Recommendation X.305

FUNCTIONALITIES OF SUBNETWORKS RELATING TO THE SUPPORT

OF THE OSI CONNECTION-MODE NETWORK SERVICE

(Melbourne, 1988)

The CCITT,

considering

(a) that Recommendation X.200 defines the reference model of open systems interconnection for CCITT applications;

(b) that Recommendation X.213 is the network service definition for open systems interconnection for CCITT applications;

(c) that Recommendation X.300 defines the general principles for interworking between public networks, and between public networks and other networks for the provision of data tansmission services; and that Recommendation X.300 indicates in particular how real pieces of network equipment can be represented as subnetworks;

(d) that different types of subnetworks need to be considered, which all support the OSI connection-mode network service in different degrees: and that the different ways in which the different types of subnetworks support the OSI connection-mode network service need to be described,

unanimously declares

(1) that the description of those functionalities of a subnetwork which relate to the connection establishment phase of the OSI connection-mode network services is given in ¤ 6;

(2) that the description of those functionalities of a subnetwork which relate to the connection release phase of the OSI connection-mode network service is given in ¤ 7;

(3) that the description of those functionalities of a subnetwork which relate to the data transfer phase of the OSI connection-mode network service is given in ¤ 8.

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0 Introduction

This Recommendation is one of a set of Recommendations produced to facilitate consideration of interworking between networks. It is related to Recommendation X.300, which defines the general principles for interworking between public networks, and between public networks and other networks for the provision of data transmission services. Recommendation X.300 indicates in particular how collections of physical equipment can be represented as ÒsubnetworksÓ for consideration of interworking situations.

This Recommendation describes those functionalities of subnetworks which relate to the support of the OSI connection-mode network service.

This Recommendation does not describe those functionalities of subnetworks which do not relate to the support of the OSI connection-mode network service (e.g., those arrangements in Recommendation X.301 which do not relate to the support of the OSI connection-mode network service).

1 Scope and field of application

This Recommendation defines those functionalities of subnetworks which relate to the OSI connection- mode network service in terms of:

a) the actions and events which occur at the interfaces to a subnetwork;

b) the parameters associated with each action and event, and the form which they take;

c) the interrelationship between, and the valid sequences of, these actions and events, for a given connection;

d) the interrelationship between different connections established through the same subnetwork.

This Recommendation also defines the ways different types of subnetworks support the OSI connection-mode network service, by including within the subnetwork part or all of the functionalities of subnetworks which relate to the OSI connection-mode network service.

The principal objective of this Recommendation is to provide guidance for consideration of interworking between subnetworks, in relation with the support of the OSI connection-mode network service.

This Recommendation does not specify products, or implementations of those functionalities in real network equipment, nor does it constrain the distribution of those functionalities among the pieces of network equipment considered within a given subnetwork (e.g. PDNs, IWFs, ISDNs, . . .).

2 References

Recommendation I.430 - Basic user-network - Layer 1 specification

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

Recommendation T.70 - Network-independent basic transport service for the telematic services

Recommendation Q.701 - Functional description of the signalling system (Message Transfer Part)

Recommendation Q.702 - Signalling data link

Recommendation Q.703 - Signalling link

Recommendation Q.704 - Signalling network functions and messages

Recommendation Q.705 - Signalling network structure

Recommendation Q.706 - Message Transfer Part signalling performance

Recommendation Q.707 - Testing and maintenance

Recommendation Q.711 - Functional description of the Signalling Connection Control Part (SCCP) of Signalling System No. 7

Recommendation Q.712 - Definition and functions of Signalling Connection Control Part messages

Recommendation Q.713 - Signalling Connection Control Part (SCCP) formats and codes

Recommendation Q.714 - Signalling Connection Control Part procedures

Recommendation Q.921 - ISDN user-network interface data link layer specification

Recommendation Q.931 - ISDN user-network interface layer 3 specification

Recommendation X.21 - Interface between data terminal equipment (DTE) and data circuit-terminating equipment (DCE) for synchronous operation on public data networks

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

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Recommendation X.75 - Packet switched signalling system between public networks providing data transmission services

Recommendation X.200 - Reference model of open systems interconnections for CCITT applications

Recommendation X.213 - Network service definition for open systems interconnection for CCITT applications

Recommendation X.223 - User of X.25 to provide the OSI connection-mode network service

Recommendation X.300 - General principles for interworking between public networks, and between public networks and other networks for the provision of data transmission services

Recommendation X.301 - General arrangements for call control within a subnetwork and between subnetworks for the provision of data transmission services

3 Definitions

3.1 This Recommendation makes use of the following terms defined in Recommendation X.200:

a) network-connection;

b) network layer;

c) network service;

d) subnetwork.

