information Octet
SLS	Signalling Link Selection Code
SUB	Sub-addressing
SVP	Switched Virtual Path
TC	Transaction Capability
TCAP	Transaction Capability Application Part
UI	Unrecognized Information
UNI	User-Network Interface
UUS	User-to-User Signalling
VCI	Virtual Channel Identifier
VPCI	Virtual Path Connection Identifier

5 Introduction to B-ISDN User Part signalling procedures

5.1 Address signalling

In general, the call setup and bearer connection procedures described are standard for broadband connections using *en bloc* address signalling for calls between B-ISDN terminals. Overlap address signalling is also specified.

5.2 Basic procedures

The basic call and connection control procedures are divided into three phases; call setup, the data/conversation phase and call cleardown. Messages on the signalling link are used to establish and terminate the different phases of a call. Standard in-band supervisory tones and/or recorded announcements are returned to the caller on appropriate connection types to provide information on call progress. Calls originating from B-ISDN terminals may be supplied with more detailed call progress information by means of additional messages in the access protocol supported by a range of messages in the network.

5.3 Extensions integrated into the basic procedures

The following Recommendations have been integrated into the "core" set of B-ISDN User Part Recommendations (Q.2761 through Q.2764):

5.3.1 Former ITU-T Recommendation Q.2723.1 (07/96), B-ISDN User Part – Support of additional traffic parameters for Sustainable Cell Rate (SCR) and Quality of Service (QOS)

This Recommendation allows for the use of additional traffic parameters for SCR and QOS in order to support the Broadband Connection-Oriented Bearer services (BCOB) as specified in Recommendation F.811.

5.3.2 Former ITU-T Recommendation Q.2723.2 (09/97), Extensions to the B-ISDN User Part – Support of ATM transfer capability in the broadband bearer capability parameter

This Recommendation extends Broadband ISDN User Part protocol to support the new requirements for the ATM transfer capabilities as defined in Recommendations I.371 and I.356.

5.3.3 Former ITU-T Recommendation Q.2723.3 (09/97), Extensions to the B-ISDN User Part – Signalling capabilities to support traffic parameters for the Available Bit Rate (ABR) ATM transfer capability

This Recommendation extends Broadband ISDN User Part protocol to support additional traffic parameters for available bit-rate services indication in a point-to-point configuration type. It allows for the use of additional traffic parameters in order to support the available bit-rate traffic capability.

5.3.4 Former ITU-T Recommendation Q.2723.4 (09/97), Extensions to the B-ISDN User Part – Signalling capabilities to support traffic parameters for the ATM Block Transfer (ABT) ATM transfer capability

This Recommendation specifies extensions to the Broadband ISDN User Part protocol to support the services that are provided through the ATM block transfer ATM layer transfer capability as defined in ITU-T Recommendation I.371. An ATM Block Transfer (ABT) capability enables the negotiation of ATM layer transfer characteristics on an ATM block basis.

Two ABT traffic handling capabilities are defined, namely the ATM Block Transfer with Delayed Transmission (ABT-DT) and the ATM Block Transfer with Immediate Transmission (ABT-IT). In ABT-DT, during the connection lifetime, the cell rate of successive ATM blocks is dynamically modified between the users of the ABT-DT capability and the network using resource management cells. Positive acknowledgement from the network is required before transmitting ATM blocks at the new cell rate. In ABT-IT, the user transmits ATM blocks without positive acknowledgement from the network. As a result, ABT-IT ATM blocks may be discarded by the network if sufficient network resources are not available.

5.3.5 Former ITU-T Recommendation Q.2723.5 (03/99), B-ISDN User Part – Support of cell delay variation tolerance indication

This Recommendation extends Broadband ISDN User Part protocol to support the Cell Delay Variation Tolerance indication at call/connection establishment. It is consistent with the traffic management requirements and ATM transfer capability features defined in the ITU Recommendation I.371.

5.3.6 Former ITU-T Recommendation Q.2723.6 (05/98), Extension to the Signalling Systems No. 7 B-ISDN User Part – Signalling capabilities to support the indication of the statistical bit rate configuration 2 (SBR 2) and 3 (SBR 3) ATM transfer capabilities

This Recommendation extends Broadband ISDN User Part protocol to support the indication of the Statistical Bit Rate Configuration 2 and 3 ATM transfer capabilities (SBR 2, SBR 3) as defined in ITU-T Recommendation I.371.

5.3.7 Former ITU-T Recommendation Q.2725.1 (05/98), B-ISDN User Part – Support of negotiation during connection setup

This Recommendation specifies extensions to the Broadband ISDN User Part protocol to support negotiation of connection characteristics during connection setup. The two cases of negotiation allowed are alternative ATM cell rate and minimum ATM cell rate.

In both cases the final bandwidth used is returned in the ATM cell rate parameter and the additional ATM cell rate parameter (if applicable) in the answer message. Interworking with narrow-band emulation services is not supported.

Negotiation can only be performed with the first party of a point-to-multipoint call. Addition of a party prior to completion of the negotiation procedure is rejected.

5.3.8 Modification procedures

The following rules apply to the modification procedures that have been integrated into the basic B-ISUP call and connection procedures:

- The request will only be accepted if all requested modifications with negotiation are accepted.
- The request can be accepted in which one or more requested parameter modifications with negotiation is the same as the present value.
- Neither re-routing nor re-establishment procedures are supported.
- Sequential modification with negotiation is applicable per connection. Parallel modification with negotiation is not applicable per connection.
- Transferring of u-plane cells is not disturbed with the modification procedure with negotiation.
- A connection release procedure takes precedence over the modification procedure with negotiation of the connection.
- Only the connection owner is allowed to initiate the modification procedures with negotiation.
- Only parameters specified during the initial connection establishment may be modified [e.g. if the Forward SCR (CLP = 0) parameter was not specified at connection establishment then it cannot be modified by this procedure]. The modification request may be for all or a subset of the parameters specified during call establishment.
- During the modification, the initiating user transmits based on an ATM traffic descriptor for which the transmit traffic parameters are the lesser of the existing transmit traffic parameters and of the requested modified transmit traffic parameters.
- No error procedure is required in the NNI for the case that a Connection Available message is not returned from the access.

5.3.8.1 Former ITU-T Recommendation Q.2725.2 (07/96), B-ISDN User Part – Modification procedures

This Recommendation covers the configuration of point-to-point single connection where the modification procedure is allowed to be initiated by the connection owner during the active phase. Connection characteristics to be modified are peak cell rate (forward, backward or both) only, and these are modified independently on an increasing or decreasing basis by indicating the result value.

Sequential modification is applicable per connection but only one parameter to modify can be requested in a Modify Request message. Transferring of U-plane cells is not disturbed with the modification procedure. For CBR class A with end-to-end timing, an interruption on the application level may be needed for synchronization purposes.

A connection release procedure takes precedence over the modification procedure of the connection. Neither re-routing nor re-establishment procedures are supported.

It will be necessary for the initiating user to reduce cell input upon sending a Modify request message to decrease the forward cell rate of a connection. Otherwise, when the modification procedure is completed at the remote local exchange, the initiating user may still be sending a high rate of cells, which results in discard and possible operations alarms at the remote local exchange.

5.3.8.2 Former ITU-T Recommendation Q.2725.3 (09/97), Extensions to the B-ISDN User Part – Modification procedures for sustainable cell rate parameters

This Recommendation extends the capabilities of Recommendation Q.2725.2, Modification Procedures to allow the connection owner to modify the Sustainable Cell Rate (SCR) and Maximum Burst Size (MBS) during the active phase of the connection. Connection characteristics that may be modified are: Forward PCR (CLP = 0 + 1), Forward PCR (CLP = 0), Forward SCR (CLP = 0 + 1), Forward SCR (CLP = 0), Forward MBS (CLP = 0 + 1), Forward MBS (CLP = 0), Backward PCR (CLP = 0 + 1), Backward PCR (CLP = 0), Backward SCR (CLP = 0 + 1), Backward SCR (CLP = 0), Backward MBS (CLP = 0 + 1), Backward MBS (CLP = 0). These parameters can be requested to be incremented or decremented independently. The request will only be accepted if all requested modifications are accepted.

