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DATA NETWORK AND OPEN SYSTEM COMMUNICATIONS

MESSAGE HANDLING SYSTEMS

INFORMATION TECHNOLOGY – MESSAGE HANDLING SYSTEMS (MHS): PROTOCOL SPECIFICATIONS

ITU-T Recommendation X.419

(Previously “CCITT Recommendation”)

FOREWORD

ITU (International Telecommunication Union) is the United Nations Specialized Agency in the field of telecommunications. The ITU Telecommunication Standardization Sector (ITU-T) is a permanent organ of the ITU. Some 179 member countries, 84 telecom operating entities, 145 scientific and industrial organizations and 38 international organizations participate in ITU-T which is the body which sets world telecommunications standards (Recommendations).

The approval of Recommendations by the Members of ITU-T is covered by the procedure laid down in WTSC Resolution No. 1 (Helsinki, 1993). In addition, the World Telecommunication Standardization Conference (WTSC), which meets every four years, approves Recommendations submitted to it and establishes the study programme for the following period.

In some areas of information technology which fall within ITU-T's purview, the necessary standards are prepared on a collaborative basis with ISO and IEC. The text of ITU-T Recommendation X.419 was approved on 21st of November 1995. The identical text is also published as ISO/IEC International Standard 10021-6.

NOTE

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

ITU-T X-SERIES RECOMMENDATIONS

DATA NETWORKS AND OPEN SYSTEM COMMUNICATIONS

(February 1994)

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Summary

This Recommendation | International Standard contains new additional optional application contexts for the new versions of P3 and P7 introduced in Recommendations X.411 and X.413. The P1 conformance requirement has been revised to achieve common text with ISO/IEC. The ASN.1 has been fully revised to use the new Recommendations X.680 and X.880, while retaining complete compatibility with the 1988 and 1992 P1 and P3 protocols. Numerous defect corrections are incorporated.

Introduction

This Protocol Specification is one of a set of Recommendations | International Standards defining Message Handling in a distributed open systems environment.

Message Handling provides for the exchange of messages between users on a store-and-forward basis. A message submitted by one user (the *originator*) is transferred through the Message Transfer System (MTS) and delivered to one or more other users (the *recipients*). A user may interact directly with the MTS, or indirectly via a Message Store (MS).

The MTS comprises a number of message-transfer-agents (MTAs), which transfer messages and deliver them to their intended recipients.

This Protocol Specification was developed jointly by ITU-T and ISO/IEC. It is published as common text as ITU-T Rec. X.419 | ISO/IEC 10021-6.

INTERNATIONAL STANDARD

ITU-T RECOMMENDATION

INFORMATION TECHNOLOGY – MESSAGE HANDLING SYSTEMS (MHS): PROTOCOL SPECIFICATIONS

SECTION 1 – INTRODUCTION

1 Scope

This Recommendation | International Standard specifies the MTS Access Protocol (P3) used between a remote user-agent and the MTS to provide access to the MTS Abstract Service defined in ITU-T Rec. X.411 and ISO/IEC 10021-4.

This Recommendation | International Standard also specifies the MS Access Protocol (P7) used between a remote user-agent and a message-store (MS) to provide access to the MS Abstract Service defined in ITU-T Rec. X.413 and ISO/IEC 10021-5.

This Recommendation | International Standard also specifies the MTS Transfer Protocol (P1) used between MTAs to provide the distributed operation of the MTS as defined in ITU-T Rec. X.411 and ISO/IEC 10021-4.

ITU-T Rec. X.402 and ISO/IEC 10021-2 identify the other Recommendations | International Standards which define other aspects of Message Handling Systems.

Section 2 specifies the MHS Access Protocols (P3 and P7). Clause 6 provides an overview of the MHS Access Protocols. Clause 7 defines the abstract-syntax of the MTS Access Protocol (P3). Clause 8 defines the abstract-syntax of the MS Access Protocol (P7). Clause 9 defines the mapping of the MHS Access Protocols onto used services. Clause 10 specifies conformance requirements for systems implementing the MHS Access Protocols.

Section 3 specifies the MTS Transfer Protocol (P1). Clause 11 provides an overview of the MTS Transfer Protocol (P1). Clause 12 defines the abstract-syntax of the MTS Transfer Protocol (P1). Clause 13 defines the mapping of the MTS Transfer Protocol (P1) onto used services. Clause 14 specifies conformance requirements for systems implementing the MTS Transfer Protocol (P1).

Annex A provides a reference definition of the MHS protocol object identifiers cited in the ASN.1 modules in the body of this Recommendation | International Standard.

Annex B describes protocol rules for interworking with implementations of Recommendation X.411 (1984) using the MTS Transfer Protocol (P1).

Annex C identifies the differences between Recommendation X.411 (1984) and this Recommendation | International Standard.

Annex D identifies the technical differences between the ISO/IEC and ITU-T versions of ITU-T Rec. X.419 and ISO/IEC 10021-6.

Annex E provides an index to this Recommendation | International Standard, categorized into: Abbreviations; Terms; Information Items; ASN.1 modules; ASN.1 information object classes; ASN.1 types; and ASN.1 values.

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 ISO and IEC 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 Open Systems Interconnection

This Protocol Specification cites the following ITU-T Recommendations and International Standards:

2.1.1 Identical Recommendations | International Standards

– ITU-T Recommendation X.216 (1994) | ISO/IEC 8822:1994, *Information technology – Open Systems Interconnection – Presentation service definition.*

– ITU-T Recommendation X.217 (1995) | ISO/IEC 8649:1996, *Information technology – Open Systems Interconnection – Service definition for the Association Control Service Element.*

– ITU-T Recommendation X.680 (1994) | ISO/IEC 8824-1:1995, *Information technology – Abstract Syntax Notation One (ASN.1) – Specification of basic notation.*

– ITU-T Recommendation X.681 (1994) | ISO/IEC 8824-2:1995, *Information technology – Abstract Syntax Notation One (ASN.1) – Information object specification.*

– ITU-T Recommendation X.682 (1994) | ISO/IEC 8824-3:1995, *Information technology – Abstract Syntax Notation One (ASN.1) – Constraint specification.*

– ITU-T Recommendation X.683 (1994) | ISO/IEC 8824-4:1995, *Information technology – Abstract Syntax Notation One (ASN.1): Parameterization of ASN.1 specifications.*

– ITU-T Recommendation X.880 (1994) | ISO/IEC 13712-1:1995, *Information technology – Remote Operations: Concepts, model and notation.*

– ITU-T Recommendation X.881 (1994) | ISO/IEC 13712-2:1995, *Information technology – Remote Operations: OSI realizations – Remote Operations Service Element (ROSE) service definition.*

– ITU-T Recommendation X.882 (1994) | ISO/IEC 13712-3:1995, *Information technology – Remote Operations: OSI realizations – Remote Operations Service Element (ROSE) protocol specification.*

2.1.2 Paired Recommendations | International Standards equivalent in technical content

– CCITT Recommendation X.218 (1988), *Reliable transfer: Model and service definition.*

ISO/IEC 9066-1:1989, *Information processing systems – Text communication – Reliable Transfer – Part 1: Model and service definition.*

– CCITT Recommendation X.228 (1988), *Reliable transfer: Protocol specification.*

ISO/IEC 9066-2:1989, *Information processing systems – Text communication – Reliable Transfer – Part 2: Protocol specification.*

2.2 Message Handling Systems

This Protocol Specification cites the following Message Handling System specifications:

2.2.1 Identical Recommendations | International Standards

– ITU-T Recommendation X.402 (1995) | ISO/IEC 10021-2:1996, *Information technology – Message Handling Systems (MHS) – Overall architecture.*

– ITU-T Recommendation X.411 (1995) | ISO/IEC 10021-4:1996, *Information technology – Message Handling Systems (MHS): Message transfer system – Abstract service definition and procedures.*

– ITU-T Recommendation X.413 (1995) | ISO/IEC 10021-5:1996, *Information technology – Message Handling Systems (MHS): Message store: Abstract service definition.*

– ITU-T Recommendation X.420 (1996) | ISO/IEC 10021-7:1996, *Information technology – Message Handling Systems (MHS): Interpersonal messaging system.*

2.2.2 Paired Recommendations | International Standards equivalent in technical content

– ITU-T Recommendation F.400/X.400 (1993), *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.*

– CCITT Recommendation X.408 (1988), *Message handling systems: Encoded information type conversion rules.*

2.3 Directory Systems

This Protocol Specification cites the following Directory System specification:

2.3.1 Additional references

– ITU-T Recommendation X.501 (1993) | ISO/IEC 9594-2:1995, *Information technology – Open Systems Interconnection – The Directory: Models.*

3 Definitions

For the purposes of this Protocol Specification the definitions given in ITU-T Rec. X.402 | ISO/IEC 10021-2 apply.

4 Abbreviations

For the purposes of this Protocol Specification the abbreviations given in ITU-T Rec. X.402 | ISO/IEC 10021-2 apply.

5 Conventions

This Protocol Specification uses the descriptive conventions described below.

5.1 Terms

Throughout this Protocol Specification the words of defined terms, and the names and values of service parameters and protocol fields, unless they are proper names, begin with a lower-case letter and are linked by a hyphen thus: defined-term. Proper names begin with an upper-case letter and are not linked by a hyphen thus: Proper Name. The names and values of the parameters of the MTS Abstract Service and the MTA Abstract Service (including components of O/R address defined in ITU-T Rec. X.402 | ISO/IEC 10021-2) are printed in **bold**.

5.2 Abstract Syntax Definitions

This Protocol Specification defines the abstract-syntax of the MHS protocols using the Abstract Syntax Notation (ASN.1) defined in ITU-T Rec. X.680 | ISO/IEC 8824-1, ITU-T Rec. X.681 | ISO/IEC 8824-2, ITU-T Rec. X.682 | ISO/IEC 8824-3 and ITU-T Rec. X.683 | ISO/IEC 8824-4 and the remote operations notation defined in ITU-T Rec. X.880 | ISO/IEC 13712-1, ITU-T Rec. X.881 | ISO/IEC 13712-2 and ITU-T Rec. X.882 | ISO/IEC 13712-3.

SECTION 2 – MESSAGE HANDLING SYSTEM ACCESS PROTOCOL SPECIFICATIONS

6 Overview of the MHS Access Protocols

6.1 MHS Access Protocol model

Clause 6 of ITU-T Rec. X.411 | ISO/IEC 10021-4 describes an abstract model of the Message Transfer System (MTS), and the MTS Abstract Service which it provides to its MTS-users.

Clause 6 of ITU-T Rec. X.413 | ISO/IEC 10021-5 describes an abstract model of a Message Store (MS), and the MS Abstract Service which it provides to its MS-user.

This clause describes how the MTS Abstract Service and the MS Abstract Service are supported by instances of OSI communication when an abstract-service user and an abstract-service provider are realized as application-processes located in different open systems.

In the OSI environment, communication between application-processes is represented in terms of communication between a pair of application-entities (AEs) using the presentation-service. The functionality of an application-entity is factored into a set of one or more application-service-elements (ASEs). The interaction between AEs is described in terms of their use of the services provided by the ASEs.

Access to the MTS Abstract Service is realized by the pairing of three ports between the MTS and the MTS-user. Each port is supported by an application-service-element; for some port types more than one version of the application-service-element is defined. The Message Submission Service Element (MSSE) supports the services of the submission-port. The Message Delivery Service Element 1988 (MDSE-88) and Message Delivery Service Element 1994 (MDSE-94) support the services of the delivery-port. The Message Administration Service Element 1988 (MASE-88) and Message Administration Service Element 1994 (MASE-94) support the services of the administration-port.

Similarly, access to the MS Abstract Service is realized by the pairing of three ports between the MS and the MS-user. Each port is supported by an application-service-element; for each port type more than one version of the application-service-element is defined. The Message Submission Service Element (MSSE) and the MS Message Submission Service Element (MS-MSSE) support the services of the MS-submission-port. The Message Retrieval Service Element 1988 (MRSE-88) and the Message Retrieval Service Element 1994 (MRSE-94) support the services of the retrieval-port. The Message Administration Service Element 1988 (MASE-88) and Message Administration Service Element 1994 (MASE-94) support the services of the administration-port. The MS-user ASEs act as the consumer, and the MS ASEs act as the supplier, of the MS Abstract Service.

These application-service-elements are in turn supported by other application-service-elements.

The Remote Operations Service Element (ROSE) supports the request/reply paradigm of the abstract operations that occur at the ports in the abstract model. The MSSE, MS-MSSE, MDSE-88, MDSE-94, MRSE-88, MRSE-94, MASE-88, and MASE-94 provide the mapping function of the abstract-syntax notation of an abstract-service onto the services provided by the ROSE.

Optionally, the Reliable Transfer Service Element (RTSE) may be used to reliably transfer the application-protocol-data-units (APDUs) that contain the parameters of the operations between AEs.

The Association Control Service Element (ACSE) supports the establishment and release of an application-association between a pair of AEs. Associations between an MTS-user and the MTS may be established by either the MTS-user or the MTS. Associations between an MS-user and an MS may be established only by the MS-user. Only the initiator of an established association can release it.

The combination of one or more of the MSSE, MS-MSSE, MDSE-88, MDSE-94, MRSE-88, MRSE-94, MASE-88, and MASE-94, together with their supporting ASEs, defines the application-context of an application-association. A single application-association may be used to support one or more port types paired between two objects in the abstract model.

Table 1 identifies the application-contexts defined in this Protocol Specification for the MTS Access Protocol and MS Access Protocol.

Table 1 – MHS Access Protocol Application Contexts

Application context	Message Handling ASEs								Supporting ASEs		
	MSSE	MS-MSSE	MDSE -88	MDSE -94	MASE -88	MASE -94	MRSE -88	MRSE -94	ROSE	RTSE	ACSE
MTS Access Protocol											
mts-access-88	C	–	C	–	C	–	–	–	X	–	X
mts-forced-access-88	S	–	S	–	S	–	–	–	X	–	X
mts-reliable-access-88	C	–	C	–	C	–	–	–	X	X	X
mts-forced-reliable-access-88	S	–	S	–	S	–	–	–	X	X	X
mts-access-94	C	–	–	C	–	C	–	–	X	–	X
mts-forced-access-94	S	–	–	S	–	S	–	–	X	–	X
mts-reliable-access-94	C	–	–	C	–	C	–	–	X	X	X
mts-forced-reliable-access-94	S	–	–	S	–	S	–	–	X	X	X
MS Access Protocol											
ms-access-88	C	–	–	–	C	–	C	–	X	–	X
ms-reliable-access-88	C	–	–	–	C	–	C	–	X	X	X
ms-access-94	–	C	–	–	–	C	–	C	X	–	X
ms-reliable-access-94	–	C	–	–	–	C	–	C	X	X	X

X Present
– Absent
C Present with initiator the consumer
S Present with initiator the supplier

If the 1994 version of the MTS Access Protocol (P3) is supported, then support for the **mts-access-94** and **mts-forced-access-94** application-contexts is mandatory for an MTA. If the 1988 version of the MTS Access Protocol (P3) is supported, then support for the **mts-access-88** and **mts-forced-access-88** application-contexts is mandatory for an MTA. If an MTA supports the **mts-reliable-access-94** application-context, it shall also support the **mts-forced-reliable-access 94**, and vice versa. If an MTA supports the **mts-reliable-access-88** application-context, it shall also support the **mts-forced-reliable-access-88**, and vice versa. Support for each of the MTS Access Protocol (P3) application-contexts is optional for an MTS-user. The 1994 versions of these application-contexts were introduced to provide revised versions of the Delivery-control and Register operations.