3.2 This Recommendation makes use of the following terms defined in Recommendation X.213:

a) calling network service user;

b) called network service user.

3.3 This Recommendation makes use of the following terms defined in Recommendation X.300:

a) type I subnetwork;

b) type II subnetwork;

c) type III subnetwork;

d) type IV subnetwork.

3.4 *Conventions*

The arrows used in the figures of ¤ 6 to 8 indicate in a generic way the exchange of information that occurs at the interface of the subnetwork. Their purpose is not to represent the NS primitives conveyed through the horizontal abstract interface between the network layer and the transport layer.

4 Abbreviations

CCSN Common channel signalling network

CONS Connection-mode network service

CS Circuit switched

CSPDN Circuit switched public data network

DTE Data terminal equipment

ISDN Integrated services digital network

IWF Interworking function

LAPB Link access procedure balanced

MTP Message transfer part

MSS Mobile satellite systems

NC Network connection

NL Network layer

NS Network service

NSP Network service part

OSI Open systems interconnection

PLMN Public land mobile network

PLP Packet level protocol

PS Packet switched

PSDN Packet switched data network

PSPDN Packet switched public data network

PSTN Public switched telephone network

QOS Quality of service

SCCP Signalling connection control part

5 Overview and general characteristics

5.1 The functionalities of a subnetwork include provision for the transparent transfer of data between two interfaces to the subnetwork, on a connection (NC). More than one NC may exist between the same pair of interfaces.

Note 1 - The extent to which a subnetwork can support more than one connection (NC) between the same pair of interfaces, may be dependent on the types of subnetworks; also the extent to which a subnetwork can support simultaneous connections (NCs) between a given interface to the subnetwork and other distinct interfaces, may be dependent on the types of subnetworks (see also Figure 5-1/X.305).

Figure 5-1/X.305 - t0706210-88

Note 2 - Also the interfaces to the subnetwork may be using either the same protocol, or different protocols depending on the nature of the system attached to that interface (e.g., X.25 if DTE, X.75 if another subnetwork).

5.2 Within a subnetwork, support of the OSI connection-mode network service may involve functionalities of that subnetwork performed:

- either at all the Layers 1 to 3,
- or at Layer 1 and 2,
- or only at Layer 1.

This may depend on the type of subnetwork which is considered.

This may also depend on the phase in the network connection (i.e., connection establishment, connection release, data transfer), and also on the element of the connection-mode network service considered within that phase.

Figure 5-2/X.305 - t0706220-88

6 Connection establishment phase

6.1 The functionalities of a subnetwork which relate to the connection establishment phase of the OSI network layer service correspond to the following actions and events at the interfaces to the subnetwork:

a) *Connect request*, with the following parameters:

- called address,
- calling address,
- receipt confirmation selection (see Note 1),
- expedited data selection (see Note 1),
- QOS-parameter set (see Note 2),
- NS-user-data (see Note 3).

b) *Connect indication*, with the following parameters:

- called address,
- calling address,
- receipt confirmation selection (see Note 1),
- expedited data selection (see Note 1),
- QOS-parameter set (see Note 2),
- NS-user-data (see Note 3).

c) *Connect response*, with the following parameters:

- responding address,
- receipt confirmation selection (see Note 1),
- expedited data selection (see Note 1),
- QOS-parameter set (see Note 2),
- NS-user-data (see Note 3).

d) *Connect confirm*, with the following parameters:

- responding address,
- receipt confirmation selection (see Note 1),
- expedited data selection (see Note 1),
- QOS-parameter set (see Note 2),
- NS-user-data (see Note 3).

Note 1 - NS provider-option.

Note 2 - The implementation of the transit delay negotiation requires urgent further study in order to have a harmonized realization in different types of subnetworks. Special attention is required as regards routing and charging consequences.

Note 3 - The objective is to make this parameter a mandatory parameter to be supported by all subnetworks in the future. However, a number of existing subnetworks cannot support it now. During the interim period, while these subnetworks exist and are not modified to provide this parameter, it is considered as a provider-option. No negotiation mechanism is needed in the OSI connection-mode network service. Limiting, in some subnetworks, length of NS-user-data to be provided to a value lower than 128 octets (e.g., 16 to 32 octets) for an interim period would imply fewer changes to existing interfaces and signalling systems and would simplify the introduction of such a service in existing subnetworks.

