ISO/IEC TR 14543-3

Edition 1.0 2000-05

TECHNICAL REPORT

Information technology – Home electronic system (HES) architecture – Part 3: Communication layers

ISO/IEC TR 14543-3:2000-05(en)

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

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

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INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

ICS 35.240.67

ISBN 2-8318-5252-8

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INFORMATION TECHNOLOGY – HOME ELECTRONIC SYSTEMS (HES) ARCHITECTURE –

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FOREWORD

1) 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.

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Technical reports of types 1 and 2 are subject to review within three years of publication to decide whether they can be transformed into International Standards. Technical reports of type 3 do not necessarily have to be reviewed until the data they provide are considered to be no longer valid or useful.

ISO/IEC 14543-3, which is a technical report of type 2, was prepared by subcommittee 25: Interconnection of information technology equipment, of ISO/IEC joint technical committee 1: Information technology.

International Standards are drafted in accordance with ISO/IEC Directives, Part 3.

This document is issued in the type 2 technical report series of publications (according to 15.2.2 of the Procedures for the technical work of ISO/IEC JTC1 (1998)) as a prospective standard for provisional application in the field of Home Electronic Systems (HES) architecture, because there is an urgent requirement for guidance on how standards in this field should be used to meet an identified need.

This document is not to be regarded as an “International Standard”. It is proposed for provisional application so that information and experience of its use in practice may be gathered. Comments on the content of this document should be sent to the IEC Central Office.

A review of this type 2 technical report will be carried out not later than three years after its publication with the options of extension for a further three years of conversion either to an International Standard or withdrawal.

ISO/IEC 14543 consists of the following parts, under the general title *Information technology – Home elecronic systems (HES) architecture:*

– *Part 1: Introduction*

– *Part 2: Device modularity*

– *Part 3: Communication layers*

Additional parts are under consideration.

INFORMATION TECHNOLOGY – HOME ELECTRONIC SYSTEMS (HES) ARCHITECTURE –

Part 3: Communication Layers

1 Scope

This part of ISO/IEC 14543 describes the architecture of a standardised home control system, called the Home Electronic System, HES.

It discusses the communication and interoperability aspects of HES. It uses the Open Systems Interconnection (OSI) model, or more precisely: the layering principles borrowed from OSI. Hence the HES reference model defines the modular (layered) structure of the HES communication protocol.

The detailed issues of addressing and application protocols for the Home Electronic System of different classes will be given in related standards.

NOTE The concept of Functional Groupings (FG) and Reference Points (RP) provides a means to model device modularity, and hence provides a basis for devide interface standards. This is dealt with in ISO/IEC TR 14543-2 (under preparation).

2 Reference documents

ISO/IEC 2382-25:1992, *Information technology – Vocabulary – Part 25: Local Area Networks*

ISO/IEC 2382-26:1993, *Information technology – Vocabulary – Part 26: Open Systems Interconnection*

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

ISO 7498-2:1989, *Information processing systems – Open Systems Interconnection – Basic Reference Model – Part 2: Security Architecture*

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 TR 15044: *Information technology – Terminology for Home Electronic System (HES)*

3 Definitions

For the purpose of this part of ISO/IEC TR 14543, the following definitions apply.

3.1 Basic reference model definitions

The following terms are defined in ISO/IEC 7498-1:

(N)-entity

(N)-service-data-unit

(N)-protocol-data-unit
application-entity
application-process
connection-mode transmission
connectionless-mode transmission
segmenting
reassembling

3.2 Definitions from ISO/IEC 2382-25

The following terms are defined in ISO/IEC 2382-25:

bridge
repeater
router

3.3 Definitions from ISO/IEC 2382-26

The following terms are defined in ISO/IEC 2382-26:

application service element

3.4 Definitions from the HES terminology

This technical report uses terms defined in ISO/IEC TR 15044.

4 HES reference model

4.1 General

The HES model is based on the OSI reference model. Because the requirements of HES are more specific than those of OSI, and also for reasons of protocol efficiency, some of the layers of the OSI reference model are null or have reduced functionality in the HES reference model. In particular, some implementations have little or no functionality at one or more of the layers: transport, session and presentation. If a layer has no functionality of its own, then it is still regarded as present, merely to map between the layer below and the layer above. Null layers impose no overhead on any implementation.

The OSI layered reference model defines a framework for functional requirements for interconnection of systems. It does explicitly not deal with: interworking (which is an application concept and hence by definition beyond the OSI domain whereas this is included in the HES reference model), nor with implementation, interfaces or modularity. The major concepts introduced and defined in the OSI model are layer, service, and protocol. The rich functionality of the full OSI model is not needed in the relatively simple case of home automation, therefore only a subset of the OSI model is used to construct the HES reference model. On the other hand the OSI model does not deal with real time signals, nor with switched circuit transmission channels as defined for HES Class 2 and 3. Therefore the OSI model needs to be extended to address HES Class 2 and 3 services (see Figure 1).

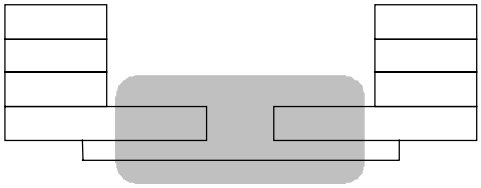

Figure 1 – Real time signals, switched channel domain

This method to construct the HES reference model is purely communication oriented. Since HES reference model also addresses network management and distributed processing in the application domain, it is also interoperability oriented.

Figure 2 depicts the overall structure of the HES reference model. An HES implementation consists of a control channel and optionally one or more information channels. Note that the control channel and information channel or channels may be on the same or different media (which may be of different types).