Only parameters specified during the initial connection establishment may be modified. For example, if the Forward SCR (CLP = 0) parameter was not specified at connection establishment, then it cannot be modified by this procedure. The modification request may be for all or a subset of the parameters specified during call establishment.

5.3.8.3 Former ITU-T Recommendation Q.2725.4 (05/98), Extensions to the Signalling System No. 7 B-ISDN User Part – Modification procedures with negotiation

This Recommendation extends the modification capabilities specified in ITU-T Recommendation Q.2725.3 to support negotiation of connection characteristics that is equivalent to that specified in ITU-T Recommendation Q.2725.1.

Modification procedure with negotiation is only allowed during the active phase. Connection characteristics that may be modified are Forward PCR (CLP = 0 + 1), Forward PCR (CLP = 0), Forward SCR (CLP = 0 + 1), Forward SCR (CLP = 0), Forward MBS (CLP = 0 + 1), Forward MBS (CLP = 0), Backward PCR (CLP = 0 + 1), Backward PCR (CLP = 0), Backward SCR (CLP = 0 + 1), Backward SCR (CLP = 0), Backward MBS (CLP = 0 + 1), Backward MBS (CLP = 0). The above parameters can be requested to be incremented or decremented independently.

5.3.9 Former ITU-T Recommendation Q.2726.1 (07/96), B-ISDN User Part – ATM end system address

This Recommendation provides formats and procedures for carrying ATM End System Address (AESA) of calling, called and connected party in B-ISDN User Part. The format of the AESA is based on the ISO Network Service Access Point (NSAP) format as described in ISO/IEC 8348. An ATM end system may or may not be directly attached to the public UNI. All AESA address formats are supported and may be used for routing.

In Recommendation Q.2726.1, only the support of the E.164 version of AESA was required. This has been extended to include all AESA address formats when this Recommendation was integrated into this edition 2 of B-ISDN User Part Recommendations Q.2761 through Q.2764.

5.3.10 Former ITU-T Recommendation Q.2727 (07/96), B-ISDN User Part – Support of frame relay

This Recommendation specifies usage of the Broadband ISDN User Part protocol to support the establishment, maintenance and clearing of B-ISDN call/connections that support Frame Relay service at the network Node Interface.

The case described in this Recommendation is an end-to-end B-ISDN connection between B-ISDN users, where the protocol in use over the user plane connection is the Frame Relay Service Specific Convergence Sublayer (FR-SSCS).

The B-ISDN Frame Relay service has the following characteristics:

1) it provides bidirectional transfer of Service Data Units across the network with order preserved;
2) the U-plane procedures use the service provided by AAL Type 5 common part on a Virtual Channel Connection (VCC) basis and the Frame Relay SSCS above it. Multiplexing of multiple Frame Relay data link connections uniquely identified by the Data Link Connection Identifier may be performed at the FR-SSCS level.

5.4 Extensions to the basic procedure presented as separate Recommendations

5.4.1 ITU-T Recommendation Q.2722.1 (1996), B-ISDN User Part – Network node interface specification for point-to-multipoint call/connection control

This Recommendation specifies the procedures for establishing, maintaining, and clearing of network point-to-multipoint connections at the B-ISDN network Node Interface.

5.4.2 ITU-T Recommendation Q.2724.1 (1996), B-ISDN User Part – Look-ahead without state change for the network node interface

This Recommendation specifies the essential features, procedures, and operations required for look-ahead without state change at the B-ISDN network node interface. The look-ahead facility allows a network to perform called-terminal availability and compatibility checking without any commitment of network resources.

5.4.3 ITU-T Recommendation Q.2726.2 (1996), B-ISDN User Part – Call priority

This Recommendation specifies optional extension to the Broadband ISDN User Part to support call priority handling. This Recommendation allows for preferential treatments for high priority calls during network congestion based on the priority level of the call.

5.4.4 ITU Recommendation Q.2726.3 (1996), B-ISDN User Part – Network generated session identifier

This Recommendation defines a network call correlation identifier for a call between the user and the network. It can be used to correlate records at multiple exchanges within a network, e.g. for accounting purposes. The identifier is not used to trigger real-time processing at a receiving exchange.

5.4.5 ITU Recommendation Q.2726.4 (1997), Extensions to the B-ISDN User Part – Application generated identifiers

This Recommendation defines the B-ISUP capability to transport application generated identifiers. This capability allows the transport through the B-ISDN of identifiers required and used by various distributed applications. This capability allows an originating entity (e.g. a calling party) to transmit identifiers that can be used by a peer entity.

5.4.6 ITU Recommendation Q.2730 (1995), Broadband integrated services digital network (B-ISDN) Signalling System No. 7 B-ISDN User Part (B-ISUP) – Supplementary services

This Recommendation describes the supplementary services supported in the Broadband ISDN applicable to B-ISUP with the exception of CUG, which is contained in Recommendation Q.2735.1.

5.4.7 ITU Recommendation Q.2735.1 (1997), Stage 3 description for community of interest supplementary services for B-ISDN using SS No. 7: Closed User Group (CUG)

This Recommendation specifies the stage 3 of the Closed User Group (CUG) supplementary service for the Broadband Integrated Services Digital Network (B-ISDN) at the network node interface (NNI) by means of the Broadband ISDN User Part (B-ISUP) protocol.

5.4.8 ITU Recommendation Q.2765 (1999), Signalling System No. 7 B-ISDN User Part (B-ISUP) – Application transport mechanism (APM)

This Recommendation describes additions to the B-ISDN User Part (B-ISUP) for the introduction of a transport mechanism for use by applications requiring a bearer in conjunction with the support of the application's signalling flow. This Application Transport Mechanism is capable of creating signalling associations between APM-user application logic located at a public initiating node (PIN) and its peer APM-user application logic located at the Public Addressed Node (PAN).

5.4.9 ITU-T Recommendation Q.2766.1 (1998), Switched Virtual Path capability

This Recommendation specifies extensions to the Broadband ISDN User Part (B-ISUP) protocol to support Switched Virtual Path (SVP) service in a point-to-point configuration. This Recommendation allows for the use of parameters already specified by ITU-T Recommendations Q.2761, Q.2762, Q.2763, and Q.2764 for the B-ISDN basic call at the NNI, in order to support the Switched Virtual Path capability.

5.4.10 ITU-T Recommendation Q.2767.1 (1998), Soft PVC capability

This Recommendation utilizes the normal procedures of Broadband ISDN User Part (B-ISUP) protocol in order to support soft Permanent Virtual Connections (soft PVCs) between their endpoints. The endpoints are responsible for maintaining the end-to-end circuit by setting up a new switched connection in case the existing switched connection is released or fails. Two types of soft PVC are supported: soft Permanent Virtual Path Connection (PVPC) and soft permanent virtual Channel Connection (CC).

5.5 B-ISDN User Part interworking

In call control interworking between two B-ISUP protocols, the application process provides the interworking logic. Supplementary services interworking will be accomplished in the application process.

Peer-to-peer interworking takes place between two exchanges that support different implementations of the same protocol.

Interworking is realized following interpretation of the protocol information received by either exchange.

Forward compatibility is ensured by the guidelines given for future protocol enhancements and the compatibility procedure as outlined in clause 8.

6 Capabilities supported by the B-ISDN User Part

Table 1 lists the signalling capabilities supported by the B-ISDN User Part.

