



INTERNATIONAL TELECOMMUNICATION UNION

ITU-T

TELECOMMUNICATION
STANDARDIZATION SECTOR
OF ITU

X.445

(04/95)

**DATA NETWORKS AND OPEN SYSTEM
COMMUNICATIONS
MESSAGE HANDLING SYSTEMS**

**ASYNCHRONOUS PROTOCOL
SPECIFICATION – PROVISION OF OSI
CONNECTION MODE NETWORK SERVICE
OVER THE TELEPHONE NETWORK**

ITU-T Recommendation X.445

(Previously "CCITT Recommendation")

FOREWORD

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ITU-T Recommendation X.445 was prepared by ITU-T Study Group 7 (1993-1996) and was approved under the WTSC Resolution No. 1 procedure on the 10th of April 1995.

NOTE

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DATA NETWORKS AND OPEN SYSTEM COMMUNICATIONS
 (February 1994)

ORGANIZATION OF X-SERIES RECOMMENDATIONS

Subject area	Recommendation Series
PUBLIC DATA NETWORKS	
Services and Facilities	X.1-X.19
Interfaces	X.20-X.49
Transmission, Signalling and Switching	X.50-X.89
Network Aspects	X.90-X.149
Maintenance	X.150-X.179
Administrative Arrangements	X.180-X.199
OPEN SYSTEMS INTERCONNECTION	
Model and Notation	X.200-X.209
Service Definitions	X.210-X.219
Connection-mode Protocol Specifications	X.220-X.229
Connectionless-mode Protocol Specifications	X.230-X.239
PICS Proformas	X.240-X.259
Protocol Identification	X.260-X.269
Security Protocols	X.270-X.279
Layer Managed Objects	X.280-X.289
Conformance Testing	X.290-X.299
INTERWORKING BETWEEN NETWORKS	
General	X.300-X.349
Mobile Data Transmission Systems	X.350-X.369
Management	X.370-X.399
MESSAGE HANDLING SYSTEMS	X.400-X.499
DIRECTORY	X.500-X.599
OSI NETWORKING AND SYSTEM ASPECTS	
Networking	X.600-X.649
Naming, Addressing and Registration	X.650-X.679
Abstract Syntax Notation One (ASN.1)	X.680-X.699
OSI MANAGEMENT	X.700-X.799
SECURITY	X.800-X.849
OSI APPLICATIONS	
Commitment, Concurrency and Recovery	X.850-X.859
Transaction Processing	X.860-X.879
Remote Operations	X.880-X.899
OPEN DISTRIBUTED PROCESSING	X.900-X.999

CONTENTS

	Page
1 Scope	1
2 References	1
3 Definitions	2
3.1 Reference model definitions	2
3.2 Service conventions definitions	3
3.3 Network service definitions	3
3.4 X.25 definitions	3
3.5 APS definitions	3
4 Abbreviations	3
4.1 Reference model abbreviations	3
4.2 Network layer abbreviations	3
4.3 X.25 abbreviations	4
4.4 Data link layer abbreviations	4
4.5 Other abbreviations	4
5 Overview	5
5.1 Configurations	5
5.2 Modes of operation and their APS layers representation	6
5.2.1 V.42-dependent mode	6
5.2.2 LAPB mode	6
5.2.3 X.25 mode	6
5.2.4 Mode negotiations	6
5.2.5 Mode support	7
6 Provision of the OSI CONS	7
6.1 Control of underlying connections	7
6.2 Mapping OSI CONS to/from X.25 PLP	9
6.3 Mapping OSI CONS to/from the APS network protocol	10
7 APS layer 2 protocols	10
7.1 Introduction	10
7.2 Start/stop LAPB	10
7.3 APS data link protocol	10
7.3.1 Reception of incorrect frames	11
7.4 Transparency	11
7.5 APS layer 2 operation and establishment of the underlying connection	11
7.5.1 Point-to-Point configuration	11
7.5.1.1 Establishment of the underlying connection	11
7.5.1.2 Data link set-up	12
7.5.1.3 LAPB addressing	13
7.5.1.4 Time fill	13
7.5.2 PAD configuration	14
7.5.2.1 Establishment of the underlying connection	14
7.5.2.2 Data link set-up	14
7.5.2.3 LAPB addressing	15
7.5.2.4 Time fill	15
7.5.2.5 Mapping of APS layer 2 frames to packets	15
7.5.2.6 Exception conditions	15
7.5.3 Direct network configuration	15
7.5.3.1 Establishment of the underlying connection	15
7.5.3.2 LAPB data link set-up	15
7.5.3.3 LAPB addressing	15
7.5.3.4 Time fill	15

