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**Information technology — Control  
network protocol —**

**Part 1:  
Protocol stack**

*Technologies de l'information — Protocole de réseau de contrôle —*

*Partie 1: Pile de protocole*

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# Contents

page

Foreword .....	7
Introduction.....	8
1 Scope.....	9
2 Normative references.....	9
3 Terms and definitions .....	9
4 Symbols and abbreviations.....	11
4.1 Symbols and graphical representations.....	11
4.2 Abbreviations.....	12
5 Overview of protocol layering.....	13
6 MAC sublayer.....	15
6.1 Service provided.....	15
6.2 Interface to the link layer .....	15
6.3 Interface to the physical layer.....	16
6.4 MPDU format.....	17
6.5 Predictive <i>p</i> -persistent CSMA — overview description.....	17
6.6 Idle channel detection.....	18
6.7 Randomising.....	19
6.8 Backlog estimation.....	19
6.9 Optional priority.....	20
6.10 Optional collision detection.....	21
6.11 Beta1, Beta2 and Preamble Timings .....	21
7 Link layer.....	23
7.1 Assumptions.....	23
7.2 Service provided.....	24
7.3 CRC .....	24
7.4 Transmit algorithm.....	25
8 Network layer .....	26
8.1 Assumptions.....	26
8.2 Service provided.....	27
8.3 Service interface.....	27
8.4 Internal structuring of the network layer .....	28
8.5 NPDU format .....	28
8.6 Address recognition.....	29
8.7 Routers .....	29
8.8 Routing algorithm.....	30
8.9 Learning algorithm — subnets .....	30
9 Transaction control sublayer .....	30
9.1 Assumptions.....	30
9.2 Service provided.....	31
9.3 Service interface.....	31
9.4 State variables .....	31
9.5 Transaction control algorithm .....	32
10 Transport layer .....	32
10.1 Assumptions.....	32
10.2 Service provided.....	32
10.3 Service interface.....	33
10.4 TPDU types and formats.....	33

10.5	Protocol diagram .....	35
10.6	Transport protocol state variables .....	35
10.7	Send algorithm .....	35
10.8	Receive algorithm.....	36
10.9	Receive transaction record pool size and configuration engineering.....	36
10.9.1	General .....	36
10.9.2	Number of retries.....	36
10.9.3	Transport layer timers.....	37
11	Session layer .....	38
11.1	Assumptions.....	38
11.2	Service Provided .....	38
11.3	Service interface.....	39
11.4	Internal structure of the session layer .....	40
11.5	SPDU types and formats .....	41
11.6	Protocol timing diagrams .....	42
11.7	Request-response state variables .....	44
11.8	Request-response protocol — client part.....	45
11.9	Request-response protocol — server part .....	45
11.10	Request-response protocol timers.....	45
11.11	Authentication protocol.....	46
11.12	Encryption algorithm .....	46
11.13	Retries and the role of the checksum function .....	46
11.14	Random Number Generation .....	47
11.15	Using Authentication.....	47
12	Presentation/application layer .....	47
12.1	Assumptions.....	47
12.2	Service provided.....	47
12.3	Service interface.....	48
12.4	APDU types and formats .....	49
12.5	Protocol diagrams .....	50
12.6	Application protocol state variables .....	51
12.7	Request - response messaging in offline state.....	51
12.8	Network variables.....	52
12.8.1	General .....	52
12.8.2	Network variable processing .....	52
12.9	Error notification to the application program.....	53
12.9.1	General .....	53
12.9.2	Error notification for messages .....	53
12.9.3	Error notification for network variables .....	53
13	Network management & diagnostics .....	53
13.1	Assumptions.....	53
13.2	Services provided.....	54
13.3	Network management and diagnostics application structure.....	54
13.4	Node states .....	54
13.5	Using the network management services.....	55
13.5.1	General .....	55
13.5.2	Addressing considerations .....	55
13.5.3	Making network configuration changes.....	56
13.5.4	Downloading an Application Program .....	56
13.5.5	Error handling conditions (informative).....	56
13.6	Using router network management commands .....	59
13.7	NMPDU formats and types .....	60
13.7.1	General .....	60
13.7.2	Query ID.....	60
13.7.3	Respond to query .....	61
13.7.4	Update domain.....	61
13.7.5	Leave domain.....	61
13.7.6	Update key .....	61

