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INTERNATIONAL STANDARD

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Information technology – Home network resource management – Part 2: Architecture

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FOREWORD

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International Standard ISO/IEC 30100-2 was prepared by subcommittee 25: Interconnection of information technology equipment, of ISO/IEC joint technical committee 1: Information technology.

A list of all currently available parts of the ISO/IEC 30100 series, published under the general title *Information technology – Home network resource management,* can be found on the IEC website.

This International Standard has been approved by vote of the member bodies, and the voting results may be obtained from the address given on the second title page.

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

IMPORTANT – The 'colour inside' logo on the cover page of this publication indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.

INTRODUCTION

The ISO/IEC 30100 series of standards specifies an abstract model for remote management of home networks conforming to the Home Electronic System (HES) architecture specified in ISO/IEC 14543-2-1. HES consists of a collection of devices that are able to interwork via a common internal network. In a home environment several HESs may operate concurrently, each with separate control and management methods. The Home resource management architecture allows uniform fault processing, diagnostics and configuration management of HES elements in a home environment.

The ISO/IEC 30100 series specifies the home network resource managment architecture and an information model for various home network elements. The information model specifies the minimum requirements of the functionalities that shall be provided by each HES entity. It is specified by the XML-based schema provided in Clause 7. The information consists of the mandatory and optional attributes including user-defined attributes. The user-defined attributes are used for a proprietary purpose or to define attributes that are not specified in the information model. In this part, the information model is specified to cover the physical space, device, network and service information. This information model can be easily extended to accommodate new types of information including user-defined attributes. These functionalities are required to accommodate changes with minimal uploads and restructuring.

Currently, ISO/IEC 30100, *Information technology – Interconnection of information technology equipment –Home Network Resource Management*, consists of the following parts:

Part 1: Requirements

Part 2: Architecture

Part 3: Management application

ISO/IEC 30100 is applicable to:

- a management server located at a home network service provider that manages home networks;
- an apartment complex server, located in an office at the apartment complex;
- a home residential gateway or set top box (STB).

INFORMATION TECHNOLOGY – HOME NETWORK RESOURCE MANAGEMENT –

Part 2: Architecture

1 Scope

This part of ISO/IEC 30100 specifies the general information model and architecture for managing the resources in a home network. Home network resources are managed objects that provide home network services. Essential home resources include device, network and service resources.

The objectives of this standard are to

- define terminology that describes logical resources of devices, networks and services in a home area network;
- specify the logical information model for describing relations among resources;
- describe the basic logical functional procedures of home area networks (e.g., remote maintenance, auto-configuration and fault processing).

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.

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

ISO/IEC 14543-2-1, *Information technology – Home electronic system (HES) architecture – Part 2-1: Introduction and device modularity*

ISO/IEC 15944-8, *Information technology – Business Operational View – Part 8: Identification of privacy protection requirements as external constraints on business transactions*

ISO/IEC 18012 (all parts), *Information technology – Home electronic system (HES) – Guidelines for product interoperability*

ISO/IEC 18012-2:2012, *Information technology – Interconnection of information technology equipment – Home Electronic System (HES) – Guidelines for product interoperability – Part 2: Taxonomy and Lexicon*

ISO/IEC 27000, *Information technology – Security techniques – Information security management systems – Overview and vocabulary*

ISO/IEC 27001, *Information technology – Security techniques – Information security management systems – Requirements*

ISO/IEC 27002, *Information technology – Security techniques – Code of practice for information security management*

ISO/IEC 27003, *Information technology – Security techniques – Information security management system implementation guidance*

ISO/IEC 27004, *Information technology – Information security management – Measurement*

ISO/IEC 27005, *Information technology – Security techniques – Information security risk management*

ISO/IEC 27006, *Information technology – Security techniques – Requirements for bodies providing audit and certification of information security management systems*

ISO/IEC 27007, *Information technology – Security techniques – Guidelines for information security management systems auditing*

ISO/IEC TR 27008, *Information technology – Security techniques – Guidelines for auditors on information security controls*

ISO/IEC 27009, *Information technology – Security techniques – Sector-specific application of ISO/IEC 27001 – Requirements*[1]

ISO/IEC 27010, *Information technology – Security techniques – Information security management system implementation guidance*

ISO/IEC 27011, *Information technology – Security techniques – Information security management guidelines for telecommunications organizations based on ISO/IEC 27002*

ISO/IEC 30100-1:2016, *Information technology – Home network resource management – Part 1: Requirements*

3 Terms, definitions and abbreviations

3.1 Terms and definitions

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

3.1.1
apartment complex
group of two or more apartment buildings with a common manager

Note 1 to entry: A common manager provides management services for the apartment buildings. These services may include the management of home networks in the apartments.

