INTERNATIONAL STANDARD

ISO/IEC 8473-5

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Information technology — Protocol for providing the connectionless-mode network service: Provision of the underlying service by ISDN circuit-switched B-channels

Technologies de l'information — Protocole pour la fourniture du service de réseau en mode sans connexion: Fourniture du service sous-jacent par canaux B commutés au circuit ISDN

Reference number
ISO/IEC 8473-5:1997(E)

Contents

Foreword

ISO (the International Organization for Standardization) and IEC (the International Electrotechnical Commission) form the specialized system for worldwide standardization. National bodies that are members of ISO or IEC participate in the development of International Standards through technical committees established by the respective organization to deal with particular fields of technical activity. ISO and IEC technical committees collaborate in fields of mutual interest. Other international organizations, governmental and non-governmental, in liaison with ISO and IEC, also take part in the work.

In the field of information technology, ISO and IEC have established a joint technical committee, ISO/IEC JTC 1. Draft International Standards adopted by the joint technical committee are circulated to national bodies for voting. Publication as an International Standard requires approval by at least 75 % of the national bodies casting a vote.

International Standard ISO/IEC 8473-5 was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, Subcommittee SC 6, *Telecommunications and information exchange between systems*, in collaboration with ITU-T. The identical text is published as ITU-T Recommendation X.625.

ISO/IEC 8473 consists of the following parts, under the general title *Information technology — Protocol for providing the connectionless-mode network service*:

— *Part 1: Protocol specification*

— *Part 2: Provisions of the underlying service by an ISO/IEC 8802 subnetwork*

— *Part 3: Provision of the underlying service by an X.25 subnetwork*

— *Part 4: Provision of the underlying service by a subnetwork that provides the OSI data link service*

— *Part 5: Provision of the underlying service by ISDN circuit-switched B-channels*

Annex A forms an integral part of this part of ISO/IEC 8473.

Introduction

This Recommendation | International Standard is one of a set of Recommendations and International Standards produced to facilitate the interconnection of open systems. The set covers the services and protocols required to achieve such interconnection.

This Recommendation | International Standard is positioned with respect to other related Recommendations and International Standards by the layers defined in ITU-T Rec. X.200 | ISO/IEC 7498-1. In particular, it defines the way in which the B-channels of an ISDN subnetwork may be used within the Network layer to provide the abstract underlying service with respect to which the protocol defined by ITU-T Rec. X.233 | ISO/IEC 8473-1 is specified.

In order to evaluate the conformance of a particular implementation of this protocol, it is necessary to have a statement of which of the protocol's capabilities and options have been implemented. Such a statement is called a Protocol Implementation Conformance Statement (PICS), as defined in CCITT Rec. X.290 and ISO/IEC 9646-1. A PICS proforma, from which a PICS may be prepared for a specific implementation, is included in this Recommendation | International Standard as Annex A.

INTERNATIONAL STANDARD

ITU-T RECOMMENDATION

INFORMATION TECHNOLOGY – PROTOCOL FOR PROVIDING THE CONNECTIONLESS-MODE NETWORK SERVICE: PROVISION OF THE UNDERLYING SERVICE BY ISDN CIRCUIT-SWITCHED B-CHANNELS

1 Scope

This Recommendation | International Standard specifies the way in which the underlying service assumed by the protocol defined by ITU-T Rec. X.233 | ISO/IEC 8473-1 is provided by a subnetwork that conforms to Recommendation Q.931 through the operation of a Subnetwork Dependent Convergence Function (SNDCF) as described in ISO/IEC 8648.

This Recommendation | International Standard also provides the PICS proforma for this protocol, in compliance with the relevant requirements, and in accordance with the relevant guidance, given in CCITT Rec. X.290 and ISO/IEC 9646-1.

2 Normative references

The following Recommendations and International Standards contain provisions which, through reference in this text, constitute provisions of this Recommendation | International Standard. At the time of publication, the editions indicated were valid. All Recommendations and Standards are subject to revision, and parties to agreements based on this Recommendation | International Standard are encouraged to investigate the possibility of applying the most recent edition of the Recommendations and Standards listed below. Members of IEC and ISO maintain registers of currently valid International Standards. The Telecommunication Standardization Bureau of the ITU maintains a list of currently valid ITU-T Recommendations.

