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Foreword

ISO (the International Organization for Standardization) and IEC (the International Electrotechnical Commission) form the specialized system for worldwide standardization. National bodies that are members of ISO or IEC participate in the development of International Standards through technical committees established by the respective organization to deal with particular fields of technical activity. ISO and IEC technical committees collaborate in fields of mutual interest. Other international organizations, governmental and non-governmental, in liaison with ISO and IEC, also take part in the work. In the field of information technology, ISO and IEC have established a joint technical committee, ISO/IEC JTC 1.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of the joint technical committee is to prepare International Standards. Draft International Standards adopted by the joint technical committee are circulated to national bodies for voting. Publication as an International Standard requires approval by at least 75 % of the national bodies casting a vote.

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ISO/IEC 10021-4 was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, Subcommittee SC 6, *Telecommunications and information exchange between systems,* in collaboration with ITU-T. The identical text is published as ITU-T Rec. X.411.

This third edition cancels and replaces the second edition (ISO/IEC 10021-4:1997), which has been technically revised. It also incorporates the Technical Corrigendum ISO/IEC 10021-4:1997/Cor. 1:1998.

ISO/IEC 10021 consists of the following parts, under the general title *Information technology — Message Handling Systems (MHS)*:

— *Part 1: System and service overview*

— *Part 2: Overall architecture*

— *Part 4: Message transfer system — Abstract service definition and procedures*

— *Part 5: Message store: Abstract service definition*

— *Part 6: Protocol specifications*

— *Part 7: Interpersonal messaging system*

— *Part 8: Electronic Data Interchange Messaging Service*

— *Part 9: Electronic Data Interchange Messaging System*

— *Part 10: MHS routing*

— *Part 11: MHS Routing — Guide for messaging systems managers* [Technical Report]

Introduction

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

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

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

This Service Definition was developed jointly by ITU-T and ISO/IEC. It is published as common text as ITU-T Rec. X.411 | ISO/IEC 10021-4.

INTERNATIONAL STANDARD ISO/IEC 10021-4
ITU-T RECOMMENDATION X.411

Information Technology – Message Handling Systems (Mhs) – Message Transfer System: Abstract Service Definition And Procedures

SECTION ONE – INTRODUCTION

1 Scope

This Recommendation | International Standard defines the abstract-service provided by the MTS (the MTS Abstract Service), and specifies the procedures to be performed by MTAs to ensure the correct distributed operation of the MTS.

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

Access to the MTS Abstract Service defined in this Recommendation | International Standard may be provided by the MTS Access Protocol (P3) defined in ITU-T Rec. X.419 | ISO/IEC 10021-6. The distributed operation of the MTS defined in this Recommendation | International Standard may be provided by the use of the MTS Transfer Protocol (P1) also defined in ITU-T Rec. X.419 | ISO/IEC 10021-6. The means by which messages may be routed through the MTS is specified in ISO/IEC 10021-10.

Section two of this Recommendation | International Standard defines the MTS Abstract Service. Clause 6 describes the Message Transfer System Model. Clause 7 provides an overview of the MTS Abstract Service. Clause 8 defines the semantics of the parameters of the MTS Abstract Service. Clause 9 defines the abstract-syntax of the MTS Abstract Service.

Section three of this Recommendation | International Standard defines the MTA Abstract Service. Clause 10 refines the model of the MTS, first presented in clause 6, to show that the MTS comprises a number of MTAs that interwork with one another to provide the MTS Abstract Service. Clause 11 provides an overview of the MTA Abstract Service. Clause 12 defines the semantics of the parameters of the MTA Abstract Service. Clause 13 defines the abstract-syntax of the MTA Abstract Service.

Section four of this Recommendation | International Standard specifies the procedures performed by MTAs to ensure the correct distributed operation of the MTS.

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

Annex B provides a reference definition of the upper bounds of the size constraints imposed upon variable length data types defined in ASN.1 modules in ITU-T Rec. X.411.

Annex C identifies the technical differences between the ISO/IEC and ITU-T versions of ITU-T Rec. X.411 and ISO/IEC 10021-4.

Annex D provides an index to this Recommendation | International Standard, categorised into: definitions of the MTS parameters; Abbreviations; Terms; ASN.1 modules; ASN.1 information object classes; ASN.1 types; and ASN.1 values.