If the MS Access Protocol (P7) is supported, then support for the **ms-access-88** application-context is mandatory for an MS, and support for the **ms-reliable-access-88 ms-access-94**, and **ms-reliable-access-94** application-contexts is optional. If an MS supports the **ms-reliable-access-94** application-context, it shall also support the **ms-reliable-access-88** and **ms-access-94** application-contexts. Support for each of the MS Access Protocol (P7) application-contexts is optional for an MS-user. The **ms-access-94** and **ms-reliable-access-94** application-contexts were introduced in the 1994 version of this Protocol Specification in order to offer a broader range of Message Store services (see 7.4 of ITU-T Rec. F.400 (1993) and ISO/IEC 10021-1 : 1990). These 1994 application-contexts may be used to offer both the original (1988) range of services and the enhanced range of services. Nevertheless, these two application-contexts are intended to stay optional in the next version of this Protocol Specification.

NOTE – An MS which supports one of the 1994 MS Access Protocols may be required to interwork with the MTS using one of the 1988 MTS Access Protocols. If the MS-user invokes Register (a 1994 operation), the MS should attempt to downgrade the Register argument to a Register-88 argument, and invoke the Register-88 operation over its association with the MTS. If this is not possible, the MS returns a register-rejected error to the MS-user.

Figure 1 models an application-context between an MTS-user and the MTS. The consumer role of the MTS-user ASEs, and the supplier role of the MTS ASEs, is indicated by a subscript 'c', or 's', respectively. This illustrates only one of the possible application-contexts supporting the MTS Access Protocol; in the 1988 version of the MTS Access Protocol, the MDSE-88 replaces the MDSE-94, and the MASE-88 replaces the MASE-94.

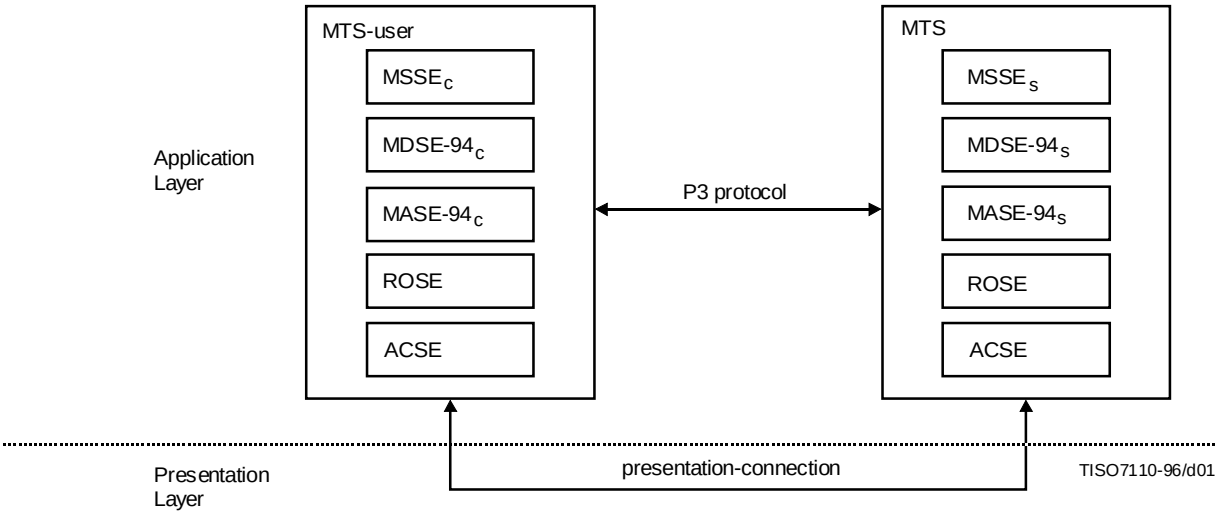

Figure 1 – MTS Access Protocol model

Similarly, Figure 2 models an application-context between an MS-user and the MS. This illustrates only one of the possible application-contexts supporting the MS Access Protocol; in the 1988 version of the MS Access Protocol, the MSSE replaces the MS-MSSE, the MRSE-88 replaces the MRSE-94, and the MASE-88 replaces the MASE-94.

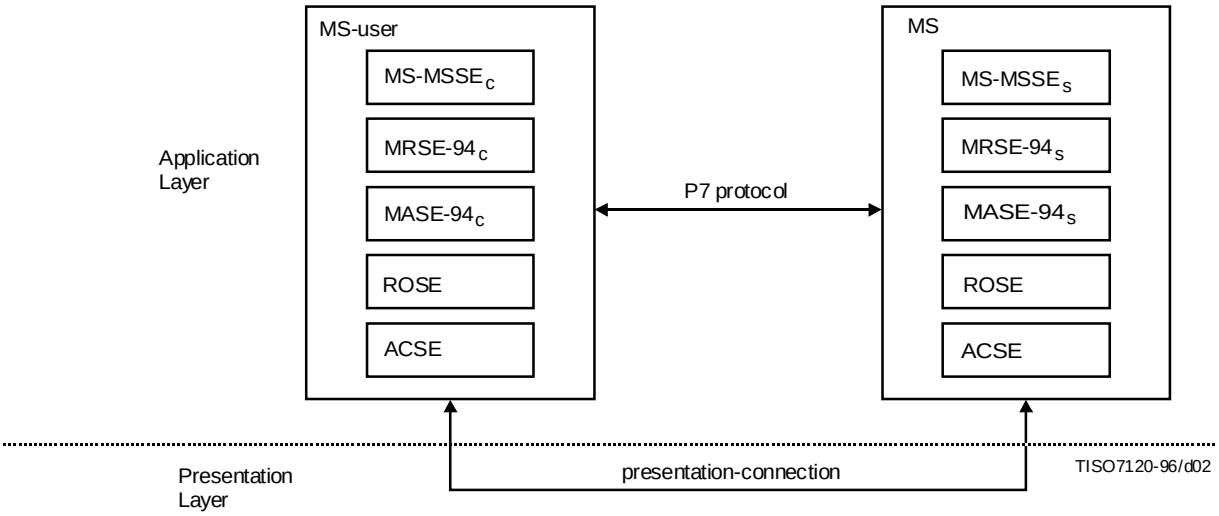

Figure 2 – An MS Access Protocol model

6.2 Services provided by the MTS Access Protocol

The MTS Access Protocol (P3) comprises the following operations which provide the services defined in ITU-T Rec. X.411 | ISO/IEC 10021-4:

MTS-bind and MTS-unbind

a) MTS-bind;

b) MTS-unbind.

Message Submission Service Element (MSSE)

c) Message-submission;

d) Probe-submission;

e) Cancel-deferred-delivery;

f) Submission-control.

Message Delivery Service Element 1988 (MDSE-88)

g) Message-delivery;

h) Report-delivery;

i) Delivery-control-88.

Message Administration Service Element 1988 (MASE-88)

j) Register-88;

k) Change-credentials.

In the 1994 version of the MTS Access Protocol, the Message Delivery Service Element 1988 and Message Administration Service Element 1988 are replaced by the following:

Message Delivery Service Element 1994 (MDSE-94)

l) Message-delivery;

m) Report-delivery;

n) Delivery-control.

Message Administration Service Element 1994 (MASE-94)

o) Register;

p) Change-credentials.

6.3 Services provided by the MS Access Protocol

The MS Access Protocol (P7) comprises the following operations which provide the services defined in ITU-T Rec. X.413 | ISO/IEC 10021-5:

MS-bind and MS-unbind

a) MS-bind;

b) MS-unbind.

Message Submission Service Element (MSSE)

c) Message-submission;

d) Probe-submission;

e) Cancel-deferred-delivery;

f) Submission-control.

Message Retrieval Service Element 1988 (MRSE-88)

g) Summarize;

h) List;

i) Fetch;

j) Delete;

k) Register-MS;

l) Alert.

Message Administration Service Element 1988 (MASE-88)

m) Register-88;

n) Change-credentials.

In the 1994 version of the MS Access Protocol, the Message Submission Service Element, the Message Retrieval Service Element 1988 and the Message Administration Service Element 1988 are replaced by the following:

MS Message Submission Service Element (MS-MSSE)

o) MS-message-submission;

p) MS-probe-submission;

q) MS-cancel-deferred-delivery;

r) MS-submission-control.

Message Retrieval Service Element 1994 (MRSE-94)

s) Modify (in addition to the operations defined for the MRSE-88).

Message Administration Service Element 1994 (MASE-94)

t) Register;

u) Change-credentials.

6.4 Use of underlying services

The MHS Access Protocols make use of underlying services as described below.

6.4.1 Use of ROSE services

The Remote Operations Service Element (ROSE) is defined in ITU-T Rec. X.880 | ISO/IEC 13712-1, ITU-T Rec. X.881 | ISO/IEC 13712-2 and ITU-T Rec. X.882 | ISO/IEC 13712-3.

The ROSE supports the request/reply paradigm of remote operations.

The MSSE, MS-MSSE, MDSE-88, MDSE-94, MRSE-88, MRSE-94, MASE-88 and MASE-94 are the sole users of the RO-INVOKE, RO-RESULT, RO-ERROR, RO-REJECT-U and RO-REJECT-P services of the ROSE.

The remote operations of the MTS Access Protocol (P3) and the MS Access Protocol (P7) are asynchronous operations, that return either a result or an error.

6.4.2 Use of RTSE services

The Reliable Transfer Service Element (RTSE) is defined in CCITT Rec. X.218 and ISO/IEC 9066-1.

The RTSE provides for the reliable transfer of application-protocol-data-units (APDUs). The RTSE ensures that each APDU is completely transferred exactly once, or that the sender is warned of an exception. The RTSE recovers from communication and end-system failure and minimizes the amount of retransmission needed for recovery.

Alternative application-contexts with and without RTSE are defined to support the MHS Access Protocols.

The RTSE is used in the normal mode. The use of the normal mode of the RTSE implies the use of the normal mode of the ACSE and the normal mode of the presentation-service.

If the RTSE is included in an application-context, the MHS Access Protocol MTS-bind and MTS-unbind (or MS-bind and MS-unbind) are the sole users of the RT-OPEN and RT-CLOSE services of the RTSE. The ROSE is the sole user of the RT-TRANSFER, RT-TURN-PLEASE, RT-TURN-GIVE, RT-P-ABORT and RT-U-ABORT services of the RTSE.

NOTE – Implementors should be aware of a potential problem when using secure messaging and RTSE. In the event of using the RTS association recovery procedure, the recovered association will no longer have peer to peer authentication.

6.4.3 Use of ACSE services

The Association Control Service Element (ACSE) is defined in ITU-T Rec. X.217 | ISO 8649.

The ACSE provides for the control (establishment, release, abort) of application-associations between AEs.

If the RTSE is not included in an application-context, the MHS Access Protocol MTS-bind and MTS-unbind (or MS-bind and MS-unbind) are the sole users of the A-ASSOCIATE and A-RELEASE services of the ACSE in normal mode. The ROSE is the user of the A-ABORT and A-P-ABORT services of the ACSE.

If the RTSE is included in the application-context, the RTSE is the sole user of the A-ASSOCIATE, A-RELEASE, A-ABORT and A-P-ABORT services of the ACSE. The use of the normal mode of the RTSE implies the use of the normal mode of the ACSE and the normal mode of the presentation-service.

6.4.4 Use of the Presentation-service

The presentation-service is defined in ITU-T Rec. X.216 | ISO 8822.

The Presentation Layer coordinates the representation (syntax) of the Application Layer semantics that are to be exchanged.

In normal mode, a different presentation-context is used for each abstract-syntax included in the application-context.

The ACSE is the sole user of the P-CONNECT, P-RELEASE, P-U-ABORT and P-P-ABORT services of the presentation-service.

If the RTSE is not included in the application-context, the ROSE is the sole user of the P-DATA service of the presentation-service.

If the RTSE is included in the application-context, the RTSE is the sole user of the P-ACTIVITY-START, P-DATA, P-MINOR-SYNCHRONIZE, P-ACTIVITY-END, P-ACTIVITY-INTERRUPT, P-ACTIVITY-DISCARD, P-U-EXCEPTION-REPORT, P-ACTIVITY-RESUME, P-P-EXCEPTION-REPORT, P-TOKEN-PLEASE and P-CONTROL-GIVE services of the presentation-service. The use of the normal mode of the RTSE implies the use of the normal mode of the ACSE and the normal mode of the presentation-service.

6.4.5 Use of Lower Layer services

The session-service is defined in Recommendation X.215. The Session Layer structures the dialogue of the flow of information between the end-systems.

If the RTSE is included in the application-association, the Kernel, Half-duplex, Exceptions, Minor-synchronize and Activity-management functional units of the session-service are used by the Presentation Layer.

If the RTSE is not included in the application-association, the Kernel and Duplex functional units of the session-service are used by the Presentation Layer.

The transport-service is defined in Recommendation X.214. The Transport Layer provides for the end-to-end transparent transfer of data over the underlying network connection.

The choice of the class of transport-service used by the Session Layer depends on the requirements for multiplexing and error recovery. Support for Transport Class 0 (non-multiplexing) is mandatory. Transport Expedited Service is not used.

Support for other classes is optional. A multiplexing class may be used to multiplex an MHS Access Protocol and other access protocols (e.g. the Directory Access Protocol (DAP) defined in Rec. X.519) over the same network connection. An error recovery class may be chosen if the RTSE is omitted from an application-context over a network connection with an unacceptable residual error rate.

An underlying network supporting the OSI network-service defined in Recommendation X.213 is assumed.

A network-address is as defined in Recommendation X.121, Recommendations E.163 and E.164, or Recommendation X.200 (OSI NSAP-address).

7 MTS Access Protocol Abstract Syntax Definition

The abstract-syntax of the 1994 and 1988 versions MTS Access Protocol (P3) is defined in Figure 3.

The abstract-syntax of the MTS Access Protocol (P3) is defined using the abstract syntax notation (ASN.1) defined in ITU-T Rec. X.680 | ISO/IEC 8824-1, ITU-T Rec. X.681 | ISO/IEC 8824-2, ITU-T Rec. X.682 | ISO/IEC 8824-3 and ITU-T Rec. X.683 | ISO/IEC 8824-4, and the remote operations notation defined in ITU-T Rec. X.880 | ISO/IEC 13712-1, ITU-T Rec. X.881 | ISO/IEC 13712-2 and ITU-T Rec. X.882 | ISO/IEC 13712-3.

