

INTERNATIONAL STANDARD

NORME INTERNATIONALE



**Industrial communication networks – Fieldbus specifications –
Part 6-12: Application layer protocol specification – Type 12 elements**

**Réseaux de communication industriels – Spécifications des bus de terrain –
Partie 6-12: Spécification du protocole de la couche application – Éléments
de type 12**



THIS PUBLICATION IS COPYRIGHT PROTECTED

Copyright © 2014 IEC, Geneva, Switzerland

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 IEC or IEC's member National Committee in the country of the requester. If you have any questions about IEC copyright or have an enquiry about obtaining additional rights to this publication, please contact the address below or your local IEC member National Committee for further information.

Droits de reproduction réservés. Sauf indication contraire, aucune partie de cette publication ne peut être reproduite ni utilisée sous quelque forme que ce soit et par aucun procédé, électronique ou mécanique, y compris la photocopie et les microfilms, sans l'accord écrit de l'IEC ou du Comité national de l'IEC du pays du demandeur. Si vous avez des questions sur le copyright de l'IEC ou si vous désirez obtenir des droits supplémentaires sur cette publication, utilisez les coordonnées ci-après ou contactez le Comité national de l'IEC de votre pays de résidence.

IEC Central Office
3, rue de Varembe
CH-1211 Geneva 20
Switzerland

Tel.: +41 22 919 02 11
Fax: +41 22 919 03 00
info@iec.ch
www.iec.ch

About the IEC

The International Electrotechnical Commission (IEC) is the leading global organization that prepares and publishes International Standards for all electrical, electronic and related technologies.

About IEC publications

The technical content of IEC publications is kept under constant review by the IEC. Please make sure that you have the latest edition, a corrigenda or an amendment might have been published.

IEC Catalogue - webstore.iec.ch/catalogue

The stand-alone application for consulting the entire bibliographical information on IEC International Standards, Technical Specifications, Technical Reports and other documents. Available for PC, Mac OS, Android Tablets and iPad.

IEC publications search - www.iec.ch/searchpub

The advanced search enables to find IEC publications by a variety of criteria (reference number, text, technical committee,...). It also gives information on projects, replaced and withdrawn publications.

IEC Just Published - webstore.iec.ch/justpublished

Stay up to date on all new IEC publications. Just Published details all new publications released. Available online and also once a month by email.

Electropedia - www.electropedia.org

The world's leading online dictionary of electronic and electrical terms containing more than 30 000 terms and definitions in English and French, with equivalent terms in 14 additional languages. Also known as the International Electrotechnical Vocabulary (IEV) online.

IEC Glossary - std.iec.ch/glossary

More than 55 000 electrotechnical terminology entries in English and French extracted from the Terms and Definitions clause of IEC publications issued since 2002. Some entries have been collected from earlier publications of IEC TC 37, 77, 86 and CISPR.

IEC Customer Service Centre - webstore.iec.ch/csc

If you wish to give us your feedback on this publication or need further assistance, please contact the Customer Service Centre: csc@iec.ch.

A propos de l'IEC

La Commission Electrotechnique Internationale (IEC) est la première organisation mondiale qui élabore et publie des Normes internationales pour tout ce qui a trait à l'électricité, à l'électronique et aux technologies apparentées.

A propos des publications IEC

Le contenu technique des publications IEC est constamment revu. Veuillez vous assurer que vous possédez l'édition la plus récente, un corrigendum ou amendement peut avoir été publié.

Catalogue IEC - webstore.iec.ch/catalogue

Application autonome pour consulter tous les renseignements bibliographiques sur les Normes internationales, Spécifications techniques, Rapports techniques et autres documents de l'IEC. Disponible pour PC, Mac OS, tablettes Android et iPad.

Recherche de publications IEC - www.iec.ch/searchpub

La recherche avancée permet de trouver des publications IEC en utilisant différents critères (numéro de référence, texte, comité d'études,...). Elle donne aussi des informations sur les projets et les publications remplacées ou retirées.

IEC Just Published - webstore.iec.ch/justpublished

Restez informé sur les nouvelles publications IEC. Just Published détaille les nouvelles publications parues. Disponible en ligne et aussi une fois par mois par email.

Electropedia - www.electropedia.org

Le premier dictionnaire en ligne de termes électroniques et électriques. Il contient plus de 30 000 termes et définitions en anglais et en français, ainsi que les termes équivalents dans 14 langues additionnelles. Egalement appelé Vocabulaire Electrotechnique International (IEV) en ligne.

