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First edition
2000-10

Information Technology – Home Electronic System (HES) Architecture –

Part 2: Device modularity

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INFORMATION TECHNOLOGY – HOME ELECTRONIC SYSTEM (HES) ARCHITECTURE –

Part 2: Device Modularity

FOREWORD

1) ISO (International Organization for Standardization) and IEC (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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- type 3, when the technical committee has collected data of a different kind from that which is normally published as an International Standard, for example 'state of the art'.

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 Technical reports of type 3 do not necessarily have to be reviewed until the data they provide are considered to be no longer valid or useful.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 14543-2, 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.

This publication was 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 JTC 1 (1998)) as a prospective standard for provisional application in the field of the Home Electronic System (HES), because there is an urgent requirement for guidance on how standards in this field should be used.

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 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 option of extension for a further three years of conversion either to an International Standard or withdrawal.

ISO/IEC TR 14543: *Information technology – Home Electronic system (HES) architecture* consists of three parts:

- *Part 1: Introduction*
- *Part 2: Device modularity*
- *Part 3: Communication layers*

Additional parts are under preparation.

INTRODUCTION

This part of ISO/IEC TR 14543, is based on the following considerations.

HES standards address both interoperability requirements, interconnectivity requirements and plug-compatibility requirements.

Devices are described as interoperable if the functionality of the higher communication layers is such that commands can be exchanged and result in meaningful action. One or more intermediate networks may be needed to provide a communication path. Direct plug-compatibility or a common interface is not required for devices to interoperate (Figure 1).

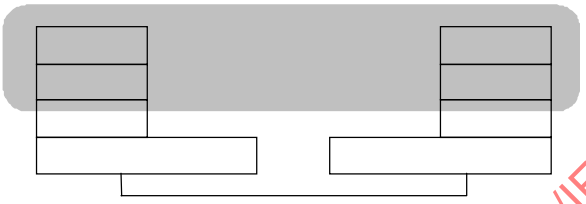


Figure 1 – Interoperability domain

For interconnectivity it is sufficient to specify mechanical, electrical, and functional (lower layer protocol) characteristics such that devices can be connected on a shared transmission medium. The functionality of the interface, or in other words the higher application layer functions to be conveyed across the interface, that is the functionality of the devices on both sides of the interface, have no direct relationship to the interface as such (Figure 2).

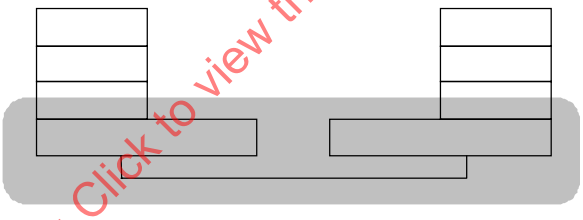


Figure 2 – Interconnectivity domain

Plug-compatibility includes both interoperability and interconnection. It usually implies that a particular interface is claimed for a particular purpose, where showing a certain interface implies interworking capabilities. This is particularly the case in the consumer environment where the availability of a particular plug on two pieces of equipment is generally understood to mean that the devices can be interconnected and will work together.

This document on Device Modularity addresses the architectural aspects of interfaces by introducing the concepts of Functional Groupings (FG) and Reference Points (RP). These concepts provide a means to describe modularity of a device, and hence serve as a basis for device interface standards (Figure 3). RPs are introduced in such a way that interfaces can be defined later on to correspond to RP. An RP provides the basic functionality of potential interfaces. The dual concept FG similarly provides the basic functionality of devices at both sides of an interface. Products may comprise concatenated FGs in which case the RPs in between vanish.

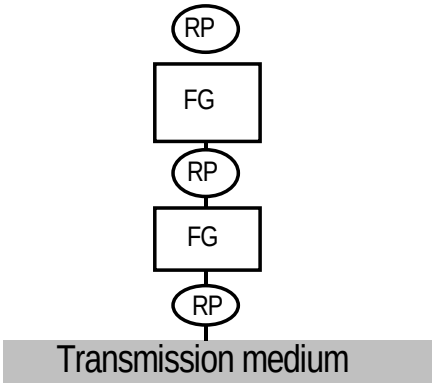


Figure 3 – Device Modularity through Functional Grouping and Reference Point

For practical reasons the FGs are defined in terms of the communication layers embodied in a certain module. Hence the RPs are mapped onto the service boundaries of the communication stack. This is the logical consequence of the combination of OSI model with the unrelated concept of FG and RP, and not an intrinsic feature of OSI itself nor of FG or RP.