3.1.2
application
field of use of the home resource management process

3.1.3
class
set of instances of home resources

[1] To be published.

3.1.4
device
distinct physical unit on a network that performs a (set of) specific function(s) in a particular context

Note 1 to entry: A device can either be an end node on the network, or an intermediate node (as in the case of a network gateway device connecting two distinct physical networks).

3.1.5
domain
range of validity of a resource object

3.1.6
HES entity
logical component that has a defined functionality in the HES architecture

3.1.7
HES interoperability framework
collection of standards defining device and network interoperability for homes

3.1.8
home resource
managed object that can be used for home network services

3.1.9
home resource management interface
data transfer between a management application and a home resource management process

3.1.10
home resource model
abstract, formal representation of resource objects in a home environment

Note 1 to entry: Resource objects include resource properties, relationships and the operations that can be performed on them.

3.1.11
management application
function to be used by an apartment complex manager for suppporting the occupants

3.1.12
management information
set of components used either in a management application or in a resource management process

3.1.13
network
devices interconnected via a common medium for communicating according the reference model specified in ISO/IEC 7498-1

3.1.14
object

3.1.14.1
object
unit of software functionality

Note 1 to entry: This definition is traditionally used in object-oriented programming. It has properties and methods for accessing these properties and/or interacting with other objects.

3.1.14.2
object
collection of related data (attributes) and methods (procedures) for operating on that data

Note 1 to entry: This definition implies a well-defined boundary (interface) and identity that encapsulates state and behaviour

3.1.15
physical space
arbitrary set of reference co-ordinates of a home resource in the real world

3.1.16
resource information provider
functions for home resource management process to control HES entities

Note 1 to entry: Collects data from HES entities and transfers the collected data to the home resource management process.

3.1.17
resource object
unit managed by the resource management process

Note 1 to entry: It has methods for accessing internal properties of the object and/or interacting with other objects. A resource object can contain one or more HES entities.

3.1.18
resource relation object
association between resource objects

3.1.19
service
field of use of an HES

3.2 Abbreviations

AFM	Automatic Fault Management
BNF	Backus-Naur Form
DM	Device Management
HAN	Home Area Network
HES	Home Electronic System
HNRM	Home Network Resource Management
HRMI	Home Resource Management Interface
HRPI	Home Resource Provider Interface
IFC	Industry Foundation Classes
IWF	Inter Working Function
IWML	Inter Working Markup Language
LSM	Layer System Management
NM	Network Management
OSI	Open System Interconnection
PLC	Power Line Carrier
QoS	Quality of Service
RM	Remote Management
STB	Set Top Box
SVC	Service object

XSD XML Schema Definitions

3.3 Conventions

Table 1 shows the SI-unit equivalents of the non-SI notations used in the attributes, diagrams and XML Schema Definitions (XSD) in Clause 7. These non-SI notations avoid syntax conflicts with the XSD tag delimiter (“/”).

Table 1 – Notations in ISO/IEC and this standard

Notations in this standard	SI units
bps	bit/s
kbps	kbit/s
mbps	Mbit/s
gbps	Gbit/s
sec	s
usec	µs

4 Conformance

In order to claim conformance to this standard a service provider offering management services for home networks shall provide the following services for each home network device as specified in ISO/IEC 14543-2-1:

- a resource management process that manages each home resource object as specified in 6.2;

- a resource management process that manages each home resource relation object as specified in 6.4;
- a resource management process that provides the mandatory information specified in Clause 7.