2.1 Identical Recommendations | International Standards

- ITU-T Recommendation X.200 (1994) | ISO/IEC 7498-1:1994, *Information technology – Open Systems Interconnection – Basic Reference Model: The Basic Model.*
- CCITT Recommendation X.213 (1992) | ISO/IEC 8348:1993, *Information technology – Open Systems Interconnection – Network service definition.*
- ITU-T Rec. X.233 (1993) | ISO/IEC 8473-1:1994, *Information technology – Protocol for providing the connectionless-mode Network service: Protocol specification.*
- ITU-T Rec. X.622 (1994) | ISO/IEC 8473-3:1995, *Information technology – Protocol for providing the connectionless-mode Network service: Provision of the underlying service by an X.25 subnetwork.*
- ITU-T Rec. X.623 (1994) | ISO/IEC 8473-4:1995, *Information technology – Protocol for providing the connectionless-mode Network service: Provision of the underlying service by a subnetwork that provides the OSI data link service.*

2.2 Paired Recommendations | International Standards identical in technical content

- CCITT Recommendation X.290 (1992), *OSI conformance testing methodology and framework for protocol Recommendations for CCITT applications – General concepts.*

  ISO/IEC 9646-1:1994, *Information technology – Open Systems Interconnection – Conformance testing methodology and framework – Part 1: General concepts.*

2.3 Additional references

- CCITT Recommendation I.231 (1988), *Circuit-mode bearer service categories.*
- ITU-T Recommendation I.430 (1993), *Basic user-network interface – Layer 1 specification.*
- ITU-T Recommendation I.431 (1993), *Primary rate user-network interface – Layer 1 specification.*

- ITU-T Recommendation Q.921 (1993), *ISDN user-network interface – Data link layer specification.*
- ITU-T Recommendation Q.931 (1993), *Digital Subscriber Signalling System No. 1 (DSS 1) – ISDN user-network interface layer 3 specification for basic call control.*
- ITU-T Recommendation X.25 (1993), *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.*
- CCITT Recommendation X.121 (1992), *International numbering plan for public data networks.*
- ISO/IEC 7776:1995, *Information technology – Telecommunications and information exchange between systems – High-level data link control procedures – Description of the X.25 LAPB-compatible DTE data link procedures.*
- ISO/IEC 8208:1995, *Information technology – Data communications – X.25 Packet Layer Protocol for Data Terminal Equipment.*
- ISO 8648:1988, *Information processing systems – Open Systems Interconnection – Internal organization of the Network Layer.*
- ISO/IEC 11575:1995, *Information technology – Telecommunications and information exchange between systems – Protocol mappings for the OSI Data Link service.*

3 Definitions

3.1 Reference model definitions

This Recommendation | International Standard makes use of the following terms defined in ITU-T Rec. X.200 | ISO/IEC 7498-1:

a) network entity;

b) Network layer;

c) service;

d) service data unit;

e) protocol control information.

3.2 Network layer architecture definitions

This Recommendation | International Standard makes use of the following terms defined in ISO/IEC 8648:

a) subnetwork;

b) subnetwork dependent convergence protocol;

c) subnetwork dependent convergence function;

d) subnetwork access protocol.

3.3 Network layer addressing definitions

This Recommendation | International Standard makes use of the following term defined in CCITT Rec. X.213 | ISO/IEC 8348:

- subnetwork point of attachment.

4 Abbreviations

For the purposes of this Recommendation | International Standard, the following abbreviations apply:

CLNP	Connectionless-mode Network Protocol
DCE	Data Circuit-terminating Equipment
DTE	Data Terminal Equipment
ES	End System
IS	Intermediate System

ISDN	Integrated Services Digital Network
PDU	Protocol Data Unit
PVC	Permanent Virtual Circuit
QOS	Quality of Service
SDU	Service Data Unit
SN	Subnetwork
SNDCF	Subnetwork Dependent Convergence Function
SNDCP	Subnetwork Dependent Convergence Protocol
SNICP	Subnetwork Independent Convergence Protocol
SNAcP	Subnetwork Access Protocol
SNPA	Subnetwork Point of Attachment
SNCR	Subnetwork Connection Reference
SNSDU	Subnetwork Service Data Unit
TA	Terminal Adapter
TE	Terminal Equipment

5 Subnetwork dependent convergence function

5.1 General model

The general model for providing the underlying service assumed by the protocol in conjunction with a real subnetwork that uses a connectionless subnetwork access protocol is as follows. The generation of an SN-UNIT-DATA Request by the CLNP results in the generation of a corresponding subnetwork-specific UNIT-DATA request by the subnetwork dependent convergence function. The receipt of a subnetwork-specific UNIT-DATA indication associated with delivery of a connectionless data unit to its destination causes the SNDCF to generate an SN-UNIT-DATA indication to the CLNP.