	<i>Page</i>
8 APS layer 3 protocols.....	15
8.1 The APS network protocol	15
8.1.1 APS network protocol elements of procedure	16
8.1.1.1 Connection establishment procedure	16
8.1.1.2 Data transfer procedure.....	17
8.1.1.3 Disconnect procedure.....	17
8.1.2 APS network protocol structure.....	18
8.1.2.1 The connect request PDU	19
8.1.2.2 The connect confirm PDU	19
8.1.2.3 The data transfer PDU	19
8.1.2.4 The disconnect request PDU	19
8.1.2.5 The disconnect confirm PDU.....	19
8.1.2.6 Maximum user data in APS NPDUs.....	19
8.2 X.25 PLP operation	20
8.2.1 Optional and negotiable parameters.....	21
8.2.1.1 Parameter usage in the Direct Network configuration	23
Annex A – Transparency.....	23
A.0 Transparency	23
A.1 Introduction	23
A.2 APS PAD transparency.....	23
Annex B – APS protocols selection string	24
B.0 APS protocols selection string.....	24
B.1 Introduction	24
B.2 APS protocols selection string format	24
B.3 Use of the call user data in X.25 call requests	24
Annex C – Use of the APS network protocol to provide the OSI Connection-mode network service	25
C.0 Use of the APS network protocol to provide the OSI connection-mode network service.....	25
C.1 Introduction	25
C.2 Network connection establishment phase.....	25
C.3 Data transfer phase	25
C.3.1 Handling of NS-user-data	25
C.3.2 The reset service	26
C.4 Network connection release phase.....	26
C.4.1 Mapping of N-DISCONNECT Parameters.....	26
Annex D – Recommended practices for use in MHS environment.....	28
D.0 Recommended practices	28
D.1 APS layer 3 protocols	28
D.1.1 Use of the APS network protocol for simultaneous communications	28
D.1.2 Handling of future versions	28
D.2 APS layer 2 protocols	28
D.2.1 LAPB retransmission timer.....	28
D.3 Start/stop framing	29
D.3.1 Fast Frame Control Check (FCS) implementation.....	29
D.4 Modems	30
D.4.1 V.42 modems	30
D.4.2 Modems with automatic data rate switching.....	31
D.4.3 Modem flow control	31
D.5 PAD operation	31
D.5.1 Recommended PAD parameters	31
D.5.2 Remote PAD parameters.....	32
D.6 Timers and counters.....	32
D.6.1 APS layer 2	32
D.6.2 APS layer 3	32

SUMMARY

This Recommendation specifies the protocols to be used to provide OSI connection mode network service to applications entities such as MHS entities (e.g. UA, MTA, MS) when communicating in an asynchronous environment (i.e. start/stop transmissions) over a telephone network.

The communication can be directly over a telephone network connection, or over a telephone network connection to a PSDN through a PAD, or over a telephone network connection to a PSDN using the packet mode.

INTRODUCTION

This Recommendation establishes the rules for asynchronous OSI communications over the telephone network.

This Recommendation is applicable in MHS (and other) environments requiring optimization of data link and network layer protocols for reliable asynchronous communication over the telephone network.

