EUROPEAN TELECOMMUNICATION STANDARD

ETS 300 150

November 1992

Source: ETSI TC-TM

Reference: DE/TM-2001

ICS: 33.020, 33.040.40

Key words: Transmission

Transmission and Multiplexing (TM); Protocol suites for Q interfaces for management of transmission systems

ETSI

European Telecommunications Standards Institute

ETSI Secretariat

Postal address: F-06921 Sophia Antipolis CEDEX - FRANCE
Office address: 650 Route des Lucioles - Sophia Antipolis - Valbonne - FRANCE
X.400: c=fr, a=atlas, p=etsi, s=secretariat - **Internet:** secretariat@etsi.fr

Tel.: +33 92 94 42 00 - Fax: +33 93 65 47 16

Contents

Blank page

Foreword

This European Telecommunication Standard (ETS) has been produced by the Transmission and Multiplexing (TM) Technical Committee of the European Telecommunications Standards Institute (ETSI).

This ETS concerns the characteristics of Q interfaces for transmission systems and equipments, and the text is based on draft CCITT Recommendation G.773. Although in 1990 CCITT SGXV agreed to adopt the Recommendation under the accelerated approval procedure, ETSI TC-TM is seeking to provide an ETS for use in Europe rather quicker than this. The text of this ETS is to be revised in due course to take account of the eventual published version of the finally approved CCITT Recommendation G.773.

NOTE: Draft CCITT Recommendation G.773 is not normatively referenced in this ETS as most of the text is included. However, it is probable that a future edition will refer to it normatively, thereby reducing the size of this ETS.

Blank page

1 Scope

This ETS defines the characteristics of protocol suites for Q interfaces for transmission systems/equipments, as defined in CCITT Recommendations M.3010 [2] and G.773. Protocol suites for Q interfaces for other systems/equipments are to be specified in other ETSs. The interfaces will support bidirectional data transfer for the management of telecommunications systems.

This ETS defines:

- the layer services;
- the layer protocols;
- the application service elements and protocols;
- the conformance requirements to be met by an implementation of these interfaces.

This ETS does not define:

- the structure or meaning of the management information that is transmitted by means of the protocol suites;
- the manner in which management is accomplished as a result of the application protocol exchanges;
- the interactions which result in the use of the application layer protocols.

2 Normative references

This ETS incorporates, by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this ETS only when incorporated in it by amendment or revision. For undated references, the latest edition of the publication referred to applies.

[1] CCITT Recommendation E.164 (1992): "Numbering plan for the ISDN era".

[2] CCITT Recommendation M.3010 (1989): "Principles for a telecommunications management network".

[3] CCITT Recommendation V.10 (1988): "Electrical characteristics for unbalanced double-current interchange circuits for general use with integrated circuit equipment in the field of data communications" (also designated as CCITT Recommendation X.26).

[4] CCITT Recommendation V.11 (1988): "Electrical characteristics for balanced double-current interchange circuits for general use with integrated circuit equipment in the field of data communications" (also designated as CCITT Recommendation X.27).

[5] CCITT Recommendation V.24 (1988): "List of definitions for interchange circuits between data terminal equipment (DTE) and data circuit-terminating equipment (DCE)".

[6] CCITT Recommendation V.28 (1988): "Electrical characteristics for unbalanced double-current interchange circuits".

[7] CCITT Recommendation V.35: "Data transmission at 48 kilobits per second using 60-108 kHz group band circuits".

[8] CCITT Recommendation X.21 (1992): "Interface between data terminal equipment (DTE) and data circuit-terminating equipment (DCE) for synchronous operation on public data networks".

[9] CCITT Recommendation X.21 bis (1988): "Use on public data networks of data terminal equipment (DTE) which is designed for interfacing to synchronous V-Series modems".

[10] CCITT Recommendation X.25: "Interface between data terminal equipment (DTE) and data circuit-terminating equipment (DCE) for terminals operating in the packet mode and connected to public data networks by dedicated circuit".

[11] CCITT Recommendation X.121 (1992): "International numbering plan for public data networks".

[12] CCITT Recommendation X.200 (1988): "Reference model of open systems interconnection for CCITT applications" (see also ISO 7498).

[13] CCITT Recommendation X.208 (1988): "Specification of abstract syntax notation one (ASN.1)" (see also ISO 8824).

[14] CCITT Recommendation X.209 (1988): "Specification of basic encoding rules for abstract syntax notation one (ASN.1)" (see also ISO 8825).

[15] CCITT Recommendation X.211 (1988): "Physical service definition of open systems interconnection for CCITT applications" (see also ISO/IEC 10022).

[16] CCITT Recommendation X.212 (1988): "Data link service definition for open systems interconnection for CCITT applications" (see also ISO 8886).

[17] CCITT Recommendation X.213 (1988): "Network service definition for open systems interconnection for CCITT applications" (see also ISO 8348).

[18] CCITT Recommendation X.214 (1988): "Transport service definition for open systems interconnection for CCITT applications" (see also ISO 8072).

[19] CCITT Recommendation X.215 (1988): "Session service definition for open systems interconnection for CCITT applications" (see also ISO 8326).

[20] CCITT Recommendation X.216 (1988): "Presentation service definition for open systems interconnection for CCITT applications" (see also ISO 8822).

[21] CCITT Recommendation X.217 (1992): "Association control service definition for open systems interconnection for CCITT applications" (see also ISO 8649).

[22] CCITT Recommendation X.219 : "Remote operations: model, notation and service definition" (see also ISO 9072-1).

[23] CCITT Recommendation X.223 : "Use of X.25 to provide the OSI connection-mode network service for CCITT Applications" (see also ISO 8878).

[24] CCITT Recommendation X.224 (1988): "Transport protocol specification for Open Systems Interconnection for CCITT Applications" (see also ISO 8073).

[25] CCITT Recommendation X.225: "Session protocol specification for Open Systems Interconnection for CCITT Applications" (see also ISO 8327).

[26] CCITT Recommendation X.226: "Presentation protocol specification for Open Systems Interconnection for CCITT Applications"(see also ISO 8823).

[27] CCITT Recommendation X.227 (1992): "Association control protocol specification for Open Systems Interconnection for CCITT Applications" (see also ISO 8650).

[28] CCITT Recommendation X.229: "Remote operations: Protocol specification" (see also ISO 9072-2).

[29] CCITT Recommendation X.244: "Procedure for the exchange of protocol identification during virtual call establishment on packet switched public data networks".

[30] ISO 2110 (1980): "Information technology - Data communication - 25-pole DTE/DCE interface connector and contact number assignments".

[31] ISO 2593 (1984): "Data communication - 34 Pin DTE/DCE interface connector and pin assignments".

[32] ISO 3309 (1988): "Information processing systems - Data communication - High-level data link control procedures - Frame structure".

[33] ISO 4335 (1987): "Information processing systems - Data communication - High-level data link control procedures - Consolidation of elements of procedures".

[34] ISO 4902 (1989): "Information technology - Data communication - 37-pole DTE/DCE interface connector and contact number assignments".

[35] ISO 4903 (1989): "Information technology - Data communication - 15-pole DTE/DCE interface connector and contact number assignments".

[36] ISO 7776 (1986): "Information processing systems - Data communication - High-level data link control procedures - Description of the X.25 - LAPB-compatible DTE data link procedures".

[37] ISO 7809 (1984): "Information processing systems - Data communication - High-level data link control procedures - Consolidation of classes of procedures".

[38] ISO 8072 (1986): "Information processing systems - Open Systems Interconnection - Transport service definition".

[39] ISO 8073 (1988): "Information processing systems - Open Systems Interconnection - Connection oriented transport protocol specification".

[40] ISO 8073/Add.1 (1988): "Information processing systems - Open Systems Interconnection - Connection oriented transport protocol specification - Addendum 1: Network connection management subprotocol".

[41] ISO 8073/Add.2 (1989): "Information processing systems - Open Systems Interconnection - Connection oriented transport protocol specification - Addendum 2: Class 4 operation over connectionless network service".

[42] ISO 8208:1987: "Information processing systems - Data communications - X.25 Packet Level Protocol for Data Terminal Equipment".

[43] ISO 8348/Add.1 (1987): "Information processing systems - Data communication - Network service definition - Addendum 1: Connectionless-mode transmission".

[44] ISO 8348/Add.2 (1988): "Information processing systems - Data communication - Network service definition - Addendum 2: Network layer addressing".

[45] ISO 8473 (1988): "Information processing systems - Data communication - Protocol for providing the connectionless-mode network service".

[46] ISO 8473/Add.3 (1989): "Information processing systems - Data communication - Protocol for providing the connectionless-mode network service - Addendum 3: Provision of the underlying service assumed by ISO 8473 over subnetworks which provide the OSI data link service".

[47] ISO 8482 (1987): "Information processing systems - Data communication - Twisted pair multipoint interconnections".

