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Open Data Communication in Building Automation, Controls and Building Management - Control Network Protocol - Part 1: Protocol Stack

Firmenneutrale Datenkommunikation für die Gebäudeautomation und Gebäudemanagement - Gebäudedatennetzprotokoll - Teil 1: Datenprotokollschichtenmodell

Réseau ouvert de communication de donées pour l'automatisation, la régulation et la gestion technique du bâtiment - Protocole de bâtiment du réseau - Partie 1 : Spécifications du protocole

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Firmenneutrale Datenkommunikation für die Gebäudeautomation und Gebäudemanagement - Gebäudedatennetzprotokoll - Teil 1: Datenprotokollschichtenmodell

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Foreword

This document (FprEN 14908-1:2012) has been prepared by Technical Committee CEN/TC 247 “Building Automation, Controls and Building Management”, the secretariat of which is held by SNV.

This document is currently submitted to the Unique Acceptance Procedure.

This document will supersede EN 14908-1:2005.

This European Standard is part of a series of standards for open data transmission in building automation, control and in building management systems. The content of this European Standard covers the data communications used for management, automation/control and field functions.

The following is a list of technical changes since the previous edition:

— EN 14908-5 has been added to the normative references;

— the normative Annex A has been re-worked for a better understanding. The reference implementation of the standard shows in detail which part is normative and hardware independent, which one is normative but hardware dependent and which one is not normative because it is hardware dependent. This information supports the development of a protocol stack and the understanding of the specified communication services.

EN 14908-1 is part of a series of European Standards under the general title *Control Network Protocol (CNP)*, which comprises the following parts:

Part 1: *Protocol stack;*

Part 2: *Twisted pair communication;*

Part 3: *Power line channel specification;*

Part 4: *IP communication;*

Part 5: *Implementation;*

Part 6: *Application elements.*

Introduction

This European Standard has been prepared to provide mechanisms through which various vendors of building automation, control, and building management systems may exchange information in a standardised way. It defines communication capabilities.

This European Standard will be used by all involved in design, manufacture, engineering, installation and commissioning activities.

This European Standard has been made in response to the essential requirements of the Constructive Products Directive.

1 Scope

This European Standard applies to a communication protocol for networked control systems in commercial Building Automation, Controls and Building Management. 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

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.

EN 14908-5, *Open Data Communication in Building Automation, Controls and Building Management Implementation Guideline — Control Network Protocol — Part 5: Implementation*

3 Terms and definitions

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

For the purposes of this European Standard, the following subclause introduces the basic terminology employed throughout this European 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.

Note 1 to entry: 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 onto another channel

3.3
store-and-forward repeater
device that stores and then reproduces data packets onto 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 shall be sent on the domain in which it was received. Furthermore, this domain shall 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 depends on 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 shall 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

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 European 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 European 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

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 European Standard.

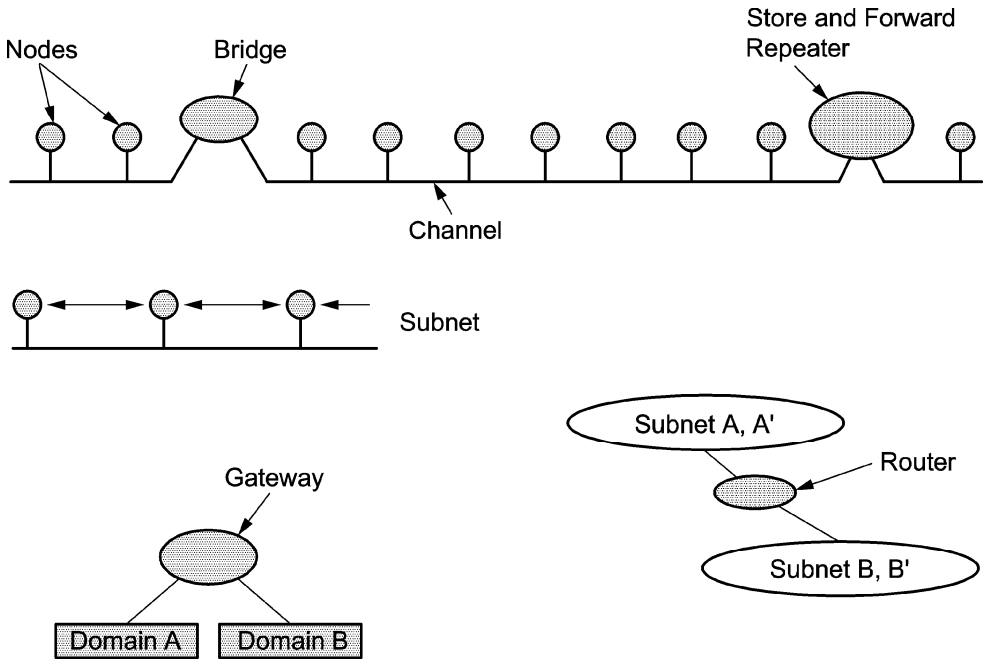

Figure 1 — Network topology & symbols

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

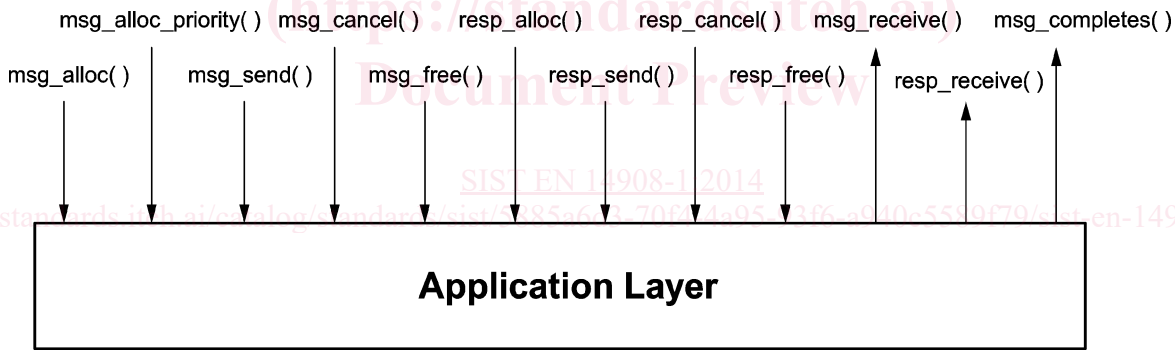

Figure 2 — Protocol terminology

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