The abstract-syntax definition of the MTS Access Protocol (P3) has the following major parts:

- *Prologue*: Declarations of the imports to the MTS Access Protocol (P3) module (see Figure 3, parts 1 and 2).
- *Application Contexts*: Definitions of application-contexts that may be used between an MTS-user and the MTS (see Figure 3, parts 2 and 3).
- *Abstract Syntaxes*: Definitions of the abstract-syntaxes for the supporting application-service-elements and for the three principal application-service-elements (each of which include ROSE):
  a) Message Submission Service Element (see Figure 3, part 4)
  b) Message Delivery Service Element 1994 and 1988 (see Figure 3, parts 4 and 5)
  c) Message Administration Service Element 1994 and 1988 (see Figure 3, part 5)

```
MTSAccessProtocol { joint-iso-itu-t mhs(6) protocols(0) modules(0) mts-access-protocol(1) version-1994(0) }

DEFINITIONS IMPLICIT TAGS ::=

BEGIN

--      Prologue

IMPORTS

        -- MTS Abstract Service

        administration, delivery, mts-access-contract, mts-connect, mts-forced-access-contract, submission
            ----
            FROM MTSAbstractService { joint-iso-itu-t mhs(6) mts(3) modules(0)
                mts-abstract-service(1) version-1994(0) }

        -- MTS Abstract Service (1988)

        administration-88, delivery-88, mts-access-contract-88, mts-forced-access-contract-88
            ----
            FROM MTSAbstractService { joint-iso-itu-t mhs(6) mts(3) modules(0)
                mts-abstract-service(1) version-1988(1988) }

        -- Remote Operations

        APPLICATION-CONTEXT
            ----
            FROM Remote-Operations-Information-Objects-extensions { joint-iso-itu-t
                remote-operations(4) informationObjects-extensions(8) version1(0) }

        Code
            ----
            FROM Remote-Operations-Information-Objects { joint-iso-itu-t remote-operations(4)
                informationObjects(5) version1(0) }

        Bind { }, InvokeId, Unbind { }
            ----
            FROM Remote-Operations-Generic-ROS-PDUs { joint-iso-itu-t remote-operations(4)
                    generic-ROS-PDUs(6) version1(0) }

        ROS-SingleAS { }
            ----
            FROM Remote-Operations-Useful-Definitions { joint-iso-itu-t remote-operations(4)
                useful-definitions(7) version1(0) }

        acse, association-by-RTSE, pData, transfer-by-RTSE
            ----
            FROM Remote-Operations-Realisations { joint-iso-itu-t remote-operations(4)
                realisations(9) version1(0) }
```

Figure 3 – Abstract Syntax Definition of the MTS Access Protocol (P3) (part 1 of 5)

```
        acse-abstract-syntax
            ----
            FROM Remote-Operations-Abstract-Syntaxes { joint-iso-itu-t remote-operations(4)
                remote-operations-abstract-syntaxes(12) version1(0) }

        -- Reliable Transfer

        RTSE-apdus
            ----
            FROM Reliable-Transfer-APDUS { joint-iso-itu-t reliable-transfer(3) apdus(0) }

        -- Object Identifiers

        id-ac-mts-access-88, id-ac-mts-access-94, id-ac-mts-forced-access-88,
        id-ac-mts-forced-access-94, id-ac-mts-forced-reliable-access-88,
        id-ac-mts-forced-reliable-access-94, id-ac-mts-reliable-access-88,
        id-ac-mts-reliable-access-94, id-as-mase-88, id-as-mase-94, id-as-mdse-88, id-as-mdse-94,
        id-as-msse, id-as-mts, id-as-mts-rtse
            ----
            FROM MHSProtocolObjectIdentifiers { joint-iso-itu-t mhs(6) protocols(0) modules(0)
                object-identifiers(0) version-1994(0) };

--      APPLICATION CONTEXTS

--      1994 Application Contexts omitting RTSE

--      MTS-user initiated

mts-access-94   APPLICATION-CONTEXT ::= {
        CONTRACT                        mts-access-contract
        ESTABLISHED BY                  acse
        INFORMATION TRANSFER BY         pData
        ABSTRACT SYNTAXES               {acse-abstract-syntax |
                                         message-submission-abstract-syntax |
                                         message-delivery-abstract-syntax |
                                         message-administration-abstract-syntax-94 |
                                         mts-bind-unbind-abstract-syntax }
        APPLICATION CONTEXT NAME        id-ac-mts-access-94 }

--      MTS initiated

mts-forced-access-94   APPLICATION-CONTEXT ::= {
        CONTRACT                        mts-forced-access-contract
        ESTABLISHED BY                  acse
        INFORMATION TRANSFER BY         pData
        ABSTRACT SYNTAXES               {acse-abstract-syntax |
                                         message-submission-abstract-syntax |
                                         message-delivery-abstract-syntax |
                                         message-administration-abstract-syntax-94 |
                                         mts-bind-unbind-abstract-syntax }
        APPLICATION CONTEXT NAME        id-ac-mts-forced-access-94 }

--      1994 Application Contexts including RTSE in normal mode

--      MTS-user initiated

mts-reliable-access-94   APPLICATION-CONTEXT ::= {
        CONTRACT                        mts-access-contract
        ESTABLISHED BY                  association-by-RTSE
        INFORMATION TRANSFER BY         transfer-by-RTSE
        ABSTRACT SYNTAXES               {acse-abstract-syntax |
                                         message-submission-abstract-syntax |
                                         message-delivery-abstract-syntax |
                                         message-administration-abstract-syntax-94 |
                                         mts-bind-unbind-rtse-abstract-syntax }
        APPLICATION CONTEXT NAME        id-ac-mts-reliable-access-94 }
```

Figure 3 – Abstract Syntax Definition of the MTS Access Protocol (P3) (part 2 of 5)

```
-- MTS initiated

mts-forced-reliable-access-94 APPLICATION-CONTEXT ::= {
        CONTRACT                        mts-forced-access-contract
        ESTABLISHED BY                  association-by-RTSE
        INFORMATION TRANSFER BY         transfer-by-RTSE
        ABSTRACT SYNTAXES               {acse-abstract-syntax |
                                         message-submission-abstract-syntax |
                                         message-delivery-abstract-syntax |
                                         message-administration-abstract-syntax-94 |
                                         mts-bind-unbind-rtse-abstract-syntax }
        APPLICATION CONTEXT NAME        id-ac-mts-forced-reliable-access-94 }

-- 1988 Application Contexts omitting RTSE

-- MTS-user initiated

mts-access-88 APPLICATION-CONTEXT ::= {
        CONTRACT                        mts-access-contract-88
        ESTABLISHED BY                  acse
        INFORMATION TRANSFER BY         pData
        ABSTRACT SYNTAXES               {acse-abstract-syntax |
                                         message-submission-abstract-syntax |
                                         message-delivery-abstract-syntax-88 |
                                         message-administration-abstract-syntax-88 |
                                         mts-bind-unbind-abstract-syntax}
        APPLICATION CONTEXT NAME        id-ac-mts-access-88 }

-- MTS initiated

mts-forced-access-88 APPLICATION-CONTEXT ::= {
        CONTRACT                        mts-forced-access-contract-88
        ESTABLISHED BY                  acse
        INFORMATION TRANSFER BY         pData
        ABSTRACT SYNTAXES               {acse-abstract-syntax |
                                         message-submission-abstract-syntax |
                                         message-delivery-abstract-syntax-88 |
                                         message-administration-abstract-syntax-88 |
                                         mts-bind-unbind-abstract-syntax}
        APPLICATION CONTEXT NAME        id-ac-mts-forced-access-88 }

-- 1988 Application Contexts including RTSE in normal mode

-- MTS-user initiated

mts-reliable-access-88 APPLICATION-CONTEXT ::= {
        CONTRACT                        mts-access-contract-88
        ESTABLISHED BY                  association-by-RTSE
        INFORMATION TRANSFER BY         transfer-by-RTSE
        ABSTRACT SYNTAXES               {acse-abstract-syntax |
                                         message-submission-abstract-syntax |
                                         message-delivery-abstract-syntax-88 |
                                         message-administration-abstract-syntax-88 |
                                         mts-bind-unbind-rtse-abstract-syntax}
        APPLICATION CONTEXT NAME        id-ac-mts-reliable-access-88 }

-- MTS initiated

mts-forced-reliable-access-88 APPLICATION-CONTEXT ::= {
        CONTRACT                        mts-forced-access-contract-88
        ESTABLISHED BY                  association-by-RTSE
        INFORMATION TRANSFER BY         transfer-by-RTSE
        ABSTRACT SYNTAXES               {acse-abstract-syntax |
                                         message-submission-abstract-syntax |
                                         message-delivery-abstract-syntax-88 |
                                         message-administration-abstract-syntax-88 |
                                         mts-bind-unbind-rtse-abstract-syntax}
        APPLICATION CONTEXT NAME        id-ac-mts-forced-reliable-access-88 }
```

Figure 3 – Abstract Syntax Definition of the MTS Access Protocol (P3) (part 3 of 5)

```
--      ABSTRACT-SYNTAXES

--      Abstract Syntax for MTS-Bind and MTS-Unbind

mts-bind-unbind-abstract-syntax ABSTRACT-SYNTAX ::= {MTSBindUnbindPDUs IDENTIFIED BY id-as-mts}

MTSBindUnbindPDUs ::= CHOICE {
        bind    Bind {mts-connect.&bind},
        unbind  Unbind {mts-connect.&unbind} }

--      Abstract Syntax for MTS-Bind and MTS-Unbind with RTSE

mts-bind-unbind-rtse-abstract-syntax ABSTRACT-SYNTAX ::= {
        RTSE-apdus -- With MTS Bind and MTS Unbind -- IDENTIFIED BY id-as-mts-rtse }

--      Abstract Syntax for Message Submission Service Element

message-submission-abstract-syntax ABSTRACT-SYNTAX ::= {
        MessageSubmissionPDUs IDENTIFIED BY id-as-msse}

MessageSubmissionPDUs ::= ROS-SingleAS {{MTSInvokeIds}, submission}

MTSInvokeIds ::= InvokeId (ALL EXCEPT absent:NULL)

--      Remote Operations

op-message-submission                   Code ::= local:3

op-probe-submission                     Code ::= local:4

op-cancel-deferred-delivery             Code ::= local:7

op-submission-control                   Code ::= local:2

--      Remote Errors

err-submission-control-violated         Code ::= local:1

err-element-of-service-not-subscribed   Code ::= local:4

err-deferred-delivery-cancellation-rejected Code ::= local:8

err-originator-invalid                  Code ::= local:2

err-recipient-improperly-specified      Code ::= local:3

err-message-submission-identifier-invalid Code ::= local:7

err-inconsistent-request                Code ::= local:11

err-security-error                      Code ::= local:12

err-unsupported-critical-function       Code ::= local:13

err-remote-bind-error                   Code ::= local:15

--      Abstract Syntax for Message Delivery Service Element 1994

message-delivery-abstract-syntax ABSTRACT-SYNTAX ::= {
        MessageDeliveryPDUs IDENTIFIED BY id-as-mdse-94 }

MessageDeliveryPDUs ::= ROS-SingleAS {{MTSInvokeIds}, delivery}
```

Figure 3 – Abstract Syntax Definition of the MTS Access Protocol (P3) (part 4 of 5)

```
--      Abstract Syntax for Message Delivery Service Element 1988

message-delivery-abstract-syntax-88   ABSTRACT-SYNTAX ::= {
        MessageDeliveryPDUs88 IDENTIFIED BY id-as-mdse-88 }

MessageDeliveryPDUs88 ::= ROS-SingleAS {{MTSInvokeIds}, delivery-88}

--      Remote Operations

op-message-delivery                 Code ::= local:5

op-report-delivery                  Code ::= local:6

op-delivery-control                 Code ::= local:2

--      Remote Errors

err-delivery-control-violated       Code ::= local:1

err-control-violates-registration   Code ::= local:14

err-operation-refused               Code ::= local:16

--      Abstract Syntax for Message Administration Service Element 1994

message-administration-abstract-syntax-94   ABSTRACT-SYNTAX ::= {
        MessageAdministrationPDUs IDENTIFIED BY id-as-mase-94 }

MessageAdministrationPDUs ::= ROS-SingleAS {{MTSInvokeIds}, administration}

--      Abstract Syntax for Message Administration Service Element 1988

message-administration-abstract-syntax-88   ABSTRACT-SYNTAX ::= {
        MessageAdministrationPDUs88 IDENTIFIED BY id-as-mase-88 }

MessageAdministrationPDUs88 ::= ROS-SingleAS {{MTSInvokeIds}, administration-88}

--      Remote Operations

op-register                         Code ::= local:1

op-change-credentials               Code ::= local:8

--      Remote Errors

err-register-rejected               Code ::= local:10

err-new-credentials-unacceptable    Code ::= local:6

err-old-credentials-incorrectly-specified   Code ::= local:5

END     -- of MTSAccessProtocol
```

Figure 3 – Abstract Syntax Definition of the MTS Access Protocol (P3) (part 5 of 5)

8 MS Access Protocol Abstract Syntax Definition

The abstract-syntax of the 1994 and 1988 versions MS Access Protocol (P7) is defined in Figure 4.

The abstract-syntax of the MS Access Protocol (P7) is defined using the abstract syntax notation (ASN.1) defined in ITU-T Rec. X.680 | ISO/IEC 8824-1, ITU-T Rec. X.681 | ISO/IEC 8824-2, ITU-T Rec. X.682 | ISO/IEC 8824-3 and ITU-T Rec. X.683 | ISO/IEC 8824-4, and the remote operations notation defined in ITU-T Rec. X.880 | ISO/IEC 13712-1, ITU-T Rec. X.881 | ISO/IEC 13712-2 and ITU-T Rec. X.882 | ISO/IEC 13712-3.

The abstract-syntax definition of the MS Access Protocol (P7) has the following major parts:

- *Prologue*: Declarations of the imports to the MS Access Protocol (P7) module (see Figure 4, parts 1 and 2).
- *Application Contexts*: Definitions of application-contexts that may be used between an MS-user and an MS (see Figure 4, parts 2 and 3).
- *Abstract Syntaxes*: Definitions of the abstract-syntaxes for MS-bind and MS-unbind, for the MS Message Submission Service Element (MS-MSSE) and the Message Retrieval Service Element 1994 and 1988 (MRSE-94 and MRSE-88) (see Figure 4, parts 3 and 4). The Message Administration Service Element 1994 and 1988 (MASE-94 and MASE-88) are defined in Figure 3.

```
MSAccessProtocol { joint-iso-itu-t mhs(6) protocols(0) modules(0) ms-access-protocol(2)
        version-1994(0) }

DEFINITIONS ::=

BEGIN

--      Prologue

IMPORTS

        -- MS Abstract Service

        ms-access-contract-88, ms-access-contract-94, ms-submission, retrieval, retrieval-88
            ----
            FROM MSAbstractService { joint-iso-itu-t mhs(6) ms(4) modules(0)
                abstract-service(1) version-1994(0) }

        -- Remote Operations

        APPLICATION-CONTEXT
            ----
            FROM Remote-Operations-Information-Objects-extensions { joint-iso-itu-t
                    remote-operations(4) informationObjects-extensions(8) version1(0) }

        Code
            ----
            FROM Remote-Operations-Information-Objects { joint-iso-itu-t remote-operations(4)
                informationObjects(5) version1(0) }

        Bind { }, InvokeId, Unbind { }
            ----
            FROM Remote-Operations-Generic-ROS-PDUs { joint-iso-itu-t remote-operations(4)
                generic-ROS-PDUs(6) version1(0) }

        ROS-SingleAS { }
            ----
            FROM Remote-Operations-Useful-Definitions { joint-iso-itu-t remote-operations(4)
                useful-definitions(7) version1(0) }
```