13.7.7	Update address.....	62
13.7.8	Query address .....	62
13.7.9	Query network variable configuration.....	62
13.7.10	Update group address .....	62
13.7.11	Query domain .....	62
13.7.12	Update network variable configuration.....	62
13.7.13	Set node mode.....	63
13.7.14	Read memory.....	63
13.7.15	Write memory.....	63
13.7.16	Checksum recalculate.....	63
13.7.17	Install .....	64
13.7.18	Memory refresh.....	78
13.7.19	Query SI.....	78
13.7.20	Network variable value fetch.....	79
13.7.21	Manual service request message .....	79
13.7.22	Network management escape code .....	79
13.7.23	Router mode .....	80
13.7.24	Router clear group or subnet table .....	80
13.7.25	Router group or subnet table download.....	80
13.7.26	Router group forward.....	80
13.7.27	Router subnet forward.....	80
13.7.28	Router Do Not forward group.....	80
13.7.29	Router Do Not forward subnet.....	80
13.7.30	Router group or subnet table report .....	80
13.7.31	Router status .....	81
13.7.32	Router half escape code.....	81
13.8	DPDU types and formats.....	81
13.8.1	General .....	81
13.8.2	Query status.....	81
13.8.3	Proxy status.....	85
13.8.4	Clear status.....	85
13.8.5	Query transceiver status.....	85
Annex A	(normative) Reference implementation .....	86
A.1	General .....	86
A.2	Predictive CSMA algorithm .....	86
A.3	LPDU transmit algorithm .....	141
A.4	LPDU receive algorithm .....	143
A.5	Routing algorithm.....	144
A.6	Learning algorithm .....	145
A.7	Transaction control algorithm .....	145
A.8	Network layer algorithm.....	152
A.9	TPDU and SPDU send algorithm with authentication .....	168
A.10	Application Layer .....	223
A.11	Network Management Commands.....	278
A.12	Configuration data structures.....	315
A.13	Include files for the reference implementation .....	334
A.14	Application protocol state variables and address recognition Structures .....	363
A.15	Query-id data structures.....	366
A.16	Respond to query data structure.....	366
A.17	Update somain data structures.....	367
A.18	Leave domain data structures .....	367
A.19	Update key data structures .....	367
A.20	Update address data structures .....	367
A.21	Query address data structures .....	368
A.22	Query NV Cnfg data structures.....	369
A.23	Update group address data structures .....	369
A.24	Query domain data structures .....	369
A.25	Update network variable configuration data structures.....	370
A.26	Set node mode data structures.....	370

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A.27	Read memory data structures.....	370
A.28	Write memory data structures .....	371
A.29	Checksum recalculate data structures .....	371
A.30	Install command data structures .....	371
A.31	Memory refresh data structures .....	380
A.32	Query SI data structures.....	380
A.33	NV fetch data structures .....	380
A.34	Manual service request message ddata structures.....	380
A.35	Product query data structures .....	381
A.36	Router mode data structures .....	381
A.37	Router table clear group or subnet table data structures.....	381
A.38	Router group or subnet download data structures .....	381
A.39	Router group forward data structures .....	382
A.40	Router subnet forward data structures.....	382
A.41	Router group No-Forward data structures .....	382
A.42	Router subnet No-Forward data structures .....	382
A.43	Group / subnet table report data structures .....	383
A.44	Router status data structures .....	383
A.45	Query status data structures .....	383
A.46	Proxy status data structures.....	384
A.47	Clear status data structures.....	384
A.48	Query transceiver status data structures .....	384
Annex B	(normative) Additional Data Structures.....	385
B.1	General .....	385
B.1.1	System image .....	385
B.1.2	Application image.....	385
B.1.3	Network image .....	386
B.2	Read-only structures.....	386
B.2.1	Fixed read-only data structures.....	386
B.2.2	Read-only structure field descriptions.....	387
B.3	Domain table.....	390
B.3.1	Domain table field descriptions .....	391
B.4	Address table.....	391
B.4.1	Declaration of group address format .....	392
B.4.2	Group address field descriptions .....	392
B.4.3	Declaration of subnet/node address format.....	392
B.4.4	Subnet/node address field descriptions .....	393
B.4.5	Declaration of broadcast address format .....	393
B.4.6	Broadcast address field descriptions .....	393
B.4.7	Declaration of turnaround address format .....	393
B.4.8	Turnaround address field descriptions.....	394
B.4.9	Declaration of protocol processor's address format .....	394
B.4.10	Protocol processor address field descriptions.....	394
B.4.11	Timer field descriptions .....	394
B.5	Network variable tables - informative.....	395
B.5.1	Network variable configuration table field descriptions - informative .....	396
B.5.2	Network variable alias table field descriptions - informative.....	397
B.5.3	Network variable fixed table field descriptions - informative .....	397
B.6	Self-Identification structures.....	397
B.6.1	SI Structure field descriptions .....	398
B.6.2	NV descriptor table field descriptions.....	398
B.6.3	SNVT table extension records .....	399
B.6.4	SNVT alias field descriptions .....	400
B.6.5	Version 2 SI data.....	400
B.7	Configuration structure .....	403
B.7.1	General .....	403
B.7.2	Configuration structure field descriptions .....	404
B.8	Statistics relative structure .....	405
Annex C	(informative) Behavioral characteristics .....	407