Table 1/Q.2761 – Signalling capabilities supported by the B-ISDN User Part

Function/Service	Origination/ Destination nodes	Transit nodes
Basic Capabilities		
Point-to-point connection configuration		
Speech/3.1 kHz audio	/	/
BCOB-A, BCOB-C, BCOB-X	/	/
ATCs (ABR, ABT, DBR, SBR)	/	/
Switched virtual path connection	/	/
N-ISDN bearer and teleservice with fallback	/	/
N-ISDN 64 kbit/s unrestricted	/	/
N-ISDN multirate connection types (Note 1)	/	/
N-ISDN n × 64 kbit/s connection types	/	/
Point-to-multipoint connection configuration		
BCOB-A, BCOB-C, BCOB-X	/	/
ATCs (ABT, DBR, SBR)	/	/
Compatibility procedure	/	/
Simple segmentation	(Note 2)	(Note 2)
User part availability control	/	/
Propagation delay determination procedure	/	/
Tones and announcements	/	/
MTP pause and resume	/	/
Signalling procedures for connection type allowing fallback	–	/
Confusion procedure	–	/
Access delivery information	/	/
Transportation of User teleservice information	–	/
Collect call request procedures	–	/

Table 1/Q.2761 – Signalling capabilities supported by the B-ISDN User Part *(continuación)*

Function/Service	Origination/ Destination nodes	Transit nodes
Call priority	/	/
Enhanced echo control procedure	–	/
Hop counter procedure	/	/
IN interaction (Note 3)	–	/
Temporary Alternative Routing	/	/
Look-ahead	/	/
Frame relay	/	/
Soft PVC (PVCC and PVPC)	/	/
Negotiation during connection setup	/	/
Modification	/	/
Modification with negotiation	/	/
Quality of service	/	/
Extended quality of service	/	/
CDVT	/	/
Application generated identifiers	/	/
Network call correlation identifier	/	/
Application transport	/	/
Pre-release information transport	/	/
Supplementary Services		
DDI	/	/
MSN	/	/
CLIP/CLIR	/	/
COLP/COLR	/	/
SUB	/	/
TP	–	/
CUG	/	/
UUS service 1 (implicit)	/	/
CF	–	/
CD	–	/
CW	–	/
HOLD	–	/
CONF	–	/
3PTY	–	/
MLPP	–	/
UUS service 1 (explicit)	–	/
UUS service 2	–	/
UUS service 3	–	/
Malicious Call Identification (MCID)	–	/

Table 1/Q.2761 – Signalling capabilities supported by the B-ISDN User Part *(fin)*

Function/Service	Origination/ Destination nodes	Transit nodes
Explicit Call Transfer (ECT)	–	/
Completion of Calls to Busy Subscriber (CCBS)	–	/
GVNS	–	/
ITCC	–	/
REV	–	/
/ represents B-ISUP support. – represents B-ISUP non-support. NOTE 1 – The current N-ISDN Multirate connection types are 2 × 64, 384, 1536 and 1920 kbit/s. NOTE 2 – The simple segmentation procedure is included in the B-ISDN User Part as a national option only, so that it can use an MTP that imposes a 272-octet transfer limit. NOTE 3 – The interaction with IN at the Origination and Destination nodes are for further study.		

7 Services assumed from the MTP

7.1 General

This subclause describes the functional interface presented by the Message Transfer Part to the B-ISDN User Part. In accordance with the description techniques defined by the OSI model, information is transferred to and from the MTP in the form of parameters carried by primitives as described in Recommendation Q.2210.

The general syntax of a primitive is as follows:

X	Generic name	Specific name	Parameter

where:

- X designates the function providing the service (the MTP in this case);
- the Generic name describes an action by X;
- the Specific name indicates the purpose of the primitive, i.e. whether it conveys a request for a service, an indication that service-related information has been received, a response to a service request, or a confirmation that the requested service has been performed; and
- the parameters contain the elements of supporting information transferred by the primitive.

7.2 Description of primitives

The following subclauses describe the primitives used across the B-ISDN User Part – MTP interface. The primitives together with the parameters carried by each primitive are shown in Table 2.

7.2.1 Transfer

The MTP_TRANSFER primitive is used either by the B-ISDN User Part to access the signalling message handling functions of the MTP or by the latter to deliver signalling message information to the B-ISDN User Part.

7.2.2 Pause

The MTP_PAUSE primitive is sent by the MTP to indicate its inability to transfer messages to the destination specified as a parameter.

7.2.3 Resume

The MTP_RESUME primitive is sent by the MTP to indicate its ability to resume unrestricted transfer of messages to the destination specified as a parameter.

7.2.4 Status

The MTP_STATUS primitive is sent by the MTP to indicate that the signalling route to a specific destination is congested or the B-ISDN User Part at the destination is unavailable. Unavailability causes can be unequipped inaccessible or unknown. The affected destination and the congestion indication are carried as parameters (see Table 2) in the primitive.

Table 2/Q.2761 – MTP Service Primitives

Primitives					
Generic name	**Specific name**				
	Req.	**Ind.**	**Resp.**	**Conf.**	**Parameter**
MTP_TRANSFER	X	X			OPC, DPC, SLS, SIO, signalling information
MTP_PAUSE		X			Affected DPC
MTP_RESUME		X			Affected DPC
MTP_STATUS		X			Affected DPC, Cause (Note)

OPC Originating point code

DPC Destination point code

SLS Signalling link selection code

SIO Service information octet

NOTE – The cause parameter can assume four values:

1) signalling network congestion level, where level is included only if national options with congestion priorities and multiple signalling states without congestion priorities (see Recommendations Q.2210 and Q.704) are implemented;
2) user part unavailability – unequipped remote user;
3) user part unavailability – inaccessible remote user;
4) user part unavailability – unknown.

8 Future enhancements

Requirements for additional protocol capabilities will result from time to time in the need to add to or modify existing protocol elements and thus to create a new protocol version. In order to ensure adequate service continuity, the insertion of a new protocol version into one part of a network should be transparent to the remainder of the network. Compatible interworking between B-ISDN User Part protocol versions should be optimized by adhering to the following guidelines when specifying a new version (release):

1) Existing protocol elements, i.e. procedures, messages, parameters and codes, should not be changed unless a protocol error needs to be corrected or it becomes necessary to change the operation of the service that is being supported by the protocol.

2) The semantics of a message, a parameter, or of a field within a parameter should not be changed.

3) Established rules for formatting and encoding messages and parameters should not be modified.

4) The all zero code point should be used exclusively to indicate an unallocated (spare) or insignificant value of a parameter field. This avoids an all zeros code, sent by one protocol version as a spare value, to be interpreted as a significant value in another version.

5) The compatibility mechanism described in 8.1 applies to this and future versions of the ITU-T B-ISDN User Part Recommendations.

Furthermore, compatibility between various capability sets of the B-ISDN signalling protocols can be achieved by conforming to the protocol model illustrated in Figure 1.

8.1 Version compatibility

Compatibility between this and future versions will be guaranteed, in the sense that any two versions can be interconnected directly with each other, and the following requirements are fulfilled:

i) *Protocol compatibility*

Connections between any two B-ISDN User Parts do not fail for the reason of not satisfying protocol requirements.

ii) *Service and functional compatibility*

This feature may be considered as compatibility typically between originating and destination exchanges. Services and functions available at these exchanges, but possibly not yet taken into account in the intermediate exchanges, are supported, provided they require only transparency of the intermediate exchanges. If this is not the case, a controlled call rejection or service rejection is required.

iii) *Resource control and management compatibility*

For these functions, occurring only link-by-link, at least a backward notification is needed, if correct handling is not possible.

The compatibility mechanism is common for all B-ISDN User Parts. It is based on forward compatibility information associated with all signalling information.

The compatibility method eases the network operation, e.g. for the typical case of a B-ISDN User Part mismatch during a network upgrading, to interconnect two networks on a different functional level, for networks using a different subset of the same B-ISDN User Part, etc.

8.2 Coding guidelines for compatibility of B-ISDN User Parts supporting different releases of B-ISDN services

8.2.1 Messages

All B-ISUP messages will contain compatibility handling directives. This information will be contained in the "Instruction Indicator" of the message compatibility information.

8.2.2 Parameters

Mixing information for different application associations (requiring different functional entity actions) inside a B-ISUP parameter is not permitted so that the behaviour of cooperating nodes can be defined using the compatibility mechanism.

All B-ISUP parameters will contain compatibility handling directives. This information will be conveyed in the "Instruction Indicator" of the parameter compatibility information within each parameter.