Figure 4 – Abstract Syntax Definition of the MS Access Protocol (P7) (part 1 of 4)

```
        acse, association-by-RTSE, pData, transfer-by-RTSE
            ----
            FROM Remote-Operations-Realisations { joint-iso-itu-t remote-operations(4)
                realisations(9) version1(0) }

        acse-abstract-syntax
            ----
            FROM Remote-Operations-Abstract-Syntaxes { joint-iso-itu-t remote-operations(4)
                remote-operations-abstract-syntaxes(12) version1(0) }

        -- Reliable Transfer

        RTSE-apdus
            ----
            FROM Reliable-Transfer-APDUS { joint-iso-itu-t reliable-transfer(3) apdus(0) }

        -- MTS Access Protocol

        message-administration-abstract-syntax-88, message-administration-abstract-syntax-94,
        message-submission-abstract-syntax
            ----
            FROM MTSAccessProtocol { joint-iso-itu-t mhs(6) protocols(0) modules(0)
                mts-access-protocol(1) version-1994(0) }

        -- Object Identifiers

        id-ac-ms-access-88, id-ac-ms-access-94, id-ac-ms-reliable-access-88,
        id-ac-ms-reliable-access-94, id-as-ms-msse, id-as-mase-88, id-as-mase-94, id-as-mdse-88,
        id-as-mdse-94, id-as-mrse-88, id-as-mrse-94, id-as-ms-88, id-as-ms-94, id-as-ms-rtse,
        id-as-msse
            ----
            FROM MHSProtocolObjectIdentifiers { joint-iso-itu-t mhs(6) protocols(0)
                modules(0) object-identifiers(0) version-1994(0) };

--      APPLICATION-CONTEXTS

--      1994 Application Context omitting RTSE

ms-access-94 APPLICATION-CONTEXT ::= {
        CONTRACT                    ms-access-contract-94
        ESTABLISHED BY              acse
        INFORMATION TRANSFER BY     pData
        ABSTRACT SYNTAXES           {acse-abstract-syntax |
                                    ms-message-submission-abstract-syntax |
                                    message-retrieval-abstract-syntax-94 |
                                    message-administration-abstract-syntax-94 |
                                    ms-bind-unbind-abstract-syntax-94}
        APPLICATION CONTEXT NAME    id-ac-ms-access-94 }

--      1994 Application Context including RTSE

ms-reliable-access-94 APPLICATION-CONTEXT ::= {
        CONTRACT                    ms-access-contract-94
        ESTABLISHED BY              association-by-RTSE
        INFORMATION TRANSFER BY     transfer-by-RTSE
        ABSTRACT SYNTAXES           {acse-abstract-syntax |
                                    ms-message-submission-abstract-syntax |
                                    message-retrieval-abstract-syntax-94 |
                                    message-administration-abstract-syntax-94 |
                                    ms-bind-unbind-rtse-abstract-syntax}
        APPLICATION CONTEXT NAME    id-ac-ms-reliable-access-94 }
```

Figure 4 – Abstract Syntax Definition of the MS Access Protocol (P7) (part 2 of 4)

```
--      1988 Application Context omitting RTSE

ms-access-88 APPLICATION-CONTEXT ::= {
        CONTRACT                        ms-access-contract-88
        ESTABLISHED BY                  acse
        INFORMATION TRANSFER BY         pData
        ABSTRACT SYNTAXES               {acse-abstract-syntax |
                                        message-submission-abstract-syntax |
                                        message-retrieval-abstract-syntax-88 |
                                        message-administration-abstract-syntax-88 |
                                        ms-bind-unbind-abstract-syntax-88}
        APPLICATION CONTEXT NAME        id-ac-ms-access-88 }

--      1988 Application Context including RTSE

ms-reliable-access-88 APPLICATION-CONTEXT ::= {
        CONTRACT                        ms-access-contract-88
        ESTABLISHED BY                  association-by-RTSE
        INFORMATION TRANSFER BY         transfer-by-RTSE
        ABSTRACT SYNTAXES               {acse-abstract-syntax |
                                        message-submission-abstract-syntax |
                                        message-retrieval-abstract-syntax-88 |
                                        message-administration-abstract-syntax-88 |
                                        ms-bind-unbind-rtse-abstract-syntax}
        APPLICATION CONTEXT NAME        id-ac-ms-reliable-access-88 }

--      ABSTRACT SYNTAXES

--      Abstract-syntax for 1994 MS-bind and MS-unbind

ms-bind-unbind-abstract-syntax-94 ABSTRACT-SYNTAX ::= {MSBindUnbindPDUs94 IDENTIFIED BY id-as-ms-94}

MSBindUnbindPDUs94 ::= CHOICE {
        bind    Bind {ms-access-contract-94.&connection.&bind},
        unbind  Unbind {ms-access-contract-94.&connection.&unbind} }

--      Abstract-syntax for 1988 MS-bind and MS-unbind

ms-bind-unbind-abstract-syntax-88 ABSTRACT-SYNTAX ::= {MSBindUnbindPDUs88 IDENTIFIED BY id-as-ms-88}

MSBindUnbindPDUs88 ::= CHOICE {
        bind    Bind {ms-access-contract-88.&connection.&bind},
        unbind  Unbind {ms-access-contract-88.&connection.&unbind} }

--      Abstract-syntax for MS-bind and MS-unbind with RTSE

ms-bind-unbind-rtse-abstract-syntax ABSTRACT-SYNTAX ::= {
        RTSE-apdus -- With MS-bind and MS-unbind -- IDENTIFIED BY id-as-ms-rtse }

--      Abstract Syntax for MS Message Submission Service Element

ms-message-submission-abstract-syntax ABSTRACT-SYNTAX ::= {
        MSMessageSubmissionPDUs IDENTIFIED BY id-as-ms-msse }

MSMessageSubmissionPDUs ::= ROS-SingleAS {{MSInvokeIds}, ms-submission}

MSInvokeIds ::= InvokeId (ALL EXCEPT absent:NULL)

--      Abstract Syntax for Message Retrieval Service Element 1994

message-retrieval-abstract-syntax-94 ABSTRACT-SYNTAX ::= {
        MessageRetrievalPDUs IDENTIFIED BY id-as-mrse-94}

MessageRetrievalPDUs ::= ROS-SingleAS {{MSInvokeIds}, retrieval}
```

Figure 4 – Abstract Syntax Definition of the MS Access Protocol (P7) (part 3 of 4)

```
--      Abstract Syntax for Message Retrieval Service Element 1988

message-retrieval-abstract-syntax-88 ABSTRACT-SYNTAX ::= {
        MessageRetrievalPDUs88 IDENTIFIED BY id-as-mrse-88}

MessageRetrievalPDUs88 ::= ROS-SingleAS {{MSInvokeIds}, retrieval-88}

--      Remote Operations

op-ms-submission-control        Code ::= local:2
op-ms-message-submission        Code ::= local:3
op-ms-probe-submission          Code ::= local:4
op-ms-cancel-deferred-delivery  Code ::= local:7
op-summarize                    Code ::= local:20
op-list                         Code ::= local:21
op-fetch                        Code ::= local:22
op-delete                       Code ::= local:23
op-register-ms                  Code ::= local:24
op-alert                        Code ::= local:25
op-modify                       Code ::= local:26

--      Remote Errors

err-attribute-error             Code ::= local:21
err-auto-action-request-error   Code ::= local:22
err-delete-error                Code ::= local:23
err-fetch-restriction-error     Code ::= local:24
err-range-error                 Code ::= local:25   -- 1988 Application Contexts only --
err-security-error              Code ::= local:26
err-service-error               Code ::= local:27
err-sequence-number-error       Code ::= local:28
err-invalid-parameters-error    Code ::= local:29
err-message-group-error         Code ::= local:30
err-ms-extension-error          Code ::= local:31
err-register-ms-error           Code ::= local:32
err-modify-error                Code ::= local:33
err-entry-class-error           Code ::= local:34

END     -- of MSAccessProtocol
```

Figure 4 – Abstract Syntax Definition of the MS Access Protocol (P7) (part 4 of 4)

9 Mapping onto used services

This clause defines the mapping of the MHS Access Protocols onto the used services.

Subclause 9.1 defines the mapping onto used services for application-contexts that omit the RTSE. Subclause 9.2 defines the mapping onto used services for application-contexts that include the RTSE. Subclause 9.3 defines the application-context negotiation mechanism for the MS Access Protocol.

9.1 Application-contexts omitting RTSE

This subclause defines the mapping of the MHS Access Protocols onto the used services for application-contexts that omit the RTSE. Support for this mapping is optional for conformance to this Protocol Specification.

9.1.1 Mapping onto ACSE

This subclause defines the mapping of the abstract-bind (MTS-bind or MS-bind) and abstract-unbind (MTS-unbind or MS-unbind) services onto the services of the ACSE in normal mode for application-contexts that omit the RTSE. The ACSE is defined in ITU-T Rec. X.217 | ISO/IEC 8649.

9.1.1.1 Abstract-bind onto A-ASSOCIATE

The abstract-bind service is mapped onto the A-ASSOCIATE service of the ACSE. The use of the parameters of the A-ASSOCIATE service is qualified in the following subclauses.

9.1.1.1.1 Mode

This parameter shall be supplied by the initiator of the association in the A-ASSOCIATE request primitive, and shall have the value 'normal mode'.

9.1.1.1.2 Application Context Name

The initiator of the association shall propose one of the application-contexts defined in this Protocol Specification that omit the RTSE in the A-ASSOCIATE request primitive (see Table 1).

9.1.1.1.3 User Information

The mapping of the bind-operation of the abstract-bind service onto the User Information parameter of the A-ASSOCIATE request primitive is defined in ITU-T Rec. X.881 | ISO/IEC 13712-2.

9.1.1.1.4 Presentation Context Definition List

The initiator of the association shall supply the Presentation Context Definition List in the A-ASSOCIATE request primitive.

The Presentation Context Definition List comprises a presentation-context-definition for each abstract-syntax included in the application-context. A presentation-context-definition comprises a presentation-context-identifier and an abstract-syntax-name for the ASE. Each named abstract-syntax for the MSSE, MS-MSSE, MDSE-88, MDSE-94, MRSE-88. MRSE-94, MASE-88, and MASE-94 includes the ROSE APDUs.

Clauses 7 and 8 define the abstract-syntaxes included in the application-contexts.

9.1.1.1.5 Quality of Service

This parameter shall be supplied by the initiator of the association in the A-ASSOCIATE request primitive, and by the responder of the association in the A-ASSOCIATE response primitive. The parameters 'Extended Control' and 'Optimized Dialogue Transfer' shall be set to not required. The remaining parameters shall be such that default values are used.

9.1.1.1.6 Session Requirements

This parameter shall be set by the initiator of the association in the A-ASSOCIATE request primitive, and by the responder of the association in the A-ASSOCIATE response primitive. The parameter shall be set to specify the following functional units:

a) Kernel;

b) Duplex.

9.1.1.2 Abstract-unbind onto A-RELEASE

The abstract-unbind service is mapped onto the A-RELEASE service of the ACSE. The use of the parameters of the A-RELEASE service is qualified in the following subclause.

9.1.1.2.1 Result

This parameter shall have the value 'affirmative'.

9.1.1.3 Use of A-ABORT and A-P-ABORT services

The ROSE is the user of the A-ABORT and A-P-ABORT services of the ACSE.

9.1.2 Mapping onto ROSE

The MSSE, MS-MSSE, MDSE-88, MDSE-94, MRSE-88. MRSE-94, MASE-88, and MASE-94 services are mapped onto the RO-INVOKE, RO-RESULT, RO-ERROR, RO-REJECT-U and RO-REJECT-P services of the ROSE. The mapping of the abstract-syntax notation of these ASEs onto the ROSE services is defined in ITU-T Rec. X.880 | ISO/IEC 13712-1.

9.2 Application-contexts including RTSE

This subclause defines the mapping of the MHS Access Protocols onto the used services for application-contexts that include the RTSE in normal mode. Support for this mapping is optional for conformance to this Protocol Specification. No mappings are defined onto the RTSE in X.410-1984 mode. The RTSE is defined in CCITT Rec. X.218 and ISO/IEC 9066-1.

9.2.1 Mapping onto RT-OPEN and RT-CLOSE

This subclause defines the mapping of the abstract-bind (MTS-bind or MS-bind) and abstract-unbind (MTS-unbind or MS-unbind) services onto the RT-OPEN and RT-CLOSE services of the RTSE in normal mode.

9.2.1.1 Abstract-bind onto RT-OPEN

The abstract-bind service is mapped onto the RT-OPEN service of the RTSE. The use of the parameters of the RT-OPEN service is qualified in the following subclauses.

9.2.1.1.1 Mode

This parameter shall be supplied by the initiator of the association in the RT-OPEN request primitive, and shall have the value ’normal mode’.

9.2.1.1.2 Application Context Name

The initiator of the association shall propose one of the application-contexts defined in this Protocol Specification that include the RTSE in normal mode in the RT-OPEN request primitive (see Table 1).

9.2.1.1.3 User-data

The mapping of the bind-operation of the abstract-bind service onto the User-data parameter of the RT-OPEN request primitive is defined in ITU-T Rec. X.881 | ISO/IEC 13712-2.

9.2.1.1.4 Presentation Context Definition List

The initiator of the association shall supply the Presentation Context Definition List in the RT-OPEN request primitive.

The Presentation Context Definition List comprises a presentation-context-definition for each abstract-syntax included in the application context. A presentation-context-definition comprises a presentation-context-identifier and an abstract-syntax-name for the ASE. Each named abstract-syntax for the MSSE, MDSE, MRSE and MASE includes the ROSE APDUs. The named abstract-syntax for the RTSE includes the abstract-syntax for the bind-operation of the abstract-bind service.

Clauses 7 and 8 define the abstract-syntaxes included in the application-contexts.

9.2.1.2 Abstract-unbind onto RT-CLOSE

The abstract-unbind service is mapped onto the RT-CLOSE service of the RTSE.

9.2.2 Mapping onto ROSE

The MSSE, MS-MSSE, MDSE-88, MDSE-94, MRSE-88. MRSE-94, MASE-88, and MASE-94 services are mapped onto the RO-INVOKE, RO-RESULT, RO-ERROR, RO-REJECT-U and RO-REJECT-P services of the ROSE. The mapping of the abstract-syntax notation of these ASEs onto the ROSE services is defined in ITU-T Rec. X.880 | ISO/IEC 13712-1.

ROSE is the user of the RT-TRANSFER, RT-TURN-PLEASE, RT-TURN-GIVE, RT-P-ABORT and RT-U-ABORT services of the RTSE. The use of the RTSE services by the ROSE is defined in ITU-T Rec. X.882 | ISO/IEC 13712-3.

9.2.2.1 Managing the Turn

ITU-T Rec. X.882 | ISO/IEC 13712-3 defines the use by the ROSE of the RT-TURN-PLEASE and RT-TURN-GIVE services of the RTSE to manage the Turn.

Table 2 defines the values of the priority parameter of the RT-TURN-PLEASE service used by the ROSE to request the Turn.

Table 2 – Remote Operation Priorities

Priority	MSSE	MS-MSSE	MDSE-88	MDSE-94	MASE-88	MASE-94	MRSE-88	MRSE-94
0	Association release							
1	RO-REJECT-U RO-ERROR							
2	RO-RESULT							
3	Submission-control Cancel-deferred-delivery	MS-submission-control MS-cancel-deferred-delivery	Delivery-control-88	Delivery-control				
4	Message-submission (urgent)	MS-message-submission (urgent)	Message-delivery (urgent)	Message-delivery (urgent)			Alert	Alert
5	Probe-submission	MS-probe-submission	Report-delivery	Report-delivery	Register-88 Change-credentials	Register Change-credentials	Register-MS Summarize List Fetch Delete	Register-MS Summarize List Fetch Delete Modify
6	Message-submission (normal)	MS-message-submission (normal)	Message-delivery (normal)	Message-delivery (normal)				
7	Message-submission (non-urgent)	MS-message-submission (non-urgent)	Message-delivery (non-urgent)	Message-delivery (non-urgent)				

Priority zero is the highest priority, and is reserved for the action of releasing the association by the initiator.

Priority one is used by the ROSE for the RORJ APDU and ROER APDU to provide the RO-REJECT-U and RO-ERROR services of the ROSE.

Priority two is used by the ROSE for the RORS APDU to provide the RO-RESULT services of the ROSE.

Priority three to seven shall be used for the ROIV APDU to provide the RO-INVOKE service for the MHS Access Protocol remote operations. In the case of a remote operation whose arguments include a message, the priority of the ROIV APDU is a function of the **priority** of the message – **urgent**, **normal** or **non-urgent**.

