

# INTERNATIONAL STANDARD

# NORME INTERNATIONALE



**Multimedia home networks – Home network communication protocol over IP for multimedia household appliances**

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**Réseaux résidentiels multimédia – Protocole de communication de réseau résidentiel sur IP destiné aux appareils domestiques multimédia**

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**Multimedia home networks – Home network communication protocol over IP for multimedia household appliances**

**Réseaux résidentiels multimédia – Protocole de communication de réseau résidentiel sur IP destiné aux appareils domestiques multimédia**

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ELECTROTECHNICAL  
COMMISSION

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

**MULTIMEDIA HOME NETWORKS –  
HOME NETWORK COMMUNICATION PROTOCOL  
OVER IP FOR MULTIMEDIA HOUSEHOLD APPLIANCES**

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International Standard IEC 62457 has been prepared by technical area 9: Audio, video and multimedia applications for end-user network, of IEC technical committee 100: Audio, video and multimedia systems and equipment.

This bilingual version (2012-10) corresponds to the monolingual English version, published in 2007-09.

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

CDV	Report on voting
100/1197/CDV	100/1271/RVC

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

The French version of this standard has not been voted upon.



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

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## INTRODUCTION

By enabling standalone-type household appliances (household appliances other than audiovisual equipment, PCs and PC-related equipment) such as white appliances (e.g. air conditioners, refrigerators), sensors, health, exercise and fitness equipment to connect to and work in conjunction with audiovisual equipment, PCs and/or PC-related equipment, it becomes possible to deliver multimedia application services, such as displaying a “washing completed” message of a washing machine on a TV screen or operating an air conditioner via a TV screen, that otherwise would not be possible (see Figure 1).

To achieve these services, a home network standard for networks of standalone-type household appliances and network standards for audiovisual equipment, PCs and PC-related equipment are needed. It is also necessary to establish a system that allows equipment belonging to a network to exchange data with other equipment of different types of networks. A commonly used approach to allow networks of different types to exchange data with each other is to use Gateways.

Because data transferred within, into and out of networks of standalone-type household appliances are control data, which are much smaller in volume than data similarly transferred for networks of audiovisual equipment, PCs and PC-related equipment, and because standalone-type household appliances have longer service lives than audiovisual equipment, PCs and PC-related equipment, home network standards for networks of standalone-type household appliances have been established separately from network standards for audiovisual equipment, PCs and PC-related equipment, and many different protocol standards have been in use for a long time in different countries<sup>1</sup>.