The OSI based aspects of modular (layered) communication and the interworking aspects of HES Architecture are covered in the companion document on Communication Layers.

INFORMATION TECHNOLOGY – HOME ELECTRONIC SYSTEM (HES) ARCHITECTURE –

Part 2: Device Modularity

1 Scope

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

It also identifies reference points and functional groupings in a home control system. Clause 4 identifies reference points and interfaces to show possible positions of standardized interfaces. Clause 5 places the reference points and interfaces of the HES in this context.

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

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this part of ISO/IEC 14543-2. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this part of ISO/IEC 14543-2 are encouraged to investigate the possibility of applying the most recent edition of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of IEC and ISO maintain registers of currently valid International Standards.

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

ISO/IEC 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 – Part 3: Naming and addressing*

ISO/IEC 7498-4:1989, *Information processing systems – Open Systems Interconnection – Basic Reference Model – Part 4: Management framework*

ISO/IEC 15044:2000, *Information technology – Terminology for the Home Electronic System*

3 Definitions

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

3.1
application process
element within a real open system which performs the information processing for a particular application

[see ISO/IEC 7498-1, definition 4.1.4]

3.2
home electronic system
The terms defined in ISO/IEC TR 15044 apply.

4 Reference points and functional groupings

4.1 General concepts

A home control system can be seen as a set of elementary components, each of them implementing one or more particular functions, and interworking with its neighbours through interface points. These elementary components are called “functional groupings”, and the boundaries between these functional groupings are called “reference points” (see Figure 4).

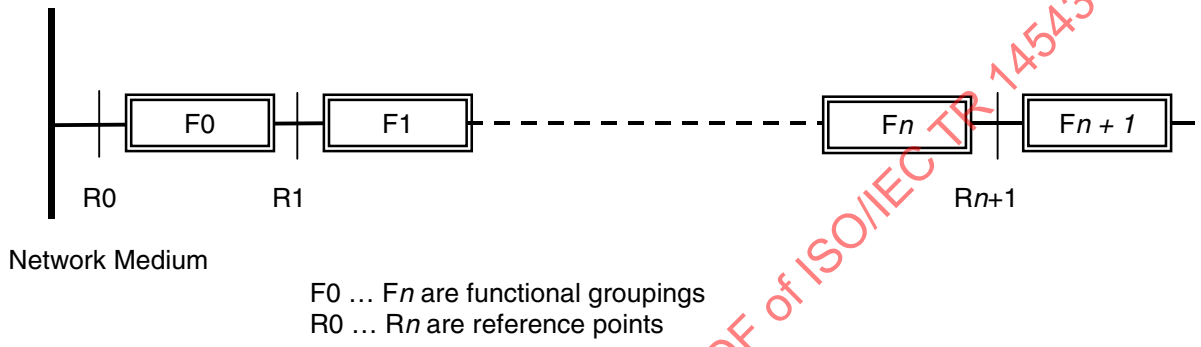


Figure 4 – Reference points and functional groupings

This model does not depend on any physical implementation, and it is neither necessary nor normal that every reference point be present physically in a home control system implementation. Two or more functional groupings may be implemented together without having the reference point physically implemented. Conversely, a functional grouping may be implemented in several parts.

The subdivision of functions into functional groupings provides a basis for defining stable interfaces for connecting different parts of the system.

A functional grouping may offer one or more implementations of reference points, each of which may face towards or away from the network medium. If there are two or more implementations of reference points facing the same direction, then they need not be the same reference point.

Figure 5 shows a functional grouping with one implementation of a network medium facing a reference point, and three implementations of a reference point facing away from the network medium. The figure represents an example of a multiple device controller.

