

This is a preview - [click here to buy the full publication](#)

INTERNATIONAL STANDARD

ISO/IEC 10021-5

Fourth edition
1999-12-15

Information technology — Message Handling Systems (MHS): Message store: Abstract service definition

*Technologies de l'information — Systèmes de messagerie (MHS): Mémoire
de messages: Définition du service abstrait*

Reference number
ISO/IEC 10021-5:1999(E)



© ISO/IEC 1999

PDF disclaimer

This PDF file may contain embedded typefaces. In accordance with Adobe's licensing policy, this file may be printed or viewed but shall not be edited unless the typefaces which are embedded are licensed to and installed on the computer performing the editing. In downloading this file, parties accept therein the responsibility of not infringing Adobe's licensing policy. The ISO Central Secretariat accepts no liability in this area.

Adobe is a trademark of Adobe Systems Incorporated.

Details of the software products used to create this PDF file can be found in the General Info relative to the file; the PDF-creation parameters were optimized for printing. Every care has been taken to ensure that the file is suitable for use by ISO member bodies. In the unlikely event that a problem relating to it is found, please inform the Central Secretariat at the address given below.

© ISO/IEC 1999

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from either ISO at the address below or ISO's member body in the country of the requester.

ISO copyright office
Case postale 56 • CH-1211 Geneva 20
Tel. + 41 22 749 01 11
Fax + 41 22 749 09 47
E-mail copyright@iso.ch
Web www.iso.ch

Published by ISO in 2000

Printed in Switzerland

CONTENTS

	<i>Page</i>
SECTION 1 – GENERAL	1
1 Scope	1
2 Normative references	1
2.1 Reference Model references	2
2.2 Presentation references	2
2.3 Remote Operations references	2
2.4 Directory references	2
2.5 Message Handling references	2
3 Definitions	2
3.1 Common Definitions for MHS	2
3.2 Message Store Definitions	3
4 Abbreviations	6
5 Conventions	6
5.1 Conventions for abstract-services	6
5.2 Conventions for attribute-types used in Tables 2 and 3 of clause 11	7
5.3 Conventions for attribute-types used in Table 4 of clause 11	7
5.4 General font conventions	7
5.5 Font conventions for ASN.1 definitions	7
5.6 Rules for ASN.1 definitions	8
5.7 Conventions for previous editions of this Service Definition	8
5.8 ASN.1 Packed Encoding Rules	8
5.9 Interpretation of UTC Time values	8
SECTION 2 – MESSAGE STORE ABSTRACT-SERVICE DEFINITION	8
6 Message Store model	8
6.1 Message Store objects and contracts	9
6.2 Message Store ports	10
6.2.1 Retrieval Ports	10
6.2.2 MS-submission Ports	11
6.2.3 Administration Ports	11
6.3 Information model	11
6.3.1 Entry-classes	11
6.3.2 Entries	12
6.3.3 Attributes	12
6.3.3.1 Attribute-type	13
6.3.3.2 Attribute-values	13
6.3.3.3 The ATTRIBUTE information object class	13
6.3.4 Main-entries, parent-entries, and child-entries	14
6.3.5 Content-specific Attributes	14
6.3.6 Entry-types	15
6.3.7 Organization of entry-classes	15
6.3.7.1 The Stored-message entry-class	16
6.3.7.2 The Message-log entry-class	16
6.3.7.3 The Auto-action-log entry-class	17
6.3.7.4 Entry-class support	17
6.3.8 Retrieval-status	17