[48] ISO 8802-2 (1988): "Information processing systems - Local area networks - Part 2: Logical link control".

[49] ISO 8802-3 (1988): "Information processing systems - Local area networks - Part 3: Carrier sense multiple access with collision detection - Access method and physical layer specifications".

[50] ISO 8880-3 (1988): "Information processing systems - Protocol combinations to provide and support the OSI network service - Part 3: Provision and support of connectionless-mode network service".

[51] ISO DIS 9545 (1989): "Information processing systems - Open Systems Interconnection - Application layer structure".

[52] ISO 9595 (1990): "Information processing systems - Open Systems Interconnection - Common Management Information Service definition (CMIS)".

[53] ISO 9595 (1989)/DAD1: "Information processing systems - Open Systems Interconnection - Common Management Information Service definition - Addendum 1 (CANCEL GET)".

[54] ISO 9595 (1989)/DAD2: "Information processing systems - Open Systems Interconnection - Common Management Information Service definition - Addendum 2 (REMOVE)".

[55] ISO 9596 (1990): "Information processing systems - Open Systems Interconnection - Common Management Information Protocol specification (CMIP)".

[56] ISO 9596 (1989)/DAD1: "Information processing systems - Open Systems Interconnection - Common Management Information Protocol specification Addendum 1: (CANCEL GET)".

[57] ISO 9596 (1989)/DAD2: "Information processing systems - Open Systems Interconnection - Common Management Information Protocol specification Addendum 2: (REMOVE)".

[58] ISO TR 9577 (1990): "Information technology - Telecommunications and information exchange between systems - Protocol identification in the OSI Network Layer".

[59] ISO DTR 10172: "Information processing systems - Data communication - Network/Transport protocol interworking specification".

[60] EIA RS 485 (1983): "Standard for electrical characteristics of generators and receivers for use in balanced digital multipoint systems".

3 Abbreviations and symbols

3.1 Abbreviations

For the purpose of this ETS, the following abbreviations apply.

AARE	A-Associate Response
AARQ	A-Associate Request
ACSE	Association Control Service Element
AFI	Authority and Format Identifier
APDU	Application Protocol Data Unit
ASE	Application Service Element
ASN.1	Abstract Syntax Notation One
CC	Connection Confirm
CD	Collision Detection
CDO	Connect Data Overflow
CLNS	Connectionless-mode Network Service
CMIP	Common Management Information Protocol
CMIS	Common Management Information Service
CMISE	Common Management Information Service Element
Conf	Confirm
CONS	Connection-mode Network Service
CR	Connection Request
CSMA/CD	Carrier Sense Multiple Access with Collision Detection
DCE	Data Circuit-terminating Equipment
DCN	Data Communication Network
DIS	Draft International Standard (ISO/IEC)
DLC	Data Link Connection
DLS	Data Link Service
DR	Disconnection Request
DSP	Domain Specific Part
DTE	Data Terminal Equipment
ER-TPDU	Error Transport Protocol Data Unit
FU	Functional Unit

HDLC	High-level Data Link Control
Ind	Indication
ISO	International Organisation for Standardisation
LAPB	Link Access Procedure Balanced
LCN	Local Communication Network
LLC	Logical link control
LME	Layer Management Entity
MAC	Media Access Control
MD	Mediation Device
NDM	Normal Disconnected Mode
NE	Network Element
NLR	Network Layer Relay
NRM	Normal Response Mode
NRZI	Non Return to Zero Inverted
NS	Network Service
NSAP	Network Service Access Point
OA	Overflow Accept
OS	Operations System
OSI	Open Systems Interconnection
PDU	Protocol Data Unit
Ph	Physical
PhC	Physical Connection
PhS	Physical Service
PICS	Protocol Implementation Conformance Statement
PLS	Physical Layer Service
PPDU	Presentation Protocol Data Unit
PV	Parameter Value
PVC	Permanent Virtual Circuit
QoS	Quality of Service
Req	RequestRes Response
ROSE	Remote Operations Service Element

SDH	Synchronous Digital Hierarchy
SLP	Single Link Procedure
SM-ASE	System Management Application Service Element
SP	Session Protocol
SPDU	Session Protocol Data Unit
SVC	Switched Virtual Circuit[1)]
TPDU	Transport Protocol Data Unit
TSAP	Transport Service Access Point
UNC	Unbalanced operation Normal response mode Class

3.2 Symbols and abbreviations used in tables [2)]

For the purpose of this ETS, the following symbols and abbreviations apply.

M	Mandatory.
-	The parameter is not present in the interaction described by the service or primitive concerned.
(=)	The value of the parameter is equal to the value of the parameter in the column to the left.
*n	See NOTE 'n' the table below.

4 Protocol suites overview

The protocol suites are based on CCITT Recommendation G.773.

CCITT Recommendation G.771 provides guidance for the selection of protocol suites from draft CCITT Recommendation G.773 and the domain of application of these standard protocol suites.

The structures of the protocol suites with the present layers are shown in figure 1. The defined communication services and protocols are in accordance with the Open Systems Interconnection (OSI) Reference Model (see CCITT Recommendation X.200 [12]).

The protocols for the different layers are based on CCITT Recommendations and/or ISO standards.

Two types of protocol suites are defined in this ETS:

- short stack: protocol suite A1;
- full 7 layer stack: protocol suites B1, B2 and B3.

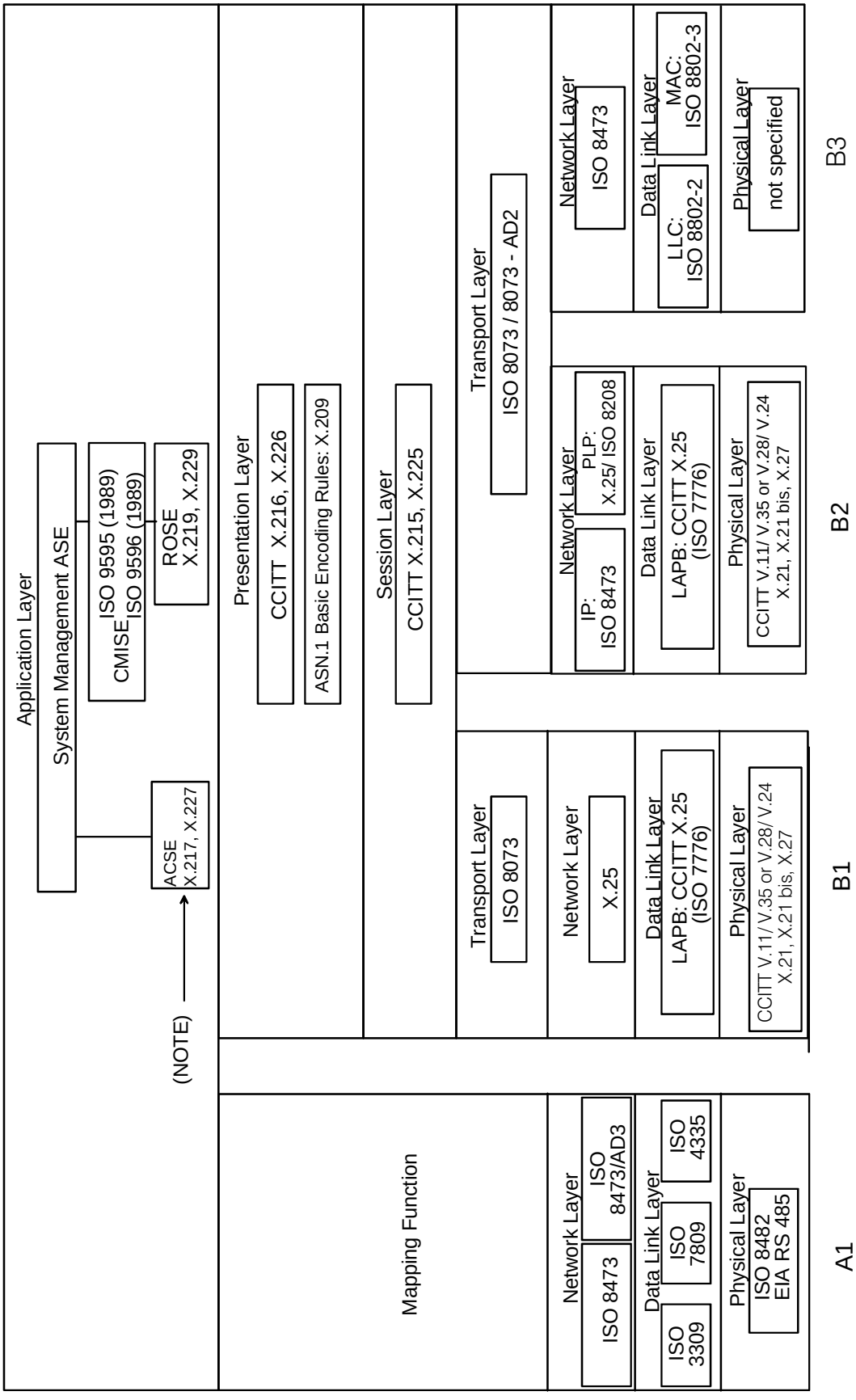
The short stack protocol suite (A1) shall be used mainly for Local Communication Network (LCN) application as specified in CCITT Recommendation M.3010 [2]. The full 7 layer stack protocol suites (B1, B2 and B3) can be applied to both LCN and Data Communication Network (DCN) applications, as defined by CCITT Recommendation M.3010 [2].