9.3 MS Access Application-context Negotiation

Where the application-context proposed by the MS-user is not supported by the MS, it may still be possible for the MS and MS-user to establish an association using a mutually acceptable application-context. This subclause defines this mechanism.

9.3.1 Application Context Name

Where an MS-user which supports the Application Context Negotiation functional unit proposes the use of one application-context but is prepared to use a different application-context, the MS-user may identify these alternative application-contexts in the Application Context Name List. If the MS-user is prepared to accept alternative application contexts (whether or not explicitly identified in the Application Context Name List), it shall supply additional information as indicated in 9.3.2 and 9.3.3. If the MS-user proposes both a 1988 and a 1994 application-context, and the MS is capable of supporting either of these, it shall accept the association establishment for the 1994 application-context.

NOTE – Where the MS-user proposes application contexts of the same vintage (e.g. ms-access-88 and ms-reliable-access-88) the choice between them is a local matter for the MS.

If the MS does not support the proposed application-context and no alternative application-contexts are identified in the Application Context Name List, the MS may respond with an alternative application-context provided that the MS-user has supplied the additional information indicated in 9.3.2 and 9.3.3.

If the MS does not support the proposed application-context but the MS-user has identified alternative application-contexts in the Application Context Name List, and has supplied the corresponding additional information specified in 9.3.2. and 9.3.3, the MS may respond with one of those alternative application-contexts. Support of the Application Context Negotiation functional unit by the MS is not essential, since the MS may analyse the User Information to discover the set of proposed alternative application-contexts.

In all cases where the MS accepts the association establishment, the Application Context Name present in the A-ASSOCIATE response shall indicate which application-context has been established.

9.3.2 User Information

If the MS-user proposes the use of an application-context but is prepared to accept the use of one or more alternative application-contexts, then the User Information parameter shall contain EXTERNAL values for the MS-bind arguments of each of these application-contexts (i.e. a value of the MS-bind argument for the application-context proposed, and one for each of the proposed alternatives), except where the values are identical.

9.3.3 Presentation Context Definition List

If the MS-user proposes the use of an application-context but is prepared to accept the use of one or more alternative application-contexts, then the Presentation Context Definition List shall include presentation-context-definitions for all the abstract-syntaxes that could be used by any of the proposed application-contexts (i.e. values for the application-context proposed, and for each of the proposed alternatives). A presentation-context-definition shall always be present for the ACSE abstract-syntax.

If the ms-access-94 application-context is proposed, presentation-context-definitions for the ACSE, MASE-94, MS-MSSE, MRSE-94, and MS-bind and MS-unbind abstract-syntaxes shall be specified.

If the ms-access-88 application-context is proposed, presentation-context-definitions for the ACSE, MASE-88, MSSE, MRSE-88, and MS-bind and MS-unbind abstract-syntaxes shall be specified.

If the ms-reliable-access-94 application-context is proposed, presentation-context-definitions for the ACSE, MASE-94, MS-MSSE, MRSE-94, and MS-bind and MS-unbind with RTSE abstract-syntaxes shall be specified.

If the ms-reliable-access-88 application-context is proposed, presentation-context-definitions for the ACSE, MASE-88, MSSE, MRSE-88, and MS-bind and MS-unbind with RTSE abstract-syntaxes shall be specified.

If several application-contexts are proposed, the Presentation Content Definition List shall contain the logical union of the presentation-context-definitions defined for each application-context.

10 Conformance

A system (UA, MS, or MTA) claiming conformance to the MHS Access Protocols specified in this Protocol Specification shall comply with the requirements in subclauses 10.1, 10.2 and 10.3.

10.1 Statement Requirements

The following shall be stated:

a) the type of system for which conformance is claimed (UA, MS, MTA or MTA/MS);

b) the application-contexts defined in Section 2 of this Protocol Specification for which conformance is claimed;

c) in the case of an MS or a UA accessing an MS:

- the optional MS entry-classes, general-attribute-types, general-matching-rules, and general-auto-action-types for which conformance is claimed;
- the content-types and corresponding content-type-specific attribute-types, matching-rules, and auto-action-types for which conformance is claimed;
- for the IPM content-type, whether conformance is claimed for support of the attribute-types derived from the (unbounded) set of extended body part types.

Conformance can be claimed to the MTS Access Protocol (P3), or the MS Access Protocol (P7), or both. Table 3 classifies the support for application-contexts required for conformance to the MTS Access Protocol (P3). Table 4 classifies the support for application-contexts required for conformance to the MS Access Protocol (P7).

Table 3 – MTS Access Protocol Conformance Requirements

Application context	MTA	MTS-user
MTS Access Protocol		
mts-access-88	Mandatory	Optional
mts-forced-access-88	Mandatory	Optional
mts-reliable-access-88	Optional (Note)	Optional
mts-forced-reliable-access-88	Optional (Note)	Optional
mts-access-94	Optional	Optional
mts-forced-access-94	Optional	Optional
mts-reliable-access-94	Optional (Note)	Optional
mts-forced-reliable-access-94	Optional (Note)	Optional
NOTE – If an MTA claims conformance to the mts-reliable-access-88 application-context, it shall also claim conformance to the mts-forced-reliable-access-88 application-context, and vice versa. If an MTA claims conformance to the mts-access-94 application-context, it shall also claim conformance to the mts-forced-access-94 application-context, and vice versa. If an MTA claims conformance to the mts-reliable-access-94 or mts-forced-reliable-access-94 application-contexts, it shall claim conformance to all application-contexts in this table.		

Table 4 – MS Access Protocol Conformance Requirements

Application context	MS	MS-user
MS Access Protocol		
ms-access-88	Mandatory	Optional
ms-reliable-access-88	Optional	Optional
ms-access-94	Optional	Optional
ms-reliable-access-94	Optional (Note)	Optional
NOTE – If an MS claims conformance to the ms-reliable-access-94 application-context, it shall also claim conformance to the ms-reliable-access-88 and ms-access-94 application-contexts.		

10.2 Static Requirements

The system shall:

a) conform to the abstract-syntax definition(s) of the MHS Access Protocols defined in clauses 7 and 8, required by the application-contexts for which conformance is claimed;

b) in the case of an MS, or a UA accessing an MS, support the MS abstract-service definition in ITU-T Rec. X.413 | ISO/IEC 10021-5 as well as the entry-classes, general-attribute-types, and general-matching-rules classified as mandatory in 6.3.7.4, Tables 2 and 3, and 12.5 respectively of ITU-T Rec. X.413 | ISO/IEC 10021-5.

10.3 Dynamic Requirements

The system shall:

a) conform to the mapping onto used services defined in clause 9, required by the application-contexts for which conformance is claimed;

b) conform to the use of underlying services defined in 6.4.

SECTION 3 – MESSAGE TRANSFER SYSTEM TRANSFER PROTOCOL SPECIFICATION

11 Overview of the MTS Transfer Protocol

11.1 Model

Clause 10 of ITU-T Rec. X.411 | ISO/IEC 10021-4 refines the abstract model of the Message Transfer System (MTS), first presented in clause 6 of ITU-T Rec. X.411 | ISO/IEC 10021-4, to reveal that the MTS object comprises a collection of message-transfer-agent (MTA) objects, which cooperate together to form the MTS and offer the MTS Abstract Service to its users.

In the refined abstract model, interactions between MTAs are modelled as a set of abstract operations which occur at the transfer-port paired between MTAs.

This clause describes how the MTA Abstract Service is supported by instances of OSI communication when the MTAs are realized as application-processes located in different open systems.

In the OSI environment, communication between application-processes is represented in terms of communication between a pair of application-entities (AEs) using the presentation-service. The functionality of an AE is factored into a set of one or more application-service-elements (ASEs). The interaction between AEs is described in terms of their use of the services provided by the ASEs.

The transfer-port services of the abstract model are supported by an application-service-element – the Message Transfer Service Element (MTSE), which in turn is supported by two other application-service-elements – the Reliable Transfer Service Element (RTSE) and the Association Control Service Element (ACSE).

The Reliable Transfer Service Element (RTSE) is used to reliably transfer application-protocol-data-units (APDUs) that contain the message, probes and reports between AEs.

The Association Control Service Element (ACSE) supports the establishment and release of an application-association between a pair of AEs. Associations between MTAs can be established by either MTA. Only the initiator of an established association can release it.

The combination of the MTSE, the RTSE and the ACSE defines the application-context of an application-association.

Figure 5 models the application-context between MTAs.

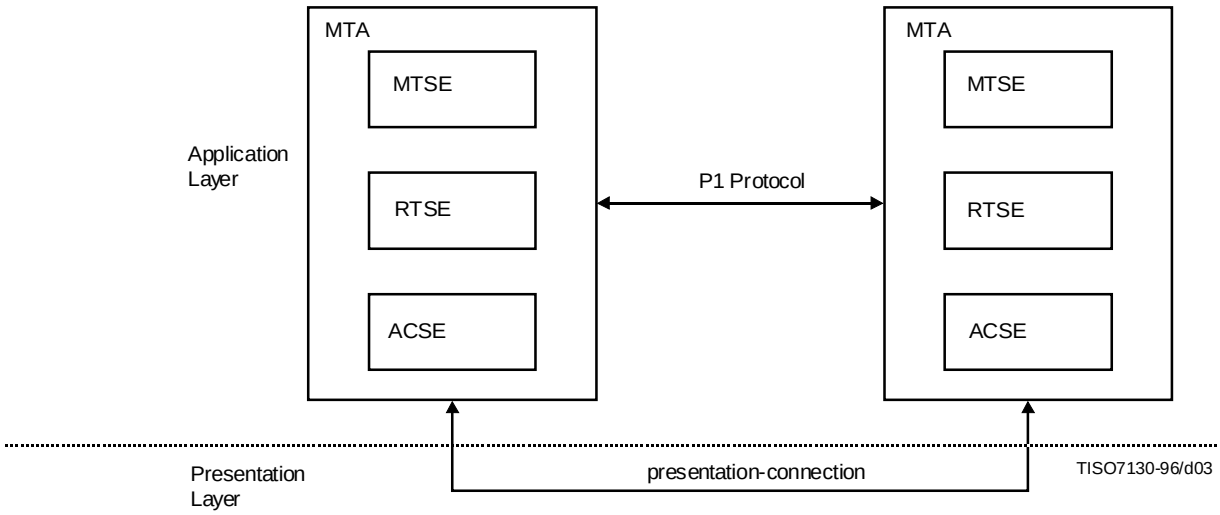

Figure 5 – MTS Transfer Protocol model

Three application-contexts are defined for the MTS Transfer Protocol as identified in Table 5.

Table 5 – MTS Transfer Protocol Application Contexts

Application context	P1	RTSE mode
mts-transfer	1988 P1	Normal
mts-transfer-protocol	1988 P1	X.410-1984
mts-transfer-protocol-1984	1984 P1	X.410-1984

The **mts-transfer** application-context is supported by the RTSE in normal mode. It is envisaged that, over time, most systems will migrate to support the **mts-transfer** application-context. Support for the **mts-transfer** application-context is mandatory for conformance to this Protocol Specification.

The **mts-transfer-protocol** is supported by the RTSE in X.410-1984 mode. Support for the **mts-transfer-protocol** is not required for conformance to this Protocol Specification.

NOTE – The **mts-transfer-protocol** is defined to enable implementations to upgrade easily to achieve conformance to Recommendation X.419 (1988). This is made possible by the availability of RTSE X.410-1984 mode.

The **mts-transfer-protocol-1984** is defined for interworking with implementations of the 1984 Recommendation X.411. In this application-context, the abstract-syntax of the MTSE is constrained to that defined in the 1984 Recommendation X.411. These constraints are identified by underlining of the 1988 extensions to the abstract syntax of the MTSE in the defining ASN.1 module in ITU-T Rec. X.411 | ISO/IEC 10021-4. The significant changes are also listed in Annex C for reference. The **mts-transfer-protocol-1984** is supported by the RTSE in X.410-1984 mode. Support for the **mts-transfer-protocol-1984** is optional for MTAs and PRMDs but mandatory for ADMDs for conformance to this Protocol Specification. A future version of this Recommendation | International Standard will make support for **mts-transfer-protocol-1984** optional.

11.2 Services Provided by the MTS Transfer Protocol

The MTS Transfer Protocol (P1) provides the following services defined in ITU-T Rec. X.411 | ISO/IEC 10021-4:

MTA-bind and MTA-unbind

a) MTA-bind;

b) MTA-unbind.

Message Transfer Service Element (MTSE)

c) Message-transfer;

d) Probe-transfer;

e) Report-transfer.

11.3 Use of underlying services

The MTS Transfer Protocol (P1) makes use of underlying services as described below.

11.3.1 Use of the RTSE services

The Reliable Transfer Service Element (RTSE) is defined in CCITT Rec. X.218 and ISO/IEC 9066-1.

The RTSE provides for the reliable transfer of application-protocol-data-units (APDUs). The RTSE ensures that each APDU is completely transferred once, or that the sender is warned of an exception. The RTSE recovers from communication and end-system failure and minimizes the amount of retransmission needed for recovery.

The RTSE services are used to support the MTS Transfer Protocol (P1). Support for the RTSE in normal mode is mandatory. Support for RTSE in X.410-1984 mode is optional for MTAs and PRMDs but mandatory for ADMDs.

The use of the normal mode of the RTSE implies the use of the normal mode of the ACSE and the normal mode of the presentation-service. The use of the X.410-1984 mode of the RTSE implies the use of the X.410-1984 mode of the ACSE and the X.410-1984 mode of the presentation-service.

The MTS Transfer Protocol (P1) is the sole user of the RT-OPEN, RT-CLOSE, RT-TRANSFER, RT-TURN-PLEASE, RT-TURN-GIVE, RT-P-ABORT and RT-U-ABORT services of the RTSE.

NOTE – Implementors should be aware of a potential problem when using secure messaging and RTSE. In the event of using the RTS association recovery procedure, the recovered association will no longer have peer-to-peer authentication.

11.3.2 Use of the ACSE services

The Association Control Service Element (ACSE) is defined in ITU-T Rec. X.217 | ISO/IEC 8649.

The ACSE provides for the control (establishment, release, abort) of application-associations between AEs.

The RTSE is the sole user of the A-ASSOCIATE, A-RELEASE, A-ABORT and A-P-ABORT services of the ACSE. The use of the normal mode of the RTSE implies the use of the normal mode of the ACSE and the normal mode of the presentation-service. The use of the X.410-1984 mode of the RTSE implies that use of the X.410-1984 mode of the ACSE and the X.410-1984 mode of the presentation-service.

11.3.3 Use of the Presentation-service

The presentation-service is defined in ITU-T Rec. X.216 | ISO/IEC 8822.

The Presentation Layer coordinates the representation (syntax) of the Application Layer semantics that are to be exchanged.

In normal mode, a different presentation-context is used for each abstract-syntax included in the application-context.

In X.410-1984 mode, a single default presentation-context is used for the underlying presentation-connection. This presentation-context includes a single abstract-syntax for all of the ASEs included in the application-context (i.e. MTSE, RTSE and ACSE).

Presentation Layer addressing is not used for the Message Transfer Protocol (P1) in X.410-1984 mode.

The ACSE is the sole user of the P-CONNECT, P-RELEASE, P-U-ABORT and P-P-ABORT services of the presentation-service.