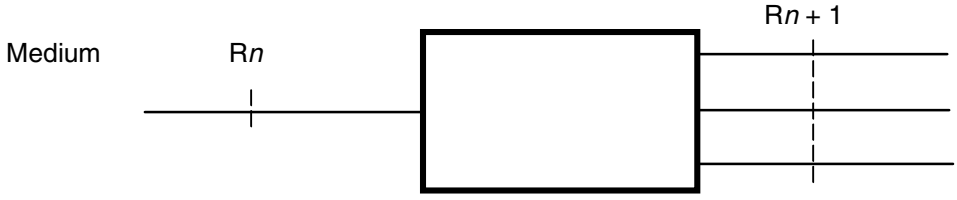


Figure 5 – Example of multiple reference points facing away from the network medium

Figure 6 shows a functional grouping with three implementations of a network medium facing a reference point and one implementation of a reference point facing away from the network medium.

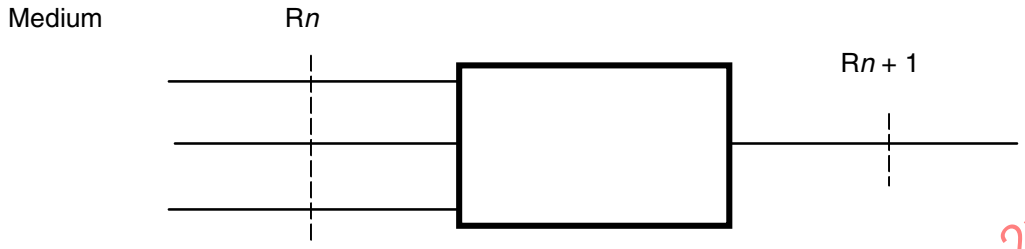


Figure 6 – Example of multiple reference points facing towards the network medium

Figure 7 shows a functional grouping with two implementations of possibly dissimilar network segments facing reference points and no reference point facing away from the network segment. An example of such a functional grouping is a gateway between different parts of a home network.

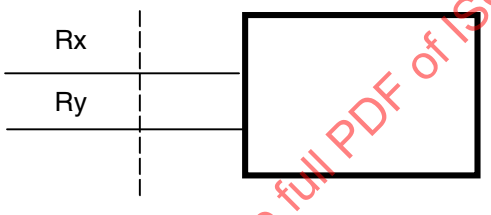


Figure 7 – Gateway between different parts of a home network

4.2 Specific reference points and functional groupings in a home control system

The connection point to a network medium is a natural reference point (the medium attachment reference point), but the interface at this point depends on the medium. Several specifications for the home network already exist with mutually incompatible interfaces at the medium attachment reference point. Therefore, it was found impractical to aim at a single standardized medium interface located at reference point R0 in

Figure 4. Instead medium independent reference points above the physical layer of the network are defined as a basis for standardized interfaces.

Based on the general considerations above, the following set of reference points for the home control system are defined.

A: Medium attachment point

B: Home network access point: medium independent but network dependent

C: Home network access point: medium, network and device-independent

D: Home network access point: medium and network independent but device dependent

E: External network access point

The hierarchy of reference points for the home control system is shown in Figure 8.

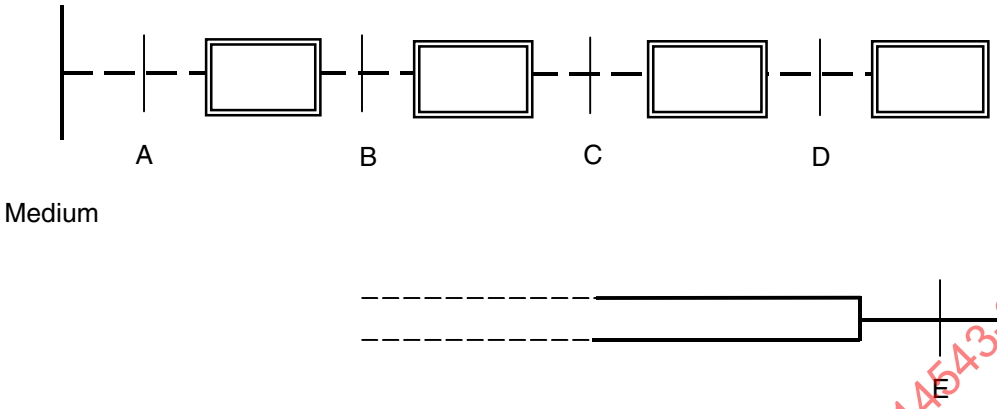


Figure 8 – Location of reference points in the home control system

Reference points provide the basis for standardized interface specifications. In practical implementations not all interfaces need to be physically present. Adjacent Functional Groupings may be combined into one physical entity, in which case the reference point in between collapses into a virtual interface.