APPENDIX I

Guidelines for use of instruction indicators

I.1 Introduction

Instruction indicators are used to indicate to an exchange receiving unrecognized information what action the exchange should take due to this information being unrecognized. Unrecognized information may be a message or one or more parameters within a message, unrecognized values within a parameter cause the parameter itself to be treated as unrecognized. Instruction indicators are only examined once the message or parameter has been detected as unrecognized.

I.2 Priority or execution

When processing instruction indicators, a certain order is implied by the type of actions which can be specified, the following list indicates a decreasing order of processing priority:

– transit at intermediate exchange indicator;
– broadband/Narrow-band interworking indicator;
– release call indicator;
– discard message, with or without notification, based on the notification indicator;
– discard parameter, with or without notification, based on the notification indicator;
– pass on not possible indicator.

Only Broadband/Narrow-band interworking exchanges examine the Broadband/Narrow-band interworking indicator, if present, in place of the conventional Release call, Discard message or Discard Parameter indicators.

I.3 Notification

The notification indicator is not strictly tied to the order of processing of the other indicators. It is recommended that notification is only required when information is discarded, this minimizes the amount of Confusion messages which may be generated along the call path for a particular piece of unrecognized information (this would not be the case if each exchange passing information on, also generated Confusion messages).

The notification (Confusion message) contains a cause code parameter with a cause value indicating if the unrecognized information was a message or parameter(s), the diagnostic field contains the message or parameter name code(s).

I.4 Considerations

I.4.1 Discarding unrecognized messages

Message compatibility information may indicate "discard message", for those messages which do not affect the basic state of the protocol, such as the NRM message, otherwise there would be a misalignment between the states of the two protocol machines. This would normally result in the release of the call due to timer expiry.

This would also be the case if an exchange generates parameter compatibility information indicating "discard message". Particular care must be taken in this case because it becomes possible that messages such as Answer may be treated as unrecognized.

I.4.2 Essential services

If a service is essential to a call and the information related to that service is unrecognized, then the call should be released. An example of this type of service is the User-to-user essential services.

I.4.3 Non-essential services

If the service is not essential to a call and the information related to that service is unrecognized, then the information should be discarded. A notification should be requested if an explicit indication needs to be generated when the service is not provided; this notification can then result in the explicit service rejection/notification being generated by the exchange which recognizes the contents of the diagnostic field of the Cause parameter contained in the Confusion message (this is an exchange which was capable of generating the information which is notified as being unrecognized). An example of this type of service is the User-to-user non-essential services.

I.4.4 Broadband/Narrow-band interworking

Services such as many of the supplementary services are developed to operate in both the Broadband and the Narrow-band networks; these services should have the Broadband/Narrow-band interworking indicator set to "pass on".

However, some information which may relate more to the nature of the networks such as the Broadband bearer capability should not be passed from the broadband to the narrow-band network, hence the Broadband/Narrow-band interworking indicator should be set to "Release call" if the bearer service is one which cannot be supported in the narrow-band; in other cases it may be set to "discard" or "pass on" dependent on whether the ability of broadband services transiting the narrow-band is supported.

I.4.5 Pass on

Pass on allows unrecognized information to be passed through an exchange which is acting as an end node.

The pass on not possible indicator must be examined when pass on has been requested but it is not possible to pass on the information. Pass on is not possible when the protocol on the other side of the exchange has a different syntax (message and parameter structure) to the ISUP (B-ISUP or N-ISUP), or the policing actions performed in the exchange prohibit the passing of unrecognized information. When it has been determined that pass on is not possible, another action must be performed such as release of the call or discarding of the information.

APPENDIX II

Text from Recommendation Q.2721.1 B-ISDN network Node Interface Signalling Capability Set 2, Step 1

The 1999 revised versions of Recommendations Q.2761 through Q.2764 incorporate most of the Recommendations that Q.2721.1 describes. Hence Q.2721.1 will be superseded but its information can provide the reader with insight background material and is reproduced here. However, where the following text and the 1999 revised Recommendations Q.2761 through Q.2764 are in disagreement, 1999 revised Recommendations Q.2761 through Q.2764 should be used as the prime source.

II.1 B-ISDN NNI CS-2.1 content

The following capabilities are added to the capabilities of B-ISUP CS-1:

- point-to-multipoint calls (multi-party calls);
- additional traffic parameters;
- look-ahead capability;
- negotiation of traffic characteristics during call setup;
- modification of traffic characteristics during the active phase of the call;

- ATM end system address;
- call priority;
- network call correlation ID;
- Frame Relay.

The following subclauses give a summary of these capabilities:

II.1.1 Point-to-multipoint calls

Procedures are provided for the setup and release of a call consisting of a single point-to-multipoint (unidirectional) connection. The characteristics of this connection, from the originator (root party) to the destinations (leaf parties) are all identical. Procedures are provided for the addition and removal of leaf parties from the call. Addition of leaf parties can only be done by the root party. Removal of a leaf can be from either the root or the affected leaf party. Additionally an "*en bloc*" release of the whole point-to-multipoint connection from the root party is provided [3].

II.1.2 Additional traffic parameters

Procedures are provided to the support of the sustainable cell rate parameter set.

A procedure for the support of the quality of service parameter is also provided [4].

II.1.3 Look-ahead

Procedures are provided for edge-to-edge look-ahead that allows a network to perform called-terminal availability and compatibility checking without any commitment of network resources. This is an optional capability that can be employed to optimize network resource usage in combination with other CS-2.1 capabilities [5].

II.1.4 Negotiation of traffic characteristics during call setup

Two cases of negotiation are allowed:

1) *Alternative ATM cell rate*

   If the bandwidth requirements in the connection request cannot be supported by the network, alternative bandwidth requirements contained in the alternative ATM cell rate may be used instead, provided that these can be supported.

   The alternative bandwidth requirements must be reduced compared to those originally requested.

2) *Minimum ATM cell rate*

   If the bandwidth requirements in the connection request cannot be supported by the network, a reduced bandwidth allocation may be substituted, provided that this still satisfies a specified minimum ATM cell rate.

   Only negotiation of peak cell rates is supported using the minimum ATM cell rate procedure.

In both cases 1) and 2), the final bandwidth used is returned in the ATM cell rate parameter and additional ATM cell rate parameter (if applicable) in the answer message. If this differs from the bandwidth allocation supported by the network, the network must modify the bandwidth allocation for the connection accordingly. The network passes the final bandwidth information back to the calling user.

II.1.5 Modification of traffic characteristic during the active phase of the call

Procedures are provided for the modification of the peak cell rate (forward, backward or both) of a point-to-point connection. Only the user that originally requested setup of the connection can request the modification. No re-routing of the connection is attempted during the connection modification [7].

II.1.6 ATM end system address

Procedures are provided for the transport of the ATM End System Address (AESA). The E.164 format of AESA is accepted at the originating exchange, and used to derive E.164 number to be carried within the called party number, and used for routing purposes. The AESA is transferred across the network and delivered to the called user. AESA for calling party is also supported [8].

II.1.7 Call priority

Priority call handling is provided for single connection point-to-point calls [9].

II.1.8 Network call correlation ID

A network generated identifier is provided to enable the network to correlate records at multiple exchanges for non-real-time purposes, e.g. accounting [10].

II.1.9 Frame relay

Procedures are provided for the setup and release of a call/connection supporting the Frame Relay service [11].

II.2 Functional limitations of B-ISDN NNI CS-2.1

The following limitations of CS-2.1 should be noted:

1) In a point-to-multipoint call, only the root party can add additional parties.
2) Only the user that originally requested setup of a connection can request modification of that connection.
3) The following capabilities are not applicable for calls employing narrow-band emulation service:
   a) point-to-multipoint calls (multi-party calls);
   b) additional traffic parameters;
   c) negotiation of traffic characteristics during call setup;
   d) modification of traffic characteristics during the active phase of the call.
4) Priority call handling is provided only for single connection point-to-point calls.
5) Table II.1 summarizes the allowed combinations of the capabilities that are supported within a single CS-2.1 call.