Glossaire IEC - std.iec.ch/glossary

Plus de 55 000 entrées terminologiques électrotechniques, en anglais et en français, extraites des articles Termes et Définitions des publications IEC parues depuis 2002. Plus certaines entrées antérieures extraites des publications des CE 37, 77, 86 et CISPR de l'IEC.

Service Clients - webstore.iec.ch/csc

Si vous désirez nous donner des commentaires sur cette publication ou si vous avez des questions contactez-nous: csc@iec.ch.

INTERNATIONAL STANDARD

NORME INTERNATIONALE



**Industrial communication networks – Fieldbus specifications –
Part 6-12: Application layer protocol specification – Type 12 elements**

**Réseaux de communication industriels – Spécifications des bus de terrain –
Partie 6-12: Spécification du protocole de la couche application – Éléments
de type 12**

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

COMMISSION
ELECTROTECHNIQUE
INTERNATIONALE

PRICE CODE **XG**
CODE PRIX

ICS 25.040.40; 35.100.70; 35.110

ISBN 978-2-8322-1762-7

**Warning! Make sure that you obtained this publication from an authorized distributor.
Attention! Veuillez vous assurer que vous avez obtenu cette publication via un distributeur agréé.**

CONTENTS

FOREWORD.....	7
INTRODUCTION.....	9
1 Scope.....	10
1.1 General.....	10
1.2 Specifications.....	11
1.3 Conformance.....	11
2 Normative references.....	11
3 Terms, definitions, symbols, abbreviations and conventions.....	12
3.1 Reference model terms and definitions.....	12
3.2 Service convention terms and definitions.....	13
3.3 Application layer definitions.....	14
3.4 Common symbols and abbreviations.....	19
3.5 Additional symbols and abbreviations.....	19
3.6 Conventions.....	21
4 Application layer protocol specification.....	25
4.1 Operating principle.....	25
4.2 Node reference model.....	26
5 FAL syntax description.....	27
5.1 Coding principles.....	27
5.2 Data types and encoding rules.....	27
5.3 AR coding.....	31
5.4 SII coding.....	36
5.5 Isochronous PDI coding.....	40
5.6 CoE coding.....	43
5.7 EoE coding.....	81
5.8 FoE Coding.....	89
6 FAL protocol state machines.....	95
6.1 Overall structure.....	95
6.2 AP-Context state machine.....	97
6.3 FAL service protocol machine (FSPM).....	97
6.4 Application Relationship Protocol Machines (ARPMs).....	97
6.5 DLL mapping protocol machine (DMPM).....	137
Bibliography.....	138
Figure 1 – Common structure of specific fields.....	21
Figure 2 – Type description example.....	23
Figure 3 – Slave Node Reference Model.....	26
Figure 4 – Encoding of Time of Day value.....	28
Figure 5 – Encoding of Time Difference value.....	28
Figure 6 – AL Control Request structure.....	31
Figure 7 – AL Control Response structure.....	31
Figure 8 – AL State Changed structure.....	34
Figure 9 – PDI Control type description.....	34

Figure 10 – Sync Configuration type description	35
Figure 11 – Distributed Clock sync and latch type description	41
Figure 12 – CoE general structure	43
Figure 13 – SDO Download Expedited Request structure.....	44
Figure 14 – SDO Download Expedited Response structure	45
Figure 15 – SDO Download Normal Request structure	46
Figure 16 – Download SDO Segment Request structure	48
Figure 17 – Download SDO Segment Response structure.....	49
Figure 18 – SDO Upload Expedited Request structure	49
Figure 19 – SDO Upload Expedited Response structure	50
Figure 20 – SDO Upload Normal Response structure.....	52
Figure 21 – Upload SDO Segment Request structure.....	53
Figure 22 – Upload SDO Segment Response structure	53
Figure 23 – Abort SDO Transfer Request structure	54
Figure 24 – SDO Information Service structure	57
Figure 25 – Get OD List Request structure.....	58
Figure 26 – Get OD List Response structure	59
Figure 27 – Get Object Description Request structure.....	60
Figure 28 – Get Object Description Response structure	61
Figure 29 – Get Entry Description Request structure.....	62
Figure 30 – Get Entry Description Response structure	63
Figure 31 – SDO Info Error Request structure.....	64
Figure 32 – EoE general structure	81
Figure 33 – EoE Timestamp structure	82
Figure 34 – EoE Fragment Data structure	83
Figure 35 – Set IP Parameter Request structure	85
Figure 36 – Set IP Parameter Response structure	86
Figure 37 – Set MAC Filter Request structure	87
Figure 38 – Set MAC Filter Response structure	88
Figure 39 – Read Request structure	89
Figure 40 – Write Request structure.....	90
Figure 41 – Data Request structure	91
Figure 42 – Ack Request structure	92
Figure 43 – Error Request structure	93
Figure 44 – Busy Request structure	95
Figure 45 – Relationship among Protocol Machines	96
Figure 46 – AR Protocol machines	97
Figure 47 – ESM Diagramm	99
Table 1 – PDU element description example.....	22
Table 2 – Example attribute description	23
Table 3 – State machine description elements	24
Table 4 – Description of state machine elements	24