6.3.9	Matching-rules	18
6.3.9.1	Generic Matching Rules.....	18
6.3.9.2	Matching Rule definition	19
6.3.9.3	The MATCHING-RULE information object class.....	19
6.4	Message grouping.....	19
6.5	Auto-actions.....	20
6.5.1	The AUTO-ACTION information object class	20
6.5.2	Auto-action registration	21
6.5.3	Auto-action errors.....	21
6.5.4	Auto-action execution.....	21
6.6	MS extensions.....	22
7	MS-bind and MS-unbind operations.....	22
7.1	MS-bind abstract-operation.....	22
7.1.1	MS-bind-argument.....	22
7.1.2	MS-bind-result	24
7.1.3	MS-bind-error	26
7.2	MS-unbind abstract-operation.....	27
8	Abstract-operations.....	27
8.1	Common data-types used in abstract-operations	27
8.1.1	Range.....	27
8.1.2	Filters.....	28
8.1.2.1	Filter	28
8.1.2.2	Filter-item	28
8.1.2.3	Attribute-value-assertion.....	29
8.1.3	Selector	29
8.1.4	Entry-information-selection	30
8.1.5	Entry-information	31
8.1.6	MS-submission-options	31
8.1.7	Common-submission-results	33
8.2	Retrieval Port abstract-operations	33
8.2.1	Summarize abstract-operation	34
8.2.1.1	Summarize-argument.....	34
8.2.1.2	Summarize-result.....	34
8.2.1.3	Summarize abstract-errors	35
8.2.2	List abstract-operation	35
8.2.2.1	List-argument	35
8.2.2.2	List-result	36
8.2.2.3	List abstract-errors.....	36
8.2.3	Fetch abstract-operation.....	36
8.2.3.1	Fetch-argument.....	36
8.2.3.2	Fetch-result	37
8.2.3.3	Fetch abstract-errors	37
8.2.4	Delete abstract-operation	37
8.2.4.1	Delete-argument.....	38
8.2.4.2	Delete-result.....	38
8.2.4.3	Delete abstract-errors.....	38
8.2.5	Register-MS abstract-operation.....	38
8.2.5.1	Register-MS-argument.....	39
8.2.5.2	Register-MS-result.....	43
8.2.5.3	Register-MS abstract-errors	43
8.2.6	Alert abstract-operation	43
8.2.6.1	Alert-argument	44
8.2.6.2	Alert-result.....	44
8.2.6.3	Alert abstract-errors.....	44
8.2.7	Modify abstract-operation.....	44
8.2.7.1	Modify-argument.....	44
8.2.7.2	Modify-result.....	46
8.2.7.3	Modify Abstract-errors	46

	<i>Page</i>
8.3 MS-submission Port abstract-operations	46
8.3.1 MS-message-submission abstract-operation	46
8.3.1.1 MS-message-submission-argument	47
8.3.1.2 MS-message-submission-result	47
8.3.1.3 MS-message-submission Abstract-errors.....	47
8.3.2 MS-probe-submission abstract-operation.....	48
8.3.2.1 MS-probe-submission-argument	48
8.3.2.2 MS-probe-submission-result	48
8.3.2.3 MS-probe-submission Abstract-errors.....	48
8.3.3 MS-cancel-deferred-delivery abstract-operation	48
8.3.4 MS-submission-control abstract-operation	49
9 Abstract-errors.....	49
9.1 Error precedence	49
9.2 Attribute-error	49
9.3 Auto-action-request-error	50
9.4 Delete-error.....	50
9.5 Fetch-restriction-error.....	51
9.6 Invalid-parameters-error	51
9.7 Range-error.....	52
9.8 Security-error.....	52
9.8.1 Security-error for Register-MS abstract-operation	52
9.8.2 Security-error for Delete, Fetch, List, Modify and Summarize abstract-operations	52
9.8.3 Security-error for MS-probe-submission and MS-message-submission abstract-operations	52
9.9 Sequence-number-error	53
9.10 Service-error	53
9.11 Message-group-error	53
9.12 MS-extension-error	54
9.13 Register-MS-error	54
9.14 Old-credentials-incorrectly-specified	55
9.15 New-credentials-unacceptable	55
9.16 Modify-error	55
9.17 Entry-class-error.....	55
SECTION 3 – GENERAL-ATTRIBUTE-TYPES, MATCHING-RULES AND AUTO-ACTION-TYPES.....	56
10 Overview.....	56
11 General-attribute-types	56
11.1 General-attribute-types overview	56
11.1.1 MS support requirements for general-attribute-types	59
11.1.2 MS-user support requirements for general-attribute-types	59
11.2 Description of the general-attribute-types.....	59
11.2.1 AC-correlated-report-list.....	59
11.2.2 AC-report-subject-entry.....	60
11.2.3 AC-report-summary.....	60
11.2.4 AC-uncorrelated-report-list.....	61
11.2.5 Auto-action-error.....	61
11.2.6 Auto-action-registration-identifier.....	62
11.2.7 Auto-action-subject-entry	62
11.2.8 Auto-action-type.....	62
11.2.9 Certificate-selectors	62
11.2.10 Child-sequence-numbers.....	62
11.2.11 Content.....	62
11.2.12 Content-confidentiality-algorithm-identifier	63
11.2.13 Content-correlator.....	63
11.2.14 Content-identifier	63
11.2.15 Content-integrity-check	63
11.2.16 Content-length.....	63