Table II.1/Q.2761 – CS-2.1 allowed capability combinations

Capability	Network call correlation ID	Frame relay	AESA	Call priority	Modifi-cation	Negotiation	Look-ahead	Traffic parameters
Point-multipoint	✓	x	✓	x	x	✓ (Note 2)	✓	✓ (Note 1)
Traffic parameters	✓	✓	✓	✓	x	✓	✓	
Look-ahead	✓	✓	✓	✓	✓ (Note 3)	✓		
Negotiation	✓	✓	✓	✓	✓			
Modification	✓	✓	✓	✓				
Call priority	✓	✓	✓					
AESA	✓	✓						
Frame relay								

x Not allowed

✓ Allowed

NOTE 1 – The traffic parameters for the first party shall apply for all parties.

NOTE 2 – This capability shall apply only for the first leaf.

NOTE 3 – Look-ahead is only applied at call setup; it is not applied for a modification request.

II.3 Common protocol principles for B-ISDN NNI CS-2.1

The B-ISDN NNI CS-2.1 builds upon the B-ISUP CS-1 in three ways:

1) It enhances the point-to-point call control application process and protocol, for the transfer of additional information, and for additional procedural functions, such as the procedures used during the active phase of the call to effect a modification of the bandwidth being used. This can be seen as an enhanced use of the model defined for B-ISUP CS-1 Annex A/Q.2764.

2) It enhances the modelling of the functionality within the call control application process: A B-ISUP CS-1 call consists of one incoming, and one outgoing, Application Entity Instance (AEI) protocol machine, coordinated by the call, control application process. For one B-ISDN NNI CS-2.1 call, the call control application process may have to coordinate many AEIs relating to the multiple connections/parties that may exist in the call. Information modelling techniques are used in the description of this complexity.

3) It enhances the signalling methods available: B-ISUP CS-1 signalling associations are always Link-to-Link (L-L), following the path of the connection through the network. In B-ISDN NNI CS-2.1, an additional signalling mode is introduced – Edge-to-Edge (E-E). This technique provides direct signalling transactions between the nodes at the edges of the public B-ISDN, typically the originating, destination local and/or gateway exchanges. B-ISDN NNI CS-2.1 makes use of this capability to provide a look-ahead capability, checking the acceptability of the potential call at the called user interface before allocating network resources for the call/connection.

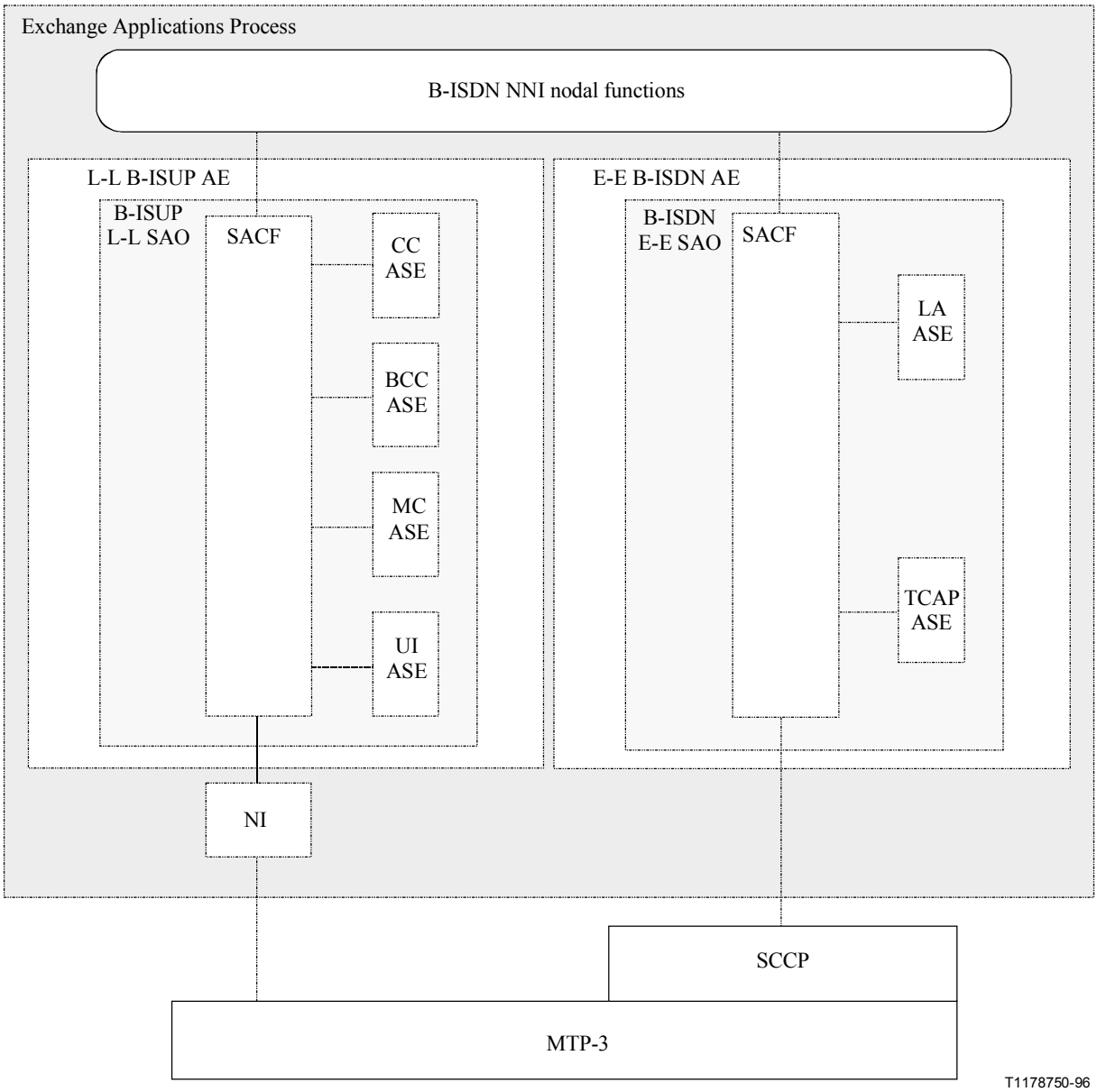
   This uses the TCAP and SCCP capabilities of Signalling System No. 7.

II.3.1 General specification model

Figure II.1 shows the general protocol architecture model for B-ISDN NNI in CS-2.1. The L-L AE is architecturally the same as the AE used in CS-1; the E-E AE is new for CS-2.1. In addition to this architecture is an information model for the call control application process. Figure II.2 shows the general information model for B-ISDN NNI in CS-2.1. This figure shows the complete set of all the

object classes. For any exchange acting as a particular exchange type, (originating/intermediate/ branching/destination exchange), for the support of a specific CS-2.1 capability, the appropriate object instances are created. Objects of all object classes are not necessarily employed in each case.

An illustration of the application of these models for the support of the CS-2.1 capabilities is given in the following subclauses.



AE Application Entity
ASE Application Service Element
BCC Bearer Connection Control
CC Call Control
LA Look-Ahead
MC Maintenance Control
NI Network Interface
SACF Single Association Control Function
SAO Single Association Object
UI Unrecognized Information

Figure II.1/Q.2761 – B-ISDN NNI protocol architecture model for CS-2.1

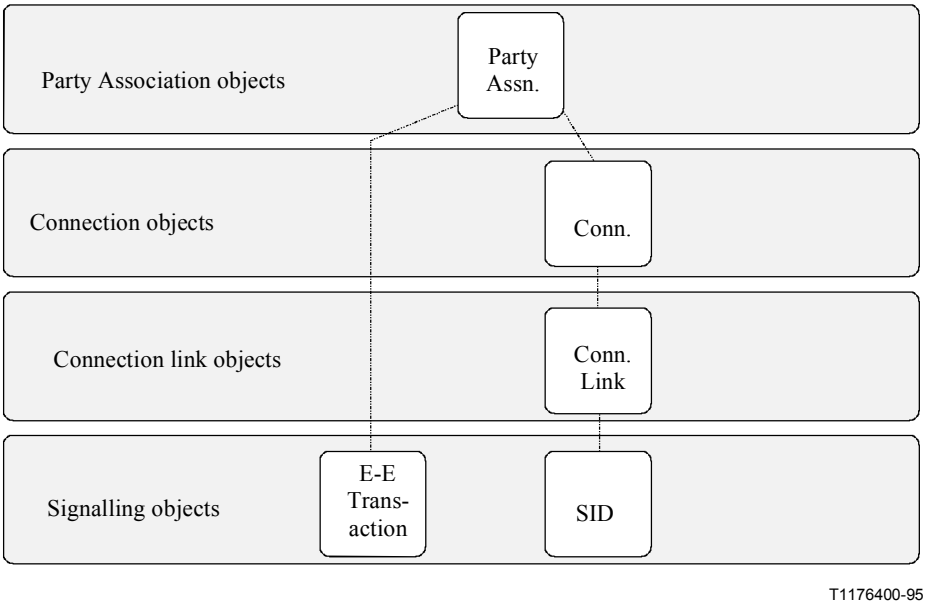


Figure II.2/Q.2761 – B-ISDN NNI application process generalized information model for CS-2.1

Instances of objects from the object classes in this model represent logical entities that are created when a call or connection is set up, referred to during the existence of the call or connection, and deleted when the call or connection is released.