The RTSE is the sole user of the P-ACTIVITY-START, P-DATA, P-MINOR-SYNCHRONIZE, P-ACTIVITY-END, P-ACTIVITY-INTERRUPT, P-ACTIVITY-DISCARD, P-U-EXCEPTION-REPORT, P-ACTIVITY-RESUME, P-P-EXCEPTION-REPORT, P-TOKEN-PLEASE, and P-CONTROL-GIVE services of the presentation-service. The use of the normal mode of the RTSE implies the use of the normal mode of the ACSE and the normal mode of the presentation-service. The use of the X.410-1984 mode of the RTSE implies the use of the X.410-1984 mode of the ACSE and the X.410-1984 mode of the presentation-service.

11.3.4 Use of Lower Layer services

The session-service is defined in Recommendation X.215. The Session Layer structures the dialogue of the flow of information between the end-systems.

The use of the RTSE requires the use of the Kernel, Half-duplex, Exceptions, Minor-synchronize and Activity-management functional units by the Presentation Layer.

Session Layer addressing is not used for the MTS Transfer Protocol (P1) when the RTSE is used in X.410-1984 mode. That is, a session-address shall not be passed in the Connect SPDU of the Session Layer.

The transport-service is defined in Recommendation X.214. The Transport Layer provides for the end-to-end transparent transfer of data over the underlying network connection.

The choice of the class of transport-service used by the Session Layer depends on the requirements for multiplexing and error recovery. Support for Class 0 is mandatory. Transport Expedited Service is not used.

Support for other classes is optional. The use of an error recovery class together with the RTSE duplicates mechanisms for error recovery.

The transport-address comprises a network-address and a transport-service-access-point identifier (TSAP-identifier). The TSAP-identifier is carried in the Transport Layer protocol. When the RTSE is used in the X.410-1984 mode, it consists of up to sixteen IA5 digits.

An underlying network supporting the OSI network-service defined in Recommendation X.213 is assumed.

A network-address is as defined in Recommendation X.121, Recommendations E.163 and E.164, or Recommendation X.200 (OSI NSAP-address).

11.4 Establishing and Releasing Associations

Associations between two MTAs are created in accordance with bilateral agreements covering the following:

a) the maximum number of associations that may exist simultaneously;

b) whether monologue or two-way-alternate associations are used;

c) which application-context is used;

d) which MTA has responsibility for establishing the associations;

e) whether associations are permanently established, or established and released as required.

If more than one association is established between two MTAs, MTS-APDUs may be assigned to associations in accordance with their priorities. Several associations may be used to carry MTS-APDUs of the same priority. On any one association, higher priority MTS-APDUs are sent before lower priority MTS-APDUs; MTS-APDUs of the same priority are sent ’first-in-first-out’.

12 MTS Transfer Protocol Abstract Syntax Definition

The abstract-syntax of the MTS Transfer Protocol (P1) is defined in Figure 6.

The abstract-syntax of the MTS Transfer Protocol (P1) is defined using the abstract-syntax notation (ASN.1) defined in ITU-T Rec. X.680 | ISO/IEC 8824-1, ITU-T Rec. X.681 | ISO/IEC 8824-2, ITU-T Rec. X.682 | ISO/IEC 8824-3 and ITU-T Rec. X.683 | ISO/IEC 8824-4, and the remote operations notation defined in ITU-T Rec. X.880 | ISO/IEC 13712-1, ITU-T Rec. X.881 | ISO/IEC 13712-2 and ITU-T Rec. X.882 | ISO/IEC 13712-3.

The abstract-syntax definition of the MTS Transfer Protocol (P1) has the following major parts (see Figure 6):

– *Prologue*: Declarations of the exports from, and imports to, the MTS Transfer Protocol (P1) module.

– *Application Contexts*: Definitions of the application-contexts used between MTAs.

– *Abstract Syntaxes*: Definitions of the abstract-syntaxes for MTA-bind and MTA-unbind, and for the Message Transfer Service Element.

```
MTSTransferProtocol { joint-iso-itu-t mhs(6) protocols(0) modules(0) transfer-protocol(3)
        version-1994(0) }

DEFINITIONS IMPLICIT TAGS ::=

BEGIN

--      Prologue

IMPORTS

        -- MTA Abstract Service

        Message, mta-transfer, Probe, Report
            ----
            FROM MTAAbstractService { joint-iso-itu-t mhs(6) mts(3) modules(0)
                mta-abstract-service(2) version-1994(0) }

        -- Remote Operations

        APPLICATION-CONTEXT
            ----
            FROM Remote-Operations-Information-Objects-extensions { joint-iso-itu-t
                remote-operations(4) informationObjects-extensions(8) version1(0) }

        Bind { }, Unbind { }
            ----
            FROM Remote-Operations-Generic-ROS-PDUs { joint-iso-itu-t remote-operations(4)
                generic-ROS-PDUs(6) version1(0) }

        association-by-RTSE, transfer-by-RTSE
            ----
            FROM Remote-Operations-Realisations { joint-iso-itu-t remote-operations(4)
                realisations(9) version1(0) }

        acse-abstract-syntax
            ----
            FROM Remote-Operations-Abstract-Syntaxes { joint-iso-itu-t remote-operations(4)
                remote-operations-abstract-syntaxes(12) version1(0) }

        -- Reliable Transfer

        RTSE-apdus
            ----
            FROM Reliable-Transfer-APDUS { joint-iso-itu-t reliable-transfer(3) apdus(0) }

        -- Object Identifiers

        id-ac-mts-transfer, id-as-mta-rtse, id-as-mtse
            ----
            FROM MHSProtocolObjectIdentifiers { joint-iso-itu-t mhs(6) protocols(0)
                modules(0) object-identifiers(0) version-1994(0) };

--      APPLICATION CONTEXTS

--      Application Context including RTSE in normal mode

mts-transfer  APPLICATION-CONTEXT ::= {
        CONTRACT                    mta-transfer
        ESTABLISHED BY              association-by-RTSE
        INFORMATION TRANSFER BY     transfer-by-RTSE
        ABSTRACT SYNTAXES           {acse-abstract-syntax |
                                    message-transfer-abstract-syntax |
                                    mta-bind-unbind-rtse-abstract-syntax }
        APPLICATION CONTEXT NAME    id-ac-mts-transfer }
```

Figure 6 – Abstract Syntax Definition of the MTS Transfer Protocol (P1) (part 1 of 2)

```
--          Application Context including RTSE in X.410-1984 mode

mts-transfer-protocol INTEGER ::= 12

--          Application Context for Interworking with 1984 P1

mts-transfer-protocol-1984 INTEGER ::= 1

--          ABSTRACT-SYNTAXES

--          Abstract Syntax for MTABind and MTAUnbind

mta-bind-unbind-rtse-abstract-syntax ABSTRACT-SYNTAX ::= {
        RTSE-apdus -- With MTA-bind and MTA-unbind -- IDENTIFIED BY id-as-mta-rtse}

--          Abstract Syntax for Message Transfer Service Element

message-transfer-abstract-syntax ABSTRACT-SYNTAX ::= {
        MTS-APDU IDENTIFIED BY id-as-mtse}

--          MTS Application Protocol Data Units

MTS-APDU ::= CHOICE {
        message [0] Message,
        probe [2] Probe,
        report [1] Report }

END     -- of MTSTransferProtocol
```

Figure 6 – Abstract Syntax Definition of the MTS Transfer Protocol (P1) (part 2 of 2)

13 Mapping onto used services

This subclause defines the mapping of the MTS Transfer Protocol (P1) onto the used services.

Subclause 13.1 defines the mapping of the MTS Transfer Protocol (P1) onto used services for application-contexts that include the RTSE in normal mode. Subclause 13.2 defines the mapping of the MTS Transfer Protocol (P1) onto used services for application-contexts that include the RTSE in X.410-1984 mode.

13.1 Mapping onto RTSE normal mode

This subclause defines the mapping of the MTS Transfer Protocol (P1) onto used services for application-contexts that include the RTSE in normal mode. Support for this mapping is mandatory for conformance to this Protocol Specification.

Subclause 13.1.1 defines the mapping of the MTA-bind and MTA-unbind services onto the RT-OPEN and RT-CLOSE services of the RTSE in normal mode. Subclause 13.1.2 defines the mapping of the Message-transfer, Probe-transfer and Report-transfer services onto the RT-TRANSFER service of the RTSE. Subclause 13.1.3 describes managing the Turn using the RT-TURN-PLEASE and RT-TURN-GIVE services of the RTSE. Subclause 13.1.4 defines the use of the RT-P-ABORT service of the RTSE. Subclause 13.1.5 defines the use of the RT-U-ABORT service of the RTSE.

13.1.1 Mapping onto RT-OPEN and RT-CLOSE

This subclause defines the mapping of the MTA-bind and MTA-unbind services onto the RT-OPEN and RT-CLOSE services of the RTSE in normal mode.

13.1.1.1 MTA-bind onto RT-OPEN

The MTA-bind service is mapped onto the RT-OPEN service of the RTSE. The use of the parameters of the RT-OPEN service is qualified in the following subclauses.

13.1.1.1.1 Mode

This parameter shall be supplied by the initiator of the association in the RT-OPEN request primitive, and shall have the value 'normal mode'.

13.1.1.1.2 Application Context Name

The initiator of the association shall propose the **mts-transfer** application-context defined in this Protocol Specification in the RT-OPEN request primitive.

13.1.1.1.3 User-data

The mapping of the bind-operation of the MTA-bind service onto the User-data parameter of the RT-OPEN service is defined in ITU-T Rec. X.880 | ISO/IEC 13712-1.

13.1.1.1.4 Presentation Context Definition List

The initiator of the association shall supply the Presentation Context Definition List in the RT-OPEN request primitive.

The Presentation Context Definition List comprises a presentation-context-definition for each abstract-syntax included in the application-context. A presentation-context-definition comprises a presentation-context-identifier and an abstract-syntax-name for the ASE. The named abstract-syntax for the RTSE includes the abstract-syntax for the bind-operation.

Clause 12 defines the abstract-syntaxes included in the application-context.

13.1.1.2 MTA-unbind onto RT-CLOSE

The MTA-unbind is mapped onto the RT-CLOSE service of the RTSE.

No parameters of the RT-CLOSE service are used in normal mode.

13.1.2 Mapping onto RT-TRANSFER

The Message-transfer, Probe-transfer and Report-transfer services are mapped onto the RT-TRANSFER service of the RTSE.

An MTSE may issue an RT-TRANSFER request primitive only if it possesses the Turn (see 13.1.3) and if there is no outstanding RT-TRANSFER confirm primitive.

The use of the parameters of the RT-TRANSFER service is qualified in the following clauses.

13.1.2.1 APDU

The value of the MTS-APDU shall be mapped onto the APDU parameter of the RT-TRANSFER request primitive by the sender.

For the Message-transfer service, the MTS-APDU is a Message. For the Probe-transfer service, the MTS-APDU is a Probe. For the Report-transfer service, the MTS-APDU is a Report.

13.1.2.2 Transfer-time

The value of this parameter is specified by a local rule of the sender. It may be related to the priority of the APDU (see 13.1.3.1.1).

13.1.3 Managing the Turn

This subclause describes managing the Turn using the RT-TURN-PLEASE and RT-TURN-GIVE services of the RTSE.

The MTSE must possess the Turn before it can use the RT-TRANSFER service to transfer a message, probe or report.

The MTSE without the Turn may issue an RT-TURN-PLEASE request primitive, the priority parameter of which reflects the highest priority APDU awaiting transfer.

The MTSE with the Turn may issue an RT-TURN-GIVE request primitive when it has no further APDUs to transfer. It shall issue an RT-TURN-GIVE request primitive in response to an RT-TURN-PLEASE indication primitive when it has no further APDUs to transfer of priority equal to, or higher than, that indicated in the RT-TURN-PLEASE indication primitive. If it has APDUs of lower priority still to transfer, it may then issue an RT-TURN-PLEASE request primitive, the priority parameter of which reflects the highest priority APDU awaiting transfer.

13.1.3.1 Use of the RT-TURN-PLEASE service

An MTSE issues the RT-TURN-PLEASE request primitive to request the Turn. It may do so only if it does not already possess the Turn.

If the initiator of the association supplied a Dialogue-mode parameter value of 'monologue' and an Initial-turn parameter value of 'association-initiator', the RT-TURN-PLEASE service shall not be used.

The use of the parameter of the RT-TURN-PLEASE service is qualified in the following subclause.

13.1.3.1.1 Priority

The value of the Priority parameter is supplied by the MTSE requesting the Turn, and reflects the highest priority APDU awaiting transfer.

Priority zero is the highest priority, and is reserved for the action of releasing the association by the initiator.

Priority one shall be assigned to Messages whose **priority** field (defined in 8.2.1.1.1.8 of ITU-T Rec. X.411 | ISO/IEC 10021-4) has the value **urgent**. Priority one shall also be assigned to Probes and Reports.

Priority two shall be assigned to Messages whose **priority** field is **normal**.

Priority three shall be assigned to Messages whose **priority** field is **non-urgent**.

13.1.3.2 Use of the RT-TURN-GIVE service

An MTSE issues the RT-TURN-GIVE request primitive to relinquish the Turn to its peer. It may do so only if it possesses the Turn.

If the initiator of the association supplied a Dialogue-mode parameter value of 'monologue' and an Initial-turn parameter value of 'association-initiator', the RT-TURN-GIVE service shall not be used.

The RT-TURN-GIVE service has no parameters.

13.1.4 Use of the RT-P-ABORT service

The application-process is the user of the RT-P-ABORT service of the RTSE.

The RT-P-ABORT service provides an indication to the application-process that the application-association cannot be maintained (e.g. because recovery not possible).

The RT-P-ABORT service has no parameters.

13.1.5 Use of the RT-U-ABORT service

The application-process is the user of the RT-U-ABORT service of the RTSE.

The RT-U-ABORT service enables the application-process to abort the application-association. The RT-U-ABORT service may be requested by either the initiator or the responder of the association.

No parameters of the RT-U-ABORT service are used in normal mode.

The RT-U-ABORT service is not available in X.410-1984 mode.

13.2 Mapping onto RTSE X.410-1984 mode

This subclause defines the mapping of the MTS Transfer Protocol (P1) onto used services for application-contexts that include the RTSE in X.410-1984 mode. Support for this mapping is optional for MTAs and PRMDs but mandatory for ADMDs for conformance to this Protocol Specification.

Subclause 13.2.1 defines the mapping of the MTA-bind and MTA-unbind services onto the RT-OPEN and RT-CLOSE services of the RTSE in X.410-1984 mode. Subclause 13.2.2 defines the mapping of the Message-transfer, Probe-transfer and Report-transfer services onto the RT-TRANSFER service of the RTSE. Subclause 13.2.3 describes managing the Turn using the RT-TURN-PLEASE and RT-TURN-GIVE services of the RTSE. Subclause 13.2.4 defines the use of the RT-P-ABORT service of the RTSE. Subclause 13.2.5 defines the use of the RT-U-ABORT service of the RTSE (not used in X.410-1984 mode).

13.2.1 Mapping onto RT-OPEN and RT-CLOSE

This subclause defines the mapping of the MTA-bind and MTA-unbind services onto the RT-OPEN and RT-CLOSE services of the RTSE in X.410-1984 mode.

13.2.1.1 MTA-bind onto RT-OPEN

The MTA-bind service is mapped onto the RT-OPEN service of the RTSE. The use of the parameters of the RT-OPEN service is qualified in the following subclauses.

13.2.1.1.1 Application-protocol

This parameter shall be supplied by the initiator of the association in the RT-OPEN request primitive, and shall have the value **mts-transfer-protocol** (an integer value of '12') or**mts-transfer-protocol-1984** (an integer value of '1').

13.2.1.1.2 User-data

The value of the type defined in the ARGUMENT clause of the MTA-bind service is mapped onto the User-data parameter of the RT-OPEN request primitive by the initiator of the association.