6.2 In relation with the support of the OSI connection-mode network service, the various actions and events at the interfaces to the subnetworks which are described in ¤ 6.1 above, are expected to be sequenced according to ¤ 11 of Recommendation X.213. In particular a successful connection establishment is expected to be as in the following figure:

Figure 6-1/X.305 - t0704160-88

6.3 In relation with the support of the OSI connection-mode network service, the parameters listed in ¤ 6.1 above are expected to be handled as described in ¤ 12 of Recommendation X.213.

6.4 The ways the different types of subnetworks support the elements of a connection establishment phase of the OSI connection-mode network service, are as follows:

a) *Type I and Type II subnetworks*

Functionalities of Type I and Type II subnetworks include all elements described in ¤¤ 6.1 to 6.3 above.

b) *Type III subnetworks*

Functionalities of Type III subnetworks do not include all elements described in ¤¤ 6.1 to 6.3 above.

Note - In some instances (i.e., Type III), the inclusion of some elements described in ¤¤ 6.1 to 6.3 within the functionalities of the subnetwork requires further study.

c) *Type IV subnetworks*

Functionalities within Type IV subnetworks either include all elements described in ¤¤ 6.1 to 6.3 above, or this type of subnetwork may only include a subset of these elements.

7 Connection release phase

7.1 The functionalities of a subnetwork which relate to the connection release phase of the OSI connection-mode network service correspond to the following actions and events at the interfaces to the subnetwork:

a) *Disconnect request*, with the following parameters:

- reason,
- NS-user-data (see Note),
- responding address.

b) *Disconnect indication*, with the following parameters:

- originator,
- reason,
- NS-user-data (see Note),
- responding address.

Note - The objective is to make this parameter a mandatory parameter to be supported by all subnetworks in the future. However, a number of existing subnetworks cannot support it now. During the interim period, while these subnetworks exist and are not modified to provide this parameter, it is considered as a provider-option. No negotiation mechanism is needed in the connection-mode network service.

7.2 In relation with the support of the OSI connection-mode network service, the various actions and events at the interfaces to the subnetwork which are described in ¤ 7.1 above, are expected to be sequenced according to ¤ 11 of Recommendation X.213. In particular an NS user initiated connection release is expected to be as in the Figure 7-1/X.305.

Figure 7-1/X.305 - T0704170-88

7.3 In relation with the support of the OSI connection-mode network service, the parameters listed in ¤ 7.1 above are expected to be operated as described in ¤ 13 of Recommendation X.213.

7.4 The ways the different types of subnetworks support the elements of a connection release phase of the OSI connection-mode network service, are as follows:

a) *Type I and Type II subnetworks*

Functionalities within Type I and Type II subnetworks include all elements described in ¤¤ 7.1 to 7.3 above.

b) *Type III subnetworks*

Functionalities within Type III subnetworks do not include all elements described in ¤¤ 7.1 to 7.3 above.

Note - In some instances (i.e., Type III), the inclusion of some elements described in ¤¤ 7.1 to 7.3 within the functionalities of the subnetwork requires further study.

c) *Type IV subnetworks*

Functionalities within Type IV subnetworks either include all elements described in ¤¤ 7.1 to 7.3 above, or this type of subnetwork may only include a subset of these elements.

8 Data transfer phase

8.1 The functionalities of a subnetwork which relate to the data transfer phase of the OSI network layer service correspond to the following actions and events at the interfaces to the subnetwork:

a) *DATA request*, with the following parameters:

- NS-user-data,
- confirmation request (see Note).

b) *DATA indication*, with the following parameters:

- NS-user-data,
- confirmation request (see Note).

c) *RESET request*, with the following parameter:

- reason.

d) *RESET indication*, with the following parameters:

- originator,
- reason.

e) *RESET response*, with no parameter.

f) *RESET confirm*, with no parameter.

g) *EXPEDITED DATA request* (see Note).

h) *EXPEDITED DATA indication* (see Note).

Note - NS provider options, when provided within a subnetwork, would lead to additional actions and events.

8.2 In relation with the support of the OSI connection-mode network service, the various actions and events at the interfaces to the subnetwork which are described in ¤ 8.1 above, are expected to be sequenced according to ¤¤ 11 and 14 of Recommendation X.213.

8.3 Also the parameters listed in ¤ 8.1 above are expected to be handled as described in ¤ 14 of Recommendation X.213.

8.4 The flow control conditions applying on a connection are expected to be as described in ¤ 9.2 of Recommendation X.213 (Model of a network connection).