**C.1 Channel capacity and throughput .....407**  
**C.2 Network metrics .....408**  
**C.3 Transaction metrics .....409**  
**C.4 Boundary conditions — power-up .....410**  
**C.5 Boundary conditions — high load .....410**  
**Annex D (normative) PDU summary .....411**  
**Annex E (normative) Naming and addressing .....413**  
**E.1 Address types and formats .....413**  
**E.2 Domains .....413**  
**E.3 Subnets and nodes .....414**  
**E.4 Groups .....414**  
**E.5 Unique\_Node\_ID and node address assignment.....415**  
**E.6 NPDU addressing .....416**  
**Annex F (normative) List of patents that pertain to this International Standard .....418**  
**Bibliography .....420**

**Figures**

Figure 1 — Network topology & symbols ..... 12  
Figure 2 — Protocol terminology ..... 12  
Figure 3 — Protocol layering ..... 14  
Figure 4 — Interface between the MAC and the link layers ..... 16  
Figure 5 — MPDU/LPDU format ..... 17  
Figure 6 — Predictive p-persistent CSMA concepts and parameters ..... 18  
Figure 7 — Allocation of priority slots within the Busy Channel Packet Cycle ..... 20  
Figure 8 — CRC register state behaviour example ..... 25  
Figure 9 — Single channel topologies ..... 26  
Figure 10 — Typical tree-like domain topology ..... 27  
Figure 11 — Network service interface ..... 28  
Figure 12 — Network layer—internal structure ..... 28  
Figure 13 — NPDU format ..... 28  
Figure 14 — Transaction control service interface ..... 31  
Figure 15 — Transport interface to upper layers ..... 33  
Figure 16 — TPDU types and formats ..... 34  
Figure 17 — Transport protocol diagram for multicast message with a loss of both the message and the ACK TPDU ..... 35  
Figure 18 — Transport protocol—Send FSM ..... 36  
Figure 19 — Transport protocol—Receive FSM ..... 36  
Figure 20 — Probability of transaction completion in k Retries ..... 37

Figure 21 — Methodology for calculating timer values .....	38
Figure 22 — Session layer interface to application layer .....	39
Figure 23 — Session layer—internal structuring.....	40
Figure 24 — SPDU types and formats .....	41
Figure 25 — Non-Idempotent request with multiple SPDU losses.....	43
Figure 26 — Secure idempotent request with multiple SPDU losses .....	44
Figure 27 — Request-response protocol—client FSM.....	45
Figure 28 — Request-response protocol—simplified server FSM.....	45
Figure 29 — Application layer interface .....	48
Figure 30 — APDU format.....	49
Figure 31 — Application protocol diagram for multicast acknowledged transaction.....	50
Figure 32 — Application protocol diagram for multicast request/response transaction.....	51
Figure B.1 — SI data .....	400
Figure C.1 — Probability of successful delivery over k hops .....	409
Figure D.1 — Protocol PDU summary .....	412
Figure E.1 — Physical topology and logical addressing (single domain) .....	415
Figure E.2 — NPDU/TPDU/SPDU addressing—physical address formats.....	416