As shown in Figure 2 the HES reference model consists of three parts:

- communication model;
- application model;
- management model.

These are defined in the following sections.

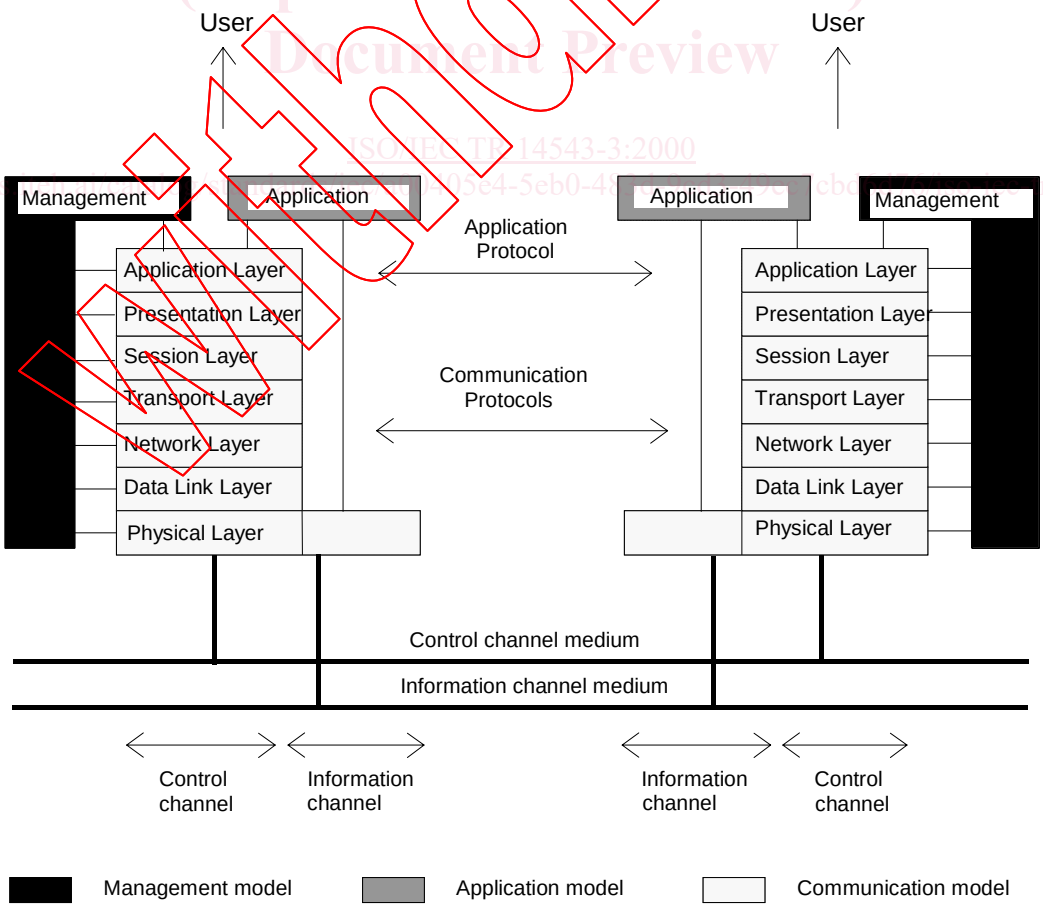

Figure 2 – Overview of the Home Electronic System Reference Model

4.2 HES Communication model

In the HES reference model a distinction is made between information and control channels. The control channel uses packet-switched transmission, whereas the information channel typically uses circuit-switched transmission.

Packet-switched transmission is fundamental to the Home Electronic System, and all HES implementations shall provide a packet-switched control channel.

The layers of the control channel correspond to the OSI reference model.

This report does not describe layers below the Network Layer. However, the HES can accommodate multiple transmission media. Since different transmission media have different characteristics, the Physical Layer and Data Link Layer services can be distinct or optimised for different media. Above the Data Link Layer the services provided are medium independent. The performance characteristics may differ according to the medium used. For instance, the potential transfer capacity of power line may be less than that of twisted pair.

Subclause 4.2 gives an overview of the functions of each layer of the control channel. Other parts of this part of ISO/IEC TR 14543 will discuss the layers in more detail. Each layer offers services to the layer immediately above. (The Application Layer provides services to an application in a device).

4.2.1 Physical Layer

A detailed discussion of the Physical Layer is not a part of this report, however, a brief overview is included below.

The Physical Layer provides mechanical, electrical, functional and procedural means for communication between data-link entities. A physical connection may involve intermediate physical repeaters, each relaying bit transmission within the Physical Layer. Physical Layer entities are interconnected by means of a physical medium.

The Physical Layer may offer two types of communication service. The control channel uses packet-switched transmission. Information channels typically use circuit-switched transmission. Every information channel shall have an associated control channel to manage it (though the same control channel may manage several information channels).

The transmission media may also provide power distribution services.

4.2.2 Data Link Layer

A detailed discussion of the Data Link Layer is not a part of this report, however, a brief overview is included below.

The Data Link Layer provides procedural means for connectionless-mode transmission between network entities; transfer of information between network entities; (optionally) establishment, maintenance and release of data link connections between network entities.

A data link connection is built upon one or more physical connections.

The Data Link Layer detects errors and may offer error correction capability. Uncorrected errors may be reported to the Network Layer. The Data Link Layer provides the means to access the medium, handling contention for access when necessary.

The Data Link Layer may also implement flow control in order to manage the rate of information transfer and sequence numbering to manage the ordering of data link service data units.