

INTERNATIONAL STANDARD

ISO/IEC
10589

Second edition
2002-11-15

Information technology — Telecommunications and information exchange between systems — Intermediate System to Intermediate System intra-domain routeing information exchange protocol for use in conjunction with the protocol for providing the connectionless-mode network service (ISO 8473)

Technologies de l'information — Communication de données et échange d'informations entre systèmes — Protocole intra-domaine de routage d'un système intermédiaire à un système intermédiaire à utiliser conjointement avec le protocole fournissant le service de réseau en mode sans connexion (ISO 8473)



Reference number
ISO/IEC 10589:2002(E)

© ISO/IEC 2002

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 2002

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.org
Web www.iso.org

Published in Switzerland

Contents

1	<i>Scope</i>	1
2	<i>Normative references</i>	1
3	<i>Definitions</i>	3
3.1	Reference model definitions	3
3.2	Network layer architecture definitions	3
3.3	Network layer addressing definitions	3
3.4	Local area network definitions	3
3.5	Routeing framework definitions	3
3.6	Additional definitions	3
4	<i>Symbols and abbreviations</i>	5
4.1	Data units	5
4.2	Protocol data units	5
4.3	Addresses	5
4.4	Miscellaneous	5
5	<i>Typographical conventions</i>	6
6	<i>Overview of the protocol</i>	6
6.1	System types	6
6.2	Subnetwork types	7
6.3	Topologies	7
6.4	Addresses	8
6.5	Functional organisation	8
6.6	Design goals and non-goals	9
6.7	Environmental requirements	11
6.8	Functional organisation of subnetwork independent components	12
7	<i>Subnetwork independent functions</i>	14
7.1	Addresses	15
7.2	Decision process	18
7.3	Update process	26
7.4	Forwarding process	45
7.5	Routeing constants and parameters	48
8	<i>Subnetwork dependent functions</i>	49
8.1	Multi-destination circuits on ISs at a domain boundary	49
8.2	Point-to-point subnetworks	50
8.3	ISO 8208 subnetworks	54
8.4	Broadcast subnetworks	59

9 Structure and encoding of PDUs	65
9.1 General encoding rules	65
9.2 Encoding of network layer addresses	65
9.3 Encoding of SNPA addresses	65
9.4 PDU types	66
9.5 Level 1 LAN IS to IS hello PDU	66
9.6 Level 2 LAN IS to IS hello PDU	69
9.7 Point-to-point IS to IS hello PDU	72
9.8 Level 1 link state PDU	75
9.9 Level 2 link state PDU	79
9.10 Level 1 complete sequence numbers PDU	84
9.11 Level 2 complete sequence numbers PDU	86
9.12 Level 1 partial sequence numbers PDU	88
9.13 Level 2 partial sequence numbers PDU	90
10 System environment	91
10.1 Generating jitter on timers	91
10.2 Resolution of timers	92
10.3 Requirements on the operation of ISO 9542	93
10.4 Requirements on the operation of ISO 8473	93
11 System management	93
11.1 General	93
--11.2 GDMO definition	94
--11.2.1 Common GDMO definitions	94
--11.3 ASN1 modules	127
12 Conformance	129
12.1 Conformance for protocol implementation	129
12.1.2 Dynamic conformance	131
12.2 Conformance for management information implementation	133
Annex A	135
A.1 Introduction	135
A.2 Abbreviations and special symbols	135
A.3 Instructions for completing the pics pro formas	135
A.4 Identification	138
A.5 Protocol summary: ISO 10589 general	139
A.6 Protocol summary: ISO 10589 level 1 specific functions	143
A.7 Protocol summary: ISO 10589 level 2 specific functions	144