2 Normative references

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

2.1 Open Systems Interconnection

This Service Definition cites the following OSI specifications:

- ITU-T Recommendation X.680 (1997) | ISO/IEC 8824-1:1998, *Information technology – Abstract Syntax Notation One (ASN.1) – Specification of Basic Notation*.
- ITU-T Recommendation X.681 (1997) | ISO/IEC 8824-2:1998, *Information technology – Abstract Syntax Notation One (ASN.1) – Information Object Specification*.
- ITU-T Recommendation X.682 (1997) | ISO/IEC 8824-3:1998, *Information technology – Abstract Syntax Notation One (ASN.1) – Constraint Specification*.
- ITU-T Recommendation X.683 (1997) | ISO/IEC 8824-4:1998, *Information technology – Abstract Syntax Notation One (ASN.1) – Parameterization of ASN.1 Specifications*.
- ITU-T Recommendation X.880 (1994) | ISO/IEC 13712-1:1995, *Information technology – Remote Operations – Concepts, Model and Notation*.

2.2 Message Handling Systems

This Service Definition cites the following Message Handling System specifications:

- ITU-T Recommendation F.400/X.400 (1999), *Message handling: System and service overview*.

  ISO/IEC 10021-1:2003, *Information technology – Message Handling Systems (MHS) – Part 1: System and service overview*.
- ITU-T Recommendation X.402 (1999) | ISO/IEC 10021-2:2003, *Information technology – Message Handling Systems (MHS) – Overall architecture*.
- ITU-T Recommendation X.413 (1999) | ISO/IEC 10021-5:1999, *Information technology – Message Handling Systems (MHS) – Message store: Abstract service definition*.
- ITU-T Recommendation X.419 (1999) | ISO/IEC 10021-6:2003, *Information technology – Message Handling Systems (MHS) – Protocol specifications*.
- ITU-T Recommendation X.420 (1999) | ISO/IEC 10021-7:2003, *Information technology – Message Handling Systems (MHS) – Interpersonal messaging system*.
- ITU-T Recommendation X.412 (1999) | ISO/IEC 10021-10:1999, *Information technology – Message Handling Systems (MHS) – MHS Routing*.
- CCITT Recommendation X.408 (1988), *Message handling systems: Encoded information type conversion rules*.

2.3 Directory Systems

This Service Definition cites the following Directory System specifications:

- ITU-T Recommendation X.500 (1997) | ISO/IEC 9594-1:1998, *Information technology – Open Systems Interconnection – The Directory – Overview of concepts, models, and services*.
- ITU-T Recommendation X.501 (1997) | ISO/IEC 9594-2:1998, *Information technology – Open Systems Interconnection – The Directory – Models*.
- ITU-T Recommendation X.509 (1997) | ISO/IEC 9594-8:1998, *Information technology – Open Systems Interconnection – The Directory – Authentication framework*.
- ITU-T Recommendation X.511 (1997) | ISO/IEC 9594-3:1998, *Information technology – Open Systems Interconnection – The Directory – Abstract service definition*.
- ITU-T Recommendation X.518 (1997) | ISO/IEC 9594-4:1998, *Information technology – Open Systems Interconnection – The Directory – Procedures for distributed operation*.
- ITU-T Recommendation X.519 (1997) | ISO/IEC 9594-5:1998, *Information technology – Open Systems Interconnection – The Directory – Protocol specifications*.
- ITU-T Recommendation X.520 (1997) | ISO/IEC 9594-6:1998, *Information technology – Open Systems Interconnection – The Directory – Selected attribute types*.
- ITU-T Recommendation X.521 (1997) | ISO/IEC 9594-7:1998, *Information technology – Open Systems Interconnection – The Directory – Selected object classes*.
- ITU-T Recommendation X.525 (1997) | ISO/IEC 9594-9:1998, *Information technology – Open Systems Interconnection – The Directory – Replication*.

– ITU-T Recommendation X.530 (1997) | ISO/IEC 9594-10:1998, *Information Technology – Open Systems Interconnection – The Directory: Use of systems management for administration of the Directory*.

2.4 Country Codes

This Service Definition cites the following Country Code specifications:

– ISO 3166-1:1997, *Codes for the representation of names of countries and their subdivisions – Part 1: Country codes*.

– ITU-T Recommendation X.121 (1996), *International numbering plan for public data networks*.

2.5 Telematic Services

This Service Definition cites the following Telematic Service specifications:

– CCITT Recommendation F.170 (1992), *Operational provisions for the international public facsimile service between public bureaux (bureaufax)*.

– ITU-T Recommendation T.30 (1993), *Procedures for document facsimile transmission in the general switched telephone network*.

3 Definitions

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

4 Abbreviations

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

5 Conventions

This Service Definition uses the descriptive conventions described below.

