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CCITT

THE INTERNATIONAL
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CONSULTATIVE COMMITTEE

X.419

(09/92)

DATA COMMUNICATION NETWORKS

MESSAGE HANDLING SYSTEMS – PROTOCOL SPECIFICATIONS

Recommendation X.419

FOREWORD

The CCITT (the International Telegraph and Telephone Consultative Committee) is a permanent organ of the International Telecommunication Union (ITU). CCITT is responsible for studying technical, operating and tariff questions and issuing Recommendations on them with a view to standardizing telecommunications on a worldwide basis.

The Plenary Assembly of CCITT which meets every four years, establishes the topics for study and approves Recommendations prepared by its Study Groups. The approval of Recommendations by the members of CCITT between Plenary Assemblies is covered by the procedure laid down in CCITT Resolution No. 2 (Melbourne, 1988).

Recommendation X.419 was revised by Study Group VII and was approved under the Resolution No. 2 procedure on the 10th of September 1992.

CCITT NOTE

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

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INTRODUCTION

This Recommendation is one of a set of Recommendations 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 Recommendation was developed jointly by CCITT and ISO/IEC. The equivalent ISO/IEC document is ISO/IEC 10021-6:1990 as modified by Technical Corrigendum 1, 2, 3 and 4.

Recommendation X.419

MESSAGE HANDLING SYSTEMS — PROTOCOL SPECIFICATIONS

(revised 1992)

SECTION 1 — INTRODUCTION

1 Scope

This Recommendation 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 CCITT Rec. X.411 | ISO/IEC 10021-4.

This Recommendation 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 CCITT Rec. X.413 | ISO/IEC 10021-5.

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

Recommendation X.402 identifies 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.

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

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

Annex D identifies the technical differences between the ISO/IEC and CCITT versions of this Recommendation and ISO/IEC 10021-6.

2 Normative references

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

2.1 *Open Systems Interconnection*

This Recommendation cites the following OSI specifications:

— CCITT Recommendation X.217 (1988), *Association Control service definition for Open Systems Interconnection for CCITT applications*.

ISO 8649:1988, *Information processing systems — Open Systems Interconnection — Service definition for the Association Control Service Element.*

ISO 8822:1988, *Information processing systems — Open Systems Interconnection — Connection oriented presentation service definition.*

— CCITT Recommendation X.208 (1988), *Specification of Abstract Syntax Notation One (ASN.1).*

ISO/IEC 8824:1990, *Information technology — Open Systems Interconnection — Specification of Abstract Syntax Notation One (ASN.1).*

— 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.*

— CCITT Recommendation X.219 (1988), *Remote operations: Model, notation and service definition.*

ISO/IEC 9072-1:1989, *Information processing systems — Text communication — Remote operations — Part 1: Model, notation and service definition.*

— CCITT Recommendation X.229 (1988), *Remote operations: Protocol specification.*

ISO/IEC 9072-2:1989, *Information processing systems — Text communication — Remote operations — Part 2: Protocol specification.*

2.2 *Message Handling Systems*

This Recommendation cites the following Message Handling System specifications:

— CCITT Recommendation X.400 (1992), *Message handling systems: 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.*

ISO/IEC 10021-1:1990/Cor. 1:1991, *Information technology — Text communication — Message-Oriented Text Interchange Systems (MOTIS) — Part 1: System and service overview — Technical Corrigendum 1.*

ISO/IEC 10021-1:1990/Cor. 2:1991, *Information technology — Text communication — Message-Oriented Text Interchange Systems (MOTIS) — Part 1: System and service overview — Technical Corrigendum 2.*

ISO/IEC 10021-1:1990/Cor. 3:1992, *Information technology — Text communication — Message-Oriented Text Interchange Systems (MOTIS) — Part 1: System and service overview — Technical Corrigendum 3.*

ISO/IEC 10021-1:1990/Cor. 4:1992, *Information technology — Text communication — Message-Oriented Text Interchange Systems (MOTIS) — Part 1: System and service overview — Technical Corrigendum 4.*

— CCITT Recommendation X.402 (1992), *Message handling systems: Overall architecture.*

ISO/IEC 10021-2:1990, *Information technology — Text communication — Message-Oriented Text Interchange Systems (MOTIS) — Part 2: Overall architecture.*

ISO/IEC 10021-2:1990/Cor. 1:1991, *Information technology — Text communication — Message-Oriented Text Interchange Systems (MOTIS) — Part 2: Overall architecture — Technical Corrigendum 1.*

ISO/IEC 10021-2:1990/Cor. 2:1991, *Information technology — Text communication — Message-Oriented Text Interchange Systems (MOTIS) — Part 2: Overall architecture — Technical Corrigendum 2.*

ISO/IEC 10021-2:1990/Cor. 3:1992, *Information technology — Text communication — Message-Oriented Text Interchange Systems (MOTIS) — Part 2: Overall architecture — Technical Corrigendum 3.*

ISO/IEC 10021-2:1990/Cor. 4:1992, *Information technology — Text communication — Message-Oriented Text Interchange Systems (MOTIS) — Part 2: Overall architecture — Technical Corrigendum 4.*

ISO/IEC 10021-2:1990/Amd.1:1993, *Information technology — Text communication — Message-Oriented Text Interchange Systems (MOTIS) — Part 2: Overall architecture — Amendment 1: Representation of O/R Addresses for Human Usage.*

ISO/IEC 10021-2:1990/Amd. 2:1993, *Information technology — Text communication — Message-Oriented Text Interchange Systems (MOTIS) — Part 2: Overall architecture — Amendment 2: Minor Enhancements.*

ISO/IEC 10021-3:1990, *Information technology — Text communication — Message-Oriented Text Interchange Systems (MOTIS) — Part 3: Abstract service definition conventions.*

ISO/IEC 10021-3:1990/Cor.1:1992, *Information technology — Text communication — Message-Oriented Text Interchange Systems (MOTIS) — Part 3: Abstract service definition conventions — Technical Corrigendum 1.*

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

— CCITT Recommendation X.411 (1992), *Message handling systems: Message transfer system : Abstract service definition and procedures.*

ISO/IEC 10021-4:1990, *Information technology — Text communication — Message-Oriented Text Interchange Systems (MOTIS) — Part 4: Message transfer system: Abstract service definition and procedures.*

ISO/IEC 10021-4:1990/Cor. 1:1991, *Information technology — Text communication — Message-Oriented Text Interchange Systems (MOTIS) — Part 4: Message transfer system: Abstract service definition and procedures — Technical Corrigendum 1.*

ISO/IEC 10021-4:1990/Cor. 2:1991, *Information technology — Text communication — Message-Oriented Text Interchange Systems (MOTIS) — Part 4: Message transfer system: Abstract service definition and procedures — Technical Corrigendum 2.*