<i>Annex B</i>	146
B.1 Addressing and routeing	146
B.2 Use of the area address field in intra-domain routeing	148
<i>Annex C</i>	150
C.1 Routeing databases	150
C.3 Forwarding process	156
<i>Annex D</i>	158
D.1 Congestion control	158
D.2 Congestion avoidance	159
<i>Annex E</i>	160
--E.1 Generic managed object class definitions	160
--E.2 ASN.1 definitions	167
<i>Annex F</i>	169
<i>Annex G</i>	170
G.1 Introduction	170
G.2 Identification of the implementation	171
G.3 Identification of the International Standard in which the management information is defined	171
<i>Annex H</i>	175
H.1 Introduction	175
H.2 Instructions for completing the MICS proforma to produce a MICS	175
H.3 Symbols, abbreviates and terms	175
H.4 Statement of Conformance to the management information	175
<i>Annex I</i>	182
I.1 Introduction	182
I.2 Adjacency managed object	182
I.3 Virtual adjacency managed object	185
I.4 Destination system managed object	187
I.5 Destination area managed object	188
I.6 reachableAddress [“ISO/IEC 10589”]	190
<i>Annex J</i>	195
J.1 Introduction	195
J.2 Instructions for completing the MRCS proforma for name binding to produce a MRCS	195
J.3 Statement of conformance to the name binding	195
<i>Index</i>	197

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 3.

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.

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

ISO/IEC 10589 was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, Subcommittee SC 6, *Telecommunications and information exchange between systems*.

This second edition cancels and replaces the first edition (ISO/IEC 10589:1992), which has been technically revised. It incorporates Cor.1:1993, Cor.2:1996, Cor.3:1996, Amd.1:1996 and Amd.2:1999.

Annexes A, E, G, H, I and J form a normative part of this International Standard. Annexes B, C, D and F are for information only.

Annexes G, H, I and J provide ICS proformas associated with intra-domain routeing protocol management information.

Introduction

This International Standard is one of a set of International Standards produced to facilitate the interconnection of open systems. The set of standards covers the services and protocols required to achieve such interconnection.

The protocol defined in this International Standard is positioned with respect to other related standards by the layers defined in ISO 7498 and by the structure defined in ISO 8648. In particular, it is a protocol of the Network Layer. This protocol permits Intermediate Systems within a routeing domain to exchange configuration and routeing information to facilitate the operation of the routeing and relaying functions of the Network Layer.

The protocol is designed to operate in close conjunction with ISO 9542 and ISO 8473. ISO 9542 is used to establish connectivity and reachability between End Systems and Intermediate Systems on individual subnetworks. Data is carried using the protocol specified in ISO 8473. The related algorithms for route calculation and maintenance are also described.

The intra-domain IS-IS routeing protocol is intended to support large routeing domains consisting of combinations of many types of subnetworks. This includes point-to-point links, multipoint links, X.25 subnetworks, and broadcast subnetworks such as ISO 8802 LANs.

In order to support large routeing domains, provision is made for intra-domain routeing to be organised hierarchically. A large domain may be administratively divided into *areas*. Each system resides in exactly one area. Routeing within an area is referred to as *Level 1 routeing*. Routeing between areas is referred to as *Level 2 routeing*. Level 2 Intermediate Systems keep track of the paths to destination areas. Level 1 Intermediate Systems keep track of the routeing within their own area. For an NPDU destined to another area, a Level 1 Intermediate System sends the NPDU to the nearest level 2 IS in its own area, regardless of what the destination area is. Then the NPDU travels via level 2 routeing to the destination area, where it again travels via level 1 routeing to the destination End System.

Information technology – Telecommunications and information exchange between systems – Intermediate System to Intermediate System intra-domain routeing information exchange protocol for use in conjunction with the protocol for providing the connectionless-mode network service (ISO 8473)

1 Scope

This International Standard specifies a protocol which is used by Network Layer entities operating the protocol specified in ISO 8473 in Intermediate Systems to maintain routeing information for the purpose of routeing within a single routeing domain. The protocol specified in this International Standard relies upon the provision of a connectionless-mode underlying service.¹⁾

This International Standard specifies:

- a) procedures for the transmission of configuration and routeing information between network entities residing in Intermediate Systems within a single routeing domain;
- b) the encoding of the protocol data units used for the transmission of the configuration and routeing information;
- c) procedures for the correct interpretation of protocol control information; and
- d) the functional requirements for implementations claiming conformance to this International Standard.

The procedures are defined in terms of

- a) the interactions between Intermediate system Network entities through the exchange of protocol data units;
- b) the interactions between a Network entity and an underlying service provider through the exchange of subnetwork service primitives; and
- c) the constraints on route determination which must be observed by each Intermediate system when each has a routeing information base which is consistent with the others.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this International Standard. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of ISO and IEC maintain registers of currently valid International Standards.