The lines between the objects in this model represent logical associations maintained by the application process logic between these objects.

Signalling objects relate one-to-one to AEIs in the protocol model.

Connection link objects relate one-to-one to the virtual circuits being controlled.

The signalling and connection link objects can be directly addressed with identifier values included in the B-ISUP messages. The connection and party association objects cannot be directly addressed.

Connection objects represent the connection through the exchange, e.g. via a branching function, i.e. via its associations with the incoming and outgoing connection link objects. It is created when a new incoming connection link object is created, and deleted when the last associated connection link object is deleted.

Party objects are used to associate all connections relating to one party. Party objects are only instantiated at nodes where the B-ISDN users are directly connected, i.e. at local exchanges where the call/connection originates/terminates at a coincident T_b/S_b interface. Where the UNI interface is via a T_b interface the party object is in the attached private network.

II.3.2 Modelling examples for CS-2.1

II.3.2.1 A simple point-to-multipoint call

Figure II.3 shows a simple point-to-multipoint call from node A, via a multi-cast function at node B to two parties on nodes C and D. The following figures show the protocol architecture that apply at the nodes in this example. It should be noted that multiple instances of the B-ISUP L-L AEI are used to set up separate signalling associations to each party. In this case there is no instantiation of the E-E AE as look-ahead is assumed not to be used in this example.

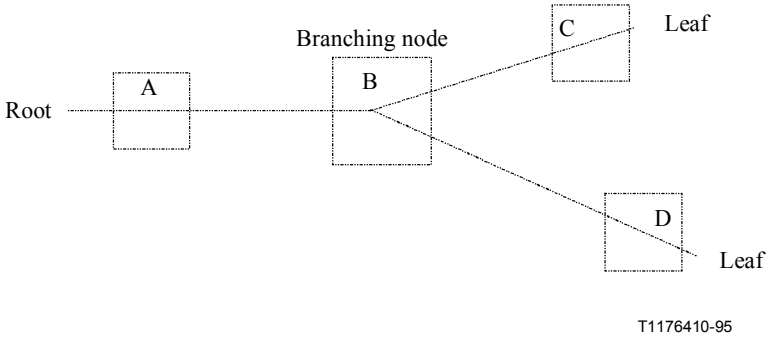


Figure II.3/Q.2761 – Example point-to-multipoint connection configuration

Figure II.4 shows the protocol architecture at exchange A. Exchange A has one outgoing virtual circuit towards exchange B, and has two signalling associations (B-ISUP AEIs): one for each leaf party.

Figure II.5 shows the corresponding application process information model.