If the responder of the association supplies the Result parameter of the RT-OPEN response primitive with the value 'accepted', the value of the type defined in the RESULT clause of the MTA-bind service is mapped onto the User-data parameter of the RT-OPEN response primitive.

In the case of error the responder of the association supplies the Result parameter of the RT-OPEN response primitive with the value 'rejected (permanent)' or 'rejected (transient)'. In the case of 'rejected (permanent)', the User-data parameter of the RT-OPEN response primitive shall be either authentication-error or unacceptable-dialogue-mode.

13.2.1.1.3 Mode

This parameter shall be supplied by the initiator of the association in the RT-OPEN request primitive, and shall have the value 'X.410-1984 mode'.

13.2.1.2 MTA-unbind onto RT-CLOSE

The MTA-unbind is mapped onto the RT-CLOSE service of the RTSE. In the X.410-1984 mode, the RT-CLOSE service has no parameters.

13.2.2 Mapping onto RT-TRANSFER

The Message-transfer, Probe-transfer and Report-transfer services are mapped onto the RT-TRANSFER service of the RTSE.

The mapping of these services onto the RT-TRANSFER service in X.410-1984 mode is identical to the mapping in normal mode, defined in 13.1.2.

13.2.3 Managing the Turn

The MTSE must possess the Turn before it can use the RT-TRANSFER service to transfer a message, probe or report.

Managing the Turn in X.410-1984 mode is identical to managing the Turn in normal mode, defined in 13.1.3.

13.2.4 Use of the RT-P-ABORT service

The application-process is the user of the RT-P-ABORT service of the RTSE.

The RT-P-ABORT service provides an indication to the application-process that the application-association cannot be maintained (e.g. because recovery not possible).

The RT-P-ABORT service has no parameters.

The use of the RT-P-ABORT service in X.410-1984 mode is identical to the use of the RT-P-ABORT service in normal mode.

13.2.5 Use of the RT-U-ABORT service

The RT-U-ABORT service of the RTSE is not available in X.410-1984 mode.

14 Conformance

An MTA, PRMD or ADMD claiming conformance to the MTS Transfer Protocol (P1) specified in this Protocol Specification shall comply with the requirements in 14.1, 14.2 and 14.3.

14.1 Statement Requirements

The following shall be stated:

a) the application-contexts defined in Section 3 for which conformance is claimed;

b) whether monologue, two-way alternate, or both monologue and two-way alternate dialogue-modes are supported;

c) whether the MTA, PRMD or ADMD can act as the initiator, or the responder, or either the initiator or the responder, of an association.

Table 6 classifies the support for application-contexts required for conformance to the MTS Transfer Protocol (P1).

Table 6 – MTS Transfer Protocol Conformance Requirements

Application context	MTA	PRMD	ADMD
MTS Transfer Protocol			
mts-transfer	Mandatory	Mandatory	Mandatory
mts-transfer-protocol	Optional	Optional	Optional
mts-transfer-protocol-1984	Optional	Optional	Mandatory

14.2 Static Requirements

The MTA, PRMD or ADMD shall:

– conform to the abstract-syntax definition of the MTS Transfer Protocol (P1) defined in clause 12.

14.3 Dynamic Requirements

The MTA, PRMD or ADMD shall:

a) conform to the procedures for distributed operation of the MTS defined in ITU-T Rec. X.411 | ISO/IEC 10021-4;

b) conform to the mapping onto used services defined in clause 13, required by the application-contexts for which conformance is claimed; support for the mapping onto the RTSE in normal mode is mandatory, and support for the mapping onto the RTSE in X.410-1984 mode is optional for MTAs and PRMDs but mandatory for ADMDs;

c) conform to the rules for interworking with MDs conforming to Recommendation X.411 (1984) defined in Annex B of this Protocol Specification if conformance to this is claimed;

d) conform to the use of underlying services defined in 11.3.

Annex A

Reference Definition of MHS Protocol Object Identifiers

(This annex forms an integral part of this Recommendation | International Standard)

This annex defines for reference purposes various object identifiers cited in the ASN.1 modules in the body of this Protocol Specification. The object identifiers are assigned in Figure A.1.

All object identifiers that this Protocol Specification assigns are assigned in this annex. However, this annex is not definitive for all assignments. Other definitive assignments occur in the modules in the body of this Protocol Specification and are referenced in this annex.

```
MHSProtocolObjectIdentifiers { joint-iso-itu-t mhs(6) protocols(0) modules(0) object-identifiers(0)
        version-1994(0) }

DEFINITIONS IMPLICIT TAGS ::=

BEGIN

--      Prologue

--      Exports Everything

IMPORTS     -- nothing -- ;

--      MHS Protocols

id-mhs-protocols OBJECT IDENTIFIER ::= { joint-iso-itu-t mhs(6) protocols(0) }
                                                        -- not definitive

--      Categories of Object Identifiers

id-mod OBJECT IDENTIFIER ::= { id-mhs-protocols 0 }     -- modules

id-ac OBJECT IDENTIFIER ::= { id-mhs-protocols 1 }      -- application contexts

id-as OBJECT IDENTIFIER ::= { id-mhs-protocols 2 }      -- abstract syntaxes

id-ase OBJECT IDENTIFIER ::= { id-mhs-protocols 3 }     -- application service elements (obsolete)

--      Modules

id-mod-object-identifiers OBJECT IDENTIFIER ::= { id-mod 0 }        -- not definitive

id-mod-mts-access-protocol OBJECT IDENTIFIER ::= { id-mod 1 }       -- not definitive

id-mod-ms-access-protocol OBJECT IDENTIFIER ::= { id-mod 2 }        -- not definitive

id-mod-mts-transfer-protocol OBJECT IDENTIFIER ::= { id-mod 3 }     -- not definitive

--      Application Contexts

--      MTS Access Protocol

id-ac-mts-access-88 OBJECT IDENTIFIER ::= { id-ac 0 }

id-ac-mts-forced-access-88 OBJECT IDENTIFIER ::= { id-ac 1 }

id-ac-mts-reliable-access-88 OBJECT IDENTIFIER ::= { id-ac 2 }

id-ac-mts-forced-reliable-access-88 OBJECT IDENTIFIER ::= { id-ac 3 }

id-ac-mts-access-94 OBJECT IDENTIFIER ::= { id-ac 7 }

id-ac-mts-forced-access-94 OBJECT IDENTIFIER ::= { id-ac 8 }

id-ac-mts-reliable-access-94 OBJECT IDENTIFIER ::= { id-ac 9 }

id-ac-mts-forced-reliable-access-94 OBJECT IDENTIFIER ::= { id-ac 10 }
```

Figure A.1 – Abstract Syntax Definition of MHS Protocol Object Identifiers (part 1 of 2)

```
--          MS Access Protocol
id-ac-ms-access-88 OBJECT IDENTIFIER ::= { id-ac 4 }
id-ac-ms-reliable-access-88 OBJECT IDENTIFIER ::= { id-ac 5 }
id-ac-ms-access-94 OBJECT IDENTIFIER ::= { id-ac 11 }
id-ac-ms-reliable-access-94 OBJECT IDENTIFIER ::= { id-ac 12 }
--          MTS Transfer Protocol
id-ac-mts-transfer OBJECT IDENTIFIER ::= { id-ac 6 }
--          Abstract Syntaxes
id-as-msse OBJECT IDENTIFIER ::= { id-as 1 }
id-as-mdse-88 OBJECT IDENTIFIER ::= { id-as 2 }
id-as-mrse-88 OBJECT IDENTIFIER ::= { id-as 5 }
id-as-mase-88 OBJECT IDENTIFIER ::= { id-as 6 }
id-as-mtse OBJECT IDENTIFIER ::= { id-as 7 }
id-as-mts-rtse OBJECT IDENTIFIER ::= { id-as 8 }
id-as-ms-88 OBJECT IDENTIFIER ::= { id-as 9 }
id-as-ms-rtse OBJECT IDENTIFIER ::= { id-as 10 }
id-as-mts OBJECT IDENTIFIER ::= { id-as 11 }
id-as-mta-rtse OBJECT IDENTIFIER ::= { id-as 12 }
id-as-ms-msse OBJECT IDENTIFIER ::= { id-as 13 }
id-as-mdse-94 OBJECT IDENTIFIER ::= { id-as 14 }
id-as-mrse-94 OBJECT IDENTIFIER ::= { id-as 15 }
id-as-mase-94 OBJECT IDENTIFIER ::= { id-as 16 }
id-as-ms-94 OBJECT IDENTIFIER ::= { id-as 17 }
--          Application Service Elements
id-ase-msse OBJECT IDENTIFIER ::= { id-ase 0 }
id-ase-mdse OBJECT IDENTIFIER ::= { id-ase 1 }
id-ase-mrse OBJECT IDENTIFIER ::= { id-ase 2 }
id-ase-mase OBJECT IDENTIFIER ::= { id-ase 3 }
id-ase-mtse OBJECT IDENTIFIER ::= { id-ase 4 }
END         -- of MHSProtocolObjectIdentifiers
```

Figure A.1 – Abstract Syntax Definition of MHS Protocol Object Identifiers (part 2 of 2)

Annex B

Interworking with 1984 Systems

(This annex forms an integral part of this Recommendation | International Standard)

This annex defines the rules to be obeyed by MTAs, PRMDs or ADMDs conforming to this Protocol Specification (hereafter referred to as '1988 systems') when claiming the ability to interwork with implementations conforming to Recommendation X.411 (1984) (hereafter referred to as '1984 systems') using the MTS Transfer Protocol (P1).

Subclause B.1 defines the rules for establishing associations that a 1988 system shall obey when interworking with a 1984 system.

Subclause B.2 defines the rules that a 1988 system shall obey when transferring an MTS-APDU to a 1984 system.

Subclause B.3 defines the rules that a 1988 system shall obey when receiving an MTS-APDU from a 1984 system.

NOTE – As Recommendation X.411 (1984) only defines the interactions at the boundary of an ADMD, the interworking rules in this annex only apply at such a boundary.

Additional types have been added to the universal class of ASN.1 types compared to those defined in Recommendation X.409 (1984). The valid replacement specifications for an ANY type are therefore extended. 1984 systems may be unable to handle the extended universal types. It is likely that a 1984 system may correctly handle these fields even if they contain the extended types. However, such fields intended for a 1984 system should be restricted to the universal types defined in Recommendation X.409 (1984).

The Basic Encoding Rules for ASN.1 give more flexibility than Recommendation X.409 (1984) for the long form of the length octets. The former permits the use of more length octets than the minimum necessary, whereas the latter does not. Therefore, when interworking with a 1984 system, it is necessary to obey this restriction, and use the fewest possible number of octets, with no leading octets having the value 0.

B.1 Association Establishment

This subclause defines the restrictions that a 1988 system shall observe with the MTA-bind when establishing an association with a 1984 system. There are no restrictions with the MTA-unbind.

The **mts-transfer-protocol-1984**, as defined in clause 12, shall be used for compatibility with the 1984 system.

B.1.1 Initiator-credentials/Responder-credentials

There are no restrictions placed on these elements as the corresponding elements in Recommendation X.411 (1984) were each defined to be an ANY type. Note, however, that a 1984 system will be restricted in its use of these elements when interworking with 1988 systems as described above.

B.1.2 Security-context

This optional element shall not be generated by a 1988 system when interworking with a 1984 system. A 1984 system is not capable of generating this element.

B.1.3 Bind-error

The bind-error value **unacceptable-security-context** shall not be generated by a 1988 system.

B.2 Rules for Transferring to 1984 systems

This subclause defines the interworking rules that a 1988 system shall obey when transferring an MTS-APDU to a 1984 system. The transformation of an MTS-APDU conforming to ITU-T Rec. X.411 | ISO/IEC 10021-4 to one conforming to Recommendation X.411 (1984) is called *downgrading*. The rules are expressed in terms of the actions to be taken on each protocol element of the MTS Transfer Protocol (P1) by the 1988 system.

For a given MTS-APDU, if none of the rules deem that downgrading would fail, then the MTS-APDU shall be downgraded in accordance with all applicable rules before being transferred to the 1984 system.

If one or more of the rules deem that downgrading has failed, then the action taken by the MTA is the same as if the transfer had failed (see clause 14 of ITU-T Rec. X.411 | ISO/IEC 10021-4.

NOTE – The potential or actual loss of information caused by applying these rules may affect an MTA's routing strategy.

The remainder of this clause specifies the rules for each of the protocol elements. Protocol elements not specifically mentioned shall be transferred unchanged. Unless otherwise specified, the rules specified apply in whichever MTS-APDU the protocol elements appear.

B.2.1 Extensions

If any **extensions** elements are present, and no **extension-field** is marked **critical-for-transfer** or **critical-for-delivery**, the **extensions** elements shall be deleted.

If any **extensions** elements are present, and any **extension-field** (other than in the **per-recipient-fields** of a **message-transfer-envelope** or a **probe-transfer-envelope**) is marked **critical-for-transfer** or **critical-for-delivery**, downgrading shall fail.

These rules shall be applied before any of the rules described in the following subclauses.

B.2.2 Per-domain-bilateral-information

If a **private-domain-identifier** is present in an element of **per-domain-bilateral-information**, then the element of **per-domain-bilateral-information** which contains that **private-domain-identifier** shall be deleted.

Otherwise, the **per-domain-bilateral-information** shall be unchanged.

B.2.3 Trace-information/Subject-intermediate-trace-information

If an **other-actions** element is present in any **trace-information-elements** or **subject-intermediate-trace-information-elements**, the **other-actions** element shall be deleted.

Otherwise, the **trace-information** or **subject-intermediate-trace-information** shall be unchanged.

B.2.4 Originator-name/Report-destination-name

If the **originator-name** in a **message-transfer-envelope** or a **probe-transfer-envelope**, or if the **report-destination-name** in a **report-transfer-envelope**, cannot be downgraded according to the rules given for **OR-name** (see B.2.7), then downgrading shall fail.

Otherwise the element shall be unchanged.

B.2.5 Per-recipient-fields of Message- or Probe-Transfer

If a **recipient-name** in the **per-recipient-fields** of a **message-transfer-envelope** or a **probe-transfer-envelope** cannot be downgraded according to the rules given for **OR-name** (see B.2.7), or any per-recipient **extension-field** exists and is marked **critical-for-transfer** or **critical-for-delivery**, then:

a) if the corresponding **responsibility** element has the value **responsible**, then downgrading for that recipient shall fail;

b) if the corresponding **responsibility** element has the value **not-responsible**, then the element for that recipient shall be deleted from **per-recipient-fields**.

If downgrading has failed for every recipient for which **responsibility** has the value **responsible**, then downgrading shall fail. If downgrading has failed for some (but not all) recipients for which **responsibility** has the value **responsible**, then the Splitter procedure (see clause 14 of ITU-T Rec. X.411 | ISO/IEC 10021-4) is invoked to split the message.

NOTE – The downgrading rules imply that **disclosure-of-recipients** is neither critical-for-transfer nor critical-for-delivery.

B.2.6 Per-recipient-fields of Report-transfer

If an **actual-recipient-name** or an **originally-intended-recipient-name** in the **per-recipient-fields** of a **report-transfer-content** cannot be downgraded according to the rules given for **OR-name** (see B.2.7), then the corresponding element of **per-recipient-fields** shall be deleted. If all the elements of **per-recipient-fields** are so deleted, downgrading shall fail.

B.2.7 OR-name

The **OR-name** shall be downgraded by deleting the **directory-name**, if present, and by downgrading the **OR-address** (see B.2.8).