Because of the nulling of the transport layer, session layer and presentation layer for the short stack protocol suite, a mapping function has been defined.

[1)] Switched Virtual Circuit corresponds to "Virtual Call" used in CCITT Recommendation X.25 [10].

[2)] The requirements are as defined in the referred standards or CCITT Recommendations.

The full 7 layer protocol suites satisfy the requirements of complex Network Elements (NEs) (e.g. equipments for the Synchronous Digital Hierarchy (SDH)). To support already existing networks and to provide maximum flexibility, several possibilities are defined for layers 1, 2 and 3. Each administration should make the selection depending on its own specific requirements and needs. Layers 5, 6 and 7 are identical for the three protocol suites B1, B2 and B3, whilst almost identical requirements apply to layer 4.



NOTE: ACSE is optional for protocol suite A1.

Figure 1: Overview of protocol suites

5 Protocol suite A1

5.1 Physical layer

5.1.1 Service

5.1.1.1 Definition

The service definition for the physical layer is in accordance with CCITT Recommendation X.211 [15].

The following classes of physical services shall be supported:

- type of transmission is synchronous;
- mode of operation is half-duplex;
- topology is point-to-multipoint by a bus.

5.1.1.2 Service provided by the physical layer

The physical layer provides the physical service primitives and parameters as listed in table 1.

Table 1: Provided physical service

Service	Primitive	Parameters
PhC-Activation	Ph-ACTIVATE-request	
	Ph-ACTIVATE-indication	
Data Transfer	Ph-DATA-request	PhS-UserData
	Ph-DATA-indication	
PhC-Deactivation	Ph-DEACTIVATE-request	
	Ph-DEACTIVATE-indication	

The services PhC-Activation and PhC-Deactivation shall be provided to the Layer Management Entity (LME) of the physical layer.

5.1.2 Physical interface

5.1.2.1 Physical characteristics

5.1.2.1.1 Configuration

Serial bus operation in accordance with ISO 8482 [47], Part 3, in half-duplex mode.

5.1.2.1.2 Transmission pairs

Two screened balanced pairs, one for each direction of transmission.

5.1.2.1.3 Connector

The administration shall specify the connector type.

5.1.2.2 Electrical characteristics

5.1.2.2.1 Static and dynamic characteristics

The static and dynamic characteristics of each bus connection shall be in accordance with ISO 8482[3)] [47]. When all generators connected to the bus are in the high impedance state, the bus shall be set to logical level "1".

5.1.2.2.2 Bus termination

Each bus end shall be terminated in accordance with ISO 8482 [47].

5.1.2.2.3 Load connection

Each receiver shall present a maximum of one unit load, as defined in ISO 8482 [47], to the bus. The number of load connections is limited to 32.

5.1.2.2.4 Bit rate

The bit rate shall be 19,2 kbit/s or 64 kbit/s. A bit rate of 128 kbit/s may be necessary in some applications. The bit rate tolerance shall be ± 0,05%.

5.1.2.2.5 Turn-off time

For bit rates of 19,2 kbit/s and 64 kbit/s, a transmitting station shall put its generator in the high impedance state within 0,75 ms from the end of the last bit of the closing flag. For a bit rate of 128 kbit/s, the turn off time shall be not more than 0,375 ms. This point is not applicable to a primary station (see subclause 5.2.2.1.3).

5.1.2.2.6 Switch-on transient

Following the enabling of the generator, an implementation dependent preamble of no more than 4 bit times shall be allowed. No assumption as to the state of the bus during this preamble shall be allowed.

5.1.2.3 Line code

The line code shall be Non Return to Zero Inverted (NRZI).

5.1.2.3.1 Principle

Each ISO 8482 [47] transition shall represent a ZERO bit and no transition shall represent a ONE bit.

5.1.2.3.2 Lock in sequence

Where required for clock extraction, it shall be possible to send a lock in sequence containing at least four transitions immediately prior to the beginning of the starting flag of the frame to be transmitted.

5.2 Data link layer

5.2.1 Service

5.1.1.1 Definition

The service definition of the data link layer is in accordance with CCITT Recommendation X.212 [16]. The class of data link service that shall be provided by the data link layer is:

- a connection-mode service.

[3)] Compliance assumes that full compatibility with EIA RS 485 [60] is guaranteed.

5.2.1.2 Service required from the physical layer

The data link layer requires the data transfer service from the physical layer.

5.2.1.3 Service provided by the data link layer

The data link layer shall provide the data link service, primitives and parameters as listed in tables 2, 3 and 4.

5.2.1.3.1 Data Link Connection (DLC)-Establishment

Table 2: DLC-Establishment service

Parameter name	Req/Ind	Res/Conf
Called address	M	-
Calling address	M	-
Responding address	-	M
Quality of Service (QoS)	M	M

5.2.1.3.2 Data Link Connection (DLC)-Release

Table 3: DLC-Release service

Parameter name	Req	Ind
Originator	-	M
Reason	M	M

5.2.1.3.3 Normal data transfer

Table 4: Normal data transfer service

Parameter name	Req	Ind
Data Link Service (DLS) User-data	M	M

5.2.2 Data link protocol

The data link protocol is synchronous High-level Data Link Control (HDLC) type.

5.2.2.1 HDLC frame structure

The HDLC frame structure shall conform to ISO 3309 [32] (frame structure).

5.2.2.1.1 Address field

The address field shall be one octet.

5.2.2.1.2 Information field

The information field in any HDLC frame shall be an integral number of octets.

Information field octets shall be sent least significant bit first. The maximum length of the information field shall be 256 octets.

5.2.2.1.3 Interframe time fill

A primary station shall transmit contiguous flags as interframe time fill.

5.2.2.2 Addressing

The secondary station shall be capable of being assigned any address in the range 1 to 254.

5.2.2.2.1 All station address

The address field bit pattern "11111111" is defined as the all station address.

5.2.2.2.2 No station address

The address field bit pattern "00000000" is defined as the no station address. The no station address shall never be assigned to a secondary station.

5.2.2.2.3 Group addresses

Not used.

5.2.2.3 HDLC procedure

The HDLC procedure is defined in ISO 4335 [33].

5.2.2.3.1 Commands and responses

The following HDLC commands and responses shall be supported.

- Commands:

  SNRM: Set Normal Response Mode;

  DISC: Disconnect.

- Commands or responses:

  I: Information;

  RR: Receive Ready;

  RNR: Receive Not Ready.

- Responses:

  FRMR: Frame Reject;

  UA: Unnumbered Acknowledgement;

  DM: Disconnect Mode.

5.2.2.3.2 Modes

Two modes are selected:

- one operational mode: Normal Response Mode (NRM);

- one non-operational mode: Normal Disconnected Mode (NDM).

5.2.2.4 Class of procedure

The Unbalanced operation Normal response mode Class (UNC) as defined in ISO 7809 [37] shall be implemented.

5.2.2.4.1 HDLC optional functions

The following HDLC optional functions shall be implemented:

- unnumbered information (option No. 4);
- data link test (option No. 12).

5.2.2.5 Other parameters of data link layer

5.2.2.5.1 Window size

The window size for unacknowledged frames is to be optional between 1 and 7. The default value is 1.

5.2.2.5.2 Waiting-time before a repetition

In the case of no-reply or lost-reply, the primary station shall provide a waiting time function. The waiting-time before a repetition shall be greater than the duration of the longest frame to be sent by the primary station, added to the response-time of the secondary station and the duration of the longest frame to be sent by the secondary station.

5.2.2.5.3 Number of repetitions

Under the conditions described in subclause 5.2.2.5.2, the maximum number of repetitions before detecting a no-reply or a lost-reply condition is fixed to 5 (6 requests).

5.2.2.5.4 Response time

The secondary station shall commence the opening flag of its response not later than 5 ms after the end of the closing flag of the frame sent from the primary station.

5.3 Network layer for A1

5.3.1 Service

5.3.1.1 Service definition

The definition of the connectionless mode network service shall comply with that specified in ISO 8348/AD 1 [43]. Address formats supported shall conform to ISO 8348/AD 2 [44].

5.3.1.2 Service required from the data link layer

The network layer requires the normal data transfer service from the data link layer.