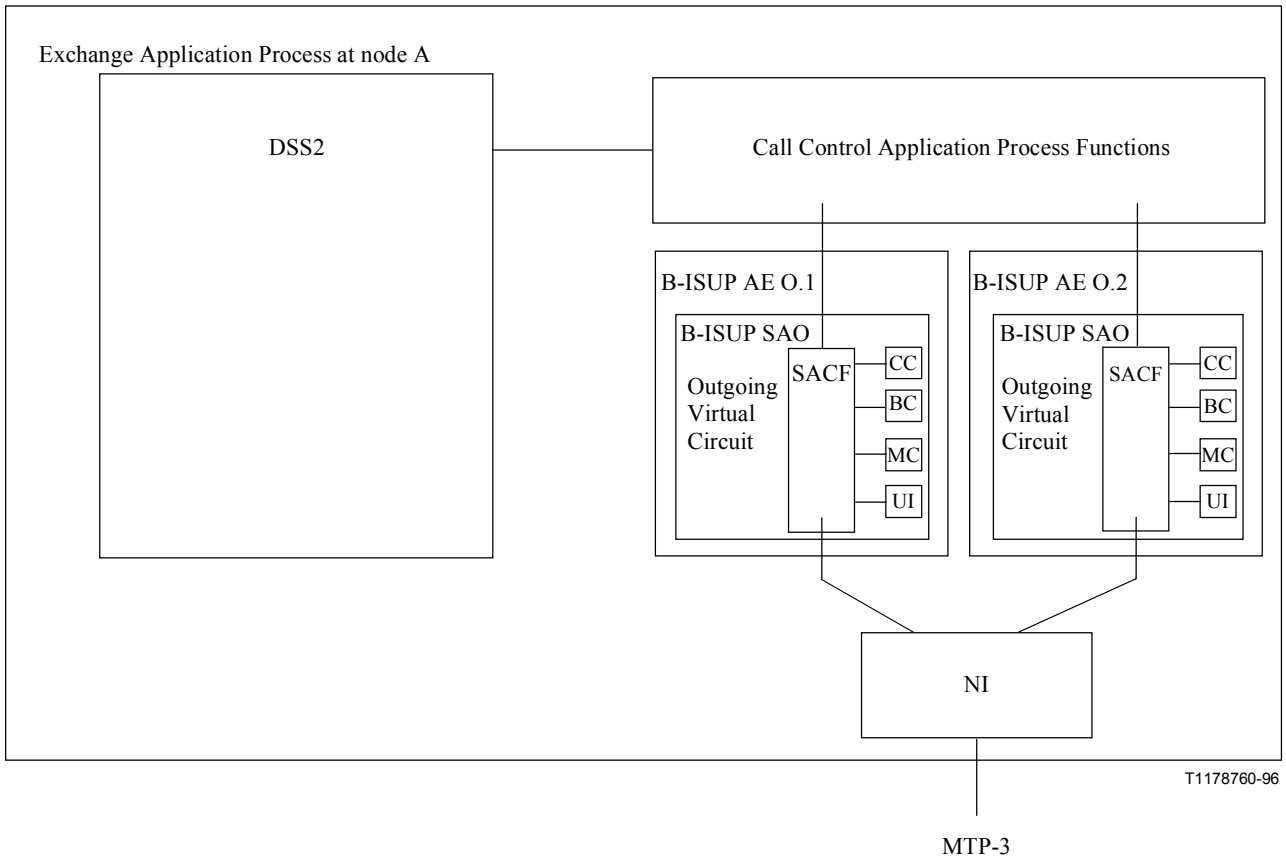


Figure II.4/Q.2761 – Protocol architecture at exchange A

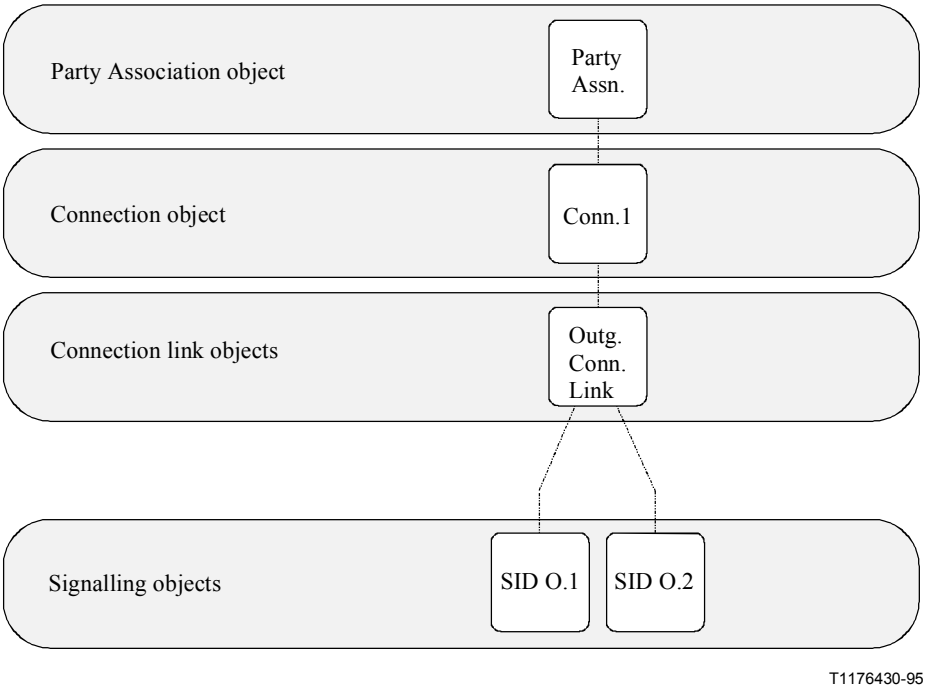


Figure II.5/Q.2761 – Application process information model relating to Figure II.4

At exchange B there are two B-ISUP AEIs, I.1 and I.2, that relate to the one incoming virtual circuit and two B-ISUP AEIs, O.1 and O.2, that each relate to one of the outgoing virtual circuits (see Figure II.6). Figure II.7 shows the information model for this case.

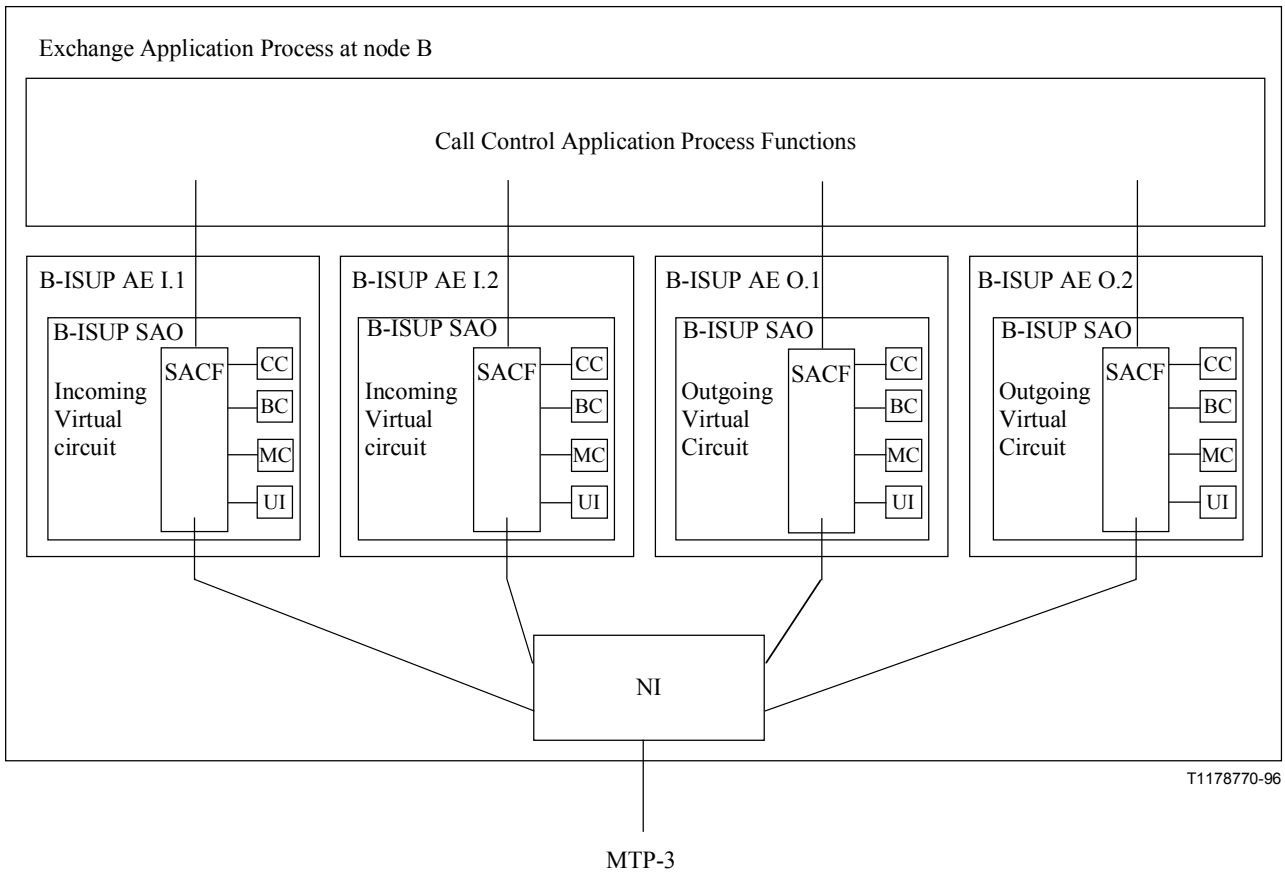


Figure II.6/Q.2761 – Protocol architecture at exchange B

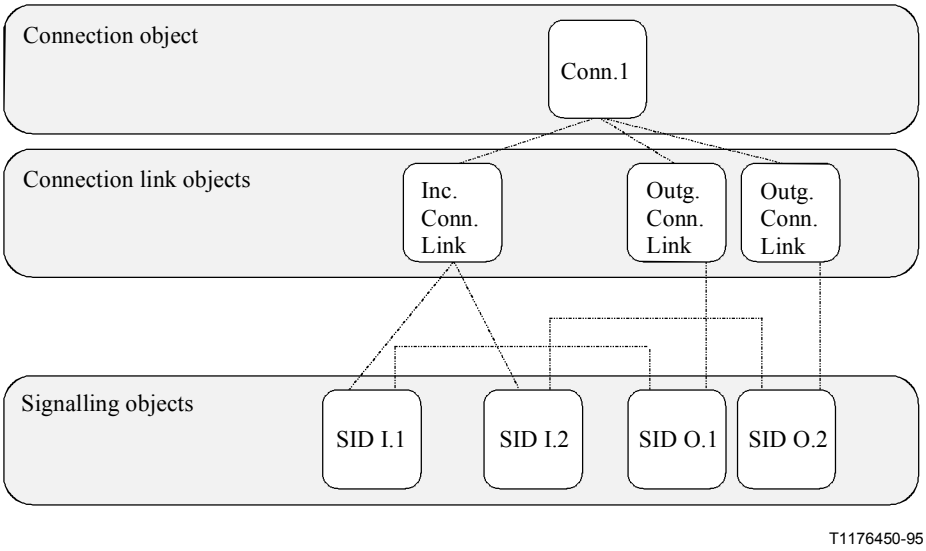


Figure II.7/Q.2761 – Application process information model relating to Figure II.6

The associations SID I.1 ↔ SID O.1 and SID I.2 ↔ SID O.2 represent the 1:1 relationships between incoming and outgoing signalling associations at an intermediate exchange. This association is used, for example, when the root party sends a release towards one of the leaf parties – it provides the linkage for passing the release on to the correct signalling association towards that leaf party.

At the leaf exchanges a single incoming virtual circuit and a corresponding single signalling association are instantiated.

See Figures II.8 and II.9.