ISO/IEC 10021-4:1990/Cor. 3:1992, *Information technology — Text communication — Message-Oriented Text Interchange Systems (MOTIS) — Part 4: Message transfer system: Abstract service definition and procedures — Technical Corrigendum 3.*

ISO/IEC 10021-4:1990/Cor. 4:1992, *Information technology — Text communication — Message-Oriented Text Interchange Systems (MOTIS) — Part 4: Message transfer system: Abstract service definition and procedures — Technical Corrigendum 4.*

ISO/IEC 10021-4:1990/Amd. 1:1993, *Information technology — Text communication — Message-Oriented Text Interchange Systems (MOTIS) — Part 4: Message transfer system: Abstract service definition and procedures — Amendment 1: Minor Enhancements.*

— CCITT Recommendation X.413 (1992), *Message handling systems: Message store: Abstract service definition.*

ISO/IEC 10021-5:1990, *Information technology — Text communication — Message-Oriented Text Interchange Systems (MOTIS) — Part 5: Message store: Abstract service definition.*

ISO/IEC 10021-5:1990/Cor. 1:1991, *Information technology — Text communication — Message-Oriented Text Interchange Systems (MOTIS) — Part 5: Message store: Abstract service definition — Technical Corrigendum 1.*

ISO/IEC 10021-5:1990/Cor. 2:1991, *Information technology — Text communication — Message-Oriented Text Interchange Systems (MOTIS) — Part 5: Message store: Abstract service definition — Technical Corrigendum 2*.

ISO/IEC 10021-5:1990/Cor. 3:1992, *Information technology — Text communication — Message-Oriented Text Interchange Systems (MOTIS) — Part 5: Message store: Abstract service definition — Technical Corrigendum 3*.

ISO/IEC 10021-5:1990/Cor. 4:1992, *Information technology — Text communication — Message-Oriented Text Interchange Systems (MOTIS) — Part 5: Message store: Abstract service definition — Technical Corrigendum 4*.

— CCITT Recommendation X.420 (1992), *Message handling systems: Interpersonal messaging system*.

ISO/IEC 10021-7:1990, *Information technology — Text communication — Message-Oriented Text Interchange Systems (MOTIS) — Part 7: Interpersonal messaging system*.

ISO/IEC 10021-7:1990/Cor. 1:1991, *Information technology — Text communication — Message-Oriented Text Interchange Systems (MOTIS) — Part 7: Interpersonal messaging system — Technical Corrigendum 1*.

ISO/IEC 10021-7:1990/Cor. 2:1991, *Information technology — Text communication — Message-Oriented Text Interchange Systems (MOTIS) — Part 7: Interpersonal messaging system — Technical Corrigendum 2*.

ISO/IEC 10021-7:1990/Cor. 3:1992, *Information technology — Text communication — Message-Oriented Text Interchange Systems (MOTIS) — Part 7: Interpersonal messaging system — Technical Corrigendum 3*.

ISO/IEC 10021-7:1990/Cor. 4:1992, *Information technology — Text communication — Message-Oriented Text Interchange Systems (MOTIS) — Part 7: Interpersonal messaging system — Technical Corrigendum 4*.

ISO/IEC 10021-7:1990/Amd. 1:1992, *Information technology — Text communication — Message-Oriented Text Interchange Systems (MOTIS) — Part 7: Interpersonal messaging system — Amendment 1: Minor Enhancements*.

2.3 *Directory Systems*

This Recommendation cites the following Directory System specification:

— CCITT Recommendation X.501 (1988), *The Directory — Models*.

ISO/IEC 9594-2:1990, *Information technology — Open Systems Interconnection — The Directory — Part 2: Models*.

3 Definitions

Definitions are given in Recommendation X.402.

4 Abbreviations

Abbreviations are listed in Annexe E.

5 Conventions

This Recommendation uses the descriptive conventions described below.

5.1 *Terms*

Throughout this Recommendation 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.

5.2 *Abstract syntax definitions*

This Recommendation defines the abstract-syntax of the MHS protocols using the abstract syntax notation (ASN.1) defined in CCITT Rec. X.208 | ISO/IEC 8824 and the remote operations notation defined in CCITT Rec. X.219 | ISO/IEC 9072-1.

SECTION 2 — MESSAGE HANDLING SYSTEM ACCESS PROTOCOL SPECIFICATIONS

6 Overview of the MHS Access Protocols

6.1 *MHS Access Protocol Model*

Clause 6 of CCITT 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 CCITT 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 realised 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 (AE) 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 supported by three application-service-elements, each supporting a type of port paired between an MTS-user and the MTS in the abstract model. The Message Submission Service Element (MSSE) supports the services of the submission-port; the Message Delivery Service Element (MDSE) supports the services of the delivery-port; and the Message Administration Service Element (MASE) supports the services of the administration-port. The MSSE, MDSE and MASE are asymmetric-ASEs; that is, the MTS-user ASEs act as the consumer, and the MTS ASEs act as the supplier, of the MTS Abstract Service.

Similarly, access to the MS Abstract Service is supported by three application-service-elements: the Message Submission Service Element (MSSE) supports the indirect-submission-port; the Message Retrieval Service Element (MRSE) supports the services of the retrieval-port; and the Message Administration Service Element (MASE) supports 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, MDSE, MRSE and MASE 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, MDSE, MRSE and MASE, together with their supporting ASEs, defines the application-context of an application-association. Note that a single application-association may be used to support one or more port types paired between two objects in the abstract model.

Table 1/X.419 identifies the application-contexts defined in this Recommendation for the MTS Access Protocol and MS Access Protocol.

TABLE 1/X.419

MHS Access Protocol application contexts

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

X Present

– Absent

C Present with initiator the consumer

S Present with intiator the supplier

If the MTS Access Protocol (P3) is supported, then support for the **mts-access** and **mts-forced-access** application-contexts is mandatory for an MTA. If an MTA supports the **mts-reliable-access** application-context, it shall also support the **mts-forced-reliable-access**, and vice versa. Support for each of the MTS Access Protocol (P3) application-contexts is optional for an MTS-user.

If the MS Access Protocol (P7) is supported, then support for the **ms-access** application-context is mandatory for an MS, and support for the **ms-reliable-access** application-context is optional. Support for each of the MS Access Protocol (P7) application-contexts is optional for an MS-user.

Figure 1/X.419 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.

Similarly, Figure 2/X.419 models an application-context between an MS-user and the MS.