5.3.1.3 Service provided by the network layer

The network layer shall provide the N-UNITDATA service as listed in table 5 below.

Table 5: N-UNITDATA service

Parameter name	Req	Ind
Source Address	M	M(=)
Destination address	M	M(=)
Qos	M	M
Network Service (NS)-User data	M	M(=)

5.3.2 Network protocol

5.3.2.1 General

The network protocol is as specified in ISO 8473 [45]. The subnetwork dependent convergence function required for protocol suite A1 is specified in ISO 8473/AD 3 [46]. In addition to the full protocol (see subclause 5.3.2.4), ISO 8473 [45] defines two subsets, namely:

- inactive network layer protocol (see subclause 5.3.2.2);

- non-segmenting network layer protocol (see subclause 5.3.2.3).

The address part shall have the structure as defined in ISO 8348/AD 2 [44].

For protocol suite A1, the Authority and Format Identifier (AFI) shall be set to 49, coded by 2 decimal digits as defined in ISO 8348/AD 2 [44], which specifies local and binary coding of the Domain Specific Part (DSP).

The full protocol and the two subsets permit the use of known subnetwork characteristics and are therefore not subnetwork independent.

Depending on the required usage and the subnetwork architecture, the full protocol, or one or both subsets, shall be supported by protocol suite A1. The selection shall be put in the Protocol Implementation Conformance Statement (PICS).

5.3.2.2 Inactive network layer protocol

The protocol shall be in accordance with the inactive subset of the protocol as defined in ISO 8473 [45].

5.3.2.3 Non-segmenting network layer protocol

The protocol shall be in accordance with category Type 1 functions of the non-segmenting subset of the protocol as defined in ISO 8473 [45].

From the optional functions (Type 3) defined in the non-segmenting subset, only the priority function shall be supported as defined in ISO 8473 [45].

5.3.2.4 Full network layer protocol

The full protocol subset of category Type 1 functions, as specified in ISO 8473 [45], shall be supported.

An implementation shall not transmit Protocol Data Units (PDUs) encoded using the inactive subset. Received PDUs encoded using the inactive subset shall be discarded.

An implementation shall not generate data PDUs without a segmentation part, i.e. the segmentation permitted flag shall be set to 1 and the segmentation part shall be included. However, an implementation shall be capable of receiving and correctly processing PDUs which do not contain the segmentation part.

5.4 Mapping function for A1

5.4.1 Introduction

No transport layer, session layer and presentation layer shall be specified for protocol suite A1.

To provide the required service to the application layer and using the provided service of the network layer, a mapping function is defined.

No protocol for the mapping function is defined.

5.4.2 Service

5.4.2.1 Service definition

The service definition of the mapping function, which provides the required presentation service to the application layer, shall be in accordance with CCITT Recommendation X.216 [20].

5.4.2.2 Service required from network layer

The mapping function requires the N-UNITDATA as the connectionless-mode network service.

5.4.2.3 Service provided by the mapping function

The mapping function shall provide the presentation service as listed in table 6 below.

Table 6: Service provided by the mapping function

Service	Primitive	Parameters
P-DATA	P-DATA-request	User data
	P-DATA-indication	

When the Association Control Service Element (ACSE) is supported in the application layer, the mapping function shall also provide the presentation services P-CONNECT, P-RELEASE, P-U-ABORT and P-P-ABORT. Only the parameters defined as mandatory in CCITT Recommendation X.216 [20] shall be supported. The value of the mode parameter of P-CONNECT shall be "normal".

5.4.3 Procedure

The mapping function shall provide the values for the source address, destination address, Quality of Service (QoS) and Network Service User Data as required by the network service parameters. The mapping function shall translate the presentation addresses to the Network Service Access Point (NSAP) addresses and vice versa. It shall provide the value of the QoS parameter of N UNITDATA Request. The Network Service User Data shall be provided by the user data of P-DATA and vice versa.

NOTE: This is not a mapping protocol. While the service description of this function is standard, the implementation itself need not be standardised.

5.5 Application layer for A1

5.5.1 Overview

The network management application layer shall provide the Common Management Information Service Element (CMISE) service to the System Management Application Service Element (SM-ASE).

The required application service elements for this service are CMISE and Remote Operations Service Element (ROSE). Some applications may require the addition of the Association Control Service Element (ACSE).

5.5.2 Syntax and encoding

The application layer protocol data unit presentation is described by using Abstract Syntax Notation One (ASN.1), as defined in CCITT Recommendation X.208 [13] and is encoded in accordance with the basic encoding rules for ASN.1, as defined in CCITT Recommendation X.209 [14].

5.5.3 Association control

5.5.3.1 Service description

The ACSE service description is detailed in CCITT Recommendation X.217 [21]. When the ACSE is used, all of the defined ACSE services (as given in table 7) are mandatory. The value of mode parameter of A-ASSOCIATE shall be "normal".

5.5.3.2 Protocol specification

The protocol specification for ACSE shall follow CCITT Recommendation X.227 [27]. When the ACSE is used, all five Application Protocol Data Units (APDUs) (see table 7) specified in this ETS shall be mandatory. The value of protocol version field of A-ASSOCIATE REQUEST (AARQ) and A-ASSOCIATE RESPONSE (AARE) shall be "version 1" only.

Table 7: ACSE services and associated APDUs

ACSE Service	Associated APDUs	Related P-Service
A-ASSOCIATE	AARQ, AARE	P-CONNECT
A-RELEASE	RLRQ, RLRE	P-RELEASE
A-ABORT	ABRT	P-U-ABORT
A-P-ABORT	(none)	P-P-ABORT

5.5.4 Remote operations

5.5.4.1 Service description

The Remote Operations Service Element (ROSE) shall be a mandatory service element for the protocol suite A1. The ROSE service description is detailed in CCITT Recommendation X.219 [22]. All of the defined ROSE services (see table 8) are mandatory.

5.5.4.2 Protocol specification

The protocol specification for ROSE shall follow CCITT Recommendation X.229 [28]. All four APDUs specified in the standard (see table 8) are mandatory. In addition, the ability to support correct origination and reception of the linked-id protocol element is required for Protocol Suite A1.

The requirement specified in table 8 below implies association Class 3 in ROSE.

Table 8: ROSE services and associated APDUs

ROSE Service	Associated APDUs	Related underlying service
RO-INVOKE	ROIV	P-DATA
RO-RESULT	RORS	P-DATA
RO-ERROR	ROER	P-DATA
RO-REJECT-U	RORJ	P-DATA
RO-REJECT-P	RORJ	P-DATA

5.5.5 Common management information

5.5.5.1 Service description

The Common Management Information Service Element (CMISE) shall be a mandatory service element for the protocol suite A1. The CMISE service description is detailed in ISO 9595 [52], ISO 9595/DAD 1 [53] and ISO 9595/DAD 2 [54]. The CMISE services are listed in table 9.

Table 9: CMISE services

Service	Type
M_EVENT-REPORT	confirmed/non confirmed
M-GET	confirmed
M-SET	confirmed/non confirmed
M-ACTION	confirmed/non confirmed
M-CREATE	confirmed
M-DELETE	confirmed
M-CANCEL-GET	confirmed

5.5.5.2 Protocol specification

The protocol specification for CMISE shall follow ISO 9596 [55], ISO 9596/DAD1 [56] and ISO 9596/DAD2 [57].

5.6 Conformance

For further study.

6 Protocol suites B1, B2 and B3

6.1 Physical layer

6.1.1 Physical layer for B1 and B2

6.1.1.1 Protocol

The protocol of the physical layer of protocol suites B1 and B2 shall comply with the following specifications:

- X.21 interface in accordance with § 1.1 of CCITT Recommendation X.25 [10];
- X.21 bis interface in accordance with § 1.2 of CCITT Recommendation X.25 [10];
- V-series interface in accordance with § 1.3 of CCITT Recommendation X.25 [10].

6.1.1.2 Bit rate

The supported bit rates are: 1 200, 2 400, 4 800, 9 600, 19 200 and 64 000 bit/s. The bit rates 48 000 bit/s and 56 000 bit/s may be used for an interim period (see NOTE to table 17).

6.1.1.3 Connector

Table 10 lists the connectors to be used in accessing the CCITT Recommendations X.21 [8] and X.21 bis [9] interfaces. Tables 11, 12 and 13 list, respectively, the pin descriptions of ISO 2110 [30], ISO 2593 [31], ISO 4902 [34] and ISO 4903 [35].