	<i>Page</i>
11.2.17 Content-returned.....	64
11.2.18 Content-type.....	64
11.2.19 Conversion-with-loss-prohibited.....	64
11.2.20 Converted-EITs.....	64
11.2.21 Creation-time.....	64
11.2.22 Deferred-delivery-cancellation-time.....	64
11.2.23 Deferred-delivery-time.....	65
11.2.24 Deletion-time.....	65
11.2.25 Delivered-EITs.....	65
11.2.26 Delivery-flags.....	65
11.2.27 DL-exempted-recipients.....	65
11.2.28 DL-expansion-history.....	66
11.2.29 DL-expansion-prohibited.....	66
11.2.30 Entry-type.....	66
11.2.31 Internal-trace-information.....	66
11.2.32 Latest-delivery-time.....	66
11.2.33 Locally-originated.....	66
11.2.34 Marked-for-deletion.....	67
11.2.35 Message-delivery-envelope.....	67
11.2.36 Message-delivery-time.....	67
11.2.37 Message-group-name.....	67
11.2.38 Message-identifier.....	67
11.2.39 Message-notes.....	68
11.2.40 Message-origin-authentication-check.....	68
11.2.41 Message-security-label.....	68
11.2.42 Message-submission-envelope.....	68
11.2.43 Message-submission-time.....	68
11.2.44 Message-token.....	68
11.2.45 MS-originated.....	69
11.2.46 MS-submission-error.....	69
11.2.47 Multiple-originator-certificates.....	69
11.2.48 Original-EITs.....	69
11.2.49 Originally-intended-recipient-name.....	69
11.2.50 Originating-MTA-certificate.....	70
11.2.51 Originator-certificate.....	70
11.2.52 Originator-name.....	70
11.2.53 Originator-report-request.....	70
11.2.54 Originator-return-address.....	70
11.2.55 Other-recipient-names.....	70
11.2.56 Parent-sequence-number.....	71
11.2.57 Per-message-indicators.....	71
11.2.58 Per-recipient-message-submission-fields.....	71
11.2.59 Per-recipient-probe-submission-fields.....	71
11.2.60 Per-recipient-report-delivery-fields.....	71
11.2.61 Priority.....	71
11.2.62 Probe-origin-authentication-check.....	72
11.2.63 Probe-submission-envelope.....	72
11.2.64 Proof-of-delivery-request.....	72
11.2.65 Proof-of-submission.....	72
11.2.66 Recipient-certificate.....	72
11.2.67 Recipient-names.....	72
11.2.68 Recipient-reassignment-prohibited.....	73
11.2.69 Redirection-history.....	73
11.2.70 Report-delivery-envelope.....	73
11.2.71 Reporting-DL-name.....	73
11.2.72 Reporting-MTA-certificate.....	73
11.2.73 Report-origin-authentication-check.....	73
11.2.74 Retrieval-status.....	74
11.2.75 Security-classification.....	74
11.2.76 Sequence-number.....	74