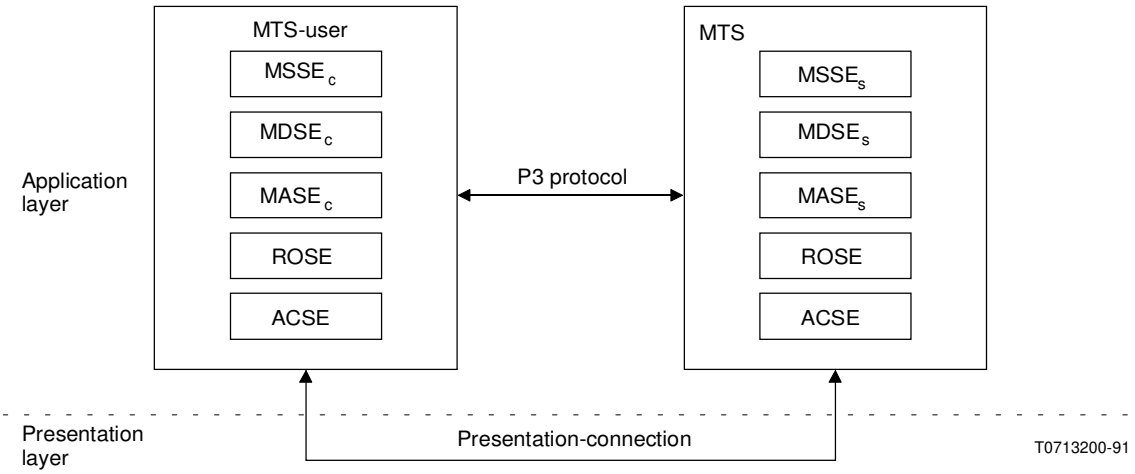


FIGURE 1/X.419

MTS access protocol model

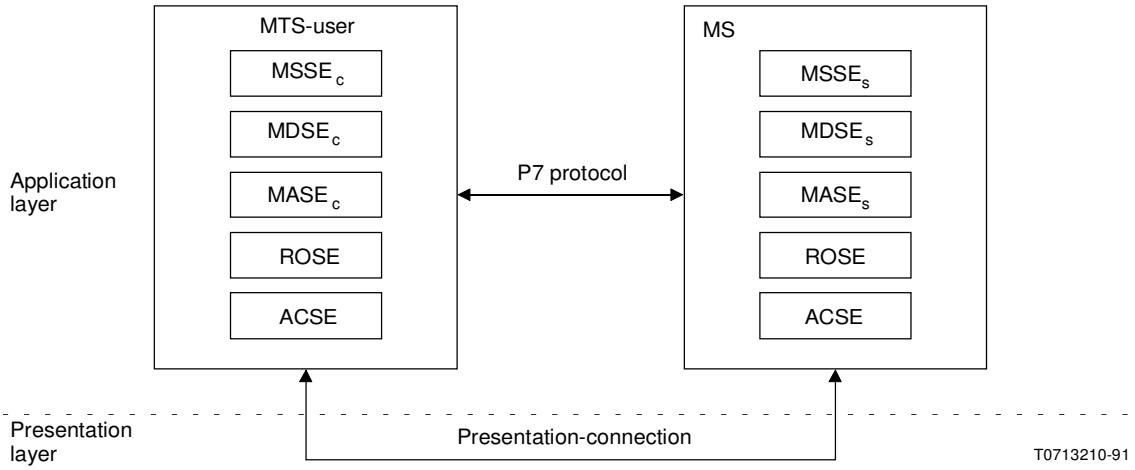


FIGURE 2/X.419

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 CCITT 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 (MDSE)

g) Message-delivery;

h) Report-delivery;

i) Delivery-control.

Message Administration Service Element (MASE)

j) Register;

k) 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 CCITT 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 (MRSE)

g) Summarize;

h) List;

i) Fetch;

j) Delete;

k) Register-MS;

l) Alert.

Message Administration Service Element (MASE)

m) Register;

n) 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 CCITT Rec. X.219 | ISO/IEC 9072-1.

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

The MSSE, MDSE, MRSE and MASE 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 Class 2 (asynchronous) operations.

6.4.2 *Use of RTSE services*

The Reliable Transfer Service Element (RTSE) is defined in CCITT Rec. X.218 | 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 minimises 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.

6.4.3 *Use of ACSE services*

The Association Control Service Element (ACSE) is defined in CCITT 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 CCITT Rec. X.216 | ISO 8822.

The Presentation Layer co-ordinates 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 Recommendation 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/E.164, or Recommendation X.200 (OSI NSAP-address).

7 MTS Access Protocol Abstract Syntax Definition

The abstract-syntax of the MTS Access Protocol (P3) is defined in Figure 3/X.419.

The abstract-syntax of the MTS Access Protocol (P3) is defined using the abstract syntax notation (ASN.1) defined in CCITT Rec. X.208 | ISO/IEC 8824, and the remote operations notation defined in CCITT Rec. X.219 | ISO/IEC 9072-1.

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

— *Prologue:* Declarations of the exports from, and imports to, the MTS Access Protocol (P3) module (Figure 3/X.419, Part 1).

— *Application Contexts:* Definitions of application-contexts that may be used between an MTS-user and the MTS (Figure 3/X.419, Parts 1 and 2).

— *Message Submission Service Element:* Definitions of the Message Submission Service Element (MSSE) and its remote operations and errors (Figure 3/X.419, Part 3).

— *Message Delivery Service Element:* Definitions of the Message Delivery Service Element (MDSE) and its remote operations and errors (Figure 3/X.419, Part 4).