The general model for providing the underlying service assumed by the CLNP in conjunction with a real subnetwork that uses a connection-mode subnetwork access protocol is as follows. The generation of an SN-UNIT-DATA request by the CLNP causes a connection (logical channel, logical link, or the equivalent) to be made available for the transmission of SN-User-data. If a connection cannot be made available, the SN-UNIT-DATA Request is discarded. The receipt of subnetwork-specific PDUs containing SN-User-data causes the SNDCF to generate an SN-UNIT-DATA indication to the CLNP.

Where a real subnetwork is designed to use either a connectionless-mode or a connection-mode subnetwork access protocol, the provision of the underlying service assumed by the CLNP is achieved by using the connectionless-mode alternative.

5.2 Subnetwork user data

The SN-Userdata is an ordered multiple of octets, and is transferred transparently between the specified subnetwork points of attachment.

The underlying service assumed by the CLNP is required to support a service data unit size of at least 512 octets.

If the minimum service data unit sizes supported by all of the subnetworks involved in the transmission of a particular PDU are known to be large enough that segmentation is not required, then either the full protocol or the non-segmenting protocol subset may be used.

Data received from a subnetwork with protocol identification specifying this protocol (see ITU-T Rec. X.233 | ISO/IEC 8473-1) shall be processed according to this Recommendation | International Standard.

NOTE – Data with other protocol identification should be ignored, since it may have been sent by an implementation supporting additional protocols intended for use with this protocol.

5.3 Subnetwork dependent convergence functions used with ISDN circuit-switched B-channel

5.3.1 The ISDN environment

This SNDCF applies when an ISDN B-channel is used to carry the PDUs as defined in ITU-T Rec. X.233 | ISO/IEC 8473-1 between systems. In this context a system may be either an End System (ES) or an Intermediate System (IS), as shown in Figure 1. The underlying ISDN service is the 64 kbit/s bearer service as described in Recommendation I.231.

NOTE – The use of more than one B-channel between a pair of systems is not precluded. When more than one B-channel is used, the single link procedures of ISO/IEC 7776 shall be used on each.

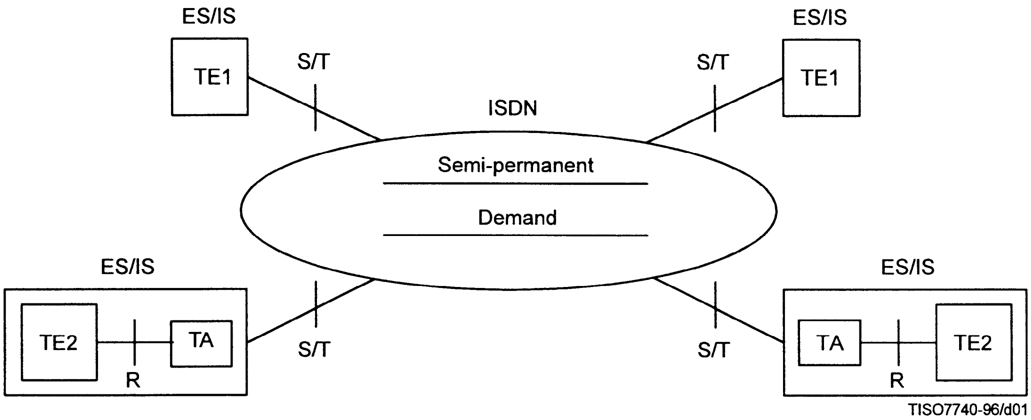

Figure 1 – ES-to-IS, IS-to-IS, or ES-to-ES directly connected via ISDN

Once the B-channel has been established (see 5.3.2.2 or 5.3.2.3) the requirements of ITU-T Rec. X.623 | ISO/IEC 8473-4 shall be applied, i.e. the SNDCF for operation over a subnetwork which provides the OSI Data Link service.

The ES or IS may be either a TE1 or TE2/TA terminal supporting the ISDN B-channel presenting the protocol stacks at the S- or T- reference point in accordance with the Recommendations and International Standards shown in Figure 2.