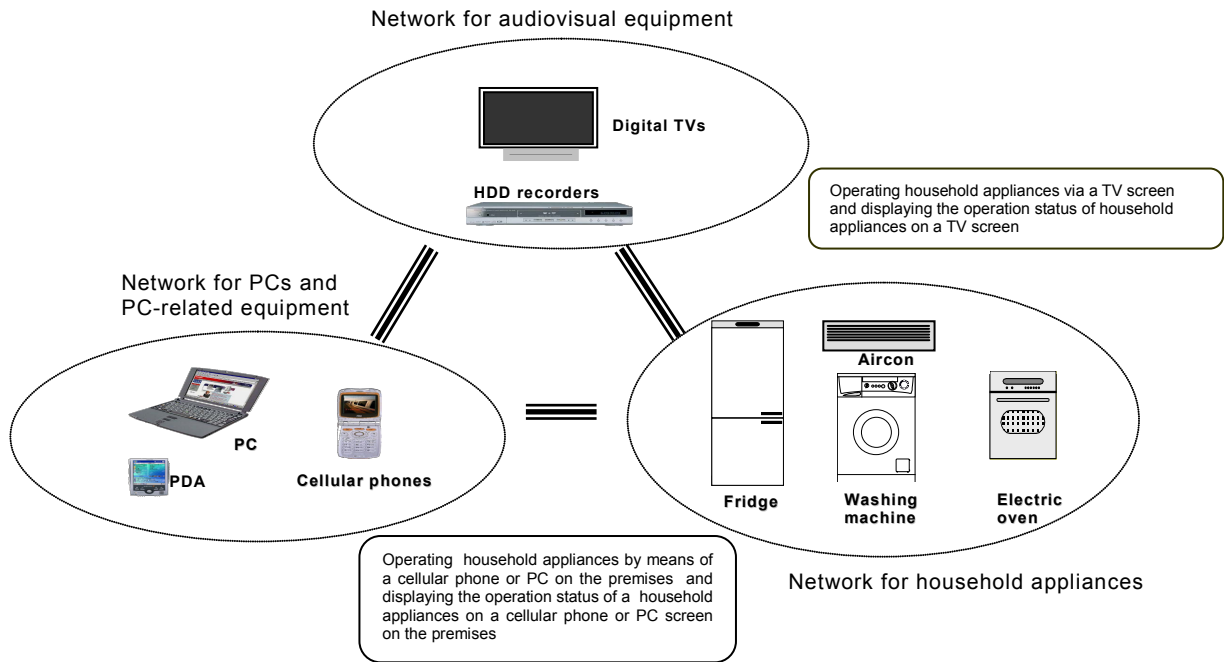
On the other hand, recent advances in device and software technology have made it possible to implement TCP/IP (which has been adopted worldwide for audiovisual equipment, PCs and PC-related equipment) in certain standalone-type household appliances, and so establishing a home network standard for networks of standalone-type household appliances in the form of a standard for layers above TCP/IP would allow data to be directly exchanged between household appliances and audiovisual equipment, PCs and PC-related equipment via TCP/IP (see Figure 2 example1, example2). In turn, this would allow the creation of multimedia application services that enable household appliances to work in conjunction with audiovisual equipment, PCs and PC-related equipment.