— *Message Administration Service Element:* Definitions of the Message Administration Service Element (MASE) and its remote operations and errors (Figure 3/X.419, Part 4).

```
MTSAccessProtocol { joint-iso-ccitt mhs-motis(6) protocols(0) modules(0) mts-access-protocol(1) }

DEFINITIONS IMPLICIT TAGS ::=

BEGIN

-- Prologue

EXPORTS
        -- Application Service Elements
        mSSE, mDSE, mASE;

IMPORTS
        -- Application Service Elements and Application Contexts
        APPLICATION-SERVICE-ELEMENT, APPLICATION-CONTEXT, aCSE
                FROM Remote-Operations-Notation-extension { joint-iso-ccitt remote-operations(4)
                        notation-extension(2) }

        rTSE
                FROM Reliable-Transfer-APDUs { joint-iso-ccitt reliable-transfer(3) apdus(0) }

        -- MTS Abstract Service Parameters
        MTSBind, MTSUnbind, MessageSubmission, ProbeSubmission, CancelDeferredDelivery,
        SubmissionControl, MessageDelivery, ReportDelivery, DeliveryControl, Register,
        ChangeCredentials, SubmissionControlViolated, ElementOfServiceNotSubscribed,
        DeferredDeliveryCancellationRejected, OriginatorInvalid, RecipientImproperlySpecified,
        MessageSubmissionIdentifierInvalid, InconsistentRequest, SecurityError,
        UnsupportedCriticalFunction, RemoteBindError, DeliveryControlViolated, ControlViolatesRegistration,
        RegisterRejected, NewCredentialsUnacceptable, OldCredentialsIncorrectlySpecified
                FROM MTSAbstractService { joint-iso-ccitt mhs-motis(6) mts(3) modules(0)
                        mts-abstract-service(1) }

        -- Object Identifiers
        id-ac-mts-access, id-ac-mts-forced-access, id-ac-mts-reliable-access, id-ac-mts-forced-reliable-access,
        id-as-acse, id-as-msse, id-as-mdse, id-as-mrse, id-as-mase, id-as-mts, id-as-mts-rtse,
        id-ase-msse, id-ase-mdse, id-ase-mase
                FROM MHSProtocolObjectIdentifiers { joint-iso-ccitt mhs-motis(6) protocols(0)
                        modules(0) object-identifiers(0) };

-- Application Contexts omitting RTSE

-- MTS-user initiated

mts-access APPLICATION-CONTEXT
        APPLICATION SERVICE ELEMENTS { aCSE }
        BIND MTSBind
        UNBIND MTSUnbind
        REMOTE OPERATIONS { rOSE }
        INITIATOR CONSUMER OF { mSSE, mDSE, mASE }
        ABSTRACT SYNTAXES {
                id-as-acse,         -- of ACSE
                id-as-msse,         -- of MSSE, including ROSE
                id-as-mdse,         -- of MDSE, including ROSE
                id-as-mase,         -- of MASE, including ROSE
                id-as-mts           -- of MTSBind and MTSUnBind -- }
        ::= id-ac-mts-access
```

FIGURE 3/X.419 (part 1 of 4)

Abstract Syntax Definition of the MTS Access Protocol (P3)

```
-- MTS initiated

mts-forced-access APPLICATION-CONTEXT
        APPLICATION SERVICE ELEMENTS { aCSE }
        BIND MTSBind
        UNBIND MTSUnbind
        REMOTE OPERATIONS { rOSE }
        RESPONDER CONSUMER OF { mSSE, mDSE, mASE }
        ABSTRACT SYNTAXES {
                id-as-acse,          -- of ACSE
                id-as-msse,          -- of MSSE, including ROSE
                id-as-mdse,          -- of MDSE, including ROSE
                id-as-mase,          -- of MASE, including ROSE
                id-as-mts            -- of MTSBind and MTSUnBind -- }
        :: = id-ac-mts-forced-access

-- Application Contexts including RTSE in normal mode

-- MTS-user intitiated

mts-reliable-access APPLICATION-CONTEXT
        APPLICATION SERVICE ELEMENTS { aCSE, rTSE }
        BIND MTSBind
        UNBIND MTSUnbind
        REMOTE OPERATIONS { rOSE }
        INITIATOR CONSUMER OF { mSSE, mDSE, mASE }
        ABSTRACT SYNTAXES {
                id-as-acse,          -- of ACSE
                id-as-msse,          -- of MSSE, including ROSE
                id-as-mdse,          -- of MDSE, including ROSE
                id-as-mase,          -- of MASE, including ROSE
                id-as-mts-rtse       -- of MTSBind and MTSUnBind, including RTSE -- }
        ::= id-ac-mts-reliable-access

-- MTS initiated

mts-forced-reliable-access APPLICATION-CONTEXT
        APPLICATION SERVICE ELEMENTS { aCSE, rTSE }
        BIND MTSBind
        UNBIND MTSUnbind
        REMOTE OPERATIONS { rOSE }
        RESPONDER CONSUMER OF { mSSE, mDSE, mASE }
        ABSTRACT SYNTAXES {
                id-as-acse,          -- of ACSE
                id-as-msse,          -- of MSSE, including ROSE
                id-as-mdse,          -- of MDSE, including ROSE
                id-as-mase,          -- of MASE, including ROSE
                id-as-mts-rtse       -- of MTSBind and MTSUnbind, including RTSE -- }
        ::= id-ac-mts-forced-reliable-access
```

FIGURE 3/X.419 (part 2 of 4)

Abstract Syntax Definition of the MTS Access Protocol (P3)

```
-- Message Submission Service Element

mSSE APPLICATION-SERVICE-ELEMENT
        CONSUMER INVOKES {
                message-submission,
                probe-submission,
                cancel-deferred-delivery }
        SUPPLIER INVOKES {
                submission-control }
        ::= id-ase-msse

-- Remote Operations

message-submission MessageSubmission ::= 3

probe-submission ProbeSubmission ::= 4

cancel-deferred-delivery CancelDeferredDelivery ::= 7

submission-control SubmissionControl ::= 2

-- Remote Errors

submission-control-violated SubmissionControlViolated ::= 1

element-of-service-not-subscribed ElementOfServiceNotSubscribed ::= 4

deferred-delivery-cancellation-rejected DeferredDeliveryCancellationRejected ::= 8

originator-invalid OriginatorInvalid ::= 2

recipient-improperly-specified RecipientImproperlySpecified ::= 3

message-submission-identifier-invalid MessageSubmissionIdentifierInvalid ::= 7

inconsistent-request InconsistentRequest ::= 11

security-error SecurityError ::= 12

unsupported-critical-function UnsupportedCriticalFunction ::= 13

remote-bind-error RemoteBindError ::= 15
```

FIGURE 3/X.419 (part 3 of 4)

Abstract Syntax Definition of the MTS Access Protocol (P3)

```
-- Message Delivery Service Element

mDSE APPLICATION-SERVICE-ELEMENT
        CONSUMER INVOKES {
                delivery-control }
        SUPPLIER INVOKES {
                message-delivery,
                report-delivery }
        ::= id-ase-mdse

-- Remote Operations

message-delivery MessageDelivery ::= 5

report-delivery ReportDelivery ::= 6

delivery-control DeliveryControl ::= 2

-- Remote Errors

delivery-control-violated DeliveryControlViolated ::= 1

control-violates-registration ControlViolatesRegistration ::= 14

-- security-error ::= 12, defined in Part 3 of this Figure

-- unsupported-critical-function ::= 13, defined in Part 3 of this Figure

-- Message Administration Service Element

mASE APPLICATION-SERVICE-ELEMENT
        CONSUMER INVOKES {
                register,
                change-credentials }
        SUPPLIER INVOKES {
                change-credentials }
        ::= id-ase-mase

-- Remote Operations

register Register ::= 1

change-credentials ChangeCredentials ::= 8

-- Remote Errors

register-rejected RegisterRejected ::= 10

new-credentials-unacceptable NewCredentialsUnacceptable ::= 6

old-credentials-incorrectly-specified OldCredentialsIncorrectlySpecified ::= 5

END -- of MTSAccessProtocol
```

FIGURE 3/X.419 (part 4 of 4)

Abstract Syntax Definition of the MTS Access Protocol (P3)

8 MS Access Protocol Abstract Syntax Definition

The abstract-syntax of the MS Access Protocol (P7) is defined in Figure 4/X.419.