5.1 Terms

Throughout this Service Definition the words of defined terms and the names and values of the parameters of the MTS Abstract Service and the MTA Abstract Service, unless they are proper names, begin with a lower-case letter and are linked by a hyphen thus: defined-term. Proper names begin with an upper-case letter and are not linked by a hyphen thus: Proper Name. The names and values of the parameters of the MTS Abstract Service and the MTA Abstract Service (including components of OR address defined in ISO/IEC 10021-2) are printed in **bold**.

5.2 Presence of Parameters

In the tables of parameters in clauses 8 and 12, the presence of each parameter is qualified as follows:

Mandatory (M): A mandatory parameter shall always be present.

Optional (O): An optional argument shall be present at the discretion of the invoker of the abstract-operation; an optional result shall be present at the discretion of the performer of the abstract-operation.

Conditional (C): A conditional parameter shall be present under the circumstances prescribed by this Service Definition.

Where a conditional parameter shall be present due to some action on the message, probe or report by the MTS, this is explicitly defined. The presence of other conditional parameters is dependent on the presence of those parameters in other abstract-operations (for example, the presence of a conditional argument of the Message-transfer abstract-operation is dependent on the presence of the same optional argument in the related Message-submission abstract-operation).

5.3 Abstract Syntax Definitions

This Service Definition defines the abstract-syntax of the MTS Abstract Service and the MTA Abstract Service using the abstract syntax notation (ASN.1) defined in ITU-T Rec. X.680 | ISO/IEC 8824-1, ITU-T Rec. X.681 |

ISO/IEC 8824-2, ITU-T Rec. X.682 | ISO/IEC 8824-3 and ITU-T Rec. X.683 | ISO/IEC 8824-4, and the abstract service definition conventions described in ITU-T Rec. X.402 | ISO/IEC 10021-2 which use the remote operations notation defined in ITU-T Rec. X.880 | ISO/IEC 13712-1.

Where there are changes implied to the protocols defined in CCITT Recommendation X.411 (1984), these are highlighted in the abstract syntax definitions by means of underlining.

Although the abstract syntax in this Service Definition contains extension markers, it has not been verified that these are present in all instances that would be required before Packed Encoding Rules could safely be used.

5.4 Interpretation of UTC Time values

Dates and times in the MHS protocols are represented using the ASN.1 *UTCTime* type which uses only two decimal digits to represent the year, leaving the century unspecified. Since MHS systems must deal with dates both in the past (e.g. submission times of old messages which may be held in local storage or forwarded) and in the future (expiry time, deferred delivery time), it is important to observe a standard convention to avoid inaccurate display or malfunction of the MHS when dates from different centuries are compared.

The two decimal digits give 100 different years that can be expressed; an implementation has to associate each of these values with a particular century. The chosen convention is that dates up to ten years prior to the current time and up to forty years ahead of the current time should be associated with the corresponding century, with the interpretation of the remaining 49 values being implementation dependent. For example, for a system operating in 1996 the values "86" to "99" are interpreted as 1986 to 1999 and the values "00" to "36" are interpreted as 2000 to 2036, and the values "37" to "85" are implementation dependent.

NOTE – This convention permits two possible implementation strategies. An implementation can choose a fixed interpretation of all the year values, such that the convention is satisfied throughout the expected life of the product, or it can interpret the dates dynamically, based on the current date, such that the implementation remains valid indefinitely. For example, an implementation could choose the fixed range 1970 to 2069 for the available values, meaning that the implementation would require revision if it is still in use by the year 2029.

SECTION TWO – MESSAGE TRANSFER SYSTEM ABSTRACT SERVICE

6 Message Transfer System Model

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*).

The MTS is described using an abstract model in order to define the services provided by the MTS as a whole – the MTS Abstract Service.

The MTS is modelled as an *object*, whose overall behaviour can be described without reference to its internal structure. The services provided by the MTS object are made available at *ports*. A type of port represents a particular view of the services provided by the MTS object.

A user of the MTS is also modelled as an object, which obtains the services provided by the MTS through a port which is paired with an MTS port of the same type.

A type of port corresponds to a set of *abstract-operations* which can occur at the port; those which can be performed by the MTS object (invoked by the MTS-user object), and those which can be invoked by the MTS object (performed by the MTS-user object).

A port may be symmetrical, in which case the set of operations performed by the MTS object may also be invoked by the MTS object, and vice versa. Otherwise, the port is asymmetrical, in which case the object is said to be the *supplier* or *consumer* with respect to the type of port. The terms *supplier* and *consumer* are used only to distinguish between the roles of a pair of ports in invoking or performing operations. The assignment of the terms is usually intuitive when one object is providing a service used by another object; the service object (e.g., the MTS) is usually regarded as being the *supplier*, and the user object (e.g., an MTS-user object) is usually regarded as being the *consumer*.