B.2.8 OR-address

If the **OR-address** contains any attributes encoded both as teletex strings and as printable strings, the teletex strings shall be deleted.

If the **OR-address** contains any attributes encoded only as teletex strings and the characters in these teletex strings are from the printable string repertoire, these teletex strings shall be replaced by the printable string equivalents, otherwise the **OR-address** cannot be downgraded.

If the **OR-address** contains the **common-name** attribute, a **domain-defined-attribute** shall be created with its type component set to "common" (not case sensitive) and its value component copied from the **common-name** attribute. The **common-name** attribute shall then be deleted. If the **OR-address** previously contained four **domain-defined-attributes**, the **OR-address** cannot be downgraded.

If the **OR-address** is a **numeric-OR-address** containing a **private-domain-name**, the **OR-address** cannot be downgraded.

If the **OR-address** is a **terminal-OR-address** that contains **terminal-type**, **common-name**, **organization-name**, **organizational-unit-name**, **personal-name** or **unformatted-postal-address**, these attributes shall be deleted.

If the **OR-address** is a **terminal-OR-address**:

a) that contains a **country-name**, an **administration-domain-name**, a **network-address**, optionally **domain-defined-attributes**, and no others, the **OR-address** shall be unchanged;

b) that contains a **network-address**, optionally a **terminal-identifier**, and no others, the **OR-address** shall be unchanged;

c) that contains combinations of attributes other than the above, all attributes except the **network-address** and the **terminal-identifier**, if present, shall be deleted.

If after applying all the above rules the **OR-address** still contains any **extension-attributes**, the **OR-address** cannot be downgraded.

B.2.9 Encoded-information-types

Basic **encoded-information-types** indicated by object identifiers shall be mapped to the corresponding bit in **built-in-encoded-information-types**, and the object identifiers shall be deleted.

Other **encoded-information-types** indicated by object identifiers shall be mapped to the **unknown** value of **built-in-encoded-information-types**, and the object identifiers shall be deleted.

Notwithstanding the above rules, **original-encoded-information-types** in a **report-transfer-content** shall be deleted.

B.2.10 Content-type and Content

If the **content-type** in a message or probe is indicated by an integer, it shall be unchanged. The **content** in the message shall also be unchanged.

If the **content-type** in a message is indicated by an object identifier, it shall be mapped to the integer value **external** in place of the object identifier. The object identifier and the **content** shall be combined together into a value of the EXTERNAL type, and this value shall be the contents of the new **content**. The object identifier shall be the EXTERNAL's direct-reference and the contents of the **content** OCTET STRING shall be its octet-aligned encoding. The encoding of the **content** OCTET STRING shall be the Basic Encoding Rules of ASN.1

If the **content-type** in a probe is indicated by an object identifier, downgrading shall fail.

The **content-type** in a report shall be deleted. The **returned-content** shall be unchanged.

B.3 Rules for Receiving from 1984 systems

This subclause defines the interworking rules which a 1988 system shall obey upon receiving an MTS-APDU from a 1984 system.

B.3.1 Message originating from 1984 systems

If **non-basic-parameters** for the **g4-class-1** or **mixed-mode** types are present these shall be deleted.

Size constraints have been defined for a number of MTS Transfer Protocol (P1) elements. Providing that a 1984 system observes these constraints, a correctly encoded MTS-APDU received from a 1984 system also conforms to 1988 MTS Transfer Protocol (P1). Therefore, a 1988 system need take no special action.

B.3.2 Messages that have previously been downgraded

If (and only if) a message is received with its **content-type** set to the integer value **external**, it shall be transformed as follows. The **content** OCTET STRING shall be decoded as an EXTERNAL using the Basic Encoding Rules of ASN.1. The EXTERNAL's direct reference object identifier shall replace the **content-type** and the octet-aligned encoding shall become the new **content**.

B.3.3 Messages containing Domain-defined-attribute of type "common"

If any **OR-address** in the MTS-APDU received from a 1984 system contains a **domain-defined-attribute** with its type component set to "common" (not case sensitive) then a **common-name** attribute shall be created in the **OR-address** with its value copied from the **domain-defined-attribute** value component, and that **domain-defined-attribute** shall be deleted.

NOTE – After upgrade, the characters will always be drawn from the Printable String repertoire, but may be represented as either a Printable String or a Teletex String.

B.4 Service irregularities

The use of redirection and distribution lists in the presence of 1988/1984 boundaries may lead to some irregularities which are listed below:

- Recipients may not be able to notice that they received a message because of DL-expansion or redirection.
- When a message traverses a 1984 domain, the expansion history and the redirection history are lost. This may cause premature routing loop detection and result in redirection or expansion failure. Only a DL with an 1984 compatible OR-address may encounter this problem.
- 1984 MTAs will return notifications to the message originator rather than redirecting them back along the DL-expansion path.
- 1984 systems may see new distinguished values for integer protocol elements which are unknown to them.

Annex C

Summary of changes to previous Editions

(This annex does not form an integral part of this Recommendation | International Standard)

This annex identifies the differences between the MTS Access Protocol (P3) and MTS Transfer Protocol (P1) defined in this Protocol Specification and the P3 and P1 protocols defined in Recommendation X.411 (1984), Recommendation X.419 (1988, 1992) and ISO/IEC 10021-6:1990. Differences of a purely editorial nature are not included here.

C.1 Differences between 1984 and 1988 CCITT MHS protocols

The differences are identified in terms of the additions or other changes made to protocol elements present in P3 and P1 as defined in Recommendation X.411 (1984). The differences are more precisely indicated in the abstract syntax definitions in ITU-T Rec. X.411 | ISO/IEC 10021-4, in which every data type that has been changed is highlighted by means of underlining.

Subclause C.1.1 identifies the differences in the MTS Access Protocol (P3). Subclause C.1.2 identifies the additional differences in the MTS Transfer Protocol (P1).

C.1.1 MTS Access Protocol (P3) differences

This subclause identifies the differences between the MTS Access Protocol (P3) defined in this Protocol Specification and the P3 protocol defined in Recommendation X.411 (1984).

C.1.1.1 Size constraints

Constraints to limit the length of string types, the number of items in a SET OF or SEQUENCE OF type, and the value range of INTEGER types have been placed on all parameters defined in Recommendation X.411 (1984) with the exception of the message **content**.

NOTE – The actual values of the constraints are not a normative part of ISO/IEC 10021-4.

C.1.1.2 Changes to Fundamental types

The parameters **OR-name**, **content-type**, **encoded-information-types** and **content**, which occur in various places in the operation arguments and results, have been extended, as described below.

C.1.1.2.1 OR-name

Two new optional parameters have been added to **OR-name**.

The first of these is a set of **extension-attributes** that provide the means of using the teletex character set for the **standard-** and **domain-defined-attributes**, of specifying a **postal-OR-address** for physical delivery, and of specifying a **terminal-address** from an **extended-network-address**.

The second of these is a **directory-name**, as defined in ITU-T Rec. X.501 | ISO/IEC 9594-2.

If only **standard-**, **domain-defined-** or **extension-attributes** are present, then the **OR-name** constitutes an **OR-address**. Otherwise, a **directory-name** is also present. If a **directory-name** alone is present, it may be necessary to map the **directory-name** to an **OR-address** (e.g. using the Directory).

C.1.1.2.2 Content-type

The option of identifying the **content-type** with an object identifier instead of an integer has been added. It is the preferred method of identifying new **content-types**, and the assignment of new integer values is discouraged. Three new values have been defined for the integer choice: **unidentified**, **external** and **interpersonal-messaging-1988**.

C.1.1.2.3 Encoded-information-types

The option of specifying a set of external **encoded-information-types** has been added. All new **encoded-information-types** will be added as object identifiers.

The **non-basic-parameters** for the **g4-class-1** and **mixed-mode** types have been removed.

C.1.1.2.4 Content

The **content** of a message is still of type OCTET STRING. If the **content-type** is identified by the integer value **external**, the **content** is termed an **external-content**. The value of the OCTET STRING for an **external-content** shall be the ASN.1 encoding of an EXTERNAL.

C.1.1.3 Extensions

Most of the extensions to the MTS Abstract Service defined in ITU-T Rec. X.411 | ISO/IEC 10021-4 are accommodated in the protocol by the addition of a single new parameter **extensions** into the operation envelopes and results. The parameter is absent when no extensions are required. It may be present in the:

- **Message-submission-envelope**, on a per-message and per-recipient basis;
- **Message-submission-result**;
- **Probe-submission-envelope**, on a per-probe and per-recipient basis;
- **Probe-submission-result**;
- **Message-delivery-envelope**; and
- **Report-delivery-envelope**, on a per-report and per-recipient basis.

C.1.1.4 Bind

In Recommendation X.411 (1984), credentials of type ANY are exchanged using the bind argument and result. The type of the ANY is restricted in this Protocol Specification to a choice of **simple-credentials** (either an IA5String or an OCTET STRING), or **strong-credentials** based on cryptographic techniques.

An optional parameter to specify a **security-context** has been added to the argument. A new error has been added to indicate an **unacceptable-security-context**.

C.1.1.5 Message-submission

The **original-encoded-information-types** and **explicit-conversion** parameters in the **message-submission-envelope** have been made optional.

Two new errors have been added: **inconsistent-request** and **security-error**.

C.1.1.6 Probe-submission

As for Message-submission – see C.1.1.5.

C.1.1.7 Cancel-deferred-delivery

This operation is virtually unchanged with the exception of the size constraints described in C.1.1.1 and the removal of the messageTransferred error (subsumed by Deferred-delivery-cancellation-rejected).

C.1.1.8 Submission-control

An optional parameter **permissible-security-context** has been added to the argument.

An optional parameter **waiting-content-types** has been added to the result to specify the **content-types** of any waiting messages held due to prevailing controls. The indicator **other-security-labels** has been added to the **waiting-messages** parameter of the result.

An error has been added: **security-error**.

C.1.1.9 Message-delivery

The **original-encoded-information-types** and **delivery-flags** parameters have been made optional in the **message-delivery-envelope**, and an optional parameter **content-identifier** has been added to it.

The operation has been made confirmed by adding a RESULT clause, which contains two optional security parameters: **recipient-certificate** and **proof-of-delivery**.

One new error has been added: **security-error**.

C.1.1.10 Report-delivery

Two new optional parameters have been added to the **report-delivery-envelope**: the **content-type** and the **original-encoded-information-types** of the original message.

Four new **non-delivery-reason-codes** and 36 new **non-delivery-diagnostic-codes** have been defined.

Five new values of the **type-of-MTS-user** parameter have been added: **message-store**, **distribution-list**, **physical-delivery-access-unit**, **physical-recipient** and **other**.

The operation has been made confirmed by adding a RESULT clause (which conveys no parameters).

One new error has been added: **security-error**.

C.1.1.11 Delivery-control

Two new optional control parameters have been added to the argument: **permissible-content-types** and **permissible-security-context**.

An optional **waiting-content-types** parameter has been added to the result.

Two new errors have been added: **control-violates-registration** and **security-error**.

C.1.1.12 Register

Two new optional parameters have been added to the argument: **deliverable-content-types** and **labels-and-redirections**.

The tags on the **restrict**, **permissible-operations** and **permissible-maximum-content-length** parameters of the **default-delivery-controls** have been altered. The **permissible-content-types** parameter has been added.

C.1.1.13 Change-credentials

The possible types supplied for the credentials in this operation have been restricted, as described in C.1.1.4. The relationship between the types supplied for the **old-credentials** and **new-credentials** has also been restricted (to be of the same type).

C.1.2 MTS Transfer Protocol (P1) differences

This subclause identifies the differences between the MTS Transfer Protocol (P1) defined in this Protocol Specification and the P1 protocol defined in Recommendation X.411 (1984).

The following changes to the MTS Transfer Protocol (P1) are the same as those defined for the MTS Access Protocol (P3): size constraints (see C.1.1.1), changes to fundamental types (see C.1.1.2) and bind (see C.1.1.4).

The following subclauses detail other changes to the MTS Transfer Protocol (P1).

C.1.2.1 Extensions

The new parameter **extensions** is used to include most of the abstract-service extensions to the MTS Transfer Protocol (P1) (see C.1.1.3). The parameter is absent when no extensions are required. It may be present in the:

- **Message-transfer-envelope**, on a per-message and per-recipient basis;
- **Probe-transfer-envelope**, on a per-probe and per-recipient basis;
- **Report-transfer-envelope**;
- **Report-transfer-content**, on a per-report and per-recipient basis.

C.1.2.2 Other differences

Two optional parameters have been added to the per-report transfer fields of the **report-transfer-envelope**: **original-encoded-information-types** and **content-type**.

An optional **private-domain-identifier** has been added to the **per-domain-bilateral-information** parameter of the **message-** and **probe-transfer-envelopes**. This permits **per-domain-bilateral-information** to be sent to PRMDs as well as ADMDs.

An optional **other-actions** parameter has been added to the elements of **trace-information**. The new parameter conveys two flags: **redirected** to indicate that the message was redirected by that MD, and **dl-operation** to indicate that the MD expanded a distribution-list.

C.2 Changes introduced in the 1994 MHS protocols

The ASN.1 has been revised to replace the use of the MACRO notation with use of information object class specification, in accordance with the 1994 version of ITU-T Rec. X.680 | ISO/IEC 8824-1.

C.2.1 MTS Access Protocol (P3) differences

This subclause identifies the differences between the MTS Access Protocol (P3) defined in this Protocol Specification, and the P3 protocol defined in CCITT Rec. X.419 (1988, 1992) and ISO/IEC 10021-6:1990.

Four new application-contexts have been introduced to accommodate the changes made to the Delivery-control and Register operations.

C.2.1.1 Delivery-control

The Delivery-control operation has been substantially revised. The original version has been renamed the Delivery-control-88 operation.

The **permissible-encoded-information-types** parameter has been changed to allow acceptable, exclusively acceptable and unacceptable EITs to be specified. An optional **extensions** parameter has been added to the argument and result of the operation.

C.2.1.2 Register

The Register operation has been substantially revised. The original version has been renamed the Register-88 operation.

The **deliverable-encoded-information-types**, **deliverable-maximum-content-length**, and **deliverable-content-types** parameters have been replaced by the **deliverable-class** parameter, and the **labels-and-redirections** parameter has been replaced by the **redirections** parameter. A **restricted-delivery** parameter has been added. An optional **extensions** parameter has been added to the argument and result of the operation.

C.2.1.3 Extensions

Further extensions to the MTS Abstract Service have been accommodated by the addition of an extensions parameter to the following operation arguments and results:

- MTS-bind-argument, MTS-bind-result;
- Probe-submission-result;
- Message-delivery-result;
- Report-delivery-result;
- Delivery-control-argument, Delivery-control-result;
- Register-argument, Register-result.

C.2.2 MS Access Protocol (P7) differences

This subclause identifies the differences between the MS Access Protocol (P7) defined in this Protocol Specification, and the P7 protocol defined in CCITT Rec. X.419 (1988, 1992) and ISO/IEC 10021-6:1990.

Two new application-contexts have been introduced to accommodate the changes made to the MS Access Protocol. These changes are documented in Annex F of ITU-T Rec. X.413 (1995) | ISO/IEC 10021-5:1996.

Annex D

Differences between ISO/IEC 10021-6 and ITU-T Recommendation X.419

(This annex does not form an integral part of this Recommendation | International Standard)

This annex identifies the technical differences between ITU-T Rec. X.419 and ISO/IEC 10021-6.
They are:

– In ITU-T Rec. X.419, requirements are made for the support of lower layer services (see 6.4.5 and 11.3.4). In ISO/IEC 10021-6, these requirements are omitted.