The advantages of applying this standard are:

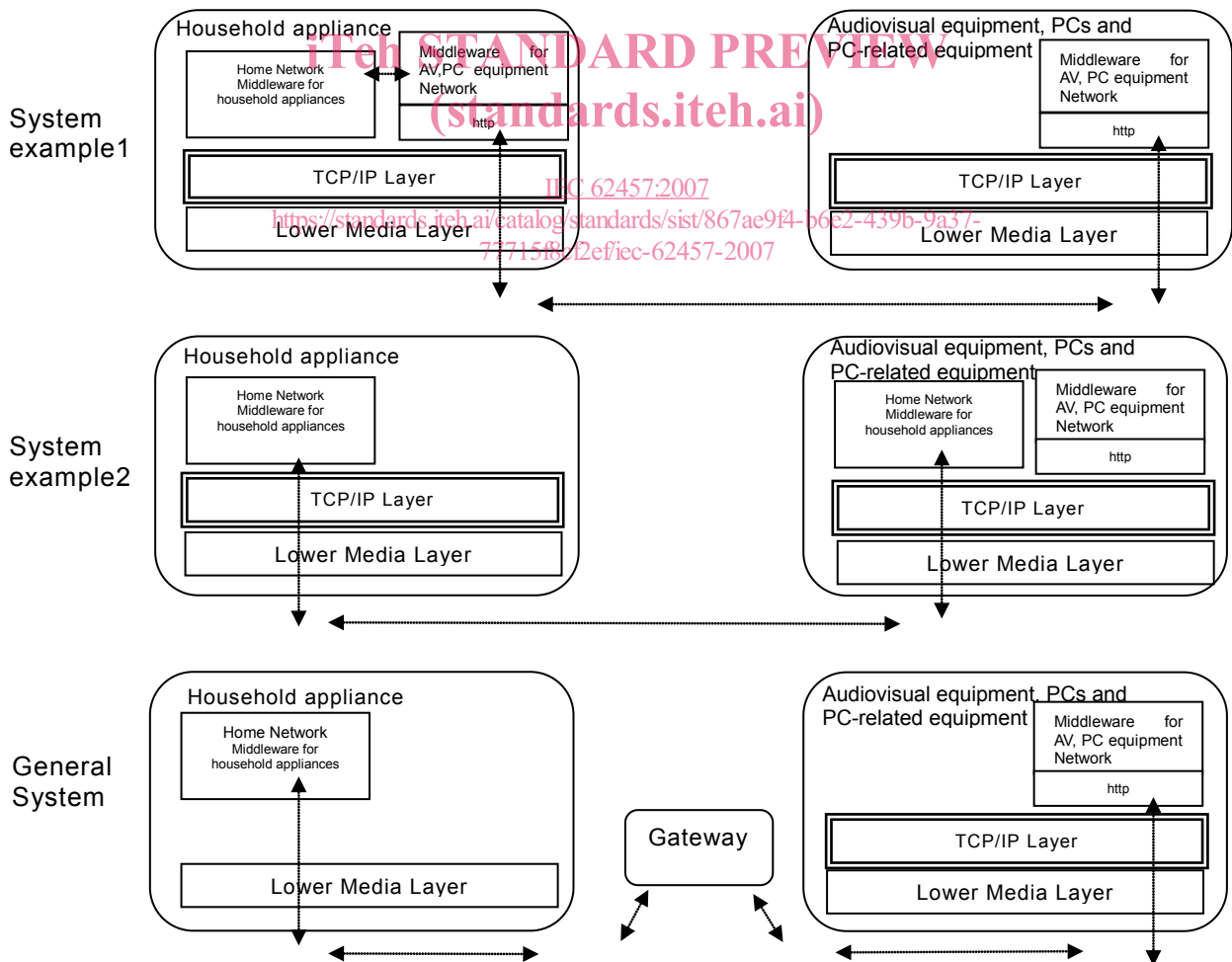
- it can be applied to many types of Home Network standards.
- both Home Network nodes with TCP/IP Layer and without can coexist under the same Home Network middleware.
- Household appliances can communicate with audiovisual equipment, PCs and PC-related equipment, and vice versa, without requiring any gateway.
- Household appliances can handle text and audiovisual data.
- Audiovisual equipment, PCs and PC-related equipment can handle Household appliances data.
- Household appliances can freely select a suitable lower-layer medium from various lower-layer media below TCP/IP.