### Tables

Table 1 — Application layer primitives .....	48
Table 2 — Resource codes .....	65
Table 3 — Space of the property ID.....	65
Table B.1 — Buffer size encodings.....	389
Table B.2 — Buffer Count Encodings .....	390
Table B.3 — Encoding of timer field values .....	395
Table B.4 — Buffer timeout encoding .....	405
Table C.1 — Key throughput parameters.....	408
Table E.1 — NPDU/TPDU/SPDU addressing - logical address formats .....	416
Table F.1 — Patents in the US.....	418
Table F.2 — Patents in Europe and other countries.....	419



## 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.

ISO/IEC 14908-1 was prepared by CEN/TC 247 and was adopted, under a special “fast-track procedure”, by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, in parallel with its approval by the national bodies of ISO and IEC.

ISO/IEC 14908 consists of the following parts, under the general title *Information technology — Control network protocol*:

- *Part 1: Protocol stack* <https://standards.iteh.ai/catalog/standards/sist/a89db252-82d2-42fd-9e0d-d9ea69f4b2fb/iso-iec-14908-1-2012>
- *Part 2: Twisted pair communication*
- *Part 3: Power line channel specification*
- *Part 4: IP communication*

## Introduction

This International Standard has been prepared to provide mechanisms through which various vendors of local area control networks may exchange information in a standardised way. It defines communication capabilities.

This International Standard is to be used by all involved in design, manufacture, engineering, installation and commissioning activities.

The International Organization for Standardization (ISO) and International Electrotechnical Commission (IEC) draw attention to the fact that it is claimed that compliance with this International Standard may involve the use of patents held by Echelon Corporation.

The ISO and IEC take no position concerning the evidence, validity and scope of this patent right. The holder of this putative patent right has assured the ISO and IEC that they are willing to negotiate free of charge licences under reasonable and non-discriminatory terms and conditions with applicants throughout the world. In this respect, the statement of the holder of the putative patent rights is registered with the ISO and IEC. Information may be obtained from:

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# INFORMATION TECHNOLOGY – CONTROL NETWORK PROTOCOL –

## Part 1: Protocol stack

### 1 Scope

This specification applies to a communication protocol for local area control networks. The protocol provides peer-to-peer communication for networked control and is suitable for implementing both peer-to-peer and master-slave control strategies. This specification describes services in layers 2 to 7. In the layer 2 (data link layer) specification, it also describes the MAC sub-layer interface to the physical layer. The physical layer provides a choice of transmission media. The interface described in this specification supports multiple transmission media at the physical layer. In the layer 7 specification, it includes a description of the types of messages used by applications to exchange application and network management data.

### 2 Normative references

None.

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### 3 Terms and definitions (standards.iteh.ai)

For the purposes of this International Standard, the following subclause introduces the basic terminology employed throughout this International Standard. Most of it is commonly used and the terms have the same meaning in both the general and the standard context. However, for some terms, there are subtle differences. For example, in general, bridges do selective forwarding based on the layer 2 destination address. There are no layer 2 addresses in this standard protocol, so bridges forward all packets, as long as the domain address in the packet matches a domain of which the bridge is a member. Routers, in general, perform network address modification so that two protocols with the same transport layer but different network layers can be connected to form a single logical network. Routers of this standard may perform network address modification, but typically they only examine the network address fields and selectively forward packets based on the network layer address fields.