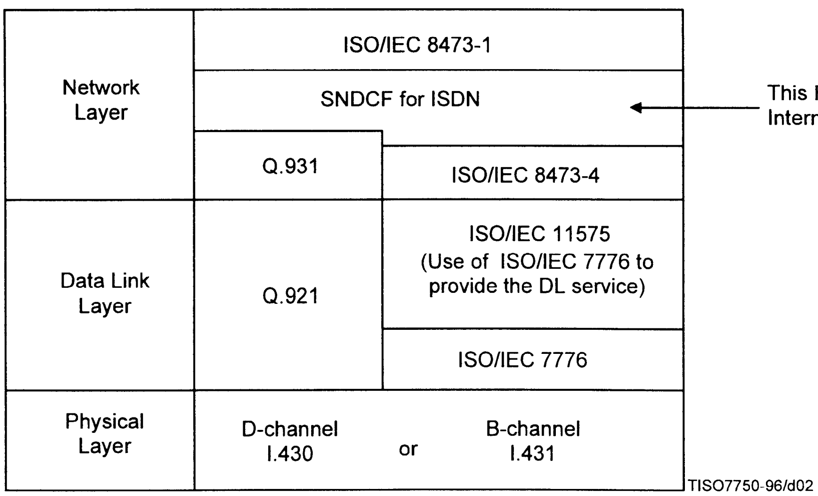

Figure 2 – Protocol layers at S- and T-reference points

5.3.2 Procedures for a TE1 or TE2/TA

This subclause covers the use of semi-permanent or demand access B-channel connections that can be available to the TE1 or TE2/TA terminals.

NOTE – The use of the D-channel to operate the CLNP is outside the scope of this Recommendation | International Standard.

The mapping of elements of the CLNS to the protocol and procedures of ISO/IEC 8473 is specified in CCITT Rec. X. 213 | ISO/IEC 8348. The following subclauses specify the provision required in addition to these mappings by systems attached to the S/T reference points.

5.3.2.1 Additional procedures for a TE1 or TE2/TA when using the ISDN B-channel to directly connect to a remote terminal.

The ES or IS shall implement at the S/T reference points the protocol stacks shown in Figure 2. One of the stacks is used to support signalling necessary to establish the ISDN circuit switched connection to the remote terminal, and the other is used to support the CLNP itself. At the physical layer, Recommendation I.430 shall be used if the access is via the basic rate interface, and Recommendation I.431 shall be used if the access is via the primary rate interface. At the data link layer, Recommendation Q.921 shall be used over the D-channel and ISO/IEC 7776 shall be used over the B-channel after it has been established. At the network layer, Recommendation Q.931 shall be used over the D-channel to convey signalling information to the ISDN for the purposes of ISDN connection establishment, and ISO/IEC 8473 shall be used over the B-channel for information transfer.

5.3.2.2 Semi-permanent B-channel connection

ISO/IEC 7776 shall be used in accordance with ISO/IEC 11575 to provide the OSI Connection-mode Data Link Service. This service may be used either:

a) in accordance with ITU-T Rec. X.623 | ISO/IEC 8473-4 to provide the ISO/IEC 8473 underlying service; or

b) in accordance with ISO/IEC 8208 to operate the X.25 packet layer protocol. In this case the ISO/IEC 8473 underlying service shall be provided in accordance with ITU-T Rec. X.622 | ISO/IEC 8473-3.

The two terminals shall agree, *a priori*, on the values of the addresses permitted by ISO/IEC 7776 that each will use.

5.3.2.3 Demand access B-channel connection

The receipt of an SN-UNIT-DATA request primitive, destined for a remote ES or IS to which no ISDN connection already exists, shall cause the SNDCF to initiate ISDN D-channel procedure for demand access to establish a B-channel connection. A circuit switched bearer service is requested and the called party number information element (of Recommendation Q.931) is set to the ISDN address corresponding to the remote ES/IS, to which the connection is to be established. The lower layer compatibility information element may also be sent indicating that layer 2 uses the X.25 Data Link control procedures (ISO/IEC 7776) and that layer 3 is either ISO/IEC 8473 (in the case that the procedures of ITU-T Rec. X.623 | ISO/IEC 8473-4 are used), or is ISO/IEC 8208 (in the case that the procedures of ITU-T Rec. X.622 | ISO/IEC 8473-3 are used).

Following successful establishment of the B-channel connection, including its entering of the data transfer phase at layer 1, the following procedures are recommended for establishing the data link connection using ISO/IEC 7776 for the data link entities in the two communicating systems:

a) upon notification of a B-channel connection, activate the receiver;

b) send a sequence of flags;

c) upon receipt of the first flag from the remote entity start the data link establishment procedures as defined in ISO/IEC 7776 (i.e. the SABM/UA exchange).

The entity that initiates the establishment of the B-channel (i.e. the calling party) shall use address A as specified in ISO/IEC 7776. The remote entity (i.e. the called party) shall use address B.

ISO/IEC 7776 shall be used in accordance with ISO/IEC 11575 to provide the OSI Connection-mode Data Link Service. This service may be used either:

a) in accordance with ITU-T Rec. X.623 | ISO/IEC 8473-4 to provide the ISO/IEC 8473 underlying service; or

b) in accordance with ISO/IEC 8208 to operate the X.25 packet layer protocol. In this case the ISO/IEC 8473 underlying service shall be provided in accordance with ITU-T Rec. X.622 | ISO/IEC 8473-3.