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<sup>1</sup> CEBus, ECHONET, Konnex, LonTalk, others.



**Figure 1 – Grouping of relationship between household appliances and audiovisual equipment, PCs and PC-related equipment**

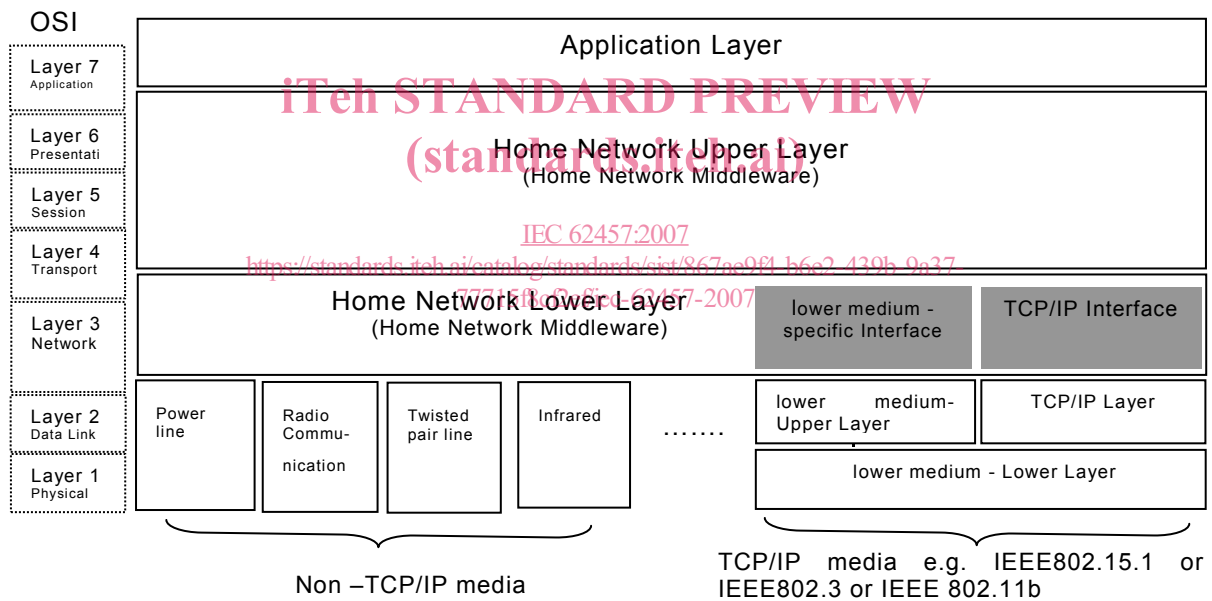


**Figure 2 – Examples of data communication between household appliance and audiovisual equipment, PCs and PC-related equipment**

# MULTIMEDIA HOME NETWORKS – HOME NETWORK COMMUNICATION PROTOCOL OVER IP FOR MULTIMEDIA HOUSEHOLD APPLIANCES

## 1 Scope

This International Standard specifies the requirements for the interface between the Home Network Lower Layer for a country’s home network of standalone-type household appliances and the TCP/IP Layer for cases where it is intended to introduce a TCP/IP Layer to each of the nodes comprising such home network of standalone-type household appliances. The specified interface in the Home Network Lower Layer consists of 2 portions, the TCP/IP Interface and the lower medium-specific Interface. Figure 3 shows the composition of the Home Network Layer and the standardized portions. In Annex C, this standard specifies the requirements for the lower medium-specific Interface One of these layers shall be IEEE 802.15.1, short-distance radio standard additional layers can be added in the future).



NOTE 1 Grey coloured portions are standardized.

NOTE 2 TCP/IP Interface is the same even if the lower medium is different, however the lower medium-specific Interface is different.

NOTE 3 Home Network Lower Layer and Home Network Upper Layer are prepared for CEBus, ECHONET, Konnex, LonTalk, others respectively.

NOTE 4 Each OSI Layer is roughly mapped to each Home Network Layer.

**Figure 3 – The composition of the Home Network layer and the specified portions**

## 2 Normative reference

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

IEEE Std 802.15.1-2005, *IEEE Standard for Information technology – Telecommunications and information exchange between systems – Local and metropolitan area networks – Specific requirements – Part 15.1: Wireless medium access control (MAC) and physical layer (PHY) specifications for wireless personal area networks (WPANs)*

## 3 Terms, definitions and abbreviations

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

### 3.1 Terms and definitions

#### 3.1.1

##### **Bluetooth**

wireless technology that is a worldwide specification for a small-form factor, low-cost radio solution providing links between mobile computers, mobile phones, other portable handheld devices, and connectivity to the Internet

NOTE The specification is developed, published and promoted by the Bluetooth Special Interest Group (SIG). Main specifications are adopted as IEEE Std 802.15.1. In this standard, Bluetooth means IEEE 802.15.1.

#### 3.1.2

##### **Bluetooth Network Encapsulation Protocol**

##### **BNEP**

protocol specified in Bluetooth. IP packet is encapsulated according to this protocol

#### 3.1.3

##### **cold start**

method for starting the Home Network node by starting initial setting processing while abandoning previous information related to network addresses

#### 3.1.4

##### **Group ad-hoc Networks**

##### **GN**

Piconet which comprises a master and a slave as defined in IEEE 802.15.1 and which is not connected to any outside network or node

#### 3.1.5

##### **Hardware address**

##### **Ha**

address based on a medium-specific addressing scheme

#### 3.1.6

##### **Home Network**

generic name for various equipment-type Home Network standards mainly for household appliances

NOTE Specifically, it refers to CEBus, Konnex, ECHONET, LonTalk, etc.

#### 3.1.7

##### **Home Network device**

a home device, home electric product, or building/store device, such as lighting, air conditioning, refrigeration, power equipment, ordinary home appliances, sensors, actuators, etc.

NOTE A Home Network node provided with a communication interface and system compatible function conforming to the Home Network standard. A Home Network node provided with a controller function for the centralized control unit with functions to monitor, control, and operate them or an operating unit (remote control, etc.).