The abstract-syntax of the MS Access Protocol (P7) is defined using the abstract syntax notation (ASN.1) defined in CCITT Rec. X.208 | ISO/IEC 8824, and the remote operations notation defined in Recommendation X.219 | ISO/IEC 9072-1.

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

— *Prologue*: Declarations of the exports from, and imports to, the MS Access Protocol (P7) module (Figure 4/X.419 Part 1).

— *Application Contexts*: Definitions of application-contexts that may be used between an MS-user and an MS (Figure 4/X.419 Part 2).

— *Message Retrieval Service Element*: Definitions of the Message Retrieval Service Element (MRSE) and its remote operations and errors (Figure 4/X.419 Parts 2 and 3).

```
MSAccessProtocol { joint-iso-ccitt mhs-motis(6) protocols(0) modules(0) ms-access-protocol(2) }

DEFINITIONS IMPLICIT TAGS ::=

BEGIN

-- Prologue

EXPORTS
        mRSE;

IMPORTS
        -- Application Service Elements and Application Contexts
        APPLICATION-SERVICE-ELEMENT, APPLICATION-CONTEXT, aCSE
                FROM Remote-Operations-Notation-extension { joint-iso-ccitt remote-operations(4)
                        notation-extension(2) }

        rTSE
                FROM Reliable-Transfer-APDUs { joint-iso-ccitt reliable-transfer(3) apdus(0) }

        mASE, mSSE,
                FROM MTSAccessProtocol { joint-iso-ccitt mhs-motis(6) protocols(0)
                        modules(0) mts-access-protocol(1) }

        -- MS Abstract Service Parameters
        Alert, AttributeError, AutoActionRequestError, Delete, DeleteError,  Fetch, FetchRestrictionError,
        InvalidParameterError, List, MSBind, MSUnbind, RangeError, Register-MS,
        SequenceNumberError, ServiceError, Summarize,
                FROM MTSAbstractService (joint-iso-ccitt mhs-motis(6) mts(3) ms(4) modules(0)
                abstract-service(1))

        -- MTS Abstract Service Parameters
        Security Error
                FROM MTSAbstractService { joint-iso-ccitt mhs-motis(6) mts(3) modules(0) abstract-service(1) }

        -- Object Identifiers
        id-ac-ms-access, id-ac-ms-reliable-access, id-as-acse, id-as-msse, id-as-mrse, id-as-mase, id-as-ms,
        id-as-ms-rtse, id-ase-mrse
                FROM MHSProtocolObjectIdentifiers { joint-iso-ccitt mhs-motis(6) protocols(0)
                        modules(0) object-identifiers(0) };
```

FIGURE 4/X.419 (part 1 of 3)

Abstract Syntax Definition of the MS Access Protocol (P7)

```
-- Application Context omitting RTSE

ms-access APPLICATION-CONTEXT
        APPLICATION SERVICE ELEMENTS { aCSE }
        BIND MSBind
        UNBIND MSUnbind
        REMOTE OPERATIONS { rOSE }
        INITIATOR CONSUMER OF { mSSE, mRSE, mASE }
        ABSTRACT SYNTAXES {
                id-as-acse,          -- of ACSE
                id-as-msse,          -- of MSSE, including ROSE
                id-as-mrse,          -- of MRSE, including ROSE
                id-as-mase,          -- of MASE, including ROSE
                id-as-ms             -- of MSBind and MSUnbind -- }
        ::= id-ac-ms-access

-- Application Context including RTSE

ms-reliable-access APPLICATION-CONTEXT
        APPLICATION SERVICE ELEMENTS { aCSE, rTSE }
        BIND MSBind
        UNBIND MSUnbind
        REMOTE OPERATIONS { rOSE }
        INITIATOR CONSUMER OF { mSSE, mRSE, mASE }
        ABSTRACT SYNTAXES {
                id-as-acse,          -- of ACSE
                id-as-msse,          -- of MSSE, including ROSE
                id-as-mrse,          -- of MRSE, including ROSE
                id-as-mase,          -- of MASE, including ROSE
                id-as-ms-rtse        -- of MSBind  and MSUnbind, including RTSE -- }
        ::= id-ac-ms-reliable-access

-- Message Retrieval Service Element

mRSE APPLICATION-SERVICE-ELEMENT
        CONSUMER INVOKES {
                Summarize,
                list,
                fetch,
                delete,
                register-MS, }
        SUPPLIER INVOKES {
                alert }
        ::= id-ase-mrse

-- Remote Operations

summarize Summarize ::= 20

list List ::= 21

fetch Fetch ::= 22

delete Delete ::= 23

register-ms Register-MS ::= 24

alert Alert ::= 25
```

FIGURE 4/X.419 (part 2 to 3)

Abstract Syntax Definition of the MS Access Protocol (P7)

-- Remote Errors

attribute-error AttributeError ::= 21

auto-action-request-error AutoActionRequestError ::= 22

delete-error DeleteError ::= 23

fetch-restriction-error FetchRestrictionError ::= 24

range-error RangeError ::= 25

security-error SecurityError ::= 26

service-error ServiceError ::= 27

sequence-number-error SequenceNumberError ::= 28

invalid-parameters-error InvalidParametersError :: = 29

END *-- of MSAccessProtocol*

FIGURE 4/X.419 (part 3 of 3)

Abstract Syntax Definition of the MS Access Protocol (P7)

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.

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 Recommendation.

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 CCITT Rec. X.217 | ISO 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 clauses.

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 Recommendation that omit the RTSE in the A-ASSOCIATE request primitive (see Table 1/X.419).

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 CCITT Rec. X.219 | ISO/IEC 9072-1.

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, MDSE, MRSE and MASE 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 “Optimised 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 clause.

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, MDSE, MRSE and MASE 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 the MSSE, MDSE, MRSE and MASE onto the ROSE services is as defined in CCITT Rec. X.219 | ISO/IEC 9072-1.

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 Recommendation. No mappings are defined onto the RTSE in X.410-1984 mode. The RTSE is defined in CCITT Rec. X.218 | 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 clauses.

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 Recommendation that include the RTSE in normal mode in the RT-OPEN request primitive (see Table 1/X.419).