A part of the home control system may be considered to be the fixed part, comprising cabling and those units that are permanently installed and not meant to be removed or relocated on a routine basis. This is referred to as the infrastructure domain. The other part, referred to as the device domain, comprises the detachable units that can be easily relocated by virtue of showing standardized interfaces.

As reference points are located at the boundary of functional groupings, it is convenient to describe them by describing the functional groupings they separate.

Functional groupings may be defined to correspond to OSI layers; in that case the services which are provided at layer boundaries or sub-layer boundaries are conveyed across reference points.

Table 1 gives a further description of the functionality of the functional groupings corresponding to the reference points defined in Figure 8 above.

Table 1 – Functional groupings between reference points

Between points	Functions	OSI layers	Depending on
A-B	Handle physical medium access and possibly lower parts of the link layer	Layer 1 and MAC part of layer 2	Medium and network implementation
B-C	Handle the whole or part of the link layer and the network layer	LLC part of layer 2 and layer 3	Network implementation
C-D	Handle the layers above the network layer and part of the application process	Layers 4 - 7 and above (with minor functionality expected for layers 4,5 and 6)	Functionality of the device
Above D	Functions a device offers to the end user	Above layer 7	Intended use or application
A/B/C-E	Gateway between a home control system and an external network	Depends on the external network	External network

4.3 Functional groupings with specific names

Some functional groupings or sets of functional groupings are given names describing their intended use. The following rules should be applied when assigning names.

- When a functional grouping provides a direct service for an end user, it shall be called a device. A device connects any reference point to the end user.
- When a functional grouping attaches to reference point A, the medium attachment reference point, it shall be called a Network Access Unit, NAU. Whenever appropriate the functionality of a NAU may be described more precisely by giving the reference point it connects to reference point A (e.g. NAU-B, NAU-C, NAU-D).

According to the rules given above, wherever more than one name is used to describe a functional grouping, any of the names may be chosen. Normally the name describing the main purpose of the functional grouping will be chosen.

4.4 Requirements for standardization at reference points

Interfaces for the Home Electronic System (HES) will be standardized at reference points as follows (see also Figure 6):

- The Universal Interface (UI) will be standardized at reference point C.
- Process interfaces will be standardized at reference point D.
- Interfaces at reference points A (Medium Interface – MI), B and E (shown in Figure 9) are either proprietary or standardized by other bodies.

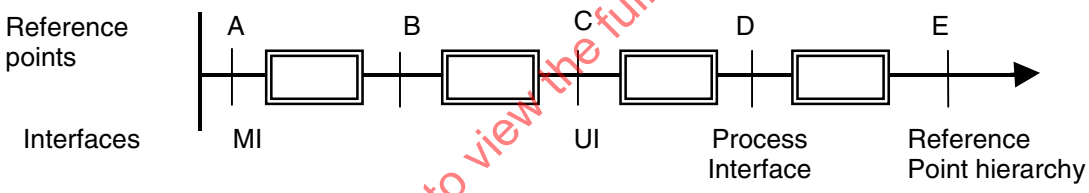


Figure 9 – Location of standardized interfaces

The definition of interfaces as given above allows modular systems that cover the requirements of a broad range of users and manufacturers. Clause 5 describes the locations of the interfaces in the OSI Basic Reference Model.