### 3.1.8

#### **Home Network domain**

a range on the network within which information transmission is logically guaranteed by the Home Network

NOTE Property and security control, including homes and stores, are generally thought to use the same range as a domain, but the domain is not limited by any standard.

### 3.1.9

#### **Home Network frame**

frame which is generated in the Home Network lower layer as specified in this standard;. the frame consists of a Home Network transmission frame or an associated managing packet

### 3.1.10

#### **Home Network gateway**

a Home Network node which connects a home network domain to an external system (including other Home Network domains)

NOTE Multiple Home Network gateways may exist in the domain depending on differences in the external system(s) to be connected.

### 3.1.11

#### **Home Network lower-layer**

interface between Home Network upper layer and the lower medium upper-layer

NOTE Some parts depend on the medium characteristics. This standard is contained in this layer. This layer mainly consists of OSI Layer 3, 4, and 2.

### 3.1.12

#### **Home Network master router**

a router that acquires a Net ID at the time of initialization and stores it; there is one Home Network master router in each Home Network subnet

### 3.1.13

#### **Home Network node**

communication node conforming to a Home Network standard, referred to as “node” herein unless otherwise specified

NOTE In a Home Network, a Home Network node is a Home Network communication function which is uniquely identified by a Network address. There is no distinction between the application functions of nodes. The term node is used to describe the function of one communication terminal of the Home Network.

### 3.1.14

#### **Home Network router**

a Home Network node used to connect Home Network subnets

NOTE A Home Network router connects the subnets of different lower-layer communication protocols (for different protocols, regardless of transmission media type) or divides the same protocol into subnets. The lower-layer communication protocol is connected seamlessly on the system using routing processing based on Network addresses as a function.

### 3.1.15

#### **Home Network subnet**

a group of nodes in the Home Network domain, using the same media or different media connected by layer 2 bridges, referred to as a “subnet” herein unless otherwise specified

NOTE Each subnet has a Net ID. Different subnets can be connected by a Home Network router.

### 3.1.16

#### **Home Network transmission frame**

frame that is generated in the Home Network upper layer and transmitted between nodes via the Home Network lower layer

NOTE Each Home Network has its own frame format, but a Home Network transmission frame normally contains headers, address information, acquisition and setting information for other nodes.

### 3.1.17

#### **Home Network upper layer**

processing block of the Home Network communication middleware

NOTE The Home Network upper layer performs the communication protocol processing to simplify the processing performed when the application software remotely controls or monitors devices, stores the information necessary for that purpose, and manages various pieces of information including that on the status of the device itself and of other devices. This layer mainly consists of OSI Layers 4, 5, 6, and 7.

### 3.1.18

#### **IPme**

#### **IP multicast address**

this address is used for IP multicasting. The specific number is assigned to this standard

### 3.1.19

#### **layer 2 bridge**

device used to store and transfer packets

NOTE Layer 2 bridges cover up to OSI Layer 2 (the data link layer). Layer 2 bridges are classified into several types by function including transparent bridges that discard or transfer packets based on MAC address values, converter bridges that perform MAC header conversions and source routing bridges with the additional capability to handle destination path information. Layer 2 bridges are defined in IEEE Std 802.1D.

### 3.1.20

#### **MAC address server**

server which allocates Network MAC addresses in a subnet

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### 3.1.21

#### **net ID**

a subnet identifier; it is also a component of a Network address

### 3.1.22

#### **Network Access Points**

#### **NAP**

an access point connected to the Internet which acts as a IEEE 802.15.1 master. IEEE 802.15.1 slaves are connected to a IEEE 802.15.1 master to form a Piconet and thus are connected to the Internet

### 3.1.23

#### **Network address**

#### **Na**

an address permitting unique identification of a Home Network node in the domain

NOTE This address enables the Home Network communication processing block and the application software to disregard differences in the lower-layer communication software. A Network address is a logical address that is defined separately from the Hardware address to lower-layer communication software; it consists of at least a Net ID and a Node ID.

### 3.1.24

#### **Network MAC address**

#### **NMa**

a unique Home Network lower layer address that allows Layer 2 communication (transmission medium) to be performed