Table 10: CCITT Recommendation X.21 [8]/X21 bis [9] connectors

Data signalling rate	X.21 bis	X.21
2 400 bit/s	ISO 2110	ISO 4903
4 800 bit/s	ISO 2110	ISO 4903
9 600 bit/s	ISO 2110	ISO 4903
19 200 bit/s	ISO 2110	ISO 4903
48 000 bit/s	ISO 2593 ISO 4902	ISO 4903
56 000 bit/s	ISO 2593	ISO 2593
64 000 bit/s	ISO 4902	ISO 4903

Table 11: ISO 2110 [30] pin description

Pin	V.24 [5] circuit	Description	NOTES
1	101	Protective ground (Shield)	*1
7	102	Signal ground	*4
2	103	Transmitted data	*4
3	104	Received data	*4
4	105	Request to send	*4
5	106	Clear to send	*4
6	107	Data set ready (DCE ready)	*4
20	108,6	Data terminal ready (DTE ready)	*2
22	125	Ring indicator	*2
8	109	Received Line signal detector	*4
24	113	Transmitter signal element timing (DTE to DCE)	*5
15	114	Transmitter signal element timing (DCE to DTE)	*3

NOTE 1: Equipment: removable strap to frame ground or other equivalent grounding arrangement. Cable: connected to shield.

NOTE 2: Additional Interchange Circuits required for Switched Service.

NOTE 3: Additional Interchange Circuits required for Synchronous Channel.

NOTE 4: Basic Interchange Circuits, All Systems.

NOTE 5: Circuit 113 is not used in OS/MD-NE interfaces.

Duplex, Interface Type D.

Circuits are grouped by function: ground, data, control and timing.

For further information, see CCITT Recommendations V.24 [5] and V.28 [6], and ISO 2110 [30].

Table 12: CCITT Recommendation V.35 [7], ISO 2593 [31] pin description

Pin	Circuit	Description	NOTE
A	101	Protective ground	NOTE
B	102	Signal ground	
P	103	Transmitted data A-wire	
R	103	Transmitted data B-wire	
S	104	Received date A-wire	
T	104	Received date B-wire	
C	105	Request to send	
D	106	Ready for sending	
E	107	Data set ready	
F	109	Data Channel Receive Line Signal Detector	
V	114	Transmitter signal element timing A (DCE to DTE)	
AA	114	Transmitter signal element timing B (DCE to DTE)	
V	115	Receiver signal element timing A (DCE to DTE)	
X	115	Receiver signal element timing B (DCE to DTE)	

NOTE: Equipment: removable strap to frame ground or other equivalent grounding arrangement. Cable: connected to shield.

The electrical characteristics of the interchange circuits 103, 104, 114 and 115 shall be balanced double-current, conforming to Appendix II of CCITT Recommendation V.35 [7].

All other circuits shall conform to CCITT Recommendation V.28 [6].

The mode is synchronous at 64 000 bit/s.

Some countries may use 56 000 bit/s for an interim period of time.

Table 13: ISO 4903 [35] pin description

Pin	X.21 Circuit	Description	NOTE
1	-	Protective ground	NOTE
8	G	Signal ground or common return	
2	T	Transmitted A-Wire	
9	T	Transmitted B-Wire	
4	R	Receive A-Wire	
11	R	Receive B-Wire	
3	C	Control A-Wire	
10	C	Control B-Wire	
5	I	Indication A-Wire	
12	I	Indication B-Wire	
6	S	Signal element timing A-Wire	
13	S	Signal element timing B-Wire	
NOTE: Equipment: removable strap to frame ground or other equivalent grounding arrangement. Cable: connected to shield.			

Circuits are grouped by functions: ground, data, control and timing.

For further information: see CCITT Recommendations V.10 [3], V.11 [4] and X.21 [8] and ISO 4903 [35].

6.1.2 Physical layer for B3

6.1.2.1 Overview

Protocol suite B3 employs Local Area Network technology for the physical and data link layers. Administrations shall select the appropriate physical medium, e.g. coaxial cable, screened pairs, optical fibre according to technological and operational requirements.

6.1.2.2 Service

The service definition for the physical layer shall comply with that specified in Clause 6 of ISO 8802-3 [49].

All of the primitives defined and listed in table 14 shall be mandatory.

Table 14: Primitives of the physical layer

Primitive
PLS-DATA-request
PLS-DATA-indication
PLS-CARRIER indication
PLS-SIGNAL indication

6.1.2.3 Bit rate

The possible bit rate shall be 1 Mbit/s, 10 Mbit/s or higher.

6.2 Data link layer

6.2.1 Data link layer for B1 and B2

It shall be mandatory that the data link layer conforms to Link Access Procedure Balanced (LAPB) as defined in CCITT Recommendation X.25 [10]. In addition, provision shall be made for connection between Data Terminal Equipments (DTEs) without an intervening packet switched network. The interface shall conform to ISO 7776 [36]. Further information is provided in subclause 6.2.1.1.

The following data link layer specification applies to all cases.

6.2.1.1 Equipment type during link set up and reset

When a packet switched network is used to connect systems, they are each designated Data Terminal Equipment (DTE) and the network acts as a Data Circuit-terminating Equipment (DCE). When a dedicated or dial-up link is provided, other means shall be used to supply the DCE role.

At the physical layer, the modems shall provide the DCE interface supplying bit synchronisation.

At the data link layer, the procedures specified in ISO 7776 [36] shall be followed. A system shall be able to start the set-up or reset of the link (a DCE function in CCITT Recommendation X.25 [10]). In addition, provision shall be made for assignments of the A/B addresses. This mandatory option is to be field-settable and stored in non-volatile memory. Equipment which meets this requirement is compatible with connection to either a DCE or remote DTE.

6.2.1.2 Window

Modulo 8 operation shall be used. Support of modulo 128 is optional. The window for unacknowledged frames is to be optional between 1 and 7 frames and 1 to 127 frames with modulo 128. The standard default is 7.

6.2.1.3 User information

The user information is to be arranged in an integral number of octets.

The maximum length of the user information shall be user settable, consistent with the range of values for the N1 parameter as shown in table 15. Maximum information field lengths that shall be supported are 131 and 259 octets with optionally 515, 1 027, 2 051 or 4 099 octets. These values provide for three packet header octets and maximum length of packet data units of 128, 256, 512, 1 024, 2 048 and 4 096 octets, respectively.

6.2.1.4 Other frame parameters

Certain other frame parameters shall be set by the user to be consistent with the bit rate, frame size and characteristics of the connecting network. A system design should be sufficiently flexible to accommodate parameter sets for diverse networks, both as order options and later reconfigurations. The range of parameters is shown in table 15. These options, like those of the physical layer, are to be set at installation, changeable by the user, and non-volatile.

Table 15: LAPB data link layer attributes

LAPB Protocol
Octet Aligned
Single Link Procedure (SLP)

	Function	Range	Default
K	I-Frames Window	With Modulo 8: 1 to 7	(7)
		With Modulo 128: 1 to 127	(7)
T1	Waiting Acknowledgement (Retry time (NOTE 1)	For up to 9 600 bit/s: 2 to 20 seconds	(3)
		For 56 000 bit/s: 0,22 to 20 seconds	(3)
T2	Response Delay parameter (NOTE 1)	Not greater than 0,3 second	
T3	Disconnect Timer	(NOTE 2)	
T4	No activity Timer	4 to 120 seconds	(20)
N1	Bits per I-Frame, excluding flags and zero bit insertion for transparency (NOTE 3)	With Modulo 8 : 1 080, 2 104 and optionally 4 152, 8 248, 16 440, 32 824	(2 104)
		With Modulo 128 : 1 096, 2 120 and optionally 4 168, 8 264, 16 456, 32 840	(2 120)
N2	Retransmission Count	2 to 16	(7)
A/B	Address Assignment	Selectable by the user	

NOTE 1: Further guidelines on the use of T1 and T2 can be found in CCITT Recommendation X.25 [10] and ISO 7776 [36]. The transport layer T1 timer should always be greater than the link layer T1 timer.

NOTE 2: The value of timer T3, the disconnect timer, is not critical for successful interworking of OSs and NEs. Therefore no value is specified.

NOTE 3: In some cases, users may need to choose a maximum information field length of 259 octets (N1 = 2 104 for Modulo 8 or N1 = 2 120 for Modulo 128) with a 128 octets packet data unit in order to accommodate call request packets containing 128 octet user data fields in addition to the packet header and facility fields. These values are based on Modulo 8 or Modulo 128 operation at both link and packet layer.

The default values shall be part of a vendor's offering. That is, unless otherwise specified by the user, the default parameters shall be the initial values supplied. They can be subsequently changed by the user within the specified range.

6.2.2 Data link layer for B3

6.2.2.1 Overview

The data link layer provides the unacknowledged connectionless mode service. The access method employed is Carrier Sense Multiple Access with Collision Detection (CSMA/CD).

6.2.2.2 Media Access Control (MAC)

The services and protocol of the CSMA/CD access method shall comply with those specified in ISO 8802-3 [49].

The address length used at the MAC sublayer shall be 48 bits.