5 Position of reference points within the HES

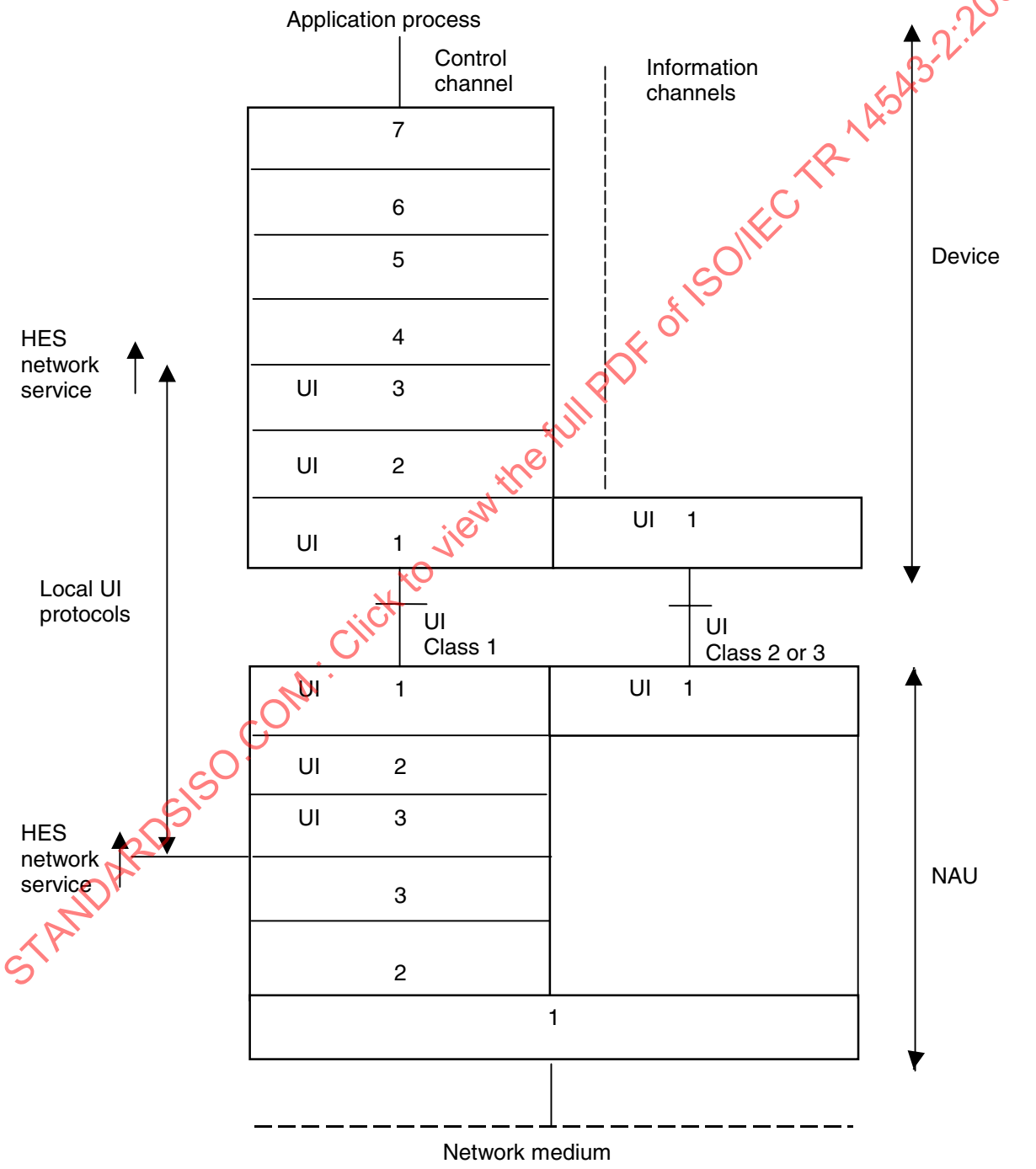
5.1 Position of the UI in HES Class 1 and HES Classes 2 and 3

The universal interface (UI) is placed at the service access point on top of layer 3. Unlike OSI service definitions, the UI is defined not only as a conceptual boundary, but also as a physical interface including mechanical, electrical, functional and procedural specifications, including protocol layers local to the UI. Dependent on the free choice of implementation as defined and illustrated in Figure 11 and Figure 12, the physical implementation of the UI is mandatory for conformance type A, but is not required for conformance type B.

Figure 10 illustrates the position of the UI in the reference model.