11.2.77	Signature-verification-status	74
11.2.78	Storage-period	75
11.2.79	Storage-time	75
11.2.80	Subject-submission-identifier	76
11.2.81	This-recipient-name	76
11.2.82	Trace-information	76
11.3	The Attribute-table information object set	76
11.4	Generation of the general-attributes	76
11.5	Attribute-types subscription	76
11.6	General-attribute-types subject to modification	81
12	General matching-rules	81
12.1	MS-string syntax	81
12.2	String matching-rules	81
12.2.1	MS-string-match	82
12.2.2	MS-string-ordering-match	82
12.2.3	MS-substrings-match	82
12.2.4	MS-single-substring-match	83
12.2.5	MS-string-case-sensitive-match	83
12.2.6	MS-string-list-match	83
12.2.7	MS-string-list-elements-match	83
12.2.8	MS-single-substring-list-match	83
12.2.9	MS-single-substring-list-elements-match	84
12.3	Syntax-based matching-rules	84
12.4	Matching-rules for complex Message Store attributes	84
12.4.1	OR-address-match	84
12.4.2	OR-address-elements-match	85
12.4.3	OR-address-substring-elements-match	85
12.4.4	OR-name-match	86
12.4.5	OR-name-elements-match	86
12.4.6	OR-name-substring-elements-match	86
12.4.7	OR-name-single-element-match	86
12.4.8	Redirection-or-DL-expansion-match	87
12.4.9	Redirection-or-DL-expansion-elements-match	87
12.4.10	Redirection-or-DL-expansion-substring-elements-match	87
12.4.11	Redirection-or-DL-expansion-single-element-match	87
12.4.12	Redirection-reason-match	87
12.4.13	MTS-identifier-match	88
12.4.14	Content-correlator-match	88
12.4.15	Content-identifier-match	88
12.5	Matching-rule support	88
12.6	The Matching-rule-table information object set	88
13	General-auto-actions	89
13.1	Auto-alert	90
13.2	Auto-modify	91
13.3	Auto-correlate-reports	92
13.4	Auto-delete	92
SECTION 4 – PROCEDURES FOR MESSAGE STORE AND PORT REALIZATION		93
14	Overview	93
15	Consumption of the Message Transfer abstract-service	93
15.1	Consumption of the Delivery Port abstract-services	93
15.1.1	Performance of the Message-delivery abstract-operation	93
15.1.2	Performance of the Report-delivery abstract-operation	94
15.1.3	Invocation of the Delivery-control abstract-operation	94
15.1.4	Generation rules for general-attributes	95

15.2	Consumption of the Submission Port abstract-services	95
15.2.1	Invocation of the Message-submission abstract-operation	95
15.2.2	Invocation of the Probe-submission abstract-operation	95
15.2.3	Invocation of the Cancel-deferred-delivery abstract-operation	96
15.2.4	Performance of the Submission-control abstract-operation	96
15.3	Consumption of the Administration Port abstract-services	96
15.3.1	Invocation of the Register abstract-operation	96
15.3.2	Invocation of the Change-credentials abstract-operation	96
15.3.3	Performance of the Change-credentials abstract-operation	97
16	Supply of the Message Store abstract-service	97
16.1	Supply of the Retrieval Port abstract-services	97
16.1.1	Performance of the Summarize abstract-operation	97
16.1.2	Performance of the List abstract-operation	97
16.1.3	Performance of the Fetch abstract-operation	98
16.1.4	Performance of the Delete abstract-operation	98
16.1.5	Performance of the Register-MS abstract-operation	99
16.1.6	Performance of the Modify abstract-operation	99
16.1.7	Invocation of the Alert abstract-operation	100
16.2	Supply of the MS-submission Port abstract-services	100
16.2.1	Performance of the MS-message-submission abstract-operation	100
16.2.2	Performance of the MS-probe-submission abstract-operation	101
16.2.3	Performance of the MS-cancel-deferred-delivery abstract-operation	102
16.2.4	Invocation of the Submission-control abstract-operation	102
16.2.5	Generation rules for general-attributes	103
16.3	Supply of the Administration Port abstract-services	103
16.3.1	Performance of the Register abstract-operation	103
16.3.2	Invocation of the Change-credentials abstract-operation	103
16.3.3	Performance of the Change-credentials abstract-operation	103
17	Ports realization	104
17.1	Retrieval Port	104
17.2	MS-submission Port	104
17.3	Administration Port	104
Annex A – Formal assignment of Object Identifiers		105
Annex B – Formal definition of the Message Store abstract-service		108
Annex C – Formal definition of general-attribute-types		121
Annex D – Formal definition of general matching-rules		131
Annex E – Formal definition of general-auto-action-types		134
Annex F – Additional MS capabilities		136
F.1	Modify capability	136
F.2	Modify retrieval-status capability	136
F.3	Protected change credentials capability	136
Annex G – Summary of Changes to previous editions		137
G.1	Changes introduced in the 1994 edition	137
G.2	Minimum changes required for support of 1994 Application Contexts	138
Annex H – Formal definition of MS parameter upper bounds		139