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 CCITT Rec. X.219 | ISO/IEC 9072-1.

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, MDSE and MASE 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 the MSSE, MDSE, MRSE and MASE onto the ROSE services is performed as defined in CCITT Rec. X.219 | ISO/IEC 9072-1.

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 CCITT Rec. X.229 | ISO/IEC 9072-2.

9.2.2.1 *Managing the Turn*

CCITT Rec. X.229 | ISO/IEC 9072-2 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/X.419 defines the values of the priority parameter of the RT-TURN-PLEASE service used by the ROSE to request the Turn.

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 ROIV APDU is prioritised as a function of the **priority** of the message — **urgent**, **normal** or **non-urgent**.

TABLE 2/X.419

Remote Operation Priorities

Priorities	MSSE	MDSE	MRSE	MASE
0	Assosciation release			
1	RO-REJECT-U RO-ERROR			
2	RO-RESULT			
3	Submission-control	Delivery-control		
4	Message-submission (urgent)	Message-delivery (urgent)	Alert	
5	Probe-submission	Report-delivery	RegisterMS Summarize List Fetch Delete	Register Change-credentials
6	Message-submission (normal)	Message-delivery (normal)		
7	Message-submission (non-urgent)	Message-delivery		

10 Conformance

A system (UA, MS, or MTA) claiming conformance to the MHS Access Protocols specified in this Recommendation shall comply with the requirements in 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 Recommendation for which conformance is claimed;

c) in the case of an MS, or a UA accessing an MS, the optional MS general-attribute-types and the MS general-auto-action-types for which conformance is claimed.

Conformance can be claimed to the MTS Access Protocol (P3), or the MS Access Protocol (P7), or both. Table 3/X.419 classifies the support for application-contexts required for conformance to the MTS Access Protocol (P3). Table 4/X.419 classifies the support for application-contexts required for conformance to the MS Access Protocol (P7).

TABLE 3/X.419

MTS Access Protocol Conformance Requirements

Application Context	MTA	MTS-user
MTS Access Protocol		
mts-access	Mandatory	Optional
mts-forced-access	Mandatory	Optional
mts-reliable-access	Optional (Note)	Optional
mts-forced-reliable-access	Optional (Note)	Optional

Note – If an MTA claims conformance to the mts-reliable-access application-context, it shall also claim conformance to the mts-forced-reliable-access application-context, and vice versa.

TABLE 4/X.419

MS Access Protocol Conformance Requirements

Application context	MS	MS-user
MS Access Protocol		
ms-access	Mandatory	Optional
ms-reliable-access	Optional	Optional

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 CCITT Rec. X.413 | ISO/IEC 10021-5 as well as the general-attribute-types classified as mandatory in Table 1 CCITT 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.

11 Overview of the MTS Transfer Protocol

11.1 *Model*

Clause 10 of CCITT Rec. X.411 | ISO/IEC 10021-4 refines the abstract model of the Message Transfer System (MTS), first presented in clause 6 of that Recommendation International Standard, 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 realised 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.

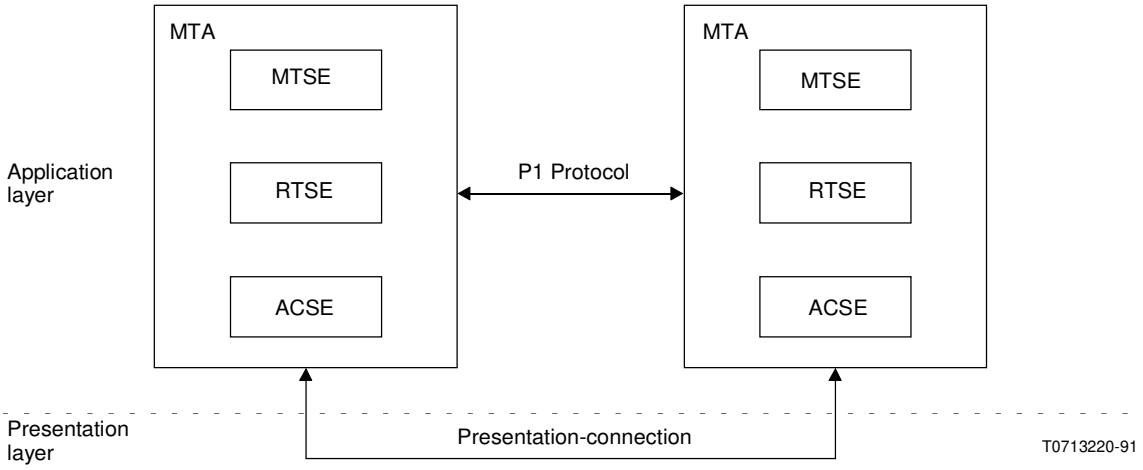
The transfer-port services of the abstract model are supported by an application-service-element the Message Transfer Service Element (MTSE), which in turn is supported by two other application-service-elements the Reliable Transfer Service Element (RTSE) and the Association Control Service Element (ACSE).

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/X.419 models the application-context between MTAs.



FIGUR E 5/X.419

MTS transfer protocol model

Three application-contexts are defined for the MTS Transfer Protocol as identified in Table 5/X.419.

Note — The following three paragraphs are taken from ISO/IEC 10021-6. They are included here for reference purposes only.

— **MTA type A** is capable of interworking with all other MTAs claiming conformance to ISO/IEC 10021-6, but will not interwork with MTAs in MDs claiming conformance to this Recommendation unless those MTAs implement the **mts-transfer** application-context. It is thus useful for intra-domain communication and direct communication with MTAs in other MDs claiming conformance to ISO/IEC 10021-6 (typically PRMDs), but not for direct communication with MDs which only claim conformance either to the 1984 Recommendation X.411 or to only the minimum conformance requirements of the 1988 Recommendation X.419 (typically ADMDs).

— **MTA type B** has the interworking capabilities of **MTA type A** and, additionally, is capable of interworking with any MD (typically ADMD) claiming conformance to this Recommendation.

— **MTA type C** has, in addition to the interworking capabilities of **MTA type A** and **MTA type B**, the capability to interwork with MDs implementing the 1984 X.400-Series Recommendations.

TABLE 5/X.419

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 Recommendation.

The **mts-transfer-protocol** is supported by the RTSE in X.410-1984 mode. Support for the **mts-transfer-protocol** is mandatory for conformance to this Recommendation.

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 CCITT Rec. X.411 | ISO/IEC 10021-4. The 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 mandatory for conformance to this Recommendation. A future version of this Recommendation will make support for **mts-transfer-protocol-1984** optional.

The interworking characteristics of the combinations of application-contexts permitted by the conformance requirements of the ISO/IEC International Standard and the CCITT Recommendations are summarised in Table 6/X.419. The permitted combinations are tabulated in Table 7/X.419.