The main strategy for HES standardization is to have standardized interfaces (the UI and the process interface) between devices and networks, and thus to make the devices network independent. This is called type A conformance. The standard allows the network dependent part to be integrated within the devices and thus devices to be connected directly to the medium. This is called type B conformance. See Figure 11 and Figure 12 for clarification of these types of conformance.

A Type B conformant device uses the HES services of network, transport and application layers but does not use the UI.



NOTE Since UI is a point-to-point connection, layer UI 3 is empty.

Figure 10 – Position of the Universal Interface

Figure 11 and Figure 12 below illustrate the UI in the HES Reference Model for Class 1 devices (control channel), also showing type A and type B conformance.

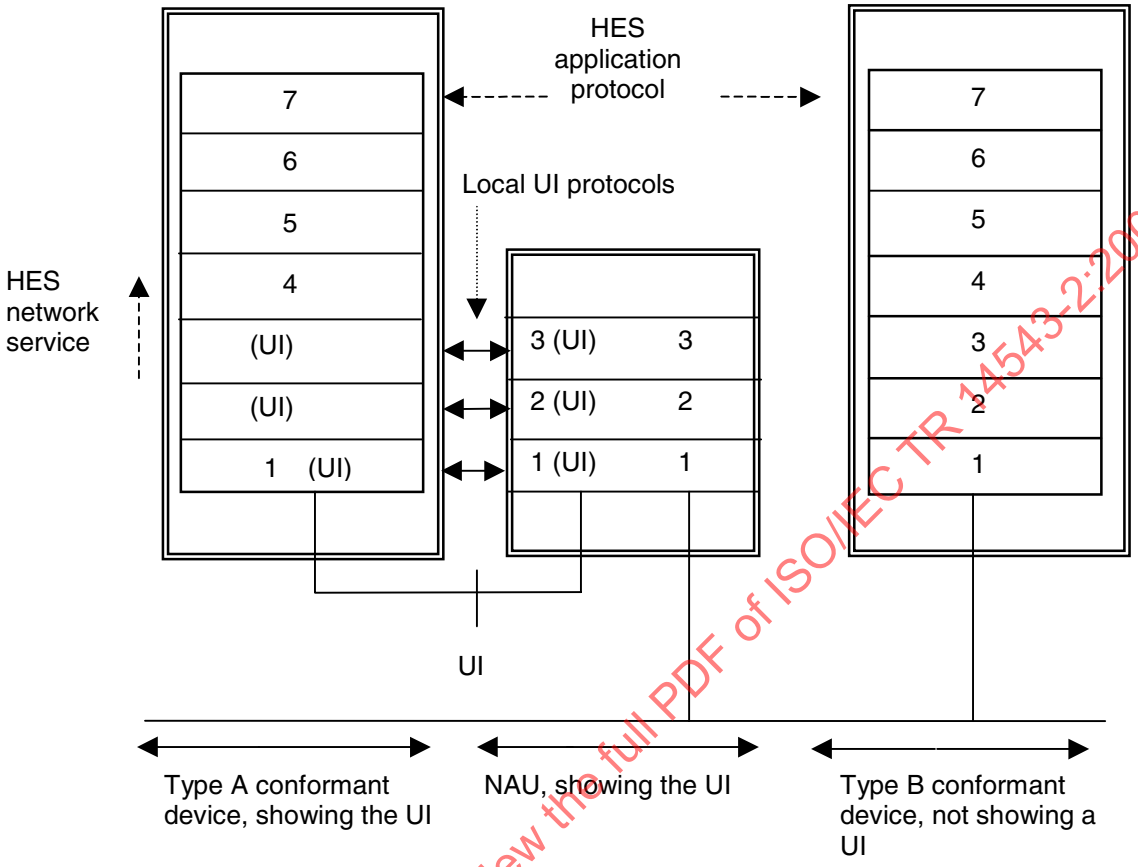


Figure 11 – Conformance types A and B

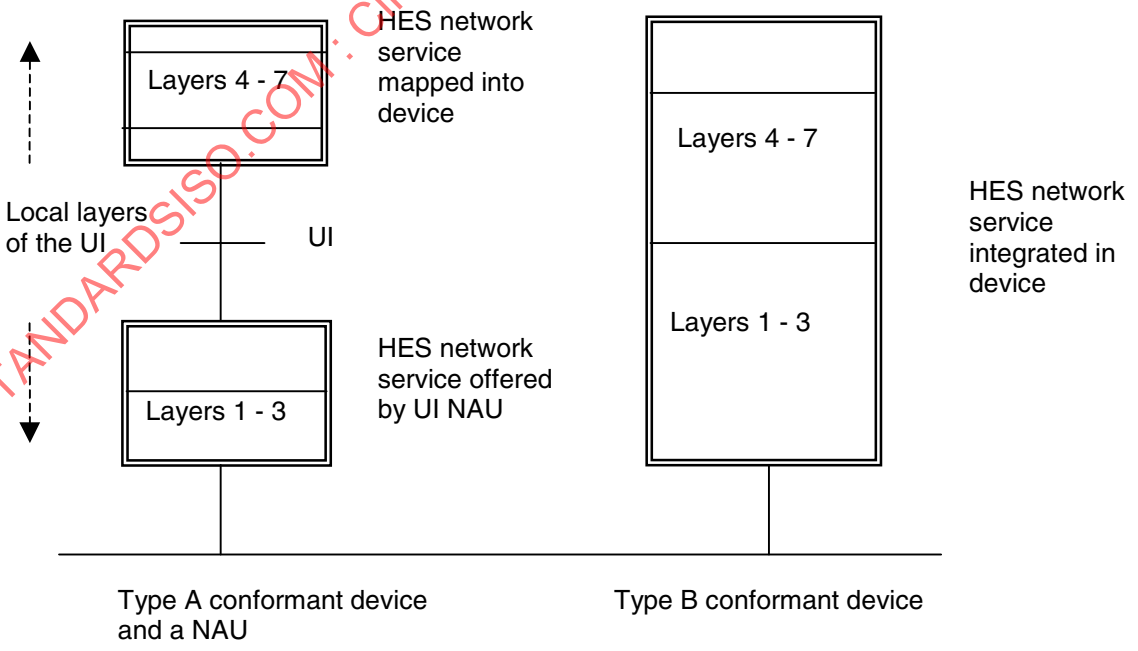
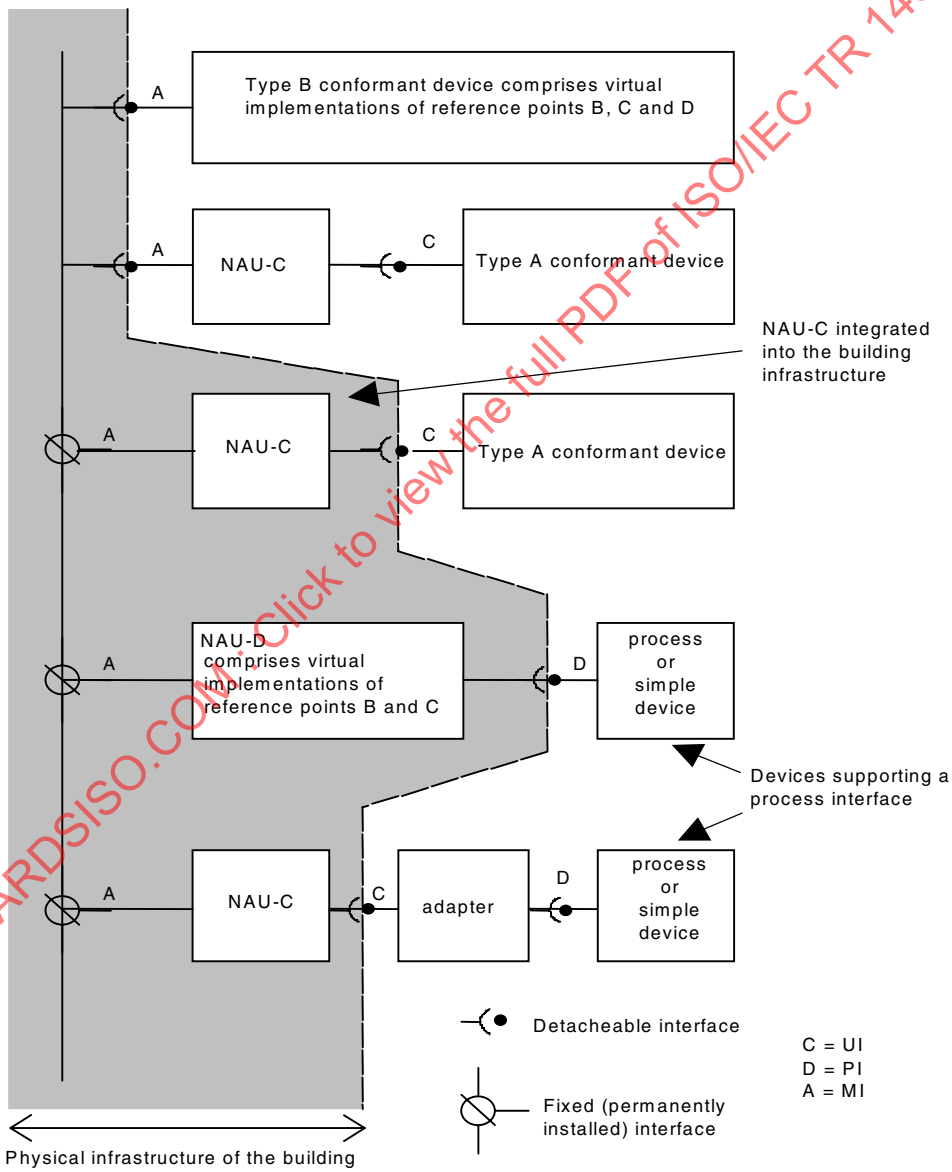