Figure 8-1/X.305 - T0704180-88

Figure 8-2/X.305 - T0704190-88

Figure 8-3/X.305 - T0704200-88

8.5 The ways the different types of subnetworks support the elements of a data transfer phase of the OSI network layer service, are as follows:

a) *Type I subnetworks*

Functionalities within Type I subnetworks include all elements described in ¤¤ 8.1 to 8.4 above (see also Annex A).

Functions and protocols required to complete the support of the OSI CONS then reside within the subnetwork, and the systems attached to the subnetwork.

b) *Type II or III subnetworks*

Functionalities within Type II or III subnetworks include some elements described in ¤¤ 8.1 to 8.4 above (see also Annex A).

Those elements correspond to the provision of a physical connection.

Functions and protocols required to complete the support of the OSI CONS then reside in systems attached to the subnetwork, and are not operated within the subnetwork.

c) *Type IV subnetworks*

Functionalities within Type IV subnetworks include some elements described in ¤¤ 8.1 to 8.4 above (see also Annex A).

Some form of packetizing or framing is operated by the subnetwork without providing all mandatory elements required for the support of the OSI CONS.

Functions and protocols required to complete the support of the OSI CONS then reside in systems related to the subnetwork, and are not operated within the subnetwork.

ANNEX A

(to Recommendation X.305)

Functionality related to the data transfer phase of the OSI CONS

within the different types of networks

TABLE A-1/X.305

Functionality related to the data transfer phase of the OSI CONS	Within a Type I subnetwork?	Within a Type II subnetwork?	Within a Type III subnetwork?	Within a Type IV subnetwork?
NSDU data transfer	Yes	No (Note 1)	No (Note 1)	No/Yes (Note 3)
Flow control	Yes	No (Note 1)	No (Note 1)	No/Yes (Note 3)
Mechanism for sequencing in the subnetwork	Yes	Yes (Note 1)	Yes (Note 1)	No/Yes (Note 3)
Error notification	Yes	No (Note 1)	No (Note 1)	No/Yes (Note 3)
Reset	Yes	No (Note 1)	No (Note 1)	No/Yes (Note 3)
Receipt confirmation (option)	Optional (Note 2)	No (Note 1)	No (Note 1)	No/Yes (Note 3)
Expedited data transfer (option)	Optional (Note 2)	No (Note 1)	No (Note 1)	No/Yes (Note 3)

Note 1 - Funcionalities within Type II and Type III subnetworks consist of the transparent transfer of bit stream. Consequently the grouping of data as NSDUs requires then an additional protocol mechanism which is not operated by the subnetwork itself. The subnetwork only preserves sequencing in the sense that all bits arrive in sequence.

Note 2 - Since it is an NS option, subnetworks are not required to contain any functionalities related to that element.

Note 3 - Some form of packetizing or framing is operated by the subnetwork, without providing all mandatory elements required for the support of the OSI CONS.

ANNEX B

(to Recommendation X.305)

Sets of protocols for the provision of the OSI CONS

over different examples of subnetworks

B.1 *General*

Annex B illustrates some examples of subnetworks (Type I, Type II, Type III subnetworks) in giving possible sets of protocols at Layers 1 to 3 for the provision of the OSI CONS over these examples of subnetworks (see Table B-1/X.305).

TABLE B-1/X.305

Protocols to provide and support the OSI connection-mode network service

Network	Provision and support of the OSI connection-mode network service
CCSN	See ¤ B.2
CSPDN	See ¤ B.3
ISDN	
- CS bearer requested	See ¤ B.4
- PS bearer requested	See ¤ B.5
Mobile data systems	See ¤ B.6
Private networks	See ¤ B.7
PSPDN	See ¤ B.8
PSTN	See ¤ B.9

Related to functionalities within subnetwork.

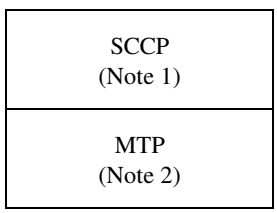
Not related to functionalities within subnetwork.

B.2 *CCSN*

The subnetwork representation for consideration of possible sets of protocols to provide the OSI CONS in the case of a CCSN is shown in Figure B-1/X.305.

Figure B-1/X.305 - T0706230-88

The possible set of protocols to provide the OSI CONS related to this representation is shown in Figure B-2/X.305.