TABLE 6/X.419

Interworking between ISO/IEC MOTIS and CCITT Rec. X.400

		CCITT		
		X.400 (1984)	X.400(1988) implementation excluding mts-transfer	X.400(1992) or X.400(1988) implementation including ACmts-transfer AC
MOTIS	MTA Type A	N	N	Y
	MTA Type B	N	Y	Y
	MTA Type C	Y	Y	Y

Y Guarantied interworking

N No guarantee of interworking

11.2 *Services Provided by the MTS Transfer Protocol*

The MTS Transfer Protocol (P1) provides the following services defined in CCITT 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 | 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 minimises 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 mandatory. Note that in ISO/IEC 10021-6, support for the RTSE in X.410-1984 mode is optional.

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.

11.3.2 *Use of the ACSE services*

The Association Control Service Element (ACSE) is defined in Recommendation X.217.

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 CCITT Rec. X.216 | ISO 8822.

The Presentation Layer co-ordinates 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/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/X.419

The abstract-syntax of the MTS Transfer Protocol (P1) is defined using the abstract-syntax notation (ASN.1) defined in CCITT Rec. X.208 | ISO/IEC 8824, and the remote operations notation defined in CCITT Rec. X.219 | ISO/IEC 9072-1.

The abstract-syntax definition of the MTS Transfer Protocol (P1) has the following major parts (Figure 6/X.419):

— *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.

— *Message Transfer Service Element*: Definitions of the Message Transfer Service Element (MTSE).

— *MTS Application Protocol Data Units*: Definitions of the MTS application-protocol-data-units (APDUs): Message, Probe and Report.

```
MTSTransferProtocol { joint-iso-ccitt mhs-motis(6) protocols(0) modules(0) transfer-protocol(3) }

DEFINITIONS IMPLICIT TAGS ::=

BEGIN

-- Prologue

EXPORTS;

IMPORTS
        -- Application Service Elements and Application Contexts
        APPLICATION-SERVICE-ELEMENT, APPLICATION-CONTEXT, aCSE
                FROM Remote-Operations-Notation-extension { joint-iso-ccitt remote-operations(4)
                        notation-extension(2) }

        rTSE
                FROM Reliable-Transfer-APDUs { joint-iso-ccitt reliable-transfer(3) apdus(0) }

        --MTA Transfer Port Abstract Service Parameters
        MTABind, MTAUnbind, Message, Probe, Report
                FROM MTAAbstractService { joint-iso-ccitt mhs-motis(6) mts(3) modules(0)
                        mta-abstract-service(2) }

        -- Object Identifiers
        id-ac-mts-transfer, id-as-acse, id-as-mta-rtse, id-as-mtse, id-ase-mtse
                FROM MHSProtocolObjectIdentifiers { joint-iso-ccitt mhs-motis(6) protocols(0)
                        modules(0) object-identifiers(0) }

-- Application Context including RTSE in normal mode

mts-transfer APPLICATION-CONTEXT
        APPLICATION SERVICE ELEMENTS { aCSE, rTSE, mTSE }
        BIND MTABind
        UNBIND MTAUnbind
        ABSTRACT SYNTAXES {
                id-as-acse,             -- of ACSE
                id-as-mts-rtse,         -- of MTABind and MTAUnbind, including RTSE
                id-as-mtse              -- of MTSE -- }
        ::= id-ac-mts-transfer

 -- Application Context including RTSE in X.410-1984)

mts-transfer-protocol INTEGER ::= 12

-- Application Context for Interworking with 1984 P1

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

--Message Transfer Service Element

mTSE APPLICATION-SERVICE-ELEMENT
        ::= id-ase-mtse

-- MTS Application Protocol Data Units

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

END -- of MTSTransferProtocol
```

FIGURE 6/X.419

Abstract Syntax Definition of the MTS Transfer Protocol (P1)

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

13.1 *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 mandatory for conformance to this Recommendation.

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 X.410-1984 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 (not used in X.410-1984 mode).

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 X.410-1984 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 *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").

13.1.1.1.2 *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.

13.1.1.1.3 *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".

13.1.1.2 *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.

13.1.2 *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 subclauses.

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

13.2 *Mapping onto RTSE normal mode*

This clause 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 Recommendation.

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 normal 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.

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 normal 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 *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".

13.2.1.1.2 *Application Context Name*

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

13.2.1.1.3 *User-data*

The mapping of the bind-operation of the MTA-bind service onto the User-data parameter of the RT-OPEN request primitive is defined in CCITT Rec. X.219 | ISO/IEC 9072-1.

13.2.1.1.4 *Presentation Context Definition List*

The initiator of the association supplies 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.

13.2.1.2 *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.

13.2.2 *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 normal mode is identical to the mapping in X.410-1984 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 normal mode is identical to managing the Turn in X.410-1984 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.

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

13.2.5 *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.

Note that the RT-U-ABORT service is not available in X.410-1984 mode.

14 Conformance

An MD claiming conformance to the MTS Transfer Protocol (P1) specified in this Recommendation 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 of this Recommendation 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 MD can act as the initiator, or the responder, or either the initiator or the responder, of an association.

Table 7/X.419 classifies the support for application-contexts required for conformance to the MTS Transfer Protocol (P1).

TABLE 7/X.419

MTS Transfer Protocol Conformance Requirements

Application Context	MOTIS MTA type			CCITT
	A	B	C	MD
MTS Transfer Protocol				
mts-transfer	Mandatory	Mandatory	Mandatory	Mandatory
mts-transfer-protocol	Optional	Mandatory	Mandatory	Mandatory
mts-transfer-protocol-1984	Optional	Optional	Mandatory	Mandatory

14.2 *Static Requirements*

The MD shall:

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

14.3 *Dynamic Requirements*

The MD shall:

a) conform to the procedures for distributed operation of the MTS defined in CCITT 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 both X.410-1984 mode and normal mode is mandatory .

c) conform to the rules for interworking with MDs conforming to Recommendation X.411 (1984) defined in Annex B;

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

ANNEX A

(to Recommendation X.419)

Reference Definition of MHS Protocol Object Identifiers

This annex defines for reference purposes various object identifiers cited in the ASN.1 modules in the body of this Recommendation. The object identifiers are assigned in Figure A-1/X.419.