Before objects can invoke operations on one another, they must be bound into an abstract *association*. The binding of an association between objects establishes a relationship between the objects which lasts until the association is released. An association is always released by the initiator of the association. The binding of an association establishes the *credentials* of the objects to interact, and the *application-context* and *security-context* of the association. The *application-context* of an association may be one or more types of port paired between the two objects.

The model presented is abstract. That is, it is not always possible for an outside observer to identify the boundaries between objects, or to decide on the moment or the means by which operations occur. However, in some cases the abstract model will be *realised*. For example, a pair of objects which communicate through paired ports may be located in different open systems. In this case, the boundary between the objects is visible, the ports are exposed, and the operations may be supported by instances of OSI communication.

The MTS object supports ports of three different types: a *submission-port*, a *delivery-port* and an *administration-port*.

A submission-port enables an MTS-user to submit messages to the MTS for transfer and delivery to one or more recipient MTS-users, and to probe the ability of the MTS to deliver a subject-message.

A delivery-port enables an MTS-user to accept delivery of messages from the MTS, and to accept reports on the delivery or non-delivery of messages and probes.

An administration-port enables an MTS-user to change long term parameters held by the MTS associated with message delivery, and enables either the MTS or the MTS-user to change their *credentials* with one another.

A message submitted by one MTS-user via a submission-port will normally be delivered to one or more recipient MTS-users via delivery-ports. The originating MTS-user may elect to be notified of the delivery or non-delivery of a message via its delivery-port.

Figure 1 models the Message Transfer System (MTS).

Clause 7 provides an overview of the MTS Abstract Service.

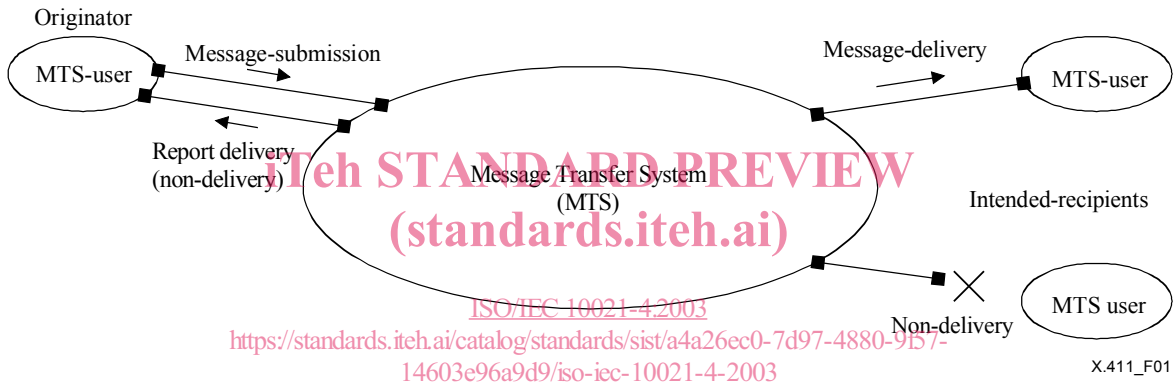

Figure 1 – Message Transfer System Model

7 Message Transfer System Abstract Service Overview

This Service Definition defines the following services that comprise the MTS Abstract Service:

MTS Bind and Unbind

a) MTS-bind

b) MTS-unbind

Submission Port Abstract Operations

c) Message-submission

d) Probe-submission

e) Cancel-deferred-delivery

f) Submission-control

Delivery Port Abstract Operations

g) Message-delivery

h) Report-delivery

i) Delivery-control

Administration Port Abstract Operations

j) Register

k) Change-credentials.

7.1 MTS Bind and Unbind

The **MTS-bind** enables either the MTS-user to establish an association with the MTS, or the MTS to establish an association with the MTS-user. Abstract-operations other than MTS-bind can only be invoked in the context of an established association.

The **MTS-unbind** enables the release of an established association by the initiator of the association.

7.2 Submission Port

The **Message-submission** abstract-operation enables an MTS-user to submit a message to the MTS for transfer and delivery to one or more recipient MTS-users.

The **Probe-submission** abstract-operation enables an MTS-user to submit a probe in order to determine whether or not a message could be transferred and delivered to one or more recipient MTS-users if it were to be submitted.

The **Cancel-deferred-delivery** abstract-operation enables an MTS-user to request cancellation of a message previously submitted (for deferred-delivery) by invocation of the Message-submission abstract-operation.

The **Submission-control** abstract-operation enables the MTS to constrain the use of the submission-port abstract-operations by the MTS-user.