Note 1 - Signalling Connection Control Part (SCCP), defined in Recommendations Q.711 to Q.714. Protocol class 3 of SCCP is used.

Note 2 - Message Transfer Part (MTP), defined in Recommendations Q.701 to Q.707.

Note 3 - The combination of the MTP and the SCCP is also called ÒNetwork Service PartÓ (NSP).

FIGURE B-2/X.305

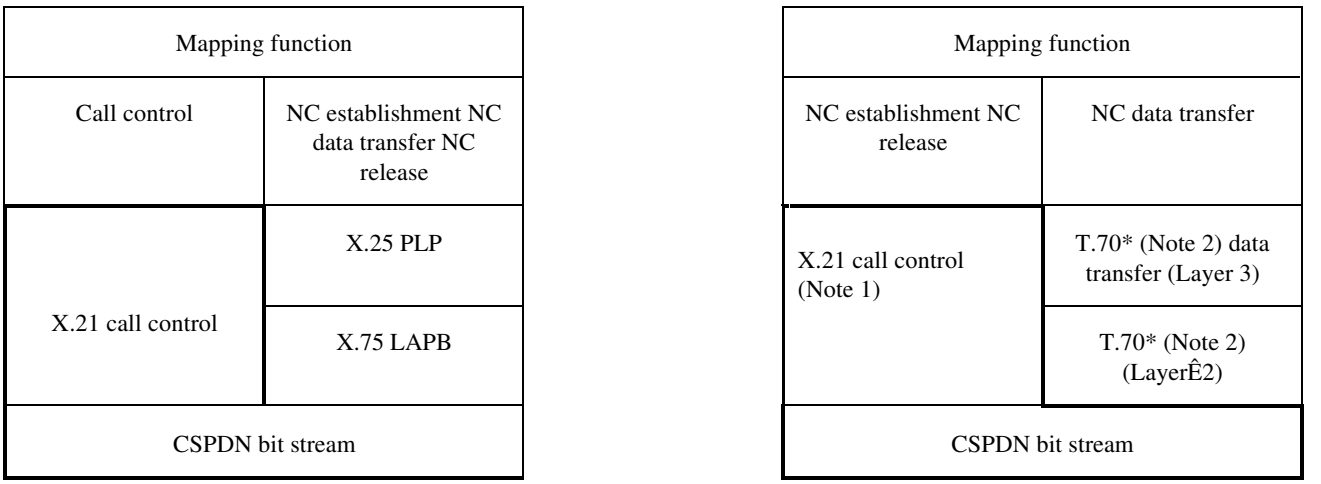
Possible protocol set to provide the OSI CONS in case of a CCSN

B.3 *CSPDN*

The subnetwork representation for consideration of possible sets of protocols to provide the OSI CONS in the case of a CSPDN is shown in Figure B-3/X.305.

Figure B-3/X.305 - T0706240-88 + T0706250-88

The possible sets of protocols to provide the OSI NLS related to this representation are shown in Figure B-4/X.305.



Note 1 - The enhancement of Recommendation X.21 is for further study.

Note 2 - T.70* represents the data phase procedure described in Recommendation T.70 for data transfer over the CSPDN, but needs to be enhanced so that the reset service is supported.

FIGURE B-4/X.305

Possible protocol set to provide the OSI CONS in case of a CSPDN

B.4 *ISDN (CS bearer is requested)*

The subnetwork representation for consideration of possible sets of protocols to provide the OSI CONS in the case of an ISDN where a CS bearer is requested is shown in Figure B-5/X.305.

Figure B-5/X.305 - T0706260-88

A possible set of protocols to provide the OSI CONS related to this representation is shown in Figure B-6/X.305.

Note - Other possible sets of protocols to provide the OSI CONS are for further study.