Annex I – Message-grouping	140
H.1 Establishing a storage framework	140
H.2 Populating the storage framework	140
H.3 Interworking considerations	140
Annex J – Example of the Summarize abstract-operation	142
I.1 The entries in the example MS	142
I.2 An example of a request for summary	142
Annex K – Differences between ITU-T Rec. X.413 (1998) and ISO/IEC 10021-5:1999	143
INDEX	144

LIST OF FIGURES

Figure 1 – Message Store abstract-service	9
Figure 2 – The Components of an entry	12

LIST OF TABLES

Table 1 – Entry-types present in entry-classes	15
Table 2 – Message Store common general-attribute-types	57
Table 3 – General-attribute-types for the Auto-action-log entry-class	59
Table 4 – Generation of the General-attribute-types	77
Table 5 – Summary of general-auto-action registration and logging capabilities	90
Table I.1 – Stored-messages in the example	142
Table I.2 – Expected result from the Summarize abstract-operation	142

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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 3.

In the field of information technology, ISO and IEC have established a joint technical committee, ISO/IEC JTC 1. 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.

Attention is drawn to the possibility that some of the elements of this part of ISO/IEC 10021 may be the subject of patent rights. ISO and IEC shall not be held responsible for identifying any or all such patent rights.

International Standard ISO/IEC 10021-5 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 Recommendation X.413.

This fourth edition cancels and replaces the third edition (ISO/IEC 10021-5:1996), which has been technically revised. It also incorporates Amendment 1:1998 and Technical Corrigendum 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 3: Abstract Service Definition Conventions*
- *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: Guide for Messaging Systems Managers*

Annexes A to G form a normative part of this part of ISO/IEC 10021. Annexes H to K are for information only.

Introduction

This Service Definition is one of a series 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).

This Service Definition defines the Message Store abstract-service (MS abstract-service) which supports message-retrieval from a Message Store (MS) and message-submission through the MS in a Message Handling System (MHS). The MS abstract-service also provides message-administration services, as defined by the Message Transfer System (MTS) abstract-service.

This Service Definition has been produced by joint ITU-T – ISO/IEC agreement. It is published as common text as ITU-T Rec. X.413 | ISO/IEC 10021-5. Annex K lists the differences between ITU-T and ISO/IEC texts.

INTERNATIONAL STANDARD**ITU-T RECOMMENDATION****INFORMATION TECHNOLOGY – MESSAGE HANDLING SYSTEMS (MHS):
MESSAGE STORE: ABSTRACT SERVICE DEFINITION****SECTION 1 – GENERAL****1 Scope**

This Recommendation | International Standard defines the Message Store abstract-service. This abstract-service is provided by the Message Store access protocol (specified in ITU-T Rec. X.419 | ISO/IEC 10021-6) in conjunction with the MTS abstract-service (defined in ITU-T Rec. X.411 | ISO/IEC 10021-4), together with the Remote Operations Service Element (ROSE) services (defined in ITU-T Rec. X.219 | ISO/IEC 9072-1). The abstract-syntax for the application-layer protocols used in this Recommendation | International Standard is defined in ITU-T Rec. X.680 | ISO/IEC 8824-1.