When a Data link connection is released, the B-channel may, as a local decision, be disconnected using the procedures of Recommendation Q.931.

The address parameters and the Quality of Service parameters in the SN-UNIT-DATA primitives shall be treated in accordance with 8.1 and 8.2 of ITU-T Rec. X.233 | ISO/IEC 8473-1, respectively.

5.3.3 Call set-up considerations

The mechanism and timing for opening a connection prior to the transmission of SN-User-data are a local matter. The opening of a connection may be initiated by:

a) the arrival of an SNSDU to be transmitted over ISDN at a time when no suitable connection is available;

b) the local queue of requests waiting for an existing connection reaching a threshold size at which an additional connection shall be made available (if possible) to maintain the requested QOS; or

c) the explicit intervention of system management.

When it has been determined that a (new) connection must be made available, the calling SNDCF performs all functions associated with establishing a connection. The called SNDCF performs those operations associated with accepting a call, but generates no SN-UNIT-DATA indication until the call set-up is completed.

5.3.4 Call clearing considerations

The mechanisms for determining when a connection is to be cleared following the transmission of SN-User-data by the SNDCF are local matters. Examples of circumstances which would cause the SNDCF to clear a connection are:

a) the expiration of a timeout period following the transmission of one or more PDUs (see 5.3.3);

b) the need to use a specific interface to open an alternate connection from the local network entity to a different remote network entity;

c) the explicit intervention of system management; or

d) a provider-initiated clear of a connection.

When it has been determined that a connection shall be cleared, the SNDCF performs all functions associated with clearing a call. In these circumstances, the SNDCF will retain user data submitted via SN-UNIT-DATA requests while attempting to establish a new circuit; however, the SNDCF shall discard the user data if the transit delay indicated to the CLNP is likely to be exceeded.

NOTE – It is not a requirement that connections be dynamically opened or closed for the correct operation of the SNDCF herein described. The use of permanent connections or the maintenance of connections in a open state from system initialization is not precluded.

5.3.5 Timeout periods

Timeout periods may be used to determine when a connection should be cleared (for example, when a connection has been idle for a long period of time) or when additional connections should be opened (for example, when there is an excessively long queue of data units waiting for transmission).

Implementations may choose to clear a connection after it has been idle for some period of time. If a timer is selected for this purpose, it is used in the following manner. When a connection is made available for the transmission of SNSDUs, a timer is initiated with a value representing the maximum period of time this connection may remain idle. Each time a data unit is transmitted by the underlying service, the timer is reset to this initial value. If no data units are queued for processing and this timer expires, the connection is cleared.

The selection of timeout values is a local matter.

NOTES

1 Additional connections may be opened when there is an excessively long queue of data units waiting for the initial logical channel. The timeout periods for determining when such additional connections are to be cleared may be shorter than the timeout period for the initial connection. (The timeout period may also be a fixed period of time.) Implementations may choose to close all additional connections if the queue of data units to be transmitted reaches some threshold (possibly zero).

2 Timeout periods are selected on the basis of economic and implementation-specific criteria. If there is no duration charge imposed by a given subnetwork authority for leaving a connection open, and if there is a charge for opening connections, then the timeout period may be selected so that the connection remains open for a long period of time. Timeout periods may also vary according to the time of day, traffic load (averaged over the recent past), or other factors.

5.3.6 Priority

As part of its operation to manage connections, the SNDCF may perform a priority function with respect to SN-UNIT-DATA requests that specify priority as a QOS parameter. Specifically, the SNDCF may open a new connection to handle the higher-priority traffic, or close an existing connection in order to free local system resources to enable it to process higher-priority traffic for which no resources would otherwise be available.

6 Conformance

6.1 Static conformance

An implementation claiming conformance to this Recommendation | International Standard shall support the use of either Semi-permanent B-channel connections or Demand access to B-channel connections, or both.

6.2 Dynamic conformance

Implementations supporting Semi-permanent B-channels shall conform to the procedures specified in 5.3.2.2, 5.3.3-5.3.6

Implementations supporting Demand Access to B-channels shall conform to the procedures specified in 5.3.2.3, 5.3.3-5.3.6.

6.3 PICS proforma

The supplier of a protocol implementation that claims conformance to this Recommendation | International Standard shall complete a copy of the PICS proforma provided in Annex A, including the information necessary to identify both the supplier and the implementation.