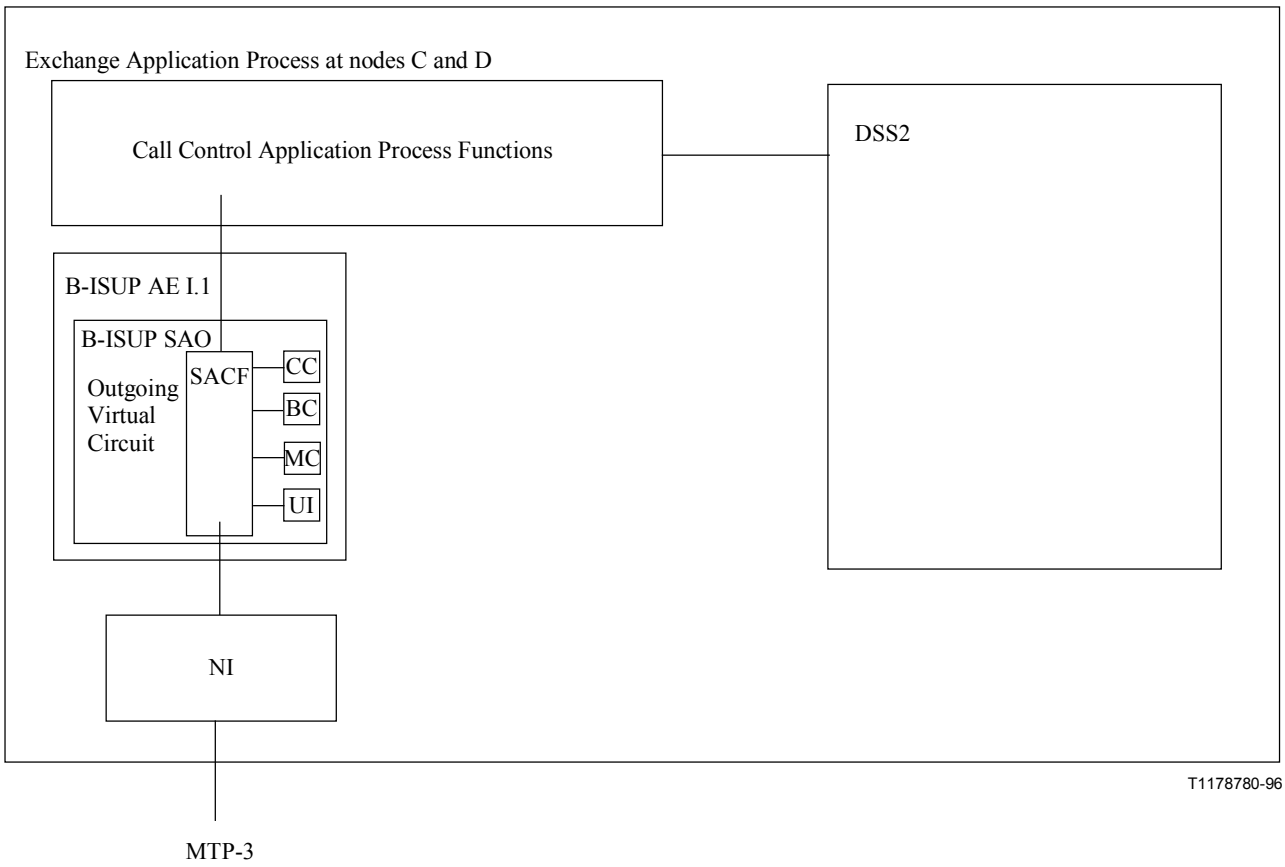


Figure II.8/Q.2761 – Protocol architecture at exchanges C and D

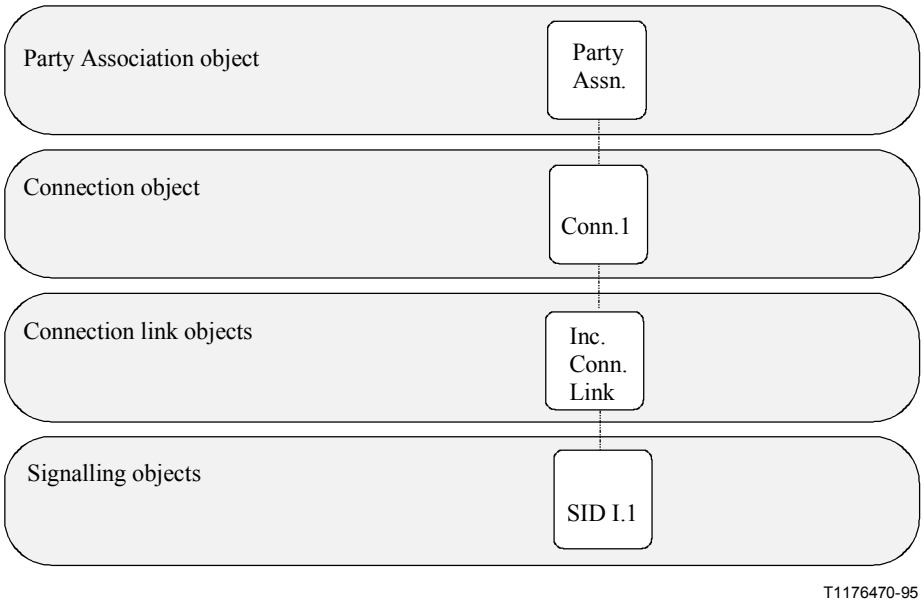


Figure II.9/Q.2761 – Application process information model relating to Figure II.8

II.3.2.1.1 Dynamic modelling aspects

The "dynamic" aspects of the model are considered to be the mechanisms by which instances of the B-ISUP objects are created, and deleted, as required to provide a particular service.

II.3.2.1.1.1 Object creation initiated by this exchange

When a function in the exchange application process decides that B-ISUP is required, e.g. B-ISUP is selected as the signalling system to be used to support an outgoing point-to-multipoint call/connection, the B-ISUP nodal functions will create an outgoing connection link object instance relating to each of the branching legs of the multi-cast connection. The application process will also create an instance of B-ISUP AE for each signalling association required.

II.3.2.1.1.2 Object creation initiated by another exchange

The distribution of messages received at the MTP-3 service access point, and the creation of B-ISUP AEIs happens as in B-ISUP CS-1 (see Recommendation Q.2764). Processing in the call control application process continues with an analysis of received connection link identifiers.

- If the message does not contain a destination connection link identifier parameter, but it does contain an origination connection link identifier parameter, a new instance of incoming connection link object will be created by the B-ISUP nodal functions. This new instance is allocated a new connection link identifier value.
- If the message contains a destination connection link identifier that corresponds to an existing connection link object, the message is handled by the application process as being related to that object.
- If the destination connection link identifier does not correspond to an existing incoming connection link object instance, an error has occurred.
- If the message contains neither an origination or a destination connection link identifier, then handling shall continue as for a B-ISUP CS-1 exchange.

II.3.2.1.1.3 Object deletion

When a B-ISUP operation is complete, e.g. a connection branch to one remote party is released, the associated AEI is deleted, and the associated connection link object instance will be deleted if it has no remaining associated AEIs. When deletion of a connection link object instance causes its parent connection object instance to have no associated connection link objects, the connection object instance is also deleted. Similarly, when a party association object instance has no remaining connection objects, it is deleted.

II.4 Interworking with CS-1 exchanges

Exchanges supporting CS-1 procedures can be used for the establishment of calls employing capabilities introduced by CS-2.1 as described in the following subclauses.

II.4.1 Point-to-multipoint calls (multi-party calls)

A CS-1 exchange can act as an intermediate or destination exchange for a point-to-multipoint call.

II.4.2 Additional traffic parameters

A CS-1 exchange can act as an intermediate exchange for a call using additional traffic parameters.

II.4.3 Look-ahead capability

A CS-1 exchange can act as an intermediate exchange for a call using look-ahead.

II.4.4 Negotiation of traffic characteristics during call setup

A CS-1 exchange can act as an intermediate or destination exchange for a call using negotiation of traffic characteristics during call setup.

II.4.5 Modification of traffic characteristics during the active phase of the call

If a modification request reaches a CS-1 exchange, the modification request will be rejected.

II.4.6 ATM end system address

A CS-1 exchange can act as an intermediate exchange for a call using ATM end system address.

II.4.7 Call priority

A CS-1 exchange can act as an intermediate or destination exchange for a call using call priority.

II.4.8 Network call correlation ID

A CS-1 exchange can act as an intermediate or destination exchange for a call using network call correlation ID.

II.4.9 Frame relay

A CS-1 exchange cannot support calls using Frame Relay.

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