#### 3.1

##### **channel**

physical unit of bandwidth linking one or more communication nodes. Refer to Annex E for further explanation of the relationship between a channel and a subnet

#### 3.2

##### **physical repeater**

device that reconditions the incoming physical layer signal on one channel and retransmits it on to the same or another channel

#### 3.3

##### **store-and-forward repeater**

device that stores and then reproduces data packets on to a second channel

#### 3.4

##### **bridge**

device that connects two channels (x and y); forwards all packets from x to y and vice versa, as long as the packets originate on one of the domain(s) that the bridge belongs to

### 3.5 configuration

non-volatile information used by the device to customise its operation. There is configuration data for the correct operation of the protocol in each device, and optionally, for application operation. The network configuration data stored in each device has a checksum associated with the data. Examples of network configuration data are node addresses, communication media parameters such as priority settings, etc. Application configuration information is application specific

### 3.6 domain

virtual network that is the network unit of management and administration. Group and subnet (see below) addresses are assigned by the administrator responsible for the domain, and they have meaning only in the context of that domain

### 3.7 flexible domain

used in conjunction with Unique\_Node\_ID and broadcast addressing. A node responds to a Unique\_Node\_ID-addressed message if the address matches, regardless of the domain on which the message was sent. To respond so that the sender receives it, the response must be sent on the domain in which it was received. Furthermore, this domain must be remembered for the duration of the transaction so that duplicate detection of any retries is possible. This transitory domain entry at a node is called the flexible domain. How many flexible domain entries a node supports is up to the implementation. However, a minimum of 1 is required

### 3.8 subnet

set of nodes accessible through the same link layer protocol; a routing abstraction for a channel; in this standard subnets are limited to a maximum of 127 nodes

### 3.9 node

abstraction for a physical node that represents the highest degree of address resolvability on a network. A node is identified (addressed) within a subnet by its (logical) node identifier. A physical node may belong to more than one subnet; when it does, it is assigned one (logical) node number for each subnet to which it belongs. A physical node may belong to at most two subnets; these subnets must be in different domains. A node may also be identified (absolutely) within a network by its Unique\_Node\_ID

### 3.10 group

uniquely identifiable set of nodes within a domain. Within this set, individual members are identified by their member number. Groups facilitate one-to-many communication and are intended to support functional addressing

### 3.11 router

device that routes data packets to their respective destinations by selectively forwarding from subnet to subnet; a router always connects two (sets of) subnets; routers may modify network layer address fields. Routers may be set to one of four modes: repeater mode, bridge mode, learning mode, and configured mode. In repeater mode, packets are forwarded if they are received with no errors. In bridge mode, packets are forwarded if they are received with no errors and match a domain that the router is a member of. Routers in learning mode learn the topology by examining packet traffic, while routers that are set to configured mode have the network topology stored in their memory and make their routing decisions solely upon the contents of their configured tables

### 3.12 (application) gateway

interconnects networks at their highest protocol layers (often two different protocols). Two domains can also be connected through an application gateway

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### 3.13

#### **Beta1**

period immediately following the end of a packet cycle. A node attempting to transmit monitors the state of the channel, and if it detects no transmission during the Beta1 period, it determines the channel to be idle

### 3.14

#### **Beta2**

randomising slot. A node wishing to transmit generates a random delay T. This delay is an integer number of randomising slots of duration Beta2

### 3.15

#### **network variable**

variable in an application program whose value is automatically propagated over the network whenever a new value is assigned to it

### 3.16

#### **Standard Network Variable Types (SNVTs)**

variables with agreed-upon semantics. These variables are interpreted by all applications in the same way, and are the basis for interoperability. Definition of specific SNVTs is beyond the scope of this International Standard

### 3.17

#### **manual service request message**

network management message containing a node's Unique\_Node\_ID. Used by a network management device that receives this message to install and configure the node. May be generated by application or system code. May be triggered by external hardware event, e.g., driving a "manual service request" input low

### 3.18

#### **transaction**

sequence of messages that are correlated together. For example, a request and the responses to the request are all part of a single transaction. A transaction succeeds when all the expected messages from every node involved in the transaction are received at least once. A transaction fails in this International Standard if any of the expected messages within the transaction are not received. Retries of messages within a transaction are used to increase the probability of success of a transaction in the presence of transient errors

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## 4 Symbols and abbreviations

### 4.1 Symbols and graphical representations

Figure 1 shows the basic topology of networks based on this protocol and the symbolic representations used in this International Standard.