The **Message-submission** and **Probe-submission** abstract-operations may cause subsequent invocation of the Report-delivery abstract-operation by the MTS.

7.3 Delivery Port

The **Message-delivery** abstract-operation enables the MTS to deliver a message to an MTS-user.

The **Report-delivery** abstract-operation enables the MTS to acknowledge to the MTS-user the outcome of a previous invocation of the Message-submission or Probe-submission abstract-operations. For the Message-submission abstract-operation, the Report-delivery abstract-operation indicates the delivery or non-delivery of the submitted message. For the Probe-submission abstract-operation, the Report-delivery abstract-operation indicates whether or not a message could be delivered if it were to be submitted. The Report-delivery abstract-operation may also convey a notification of physical-delivery by a PDS.

The **Delivery-control** abstract-operation enables an MTS-user to constrain the use of the delivery-port abstract-operations by the MTS.

7.4 Administration Port

The **Register** abstract-operation enables an MTS-user to change long term parameters of the MTS-user held by the MTS, associated with message delivery.

The **Change-credentials** abstract-operation enables either an MTS-user to change it's **credentials** with the MTS, or the MTS to change it's **credentials** with the MTS-user.

8 Message Transfer System Abstract Service Definition

This clause defines the semantics of the parameters of the MTS Abstract Service.

Clause 8.1 defines the MTS-bind and MTS-unbind. Clause 8.2 defines the submission-port. Clause 8.3 defines the delivery-port. Clause 8.4 defines the administration-port. Clause 8.5 defines some common parameter types.

The abstract-syntax of the MTS Abstract Service is defined in clause 9.

8.1 MTS-bind and MTS-unbind

This clause defines the MTS-bind and MTS-unbind used to establish and release associations between an MTS-user and the MTS.

8.1.1 Abstract-bind and Abstract-unbind

This clause defines the following abstract-bind and abstract-unbind operations:

a) MTS-bind

b) MTS-unbind.

8.1.1.1 MTS-bind

The MTS-bind enables an MTS-user to establish an association with the MTS, or the MTS to establish an association with an MTS-user.

The MTS-bind establishes the **credentials** of an MTS-user and the MTS to interact, and the **application-context** and security-context of the association. An association can only be released by the initiator of that association (using MTS-unbind).

Abstract-operations other than MTS-bind can only be invoked in the context of an established association.

The successful completion of the MTS-bind signifies the establishment of an association.

The disruption of the MTS-bind by a bind-error indicates that an association has not been established.

8.1.1.1.1 Arguments

Table 1 lists the arguments of the MTS-bind, and for each argument qualifies its presence and indicates the clause in which the argument is defined.

Table 1 – MTS-bind Arguments

Argument	Presence	Clause
Bind Arguments		
Initiator-name	M	8.1.1.1.1.1
Initiator-credentials	M	8.1.1.1.1.2
Security-context	O	8.1.1.1.1.3
Messages-waiting	O	8.1.1.1.1.4

8.1.1.1.1.1 Initiator-name

This argument contains a name for the initiator of the association. It shall be generated by the initiator of the association.

If the initiator is an MTS-user, the name is the **OR-name** of the MTS-user, which is registered with the MTS (see 8.4.1.1.1.1). The **initiator-name** shall contain the **OR-address**, and may optionally also contain the **directory-name**, of the MTS-user (**OR-address-and-optional-directory-name**). The **initiator-name** shall also indicate whether the initiator is a UA or an MS.

If the initiator is the MTS (or an MTA – see clause 11), the name is an **MTA-name**, which is known to the MTS-user.

8.1.1.1.1.2 Initiator-credentials

This argument contains the **credentials** of the initiator of the association. It shall be generated by the initiator of the association.

The **initiator-credentials** may be used by the responder to authenticate the identity of the initiator (see ITU-T Rec. X.509 | ISO/IEC 9594-8).

If only simple-authentication is used, the **initiator-credentials** comprise a simple **password** associated with the **initiator-name**.

If protected-authentication is used, the **initiator-credentials** comprise a **password** protected as described in clause 6 of ITU-T Rec. X. 509 | ISO/IEC 9594-8 (either Protected1 or Protected2) and optionally arguments for that protection process (time1, time2, random1 and random2) which derive their meaning by bilateral agreement. The description of protected-authentication in Annex H of ITU-T Rec. X.402 | ISO/IEC 10021-2 applies equally to MTS-bind (apart from the protected mechanism to change the password).

If strong-authentication is used, the **initiator-credentials** comprise an **initiator-bind-token** and, optionally, an **initiator-certificate** or **certificate-selector**.