These environments include:

- communications over direct telephone network connection;
- communications over a telephone network connection to a PSDN through a PAD;
- communications over a telephone network connection to a PSDN using the packet mode.

Recommendation X.445

ASYNCHRONOUS PROTOCOL SPECIFICATION – PROVISION OF OSI CONNECTION MODE NETWORK SERVICE OVER THE TELEPHONE NETWORK

(Geneva, 1995)

1 Scope

This Recommendation is applicable in MHS (and other) environments requiring optimization of data link and network layer protocols for reliable asynchronous communication over the telephone network.

These environments include:

- communications over direct telephone network connection;
- communications over a telephone network connection to a PSDN through a PAD;
- communications over a telephone network connection to a PSDN using the packet mode.

NOTE – For simplicity, the term MHS is used throughout this Recommendation to represent any application environment. For example, other applications environments may include the OSI Directory, etc.

2 References

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

- CCITT Recommendation V.42 (1988), *Error-correcting procedures for DCEs using asynchronous-to-synchronous conversion*.
- ITU-T Recommendation X.3 (1993), *Packet Assembly/Disassembly facility (PAD) in a public data network*.
- 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*.
- ITU-T Recommendation X.28 (1993), *DTE/DCE interface for a start-stop mode data terminal equipment accessing the Packet Assembly/Disassembly facility (PAD) in a public data network situated in the same country*.
- ITU-T Recommendation X.29 (1993), *Procedures for the exchange of control information and user data between a Packet Assembly/Disassembly (PAD) facility and a packet mode DTE or another PAD*.
- ITU-T Recommendation X.32 (1993), *Interface between Data Terminal Equipment (DTE) and Data Circuit-terminating Equipment (DCE) for terminals operating in the packet mode and accessing a packet switched public data network through a public switched telephone network or an integrated services digital network or a circuit switched public data network*.
- ITU-T Recommendation X.200 (1994) | ISO/IEC 7498-1:1994, *Information technology – Open Systems Interconnection – Basic Reference Model: The Basic Model*.
- ITU-T Recommendation X.210 (1993) | ISO/IEC 10731:1994, *Information technology – Open Systems Interconnection – Conventions for the definition of OSI services*.
- CCITT Recommendation X.213 (1992) | ISO/IEC 8348:1993, *Information technology – Open Systems Interconnection – Network service definition*.

- ITU-T Recommendation X.223 (1993), *Use of X.25 to provide the OSI connection-mode network service for ITU-T applications.*
- ISO/IEC 8878:1992, *Information technology – Telecommunications and information exchange between systems – Use of X.25 to provide the OSI connection-mode network service.*
- CCITT Recommendation F.400/X.400 (1992), *Message handling services: Message handling system and service overview.*
- ISO/IEC 10021-1:1990, *Information technology – Text Communication – Message-Oriented Text Interchange Systems (MOTIS) – Part 1: System and Service Overview plus Technical Corrigendum 1 (1991), Technical Corrigendum 2 (1991), Technical Corrigendum 3 (1992), and Technical Corrigendum 4 (1992).*
- CCITT Recommendation X.419 (1992), *Message handling systems – Protocol specifications.*
- ISO/IEC 10021-6:1990, *Information technology – Text Communication – Message-Oriented Text Interchange Systems (MOTIS) – Part 6: Protocol specifications plus Technical Corrigendum 1 (1991), Technical Corrigendum 2 (1991), Technical Corrigendum 3 (1992), and Technical Corrigendum 4 (1992).*
- ITU-T Recommendation X.500 (1993) | ISO/IEC 9594-1:1994, *Information technology – Open Systems Interconnection – The Directory: Overview of concepts, models and services.*
- CCITT Recommendation X.614 (1992) | ISO/IEC 10732:1993, *Information technology – Use of the X.25 packet layer protocol to provide the OSI connection-mode network service over the telephone network.*
- ISO/IEC 3309:1993, *Information technology – Telecommunications and information exchange between systems – High-level data link control (HDLC) procedures – Frame structure.*
- ISO 7776:1986, *Information processing systems – Datacommunications – High-level data link control procedures – Description of the X.25 LAPB-compatible DTE data link procedures.*
- ISO/IEC 7809:1993, *Information technology – Telecommunications and information exchange between systems – High-level Data Link Control (HDLC) procedures – Classes of procedures.*
- ISO/IEC 8208:1990, *Information technology – Data communications – X.25 Packet Layer Protocol for Data Terminal Equipment.*
- ISO/IEC ISP 10609-9:1992, *Information technology – International Standardized Profiles TB, TC, TD and TE – Connection-mode Transport Service over connection-mode Network Service – Part 9: Subnetwork-type dependent requirements for Network Layer, Data Link Layer, and Physical Layer concerning permanent access to a packet switched data network using virtual calls.*
- ISO/IEC 646:1991, *Information technology – ISO 7-bit coded character set for information interchange.*
- ISO/IEC 4335:1993, *Information technology – Telecommunications and information exchange between systems – High-level Data Link Control (HDLC) procedures – Elements of procedures.*