6.2.2.3 Logical Link Control (LLC)

The definition of the unacknowledged connectionless mode LLC service shall comply with that specified in ISO 8802-2 [48]. All of the primitives defined for Type 1 operation shall be supported.

The protocol used to provide the unacknowledged connectionless mode LLC service shall be as specified in ISO 8802-2 [48]. All of the commands and responses defined for Type 1 operation shall be supported.

6.3 Network layer

6.3.1 Network layer for B1

It shall be mandatory that the packet layer conforms to CCITT Recommendation X.25 [10]. In addition, the packet layer shall provide for connection of DTEs without an intervening packet network; the required interface for this purpose conforms to ISO 8208 [42]. In addition, the provisions of CCITT Recommendation X.223 [23] shall apply.

The attributes which shall be supported are summarised in tables 16 and 17. Note in particular that these tables show the different attributes needed to support Permanent Virtual Circuits (PVCs) (the CCITT Recommendation X.25 [10] PVC procedures) and Switched Virtual Circuits (SVCs) (the CCITT Recommendation X.25 [10] SVC procedures).

6.3.1.1 Equipment type during restart

When the packet level CCITT Recommendation X.25 [10] interface is used, automatic selection of the DCE/DTE role during restart is required, as specified in ISO 8208 [42].

6.3.1.2 Other features and parameters

The packet layer attributes are summarised in tables 16 and 17.

Table 16: CCITT Recommendation X.25 [10] packet layer attributes for permanent virtual circuits

	Range	Default
Extended packet sequence numbering	Modulo 128 optional	
Packet size (octets)	128, 256 512, 1 024, 2 048, 4 096 optional	(128)
Window size Extended sequence Number option	1-7 (with Modulo 8) 1-127 (with optional Modulo 128)	(2) (2)
Interrupt packets	Optional	

The default values shall be part of a vendor's offering. That is, unless otherwise specified by the user, the default parameters shall be the initial values supplied. They can be subsequently changed by the user within the specified range.

The attributes which are not marked optional shall be mandatory.

The ranges specified for negotiated parameters in no way affect the normal negotiation rules specified in the international standards.

6.3.1.3 Expedited data negotiation

The initiator shall be capable of proposing the non-use of the expedited data service. Responders shall be capable of receiving requests for the expedited data service, but shall be capable of responding with non-use of the service. The expedited data service is neither required nor precluded by this ETS.

6.3.1.4 Receipt confirmation negotiation

The initiator shall be capable of setting bit 7 of the general format identifier to 0. Responders shall be capable of receiving bit 7 set to 1, but shall be capable of responding with bit 7 set to 0. The receipt confirmation service is neither required nor precluded by this ETS.

Table 17: CCITT Recommendation X.25 [10] packet layer attributes for switched virtual circuits

		Range	Default
Flow control parameter negotiation			
	Packet size (octets)	128, 256 512 optional	128
	Window size	1-7 (with Modulo 8)	2
	Extended sequence Number option	1-127 (with optional Modulo 128)	2
Throughput class negotiation (NOTE) Bit rate (bit/s)		 1 200, 2 400, 4 800, 9 600, 19 200 and 64 000	 2 400
Expedited data negotiation			
Closed user group Closed user group selection Basic format		 2 decimal digits	
Fast select Fast select acceptance		128 octets	
Hunt group		Optional	
Transit delay selection and indication Calling address extension Called address extension Minimum throughput class negotiation End-to-end transit delay negotiation			
NOTE:	Some countries may use 56 000 bit/s for an interim period of time. In addition to the codes specified in the table in paragraph 7.2.2.2 of CCITT Recommendation X.25 [10], 56 000 bit/s shall be encoded as binary 1100. 48 000 bit/s is encoded as binary 1100 in that table, but when 56 000 bit/s is supported, the code shall stand for 56 000 bit/s.		

The default values shall be part of a vendor's offering. That is, unless otherwise specified by the user, the default parameters shall be the initial values supplied. They can be subsequently changed by the user within the specified range.

The attributes which are not marked optional shall be mandatory.

The ranges specified for negotiated parameters in no way affect the normal A negotiation rules specified in the international standards.

6.3.1.5 Throughput class

When the end system requires only one network layer connection on a physical access port, support of throughput classes up to the access line transmission rate is required. When multiple network layer connections are required, support of the throughput class equal to the access line transmission rate is optional. Further study of throughput class range and default values at various access line rates is needed.

6.3.1.6 Packet size negotiation

Interoperability is achieved by having the initiator propose a packet size from the set specified in tables 16 and 17 and by the responder selecting the most appropriate packet size between 128 and the proposed packet size. The rules for negotiation of the size of the packet to be used in a given instance of communication are specified in ISO 8208 [42].

The choice of packet size is a local issue which can depend on, for example, the QoS requested or needed by the user or application and the subnetwork characteristics.

6.3.1.7 User data field

When layers above CCITT Recommendation X.25 [10] are used, the initial octets of a DATA primitive and the corresponding data transfer packet are used for peer-to-peer protocol data for those layers.

In following the procedures of CCITT Recommendation X.244 [29], ISO DTR 9577 [58], Annex B of CCITT Recommendation X.224 [24] and ISO 8073/AD 1 [40], the initial octets of the user data field of the call request packet may only be used for protocol identification. For those cases in which the fast select feature is used, the call request packet may contain a call user data field of up to 128 octets.

6.3.1.8 Numbering plans

To support communications over public networks, public numbering plans may be used on the packet-switched network between OSs/MDs and NEs. CCITT Recommendations E.164 [1] and X.121 [11] specify public numbering plans. Equipment may be assigned numbers in accordance with either of these Recommendations. The escape code values of "0" and "9" shall be supported as specified in table 2/X.121 of CCITT Recommendation X.121 [11]. Where a public numbering plan is not necessary, a private numbering plan may be used.

6.3.1.9 Addressing

Network layer addressing, as specified in CCITT Recommendation X.213 [17], Annex A and ISO 8348/AD 2 [44], shall be supported.

6.3.2 Network layer for B2

6.3.2.1 Protocol

The protocols for the network layer shall be identical to the network layer protocol of protocol suite B1 (see subclause 6.3.1) with the inclusion of ISO 8473 [45] as specified in ISO 8880/3 [50], Clause 4, to provide the connectionless-mode network service over the connection-mode network service.

For those instances of communication requiring interworking between a Connection-mode Network Service (CONS) and a Connectionless-mode Network Service (CLNS), ISO DTR 10172 [59] provides an ISO compatible interworking capability. This capability is known as a Network Layer Relay (NLR) and utilizes the ISO 8473 [45] protocol to provide this service.

6.3.2.2 Network layer attributes

Characteristics of the connectionless-mode network layer service, and the connectionless-mode network layer protocol shall be as shown in table 18.

6.3.3 Network layer for B3

6.3.3.1 Service

The definition of the CLNS shall comply with that specified in ISO 8348/AD 1 [43]. Address formats supported shall conform to ISO 8348/AD 2 [44].

The network layer shall provide the N-UNITDATA service as specified in ISO 8348/AD 1 [43].

6.3.3.2 Protocol

The protocol shall be in accordance with the full protocol subset of category "Type 1" functions, as specified in ISO 8473 [45].

6.3.3.3 Network layer attributes

Characteristics of the connectionless-mode network layer service and the connectionless-mode network layer protocol shall be as shown in table 18.

Table 18: Network layer service/protocol parameters

a	Destination and Source addresses used by this protocol shall be Network Service Access Points (NSAP) addresses, as specified in ISO 8348/AD2 [44] or CCITT Recommendation X.213 [17], Annex A. The Destination and Source addresses are of variable length. The Destination and Source address fields shall be as Network Protocol Address Information using the Preferred Binary Encoding specified in ISO 8348/AD2 [44].
b	The setting of Error Reporting Flag (E/R) shall be a local matter. NOTE: The use of error reporting and setting the E/R to 1 may lead to excessive network traffic.
c	Partial Source Routing shall NOT be supported. A defect exits with this option which can cause PDUs to loop in the network until their lifetime expires.
d	Inactive Subset - Implementations shall not transmit PDUs encoded using the ISO 8473 [45] inactive subset. Received PDUs encoded with the inactive subset shall be discarded.
e	Segmentation - The non-segmentation subset shall NOT be used. However, implementations shall be capable of receiving and correctly processing PDUs which do not contain the segmentation part.
f	Segmentation Permitted Flag - Implementations shall NOT generate data PDUs without a segmentation part, i.e., the Segmentation Permitted Flag shall be set to 1 and segmentation part shall be included.
g	Lifetime Control - The lifetime parameter shall be used as specified in subclause 6.4 of ISO 8473 [45]. This parameter shall have an initial value of at least three times the network span (number of network entities) or three times the maximum transmission delay (in units of 500 milliseconds), whichever is greater.