All object identifiers that this Recommendation 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 Recommendation and are referenced in this annex.

```
MHSProtocolObjectIdentifiers { joint-iso-ccitt mhs-motis (6) protocols (0) modules(0)
object-identifiers(0) }

DEFINITIONS IMPLICIT TAGS ::=

BEGIN

-- Prologue
-- Exports Everything

IMPORT -- nothing --;

-- MHS Protocols

id-mhs-protocols OBJECT IDENTIFIER ::= (joint-iso-ccitt/mhs-motis(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

-- 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 OBJECT  IDENTIFIER ::= { id-ac 0 }

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

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

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

FIGURE A-1/X.419 (part 1 of 2)

Abstract Syntax Definition of MHS Protocol Object Identifiers

```
-- MS Access Protocol

id-ac-ms-access OBJECT IDENTIFIER ::= { id-ac 4 }

id-ac-ms-reliable-access OBJECT IDENTIFIER ::= { id-ac 5 }

-- MTS Transfer Protocol

id-ac-mts-transfer OBJECT IDENTIFIER ::= { id-ac 6 }

-- Abstract Syntaxes

id-as-acse OBJECT IDENTIFIER ::= { joint-iso-ccitt association-control(2) abstract-syntax(1) apdus(0)
version 1(1) }

id-as-msse OBJECT IDENTIFIER ::= { id-as 1 }

id-as-mdse OBJECT IDENTIFIER ::= { id-as 2 }

id-as-mrse OBJECT IDENTIFIER ::= { id-as 5 }

id-as-mase 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 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 }

--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/X.419 (part 2 of 2)

Abstract Syntax Definition of MHS Protocol Object Identifiers

ANNEX B

(to Recommendation X.419)

Interworking with 1984 Systems

This annex defines the rules to be obeyed by MDs claiming conformance to this Recommendation (hereafter referred to as "1988 systems") when interworking 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. Note that 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. Note that 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 CCITT 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 CCITT 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 CCITT 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** is a **numeric-OR-address** or a **terminal-OR-address** containing a **private-domain-name**, the **OR-address** cannot be downgraded.

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 **undefined** bit in **built-in-encoded-information-types**, and the object identifiers shall be deleted.

Any **non-basic-parameters** other than **g4-class-1** and **mixed-mode** types shall not be altered. Those for **g4-class-1** and **mixed-mode** may be transferred according to rules deduced from Recommendations T.73 (1984), T.400, T.501 and T.503; if this is not possible, downgrading shall fail.

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*

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.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. Note that 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

(to Recommendation X.419)

Differences between 1984 and 1988 MHS Protocols

This annex identifies the differences between the MTS Access Protocol (P3) and MTS Transfer Protocol (P1) defined in this Recommendation and the P3 and P1 protocols defined in Recommendation X.411 (1984). Differences of a purely editorial nature are not included here.

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 Recommendation X.411, in which every data type that has been changed is highlighted by means of underlining.

Subclause C.1 identifies the differences in the MTS Access Protocol (P3). Subclause C.2 identifies the additional differences in the MTS Transfer Protocol (P1).

C.1 *MTS Access Protocol (P3) Differences*

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

C.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.1.2 *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.1.2.1 *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 CCITT 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.1.2.2 *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.1.2.3 *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 definition of the **non-basic-parameters** for the **g4-class-1** and **mixed-mode** types has been amended in that the definition referenced in Recommendations T.400, T.501 and T.503 has changed from that previously referenced in Recommendation T.73 (1984), and in that it now uses explicit instead of implicit tagging.

C.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.1.3 *Extensions*

Most of the extensions to the MTS Abstract Service defined in CCITT 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.1.4 *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 Recommendation 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.1.5 *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.1.6 *Probe-submission*

As for Message-submission — see C.1.5.

C.1.7 *Cancel-deferred-delivery*

This operation is virtually unchanged with the exception of the size constraints described in C.1.1 and the removal of the messageTransferred error (subsumed by Deferred-delivery-cancellation-rejected).

C.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.1.9 *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.1.10 *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.1.11 *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.1.12 *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.1.13 *Change-credentials*

This possible types supplied for the credentials in this operation have been restricted, as described in C.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.2 *MTS Transfer Protocol (P1) Differences*

This subclause identifies the differences between the MTS Transfer Protocol (P1) defined in this Recommendation 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), changes to fundamental types (see C.1.2) and bind (see C.1.4).

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

C.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.1.3). 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.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.

ANNEX D

(to Recommendation X.419)

Differences between ISO/IEC 10021-6 and this Recommendation

This annex identifies the technical differences between the ISO/IEC and CCITT versions of the text of this Recommendation and ISO/IEC 10021-6 as they relate to the support of the MTS Transfer Protocol (P1).

They are:

1) In this Recommendation, it is a mandatory conformance requirement to have the capability to interwork with implementations of the Recommendation X.411 (1984) using the MTS Transfer Protocol (P1) (for ADMD — ADMD and ADMD — PRMD). In ISO/IEC 10021-6, the capability to interwork with 1984 systems is optional (for PRMD — PRMD and intra-domain).

2) In this Recommendation, support for the mapping of the MTS Transfer Protocol (P1) onto the RTSE in both X.410-1984 mode and normal mode is a mandatory conformance requirement. In ISO/IEC 10021-6, support for the mapping onto the RTSE in normal mode is mandatory; support for the mapping onto the RTSE in X.410-1984 mode is optional.

3) In this Recommendation, requirements are made for the support of lower layer services (see 11.3.4). In ISO/IEC 10021-6, these requirements are omitted.

ANNEX F

(to Recommendation X.419)

Alphabetical list of abbreviations used in this Recommendation

A/SYS	Access system
AC	Application context
ACSE	Association control service element
ADMD	Administration management domain
AE	Application-entity
APDU	Application protocol data unit
AS/SYS	Access and storage system
ASE	Application service element
ASN.1	Abstract syntax notation one
AST/SYS	Access, storage and transfer system
AT/SYS	Access and transfer system
AU	Access unit
C	Conditional
COMPUSEC	Computer security

D	Defaultable
DAP	Directory access protocol
DL	Distribution list
DSA	Directory system agent
EIT	Encoded information type
IA5	International Alphabet No. 5
M	Mandatory
MASE	Message administration service element
MD	Management domain
MDSE	Message delivery service element
MHE	Message handling environment
MHS	Message handling system
MRSE	Message retrieval service element
MS	Message store
MSSE	Message submission service element
MTA	Message transfer agent
MTS	Message transfer system
MTSE	Message transfer service element
O	Optional
O/R	Originator/recipient
OSI	Open systems interconnection
P1	Protocol 1
P3	Protocol 3
P7	Protocol 7
PDAU	Physical delivery access unit
PDS	Physical delivery system
PRMD	Private management domain
RO	Remote operation
ROSE	Remote operation service element
RT	Reliable transfer
RTSE	Reliable transfer service element
S/SYS	Storage system
ST/SYS	Storage and transfer system
T/SYS	Transfer system
UA	User agent
UE	User element