ISO/IEC 7498-1:1994, *Information technology – Open Systems Interconnection – Basic Reference Model: The Basic Model*

ISO/IEC 7498-3:1997, *Information technology – Open Systems Interconnection – Basic Reference Model: Naming and addressing*

ISO/IEC 7498-4:1989, *Information processing systems – Open Systems Interconnection – Basic Reference Model – Part 4: Management framework*

ISO/IEC 8208:2000, *Information technology – Data communications – X.25 Packet Layer Protocol for Data Terminal Equipment*

¹⁾ See ISO 8473 and its addendum 3 for the mechanisms necessary to realize this service on subnetworks based on ISO/IEC 8208, ISO 8802, and the OSI Data Link Service.

ISO/IEC 8348:1996, *Information technology – Open Systems Interconnection – Network Service Definition*

ISO/IEC 8473-1:1998, *Information technology – Protocol for providing the connectionless-mode network service: Protocol specification*

ISO/IEC 8473-4:1995, *Information technology – Protocol for providing the connectionless-mode network service: Provision of the underlying service by a subnetwork that provides the OSI data link service*

ISO 8648:1988, *Information processing systems – Open Systems Interconnection – Internal organization of the Network Layer*

ISO/IEC TR 8802-1:1997, *Information technology – Telecommunications and information exchange between systems – Local and metropolitan area networks – Specific requirements – Part 1: Overview of Local Area Network Standards*

ISO/IEC 8802-2:1998, *Information technology – Telecommunications and information exchange between systems – Local and metropolitan area networks – Specific requirements – Part 2: Logical link control*

ISO/IEC 8802-3:2000, *Information technology – Telecommunications and information exchange between systems – Local and metropolitan area networks – Specific requirements – Part 3: Carrier sense multiple access with collision detection (CSMA/CD) access method and physical layer specifications*

ISO/IEC 8802-5:1998, *Information technology – Telecommunications and information exchange between systems – Local and metropolitan area networks – Specific requirements – Part 5: Token ring access method and physical layer specifications*

ISO/IEC 8802-6:1994, *Information technology – Telecommunications and information exchange between systems – Local and metropolitan area networks – Specific requirements – Part 6: Distributed Queue Dual Bus (DQDB) access method and physical layer specifications*

ISO/IEC 9314 (all parts), *Information technology – Fibre Distributed Data Interface (FDDI)*

ISO 9542:1988, *Information processing systems – Telecommunications and information exchange between systems – End system to Intermediate system routeing exchange protocol for use in conjunction with the Protocol for providing the connectionless-mode network service (ISO 8473)*

ISO/IEC TR 9575:1995, *Information technology – Telecommunications and information exchange between systems – OSI Routeing Framework*

ISO/IEC TR 9577:1999, *Information technology – Protocol identification in the network layer*

ISO/IEC 15802-1:1995, *Information technology – Telecommunications and information exchange between systems – Local and metropolitan area networks – Common specifications – Part 1: Medium Access Control (MAC) service definition*

ISO/IEC 10165-1:1993, *Information technology – Open Systems Interconnection – Management Information Services – Structure of management information: Management Information Model*

ISO/IEC 10165-4:1992, *Information technology – Open Systems Interconnection – Structure of management information – Part 4: Guidelines for the definition of managed objects*

ISO/IEC 10733:1998, *Information technology – Elements of management information related to the OSI Network Layer*

ISO/IEC 8824-1:1998, *Information technology – Abstract Syntax Notation One (ASN.1): Specification of basic notation*

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)*

ISO/IEC 9646-7:1995, *Information technology – Open Systems Interconnection – Conformance testing methodology and framework – Part 7: Implementation Conformance Statements*

ISO/IEC 10165-6:1997, *Information technology – Open Systems Interconnection – Structure of management information: Requirements and guidelines for implementation conformance statement proformas associated with OSI management*

NOTE 1 – ISO/IEC 9646-1:1994 and ISO/IEC 9646-2:1994 supersede ISO/IEC 9646-1:1991 and ISO/IEC 9646-2:1991 respectively. However, when this International Standard was under development, the previous editions were valid and this International Standard is therefore based on these editions, which are listed below.

ISO/IEC 9646-1:1991, *Information technology – Open Systems Interconnection – Conformance testing methodology and framework – Part 1: General concepts*

ISO/IEC 9646-2:1991, *Information technology – Open Systems Interconnection – Conformance testing methodology and framework – Part 2: Abstract test suite specification*