6.4 Transport layer

6.4.1 Transport layer for B1

It shall be mandatory that for the CONS, the transport layer shall conform to CCITT Recommendations X.214 [18] and X.224 [24] and to those provisions of ISO 8072 [38] and ISO 8073 [39] that apply to the use of the CONS.

6.4.1.1 Class of service

Classes 4, 2 and 0 shall be supported as shown in table 19 in countries requiring the features of transport layer Class 4. The conformance rules of CCITT Recommendation X.224 [24] require that Classes 0 and 2 be supported as well when Class 4 is specified.

Table 19: Transport layer attributes for connection-mode network service

	Range	**Default** (NOTE 5)
Maximum TPDU (octets)	128, 256, 512, 1 024 (2 048, 4 096, 8 192 optional)	(128)
TSAP - ID (NOTE 1)	Up to 32 octets	
Class of service Preferred class Alternative class Expedited data	4, 2, 0 4, 2, 0 0, none non-use	 (4) (none)
Options for Class 4 Data TPDU numbering (NOTE 2)	 Normal, Extended	 (Normal)
Checksum (NOTE 3)	Use, non-use	Non-use
Options for Class 2 Data TPDU numbering (NOTE 2) Flow control	 Normal extended Explicit	 (Normal)
Parameters for Class 4 T1 Retransmission time N Retransmissions L Bound on reference I Inactivity time	 0,25-64 seconds (NOTE 4) 2 (other values for further study) 1-256 seconds 2-512 seconds	 (8) (32) (64)

NOTE 1: Some systems may require TSAP-IDs. However, all systems shall be capable of generating called TSAP-IDs in CR TPDUs and capable of receiving calling and called TSAP-IDs in received CR and CC TPDUs, respectively.

NOTE 2: Extended format option shall be implemented. Non-use of this option shall be negotiable The responder shall honour the initiator's request whenever possible. Negotiation to other than what has been requested shall only occur under abnormal conditions: for example, severe congestion, as determined by the implementor. Initiators shall be prepared to operate in the mode confirmed by the responder.

NOTE 3: Use of checksum is required for the CR TPDU. An additional requirement is that all implementations shall support the negotiated "non-use" of the checksum. Initiators shall request and responders shall agree to "non-use" of the checksum.

NOTE 4: The transport layer T1 timer should always be greater than the link layer T1 timer.

NOTE 5: The default values shall be part of a vendor's offering. That is, unless otherwise specified by the user, the default parameters shall be initial values supplied. They can be subsequently changed by the user within the specified range.

For existing equipments and in countries not requiring Class 4, support of Classes 0 and 2 shall be mandatory.

In addition to the requirements specified in CCITT Recommendation X.224 [24], equipment shall meet the following requirement: if a responder receives an alternate class of "none", it shall respond with the preferred class. Rules for responders are specified in table 20. Acceptance rules for initiators are specified in table 21.

User options shall be provided to designate the preferred and alternate classes (see table 3 of CCITT Recommendation X.224 [24]). When all of the classes are supported, the preferred class for connection is Class 4.

Table 20: Transport class selection - response rules for responder

Prefered class	**Alternative class**		
	0	2	None
0	Not valid	Not valid	Class 0
2	Class 0, 2	Class 2	Class 2
4	Class 0, 2, 4	Class 2 or 4	Class 4

When all of the classes are supported, the preferred class, when initiating a CR-TPDU, shall be Class 4.

If a responder receives an alternative class of "none" it shall respond with the preferred class.

Table 21: Transport class selection - acceptance rules for initiator

Prefered class	Alternative class		
	0	2	None
0	Not valid	Not valid	Class 0
2	Class 0, 2	Class 2	Class 2
4	Class 0, 2, 4	Class 2 or 4	Class 2 or 4

When all of the classes are supported, the preferred class, when initiating a CR-TPDU, shall be Class 4.

If Class 4 is proposed, then Class 2 is a valid response.

6.4.1.2 Protocol identification

For the purpose of transport layer protocol identification, the procedures specified in CCITT Recommendation X.224 [24], Annex B and ISO 8073/AD 1 [40] shall be used. The conventions for protocol identification given in ISO DTR 10172 [59] should be followed. Selection of codes not specified in the referenced standards is for further study. The absence of call user data in a call request, or call accept packet of CCITT Recommendation X.25 [10] and ISO 8208 [42] indicates the operation of the transport layer procedures of ISO 8073 [39] and CCITT Recommendation X.224 [24].

6.4.1.3 Attributes

Attributes of the transport layer for use with CONS are summarised in table 19. The selection of values within required and optional ranges depends on the characteristics of the messages.

The need to support high priority messages that require low transit delay on a given transport connection shall be reflected in the QoS parameters requested when the transport connection is established. A properly implemented transport entity should not multiplex high priority messages that require low transit delay if it cannot provide the requested QoS.

6.4.1.4 User data in connection request and connection confirm TPDUs

User data in the connection request and connection confirm TPDUs are optional in CCITT Recommendation X.224 [24]. No transport service user shall send it; all protocol implementations shall be prepared to receive it and all implementations may ignore it, i.e. it shall not cause a disconnect.

6.4.1.5 Splitting

Responders may refuse network connections which could impose an unnecessary restriction on the ability to establish outgoing network connections. To prevent repeated ineffective attempts during splitting, initiators shall refrain from immediately requesting additional network connections for a transport connection after a network connection has been refused. The time delay before requesting additional network connections is for further study.

6.4.1.6 Quality of Service (QoS) negotiation

QoS negotiation is outside the scope of this ETS. If QoS negotiation is not supported, receipt of the parameters "throughput", "residual error rate", "priority" and "transit delay" in the CR and CC TPDUs shall be ignored.

6.4.1.7 TPDU size negotiation

Interoperability is achieved by having the initiator propose a TPDU size from the set specified in table 19 and by the responder selecting the most appropriate TPDU size between 128 and the proposed TPDU size. The rules for negotiation of the size of the TPDU to be used in a given instance of communication are specified in ISO 8073 [39].

The choice of TPDU size is a local implementation issue.

6.4.1.8 Class 0 Error TPDU

When transport Class 0 has been negotiated, the Error Transport Protocol Data Unit (ER-TPDU) may be used at any time and upon receipt requires that the recipient disconnect the network connection and, by extension, the transport connection.

6.4.1.9 Negotiation of protection

Negotiation of protection is outside the scope of this ETS. If negotiation of protection is not supported, receipt of the protection parameters in any CR TPDU and any CC TPDU shall be ignored.

6.4.1.10 Unknown CR TPDU parameters

An unknown parameter in any received CR TPDU shall be ignored.

6.4.1.11 Invalid values of known CR TPDU parameters

Table 22: TPDU parameters

Parameter	Action
TSAP id	Send DR TPDU
TPDU size	Ignore parameter, use default
Version	Ignore parameter, use default
Checksum	Discard CR-TPDU
Alternate protocol classes	Protocol error

6.4.1.12 Additional options parameter

Unrecognised or not applicable bits of the "Additional options" shall be ignored.

6.4.1.13 Code misalignment (for further study)

A misalignment between CCITT Recommendation X.224 [24] and ISO 8073 [39] code values for subsequence number and flow control confirmation has been identified. As a short term solution, the code values set out in ISO 8073 [39] shall apply.

Subsequence number 1000 1010

Flow control confirmation 1000 1100

It is intended that when an ISO/CCITT solution to this defect is available, this ETS shall be modified to align with the solution.

6.4.2 Transport layer for B2 and B3

6.4.2.1 Protocol

Operation of the transport protocol over the CLNS, as described in ISO 8348/AD 1 [43], shall use the elements of ISO 8073/AD 2 [41], Class 4 operation over the CLNS.

6.4.2.2 Class of service

Support of Class 4 operation of ISO 8073/AD 2 [41] shall be mandatory.

6.4.2.3 Transport layer attributes

Transport layer attributes for Class 4 operation over the CLNS shall be as shown in table 23.

Table 23: Transport layer attributes for connectionless network service

	Range	Default (NOTE 5)
Maximum TPDU (octets)	128, 256, 512, 1 024 (2 048, 4 096, 8 192 optional)	(128)
TSAP - ID (NOTE 1) Class of service Preferred class Alternative class Expedited data	Up to 32 octets 4 4 none non-use	
Options for Class 4 Security parameters Data TPDU numbering (NOTE 2) Checksum (NOTE 3)	 Optional Normal, Extended Use, non-use	 (Normal) Non-use
Parameters T1 Retransmission time N Retransmissions L Bound on reference I Inactivity time	 0,25-64 seconds (NOTE 4) 2-15 seconds 1-256 seconds 2-512 seconds	 (8) (2) (32) (64)

NOTE 1: Some systems may require TSAP-IDs. However, all systems shall be capable of generating called TSAP-IDs in CR TPDUs and capable of receiving calling and called TSAP-IDs in received CR and CC TPDUs, respectively.