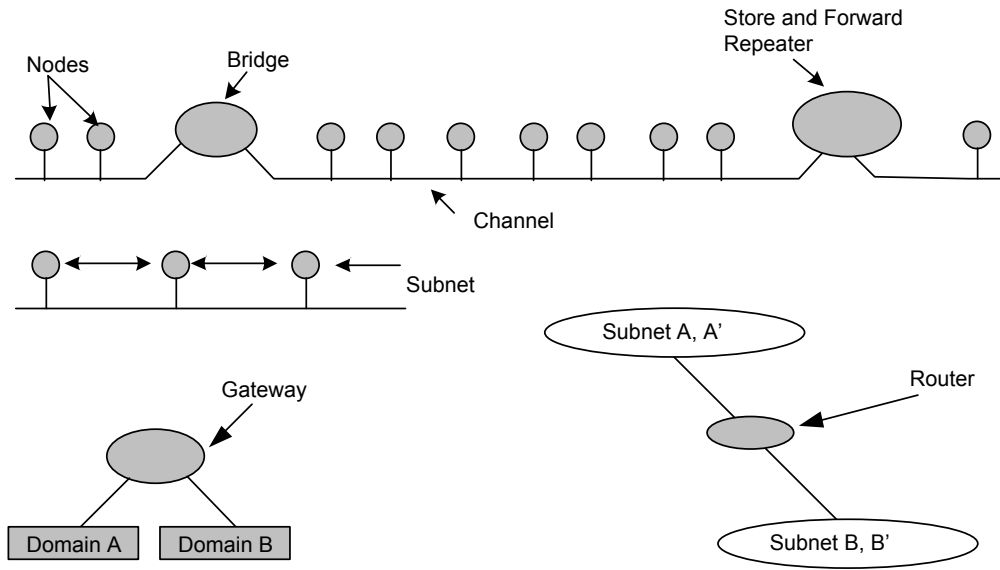


Figure 1 — Network topology & symbols

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The layering of this protocol is described using standard OSI terminology, as shown in Figure 2.

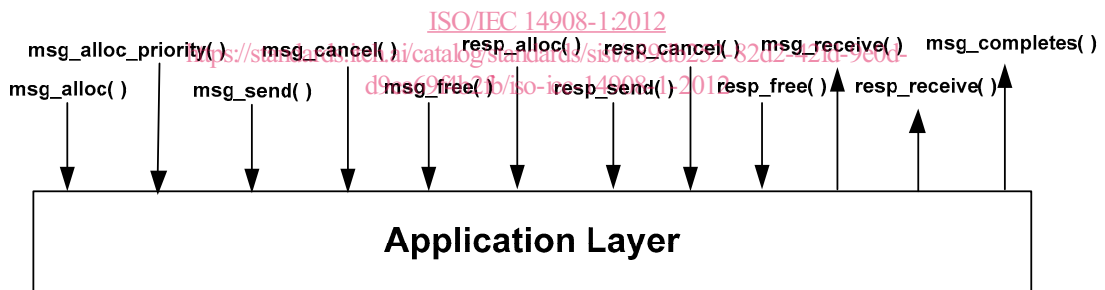


Figure 2 — Protocol terminology

4.2 Abbreviations

— CNP Control Network Protocol

The Protocol Data Unit (PDU) abbreviations used throughout this Standard are:

— PPDU Physical Protocol Data Unit, or frame

— MPDU MAC Protocol Data Unit, or frame

— LPDU Link Protocol Data Unit, or frame

— NPDU Network Protocol Data Unit, or packet

— TPDU Transport Protocol Data Unit, or a message/ack

— SPDU Session Protocol Data Unit, or request/response

- NMPDU      Network Management Protocol Data Unit
- DPDU      Diagnostic Protocol Data Unit
- APDU      Application Protocol Data Unit
- FSM      Finite State Machine (diagram)

Annex D (PDU Summary) contains the details of these PDUs.

## 5 Overview of protocol layering

The protocol specified by this Standard consists of the layers shown in Figure 3. Each layer is described below.

*Multiple physical layer* protocols and data encoding methods are allowed in systems based on this International Standard. Each encoding scheme is medium-dependent.

The MAC (Medium Access Control) sublayer employs a collision avoidance algorithm called Predictive *p*-persistent CSMA (Carrier Sense, Multiple Access). For a number of reasons, including simplicity and compatibility with the multicast protocol, the link *layer* supports a simple connectionless service. Its functions are limited to framing, frame encoding, and error detection, with no error recovery by re-transmission.

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