Other Recommendations | parts of ISO/IEC 10021 define other aspects of the MHS. ITU-T Rec. F.400/X.400 | ISO/IEC 10021-1 defines the user-oriented services provided by the MHS. ITU-T Rec. X.402 | ISO/IEC 10021-2 provides an architectural overview of the MHS. ITU-T Rec. X.420 | ISO/IEC 10021-7 defines the abstract-service for Interpersonal Messaging and defines the format of Interpersonal Messages.

Section 2 of this Recommendation | International Standard contains the Message Store abstract-service definition. Clause 6 describes the MS model. Clause 7 defines the semantics and abstract-syntax of the MS-bind and the MS-unbind abstract-operations. Clause 8 defines the semantics and abstract-syntax of the operations of the MS abstract-service. Clause 9 defines the semantics and abstract-syntax of the errors of the abstract-service.

Section 3 of this Recommendation | International Standard defines the general-attribute-types, general-matching-rules, and general-auto-action-types related to the MS. Clause 10 contains an overview. Clause 11 defines the semantics and abstract-syntax of the general-attribute-types. Clause 12 defines the semantics and abstract-syntax of the general-matching-rules. Clause 13 defines the semantics and abstract-syntax of the general-auto-action-types.

Section 4 of this Recommendation | International Standard describes the procedures for Message Store and the ports realization. Clause 14 contains an overview. Clause 15 describes how the Message Transfer System abstract-service is consumed. Clause 16 describes how the Message Store abstract-service is supplied. Clause 17 describes how the MS ports are realized.

The requirements for conformance to this Recommendation | International Standard are stated in clause 10 of ITU-T Rec. X.419 | ISO/IEC 10021-6.

2 Normative references

The following Recommendations and International Standards contain provisions which, through reference in this text, constitute provisions of this Recommendation | International Standard. At the time of publication, the editions indicated were valid. All Recommendations and Standards are subject to revision, and parties to agreements based on this Recommendation | International Standard are encouraged to investigate the possibility of applying the most recent edition of the Recommendations and Standards listed below. Members of IEC and ISO 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 Reference Model references

This Recommendation | International Standard cites the following Reference Model specification:

- ITU-T Recommendation X.200 (1994) | ISO/IEC 7498-1: 1994, *Information technology – Open Systems Interconnection – Basic Reference Model: The Basic Model*.

2.2 Presentation references

This Recommendation | International Standard cites the following Presentation 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.690 (1997) | ISO/IEC 8825-1: 1998, *Information technology – ASN.1 encoding rules: Specification of Basic Encoding Rules (BER), Canonical Encoding Rules (CER), and Distinguished Encoding Rules (DER)*.

2.3 Remote Operations references

This Recommendation | International Standard cites the following Remote Operations specification:

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

2.4 Directory references

This Recommendation | International Standard cites the following Directory specifications:

- 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.520 (1997) | ISO/IEC 9594-6: 1998, *Information technology – Open Systems Interconnection – The Directory: Selected attribute types*.

2.5 Message Handling references

This Recommendation | International Standard cites the following Message Handling System specifications:

- ITU-T Recommendation F.400/X.400 (1999), *Message handling services: Message handling system and service overview*.
ISO/IEC 10021-1: 1999, *Information technology – Message Handling Systems (MHS) – Part 1: System and service overview*.
- ITU-T Recommendation X.402 (1999) | ISO/IEC 10021-2: 1999, *Information technology – Message Handling Systems (MHS): Overall architecture*.
- ITU-T Recommendation X.411 (1999) | ISO/IEC 10021-4: 1999, *Information technology – Message Handling Systems (MHS): Message transfer system: Abstract service definition and procedures*.
- ITU-T Recommendation X.419 (1999) | ISO/IEC 10021-6: 1999, *Information technology – Message Handling Systems (MHS): Protocol specifications*.
- ITU-T Recommendation X.420 (1999) | ISO/IEC 10021-7: 1999, *Information technology – Message Handling Systems (MHS): Interpersonal messaging system*.