NOTE 2: Extended format option shall be implemented. Non-use of this option shall be negotiable The responder shall honour the initiator's request whenever possible. Negotiation to other than what has been requested shall only occur under abnormal conditions: for example, severe congestion, as determined by the implementor. Initiators shall be prepared to operate in the mode confirmed by the responder.

NOTE 3: Use of checksum is required for the CR TPDU. An additional requirement is that all implementations shall support the negotiated "non-use" of the checksum. Initiators shall request and responders shall agree to "non-use" of the checksum.

NOTE 4: The transport layer T1 timer should always be greater than the link layer T1 timer.

NOTE 5: The default values shall be part of a vendor's offering. That is, unless otherwise specified by the user, the default parameters shall be initial values supplied. They can be subsequently changed by the user within the specified range.

NOTE 6: A conflict in the code values for subsequence number and flow control confirmation exists between ISO and CCITT. The conflict is expected to be resolved as specified in ISO 8073 [39].

6.5 Session layer for B1, B2 and B3

The session layer conforms to the service definition and protocol specification in CCITT Recommendations X.215 [19] and X.225 [25] respectively. Support of Version 2 of the Session Protocol (SP) shall be mandatory. Two session layer Functional Units (FU) are required in this ETS:

1) Kernel;

2) Duplex.

Restrictions applied to parameters and their values are specified in the following subclauses.

6.5.1 Session Protocol Data Units (SPDUs)

The Session Protocol Data Units (SPDUs) associated with the Kernel and Duplex functional units shall be supported as detailed in table 24.

Table 24: Session PDUs

(1)	Connect	(CN SPDU)
(2)	Accept	(AC SPDU)
(3)	Refuse	(RF SPDU)
(4)	Finish	(FN SPDU)
(5)	Disconnect	(DN SPDU)
(6)	Abort	(AB SPDU)
(7)	Abort Accepted	(AA SPDU)
(8)	Data Transfer	(DT SPDU)

6.5.2 Transport expedited service

The use of the transport expedited service is as stated in CCITT Recommendation X.225 [25]: if available, it shall be used. When the transport expedited service is available, the Prepare (PR) SPDU shall be supported as in CCITT Recommendation X.225 [25]. The "Prepare Type" parameter value in the PR SPDU, to indicate the arrival of an Abort (AB) SPDU, is ABORT.

6.5.3 Parameters

All mandatory parameters defined in CCITT Recommendation X.225 [25] for the SPDUs required by the kernel and duplex FUs shall mandatory parameters for this ETS.

6.5.4 User data

The maximum length of the session user data shall be 10 240 octets. This restriction implies that the Overflow Accept (OA) and Connect Data Overflow (CDO) SPDUs are not required to be supported. "Session-selector" parameter values shall have a maximum length of 16 octets.

6.5.5 Re-use

Re-use of the transport connection is not required. The transport disconnect Parameter Value (PV) field may be absent or set to "transport connection is released" in appropriate SPDUs. Furthermore, on receipt of a transport disconnect PV field indicating "transport connection is kept", the transport connection can be released.

6.5.6 Segmentation

The "segmentation" feature in the session layer is not required. Support for extended concatenation of SPDUs is not required.

6.5.7 Invalid SPDUs

Upon receipt of an invalid SPDU, the session protocol machine shall take any action specified in § A.4.3.2 of CCITT Recommendation X.225 [25], with the exception of action "d" (take no action).

6.6 Presentation layer for B1, B2 and B3

It shall be mandatory that the presentation layer conforms to the services and protocols specified in CCITT Recommendations X.216 [20] and X.226 [26] respectively. One presentation layer FU is required in this ETS:

1) Kernel.

The presentation protocol shall be used in the "normal mode". Restrictions applied to parameters and their values are specified in the following subclauses.

6.6.1 Presentation Protocol Data Units (PPDU)

The Presentation Protocol Data Units (PPDU) associated with the Kernel FU shall be supported as detailed in table 25.

Table 25: Presentation PDUs

(1)	Connect Presentation	(CP PPDU)
(2)	Connect Presentation Accept	(CPA PPDU)
(3)	Connect Presentation Reject	(CPR PPDU)
(4)	Abnormal Release Provider	(ARP PPDU)
(5)	Abnormal Release User	(ARU PPDU)
(6)	Presentation Data	(TD PPDU)

6.6.2 Parameters

All mandatory parameters defined in CCITT Recommendation X.226 [26] for the above PPDUs shall be mandatory for this ETS. The "presentation context identifier" value shall be encoded in no more than 2 octets. Also, the value(s) in the parameter "presentation context definition list" shall be consistent with the value(s) defined in the application-specific standards. "Presentation-selector" parameter values shall have a maximum length of 4 octets.

6.6.3 Encoding rules for transfer syntax

The encoding rules defined in CCITT Recommendation X.209 [14] shall be applied to derive the transfer syntax for the Application Protocol Data Units (APDUs). The ASN.1 OBJECT IDENTIFIER [joint-ISO-CCITT ASN1 (1) basic-encoding (1)] shall be used as the value for the transfer syntax name. The maximum value of an ASN.1 basic encoding tag that needs to be handled for conformance to this ETS is 16.383. This is the largest unsigned integer that can be represented in 14 bits. Hence the identifier octets shall consist of an initial octet and up to two more octets, thus occupying a maximum of three octets. Also, the largest number of octets in the "contents octets" component of an ASN.1 data value encoding that needs to be handled for conformance to this ETS is 4.294 967 295. This is the largest unsigned integer that can be represented in 32 bits. Hence in the "long form" encoding, the length octets shall consist of an initial octet and up to four more octets, thus occupying a maximum of five octets.

NOTE: This restriction does not apply to "indefinite length" encodings.

6.7 Application layer for B1, B2 and B3

It shall be mandatory that the application layer conforms to the architecture for the application layer outlined in ISO 9545 [51]. ASN.1 shall be used as the abstract syntax for specifying application protocols.

6.7.1 Association Control Service Element (ACSE)

6.7.1.1 Services and protocols

It shall be mandatory that the Association Control Service Element (ACSE) conform to the services and protocols specified in CCITT Recommendations X.217 [21] and X.227 [27]. The ACSE shall establish, release and abort the associations required. The ACSE service shall operate in the "normal mode".

6.7.1.2 Application Protocol Data Units (APDUs)

The APDUs shall be supported as detailed in table 26.

Table 26: Application PDU

(1)	A-Associate-Request	(AARQ APDU)
(2)	A-Associate-Response	(AARE APDU)
(3)	A-Release-Request	(RLRQ APDU)
(4)	A-Release-Response	(RLRE APDU)
(5)	A-Abort	(ABRT APDU)

All mandatory parameters defined in CCITT Recommendation X.227 [27] for the above APDUs shall be mandatory for this ETS.

6.7.1.3 Abstract syntax name

The ACSE abstract syntax name has the ASN.1 type OBJECT IDENTIFIER. The following value shall be used to identify the ACSE abstract-syntax-definition:

```
{
joint-ISO-CCITT association-control(2) abstract-syntax(1) APDUS(0) version(1)
}
```

6.7.2 Common Management Information Service Element (CMISE)

Network Management applications shall use the Common Management Information Service Element (CMISE). Services defined by CMISE that are applicable include:

1) the reporting of an event to an OS/MD;

2) the transfer of information between OSs/MDs and NEs;

3) the transfer of action requests and results between OSs/MDs and NEs.

6.7.2.1 Service

The CMISE shall be a mandatory service element for the protocol suites B1, B2 and B2. The CMISE service description is detailed in ISO 9595 [52], ISO 9595/DAD 1 [53] and ISO 9595/DAD 2 [54].

Multiple object selection, filter and multiple reply functional units as defined in ISO 9595 [52] are optional. Their use is application dependent. The negotiation during association establishment to use or not use the FUs shall be supported.

Support of the extended service FU defined in ISO 9595 [52] is not required for conformance to this ETS and negotiation shall be supported, at association establishment, for its non-use.

6.7.2.2 Protocol

Implementations shall support those operations defined in ISO 9596 [55], ISO 9596/DAD1 [56] and ISO 9596/DAD2 [57] that are required by specific applications. All mandatory parameters defined in ISO 9596 [55], ISO 9596/DAD1 [56] and ISO 9596/DAD2 [57] for the required operations are mandatory parameters for this ETS.

6.7.3 Remote Operations Service Element (ROSE)

Network management transaction-oriented applications shall use the following underlying service defined in CCITT Recommendation X.219 [22]:

- Remote Operations Service Element (ROSE). The protocol is specified in CCITT Recommendation X.229 [28];

- the requirement specified above implies association Class 3 in ROSE.

6.8 Conformance

For further study.

History

Document history	
November 1992	First Edition
March 1996	Converted into Adobe Acrobat Portable Document Format (PDF)