Table 5 – Conventions used in state machines	25
Table 6 – Transfer Syntax for bit sequences	29
Table 7 – Transfer syntax for data type Unsignedn	29
Table 8 – Transfer syntax for data type Integern	30
Table 9 – AL Control Description	31
Table 10 – AL Control Response	32
Table 11 – AL Status Codes	32
Table 12 – AL State Changed	34
Table 13 – PDI Control	35
Table 14 – PDI Configuration	35
Table 15 – Sync Configuration	35
Table 16 – Slave Information Interface Area	36
Table 17 – Slave Information Interface Categories	37
Table 18 – Mailbox Protocols Supported Types	37
Table 19 – Categories Types	37
Table 20 – Structure Category String	38
Table 21 – Structure Category General	38
Table 22 – Structure Category FMMU	39
Table 23 – Structure Category SyncM for each Element	39
Table 24 – Structure Category TXPDO and RXPDO for each PDO	40
Table 25 – Structure PDO Entry	40
Table 26 – Distributed Clock sync parameter	42
Table 27 – Distributed Clock latch data	43
Table 28 – CoE elements	44
Table 29 – SDO Download Expedited Request	45
Table 30 – SDO Download Expedited Response	46
Table 31 – SDO Download Normal Request	47
Table 32 – Download SDO Segment Request	48
Table 33 – Download SDO Segment Response	49
Table 34 – SDO Upload Expedited Request	50
Table 35 – SDO Upload Expedited Response	51
Table 36 – SDO Upload Normal Response	52
Table 37 – Upload SDO Segment Request	53
Table 38 – Upload SDO Segment Response	54
Table 39 – Abort SDO Transfer Request	55
Table 40 – SDO Abort Codes	56
Table 41 – SDO Information Service	57
Table 42 – Get OD List Request	58
Table 43 – Get OD List Response	59
Table 44 – Get Object Description Request	60
Table 45 – Get Object Description Response	61
Table 46 – Get Entry Description Request	62
Table 47 – Get Entry Description Response	63

Table 48 – SDO Info Error Request.....	65
Table 49 – Emergency Request	66
Table 50 – Emergency Error Codes	67
Table 51 – Error Code	67
Table 52 – Diagnostic Data.....	68
Table 53 – Sync Manager Length Error.....	68
Table 54 – Sync Manager Address Error.....	68
Table 55 – Sync Manager Settings Error.....	68
Table 56 – RxPDO Transmission via mailbox.....	69
Table 57 – TxPDO Transmission via mailbox	69
Table 58 – RxPDO Remote Transmission Request	70
Table 59 – TxPDO Remote Transmission Request.....	70
Table 60 – Command object structure.....	71
Table 61 – Object Dictionary Structure.....	71
Table 62 – Object Code Definitions.....	71
Table 63 – Basic Data Type Area.....	72
Table 64 – Extended Data Type Area	73
Table 65 – Enumeration Definition	74
Table 66 – CoE Communication Area	74
Table 67 – Device Type	75
Table 68 – Error Register.....	76
Table 69 – Manufacturer Device Name	76
Table 70 – Manufacturer Hardware Version	76
Table 71 – Manufacturer Software Version	77
Table 72 – Identity Object.....	77
Table 73 – Receive PDO Mapping	78
Table 74 – Transmit PDO Mapping	78
Table 75 – Sync Manager Communication Type.....	79
Table 76 – Sync Manager Channel 0-31	80
Table 77 – Sync Manager Synchronization	81
Table 78 – Initiate EoE Request.....	82
Table 79 – Initiate EoE Response	83
Table 80 – EoE Fragment Data.....	83
Table 81 – EoE Data.....	84
Table 82 – Set IP Parameter Request.....	85
Table 83 – Set IP Parameter Response	86
Table 84 – EoE Result Parameter	87
Table 85 – Set MAC Filter Request.....	87
Table 86 – Set MAC Filter Response	89
Table 87 – Read Request	90
Table 88 – Write Request	91
Table 89 – Data Request	92
Table 90 – Ack Request.....	93