3 Definitions

For the purposes of this Recommendation, the following definitions apply.

3.1 Reference model definitions

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

- a) Network connection;
- b) Network layer;
- c) Network service.

3.2 Service conventions definitions

This Recommendation makes use of the following terms defined in ITU-T Rec. X.210 | ISO/IEC 10731:

- a) Network service provider;
- b) Network service user.

3.3 Network service definitions

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

- a) N-CONNECT request;
- b) N-CONNECT indication;
- c) N-CONNECT response;
- d) N-CONNECT confirm;
- e) N-DISCONNECT indication;
- f) N-DISCONNECT request;
- g) N-DATA request;
- h) N-DATA indication.

3.4 X.25 definitions

This Recommendation makes use of the following concepts as developed in Recommendation X.25:

- a) Virtual circuit;
- b) Virtual call;
- c) Data circuit-terminating equipment;
- d) Data terminal equipment.

3.5 APS definitions

This Recommendation makes use of the following terms and definitions:

3.5.1 APS layer 1: Provides the same functionality as OSI Layer 1 (Physical Layer). In the case of PAD configuration defined in 5.1, it includes the functions and protocols defined in Recommendations X.3, X.28, and X.29.

3.5.2 APS layer 2: Provides the same functionality as OSI Layer 2 (Data Link Layer).

3.5.3 APS layer 3: Provides the same functionality as OSI Layer 3 (Network Layer).

3.5.4 end system: A client or a server system as defined in clause 5.

3.5.5 underlying connection: An APS layer 1 connection established by the client system and it comprises the telephone network connection and, if in PAD configuration, the PAD virtual call.

4 Abbreviations

For the purposes of this Recommendation, the following abbreviations apply.

4.1 Reference model abbreviations

OSI Open Systems Interconnection

4.2 Network layer abbreviations

CONS Connection-mode Network Service

NPDU Network Protocol Data Unit

NSAP	Network Service Access Point
NSDU	Network Service Data Unit
QOS	Quality of Service

4.3 X.25 abbreviations

DCE	Data Circuit-terminating Equipment
DTE	Data Terminal Equipment
ICRD	Inter-network Call Redirection and Deflection
NPI	Numbering Plan Identification
TOA	Type of Address
PLP	Packet Layer Protocol

4.4 Data link layer abbreviations

DISC	Disconnect (frame)
DL	Data Link
DM	Disconnect Mode
FCS	Frame Check Sequence
LAPB	Link Access Protocol Balanced
LAPM	Link Access Protocol for Modems
SABM	Set Asynchronous Balanced Mode
SABME	Set Asynchronous Balanced Mode Extended
SLP	Single Link Procedures
UI	Unnumbered Information (frame)