Figure 12 – Simplified representation of conformance types A and B

For the information channels (Classes 2 and 3) only the Physical Layer OSI Reference Model (layer 1) is defined. The use of information channels, the required coding and the representation of the information is left to the application domain, and is outside the scope of this part of ISO/IEC TR 14543.

Figure 13 shows examples of functional groupings. It also shows some possible positions of the physical boundary between the permanent part and the detachable units.

The NAUs may be integrated into the physical infrastructure of the building (for example, embedded in walls or ceiling cavities). Alternatively, the NAUs may be portable cabled devices. Figure 13 shows examples of the possibilities; other combinations are possible.



Note that Type B conformant devices may, like NAU-Cs, be contained within the physical infrastrucure of the building.

Figure 13 – Examples of detachable, permanent and virtual implementations of Reference Points

5.2 Position of the process interfaces in the HES

For devices that do not necessarily interpret the HES application protocol, interfaces called process interfaces are defined above the HES application layer. Figure 14 illustrates the position of the PIs in the reference model. The different PIs are defined with mechanical, electrical, functional and procedural specifications in subsequent parts of this standard.

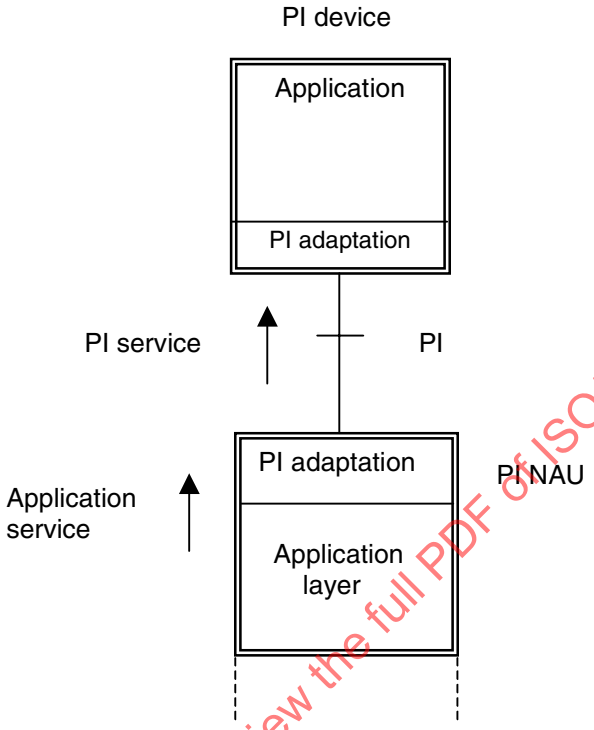


Figure 14 – Position of process interfaces