Table 91 – Error Request.....	94
Table 92 – Error codes of FoE	94
Table 93 – Busy Request.....	95
Table 94 – State transitions and local management services	99
Table 95 – Primitives issued by ESM to DL.....	100
Table 96 – Primitives issued by DL to ESM.....	100
Table 97 – Primitives issued by Application to ESM	101
Table 98 – Primitives issued by ESM to Application	101
Table 99 – ESM Variables	102
Table 100 – ESM macros.....	102
Table 101 – ESM functions	103
Table 102 – ESM state table.....	104
Table 103 – Primitives issued by Mailbox handler to DL.....	115
Table 104 – Primitives issued by DL to Mailbox handler.....	115
Table 105 – Primitives issued by Protocol handler to Mailbox handler.....	115
Table 106 – Primitives issued by Mailbox handler to Protocol handler.....	116
Table 107 – Primitives issued by Application to CoESM.....	116
Table 108 – Primitives issued by CoESM to Application.....	117
Table 109 – CoESM state table.....	118
Table 110 – Primitives issued by Application to EoESM	127
Table 111 – Primitives issued by EoESM to Application	127
Table 112 – EoESM state table.....	128
Table 113 – Primitives issued by Application to FoESM	133
Table 114 – Primitives issued by FoESM to Application	133
Table 115 – FoESM state table.....	133

generated by EVS

INTERNATIONAL ELECTROTECHNICAL COMMISSION

**INDUSTRIAL COMMUNICATION NETWORKS –
FIELDBUS SPECIFICATIONS –****Part 6-12: Application layer protocol specification –
Type 12 elements**

FOREWORD

- 1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
- 2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.
- 3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
- 4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
- 5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.
- 6) All users should ensure that they have the latest edition of this publication.
- 7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
- 8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
- 9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

Attention is drawn to the fact that the use of the associated protocol type is restricted by its intellectual-property-right holders. In all cases, the commitment to limited release of intellectual-property-rights made by the holders of those rights permits a layer protocol type to be used with other layer protocols of the same type, or in other type combinations explicitly authorized by its intellectual-property-right holders.

NOTE Combinations of protocol types are specified in IEC 61784-1 and IEC 61784-2.

International Standard IEC 61158-6-12 has been prepared by subcommittee 65C: Industrial networks, of IEC technical committee 65: Industrial-process measurement, control and automation.

This third edition cancels and replaces the second edition published in 2010. This edition constitutes a technical revision. The main changes with respect to the previous edition are listed below:

- bug fixes;
- editorial improvements;
- support of Explicit Device Identification added in ESM (Clause 6).

The text of this standard is based on the following documents:

FDIS	Report on voting
65C/764/FDIS	65C/774/RVD

Full information on the voting for the approval of this standard can be found in the report on voting indicated in the above table.

This publication has been drafted in accordance with ISO/IEC Directives, Part 2.

A list of all parts of the IEC 61158 series, published under the general title *Industrial communication networks – Fieldbus specifications*, can be found on the IEC web site.

The committee has decided that the contents of this publication will remain unchanged until the stability date indicated on the IEC web site under "<http://webstore.iec.ch>" in the data related to the specific publication. At this date, the publication will be:

- reconfirmed;
- withdrawn;
- replaced by a revised edition, or
- amended.

IMPORTANT – The 'colour inside' logo on the cover page of this publication indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.

INTRODUCTION

This part of IEC 61158 is one of a series produced to facilitate the interconnection of automation system components. It is related to other standards in the set as defined by the “three-layer” fieldbus reference model described in IEC 61158-1.

The application protocol provides the application service by making use of the services available from the data-link or other immediately lower layer. The primary aim of this standard is to provide a set of rules for communication expressed in terms of the procedures to be carried out by peer application entities (AEs) at the time of communication. These rules for communication are intended to provide a sound basis for development in order to serve a variety of purposes:

- as a guide for implementors and designers;
- for use in the testing and procurement of equipment;
- as part of an agreement for the admittance of systems into the open systems environment;
- as a refinement to the understanding of time-critical communications within OSI.

This standard is concerned, in particular, with the communication and interworking of sensors, effectors and other automation devices. By using this standard together with other standards positioned within the OSI or fieldbus reference models, otherwise incompatible systems may work together in any combination.

INDUSTRIAL COMMUNICATION NETWORKS – FIELDBUS SPECIFICATIONS –

Part 6-12: Application layer protocol specification – Type 12 elements

1 Scope

1.1 General

The Fieldbus Application Layer (FAL) provides user programs with a means to access the fieldbus communication environment. In this respect, the FAL can be viewed as a “window between corresponding application programs.”