4.5 Other abbreviations

APS	Asynchronous Protocol Specification
CR	Carriage Return
DLE	Data Link Escape
MS	Message Store
MTA	Message Transfer Agent
PAD	Packet Assembly/Disassembly
PDU	Protocol Data Unit
PSDN	Packet Switched Data Network
ROA	Recognized Operating Agency
UA	User Agent
UART	Universal Asynchronous Receiver-Transceiver
XOFF	Device Off
XON	Device On

5 Overview

This Recommendation defines protocol mappings to the OSI network service and protocol exchanges between an initiator of a connection called the **client** and a responder called the **server**. In MHS environment, the client is any MHS entity that initiates a connection like for instance, a remote User Agent (UA) or a Message Transfer Agent (MTA); the server is any MHS entity that responds to a connection like for instance, a Message Store (MS), or an MTA. The principle protocol exchanges used are called the **APS Network Protocol** and the **APS Data Link Protocol** defined in 8.1 and 7.3 respectively.

This clause illustrates a set of possible **client-server** configurations that exemplify the interactions in an asynchronous communication environment.

5.1 Configurations

Three configurations for client-server asynchronous communications are considered in this Recommendation as shown in Figure 1:

- The **Point-to-Point** configuration where the client establishes a connection directly with the server using the telephone network .
- The **PAD** configuration where the client establishes a connection with the server over a telephone network connection to a PSDN via a PAD.
- The **Direct Network** configuration where the client establishes a connection with the server over a telephone network connection to a PSDN using the packet mode.

NOTE – In b) and c) configurations the server is connected to the PSDN in the packet mode.

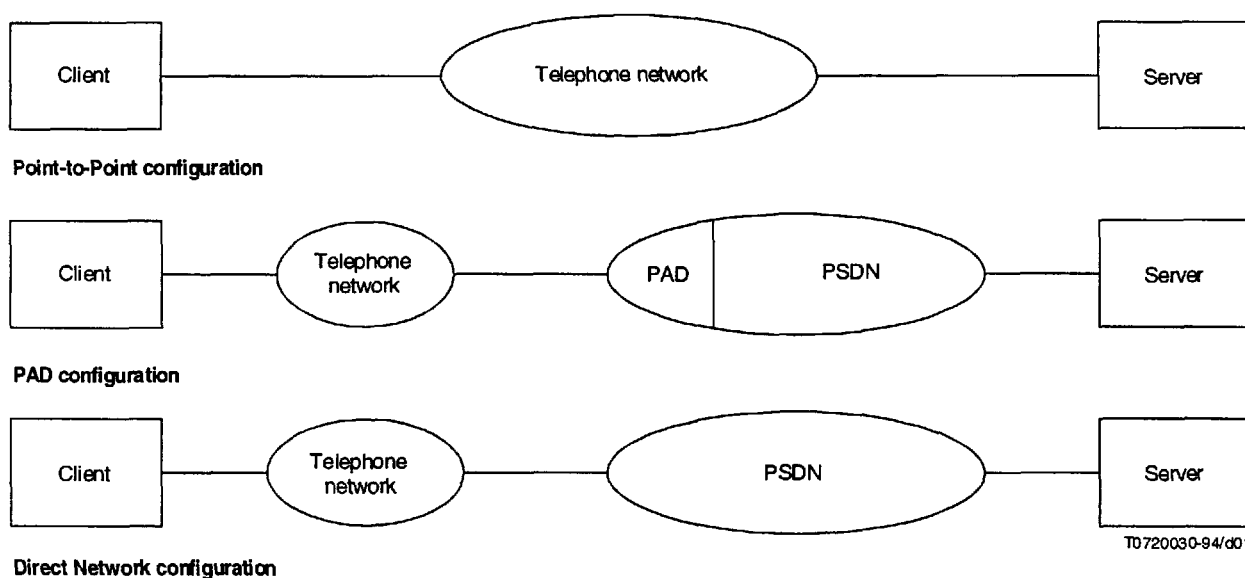


FIGURE 1/X.445
Client-server configurations