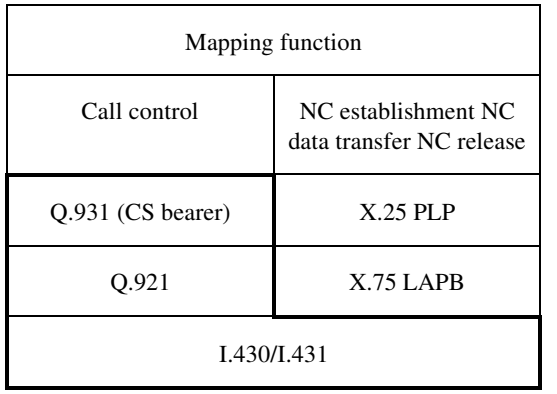


FIGURE B-6/X.305

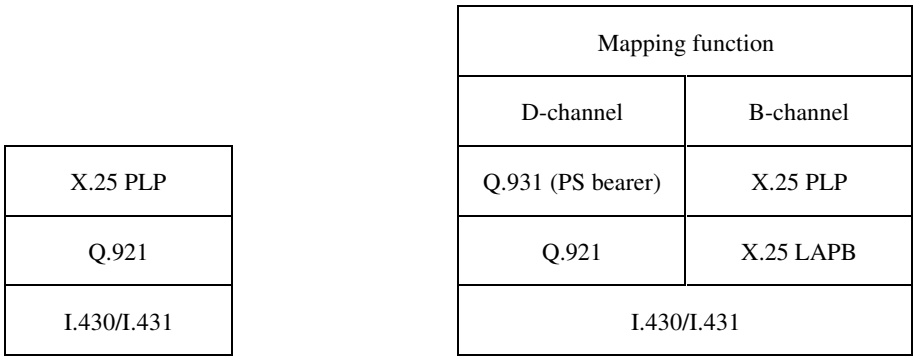
Possible protocol set to provide the OSI CONS in case of a ISDN where a CS bearer is requested

B.5 *ISDN (PS bearer is requested)*

The subnetwork representation for consideration of possible sets of protocols to provide the OSI CONS in the case of an ISDN where a PS bearer is requested is shown in Figure B-7/X.305.

Figure B-7/X.305 - T0706270-88

The possible sets of protocols to provide the OSI CONS related to this representation are shown in Figure B-8/X.305.



Note - Q.931 procedures are not used in the hot line access case.

a) Possible protocol set to provide the OSI CONS in case of a ISDN where a PS bearer on the D-channel is requested.

b) Possible protocol set to provide the OSI CONS in case of a ISDN where a PS bearer on the B-channel is requested.

FIGURE B-8/X.305

B.6 *Mobile data systems*

The subnetwork representation for consideration of possible sets of protocols to provide the OSI CONS in the case of mobile data systems is shown in Figure B-9/X.305.

Figure B-9/X.305 - T0706290-88

The possible sets of protocols to provide the OSI CONS related to this representation are shown in Figure B-10/X.305.

FIGURE B-10/X.305

Possible protocol set to provide the OSI CONS in case of Mobile Systems

B.7 *Private networks*

The subnetwork representation for consideration of possible sets of protocols to provide the OSI CONS in the case of private networks depends on the type of private network that is used. In case of private PSDNs, see ¤ B.8. In case of private ISDNs, see ¤¤ B.4 and B.5.

B.8 *PSPDN*

The subnetwork representation for consideration of possible sets of protocols to provide OSI CONS in the case of a PSPDN is shown in Figure B-11/X.305.

Figure B-11/X.305 - T0706300-88

The possible-set of protocols to provide the OSI CONS related to this representation is shown in Figure B-12/X.305.

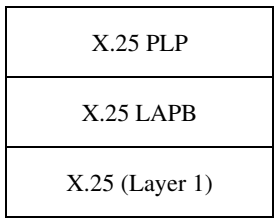


FIGURE B-12/X.305

Possible protocol set to provide the OSI CONS in case of a PSPDN

B.9 *PSTN*

The subnetwork representation for consideration of possible sets of protocols to provide the OSI CONS in the case of a PSTN is shown in Figure B-13/X.305.

Figure B-13/X.305 - T0706310-88

The possible set of protocols to provide the OSI CONS related to this representation is shown in Figure B-14/X.305.

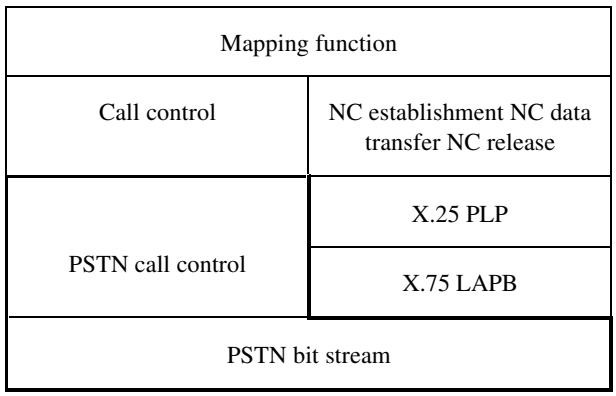


FIGURE B-14/X.305

Possible protocol set to provide the OSI CONS in case of a PSTN