This standard provides common elements for basic time-critical and non-time-critical messaging communications between application programs in an automation environment and material specific to Type 12 fieldbus. The term “time-critical” is used to represent the presence of a time-window, within which one or more specified actions are required to be completed with some defined level of certainty. Failure to complete specified actions within the time window risks failure of the applications requesting the actions, with attendant risk to equipment, plant and possibly human life.

This standard defines in an abstract way the externally visible behavior provided by the different Types of the fieldbus Application Layer in terms of

- a) the abstract syntax defining the application layer protocol data units conveyed between communicating application entities,
- b) the transfer syntax defining the application layer protocol data units conveyed between communicating application entities,
- c) the application context state machine defining the application service behavior visible between communicating application entities; and
- d) the application relationship state machines defining the communication behavior visible between communicating application entities; and.

The purpose of this standard is to define the protocol provided to

- a) define the wire-representation of the service primitives defined in IEC 61158-5-12, and
- b) define the externally visible behavior associated with their transfer.

This standard specifies the protocol of the IEC fieldbus Application Layer, in conformance with the OSI Basic Reference Model (ISO/IEC 7498) and the OSI Application Layer Structure (ISO/IEC 9545).

FAL services and protocols are provided by FAL application-entities (AE) contained within the application processes. The FAL AE is composed of a set of object-oriented Application Service Elements (ASEs) and a Layer Management Entity (LME) that manages the AE. The ASEs provide communication services that operate on a set of related application process object (APO) classes. One of the FAL ASEs is a management ASE that provides a common set of services for the management of the instances of FAL classes.

Although these services specify, from the perspective of applications, how request and responses are issued and delivered, they do not include a specification of what the requesting and responding applications are to do with them. That is, the behavioral aspects of the applications are not specified; only a definition of what requests and responses they can

send/receive is specified. This permits greater flexibility to the FAL users in standardizing such object behavior. In addition to these services, some supporting services are also defined in this standard to provide access to the FAL to control certain aspects of its operation.

1.2 Specifications

The principal objective of this standard is to specify the syntax and behavior of the application layer protocol that conveys the application layer services defined in IEC 61158-5-12.

A secondary objective is to provide migration paths from previously-existing industrial communications protocols. It is this latter objective which gives rise to the diversity of protocols standardized in subparts of IEC 61158-6.

1.3 Conformance

This standard does not specify individual implementations or products, nor does it constrain the implementations of application layer entities within industrial automation systems.

There is no conformance of equipment to the application layer service definition standard. Instead, conformance is achieved through implementation of this application layer protocol specification.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

NOTE All parts of the IEC 61158 series, as well as IEC 61784-1 and IEC 61784-2 are maintained simultaneously. Cross-references to these documents within the text therefore refer to the editions as dated in this list of normative references.

IEC 61158-3-12, *Industrial communication networks – Fieldbus specifications – Part 3-12: Data-link layer service definition – Type 12 elements*

IEC 61158-5-12, *Industrial communication networks – Fieldbus specifications – Part 5-12: Application layer service definition – Type 12 elements*

IEC 61158-6 (all parts), *Industrial communication networks – Fieldbus specifications – Part 6: Application layer protocol specification*

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

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

ISO/IEC 8802-3, *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 9545, *Information technology – Open Systems Interconnection – Application Layer structure*

ISO/IEC 9899, *Information technology – Programming languages – C*

ISO/IEC 10731, *Information technology – Open Systems Interconnection – Basic Reference Model – Conventions for the definition of OSI services*

ISO/IEC/IEEE 60559, *Information technology – Microprocessor Systems – Floating-Point arithmetic*

IEEE 802.1D, *IEEE standard for Local and metropolitan area networks – Common specifications – Media access control (MAC) Bridges*; available at <<http://www.ieee.org>>

IEEE 802.1Q, *IEEE standard for Local and metropolitan area networks – Virtual bridged local area networks Bridges*; available at <<http://www.ieee.org>>

IETF RFC 768, *User Datagram Protocol*; available at <<http://www.ietf.org>>

IETF RFC 791, *Internet Protocol darpa internet program protocol specification*; available at <<http://www.ietf.org>>

IETF RFC 826, *An Ethernet Address Resolution Protocol or Converting Network Protocol Addresses to 48.bit Ethernet Address for Transmission on Ethernet Hardware*; available at <<http://www.ietf.org>>

3 Terms, definitions, symbols, abbreviations and conventions

For the purposes of this document, the following terms, definitions, symbols, abbreviations and conventions apply.

3.1 Reference model terms and definitions

This standard is based in part on the concepts developed in ISO/IEC 7498-1 and ISO/IEC 7498-3, and makes use of the following terms defined therein:

Document is a preview generated by EVS