5 Home network resource management

5.1 Information resouce categories

To extend the HES interoperability architecture specified in the ISO/IEC 18012 series from products to the management of network resources, several categories of information resources are specified. These categories shall include devices, and may include services, networks and physical spaces, as illustrated in Figure 1. Each category includes elements that shall provide information resources, as described in 6.1 and Figure 2 of ISO/IEC 30100-1:2016. For example, ISO 16739 (IFC) can act as an information resource for the physical elements (floor plan). Also the resource management requires defined representation models for the components of each information category and a mapping method to represent the relations between the categories, which is explained in Clause 6. In this standard, an information category is a synonym for domain information.

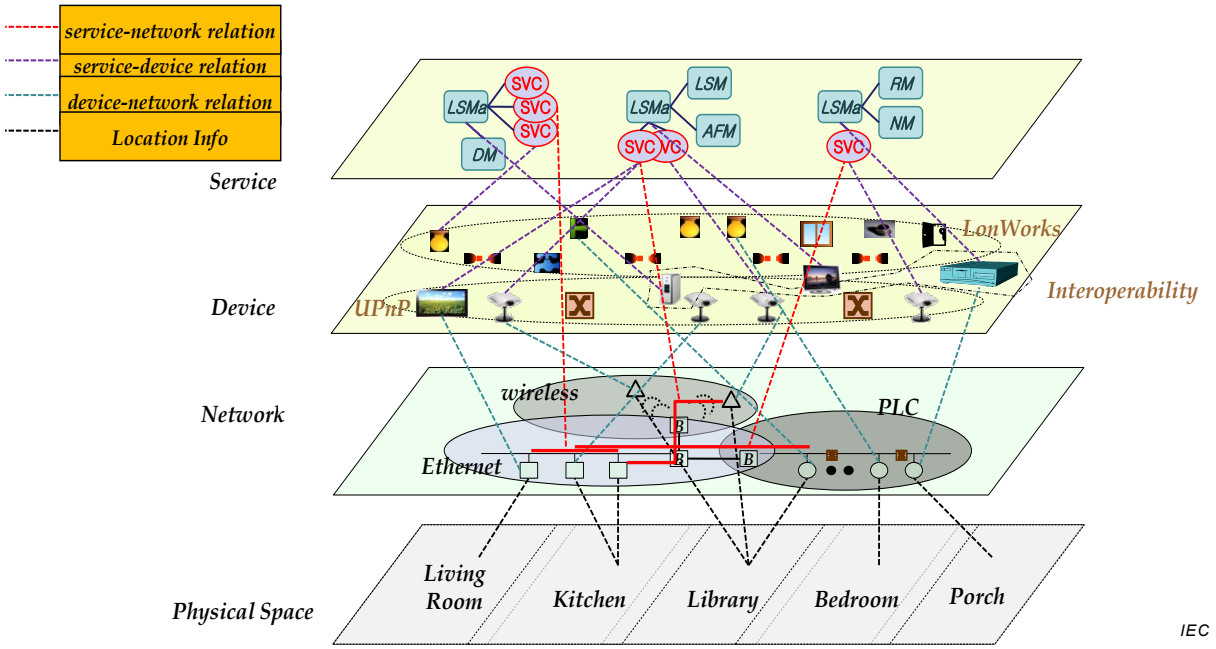

Figure 1 – Logical concept of home resource management architecture

5.2 Architecture

The HNRM system uses the HES interoperability framework (ISO/IEC 18012 series) to integrate resource information from devices, networks and services. This integrated information enables management services such as fault diagnosis and remote management of HES systems.

Figure 2 illustrates the overview of the home network resource management architecture. In Figure 2 the HES interoperability framework applies only to devices (as shown in Figure 1). Because home network resources include more than devices, e.g. network resources or service resources, it is reasonable to expect support in the future for the other elements shown in Figure 1, as are services, networks, and physical spaces. However, the specification of management services for these elements are out of scope for this standard.

The HES interoperability framework in Figure 2 includes an interworking function that translates generic messages of the resource information provider into specific messages of various home network technologies. For example, there is an application for device control or configuration located in the management application in Figure 2. It requests device information about how to control or configure the device for the home resource management process through the HRPI (Home Resource Provider Interface). The home resource management process sends the request from the application to the resource information provider using HRMI (Home Resource Management Interface). The resource information provider relays the request for the device information to the HES interoperability framework via the framework interface. The requested message from the resource information provider to the HES interoperability framework is called a “generic message”.

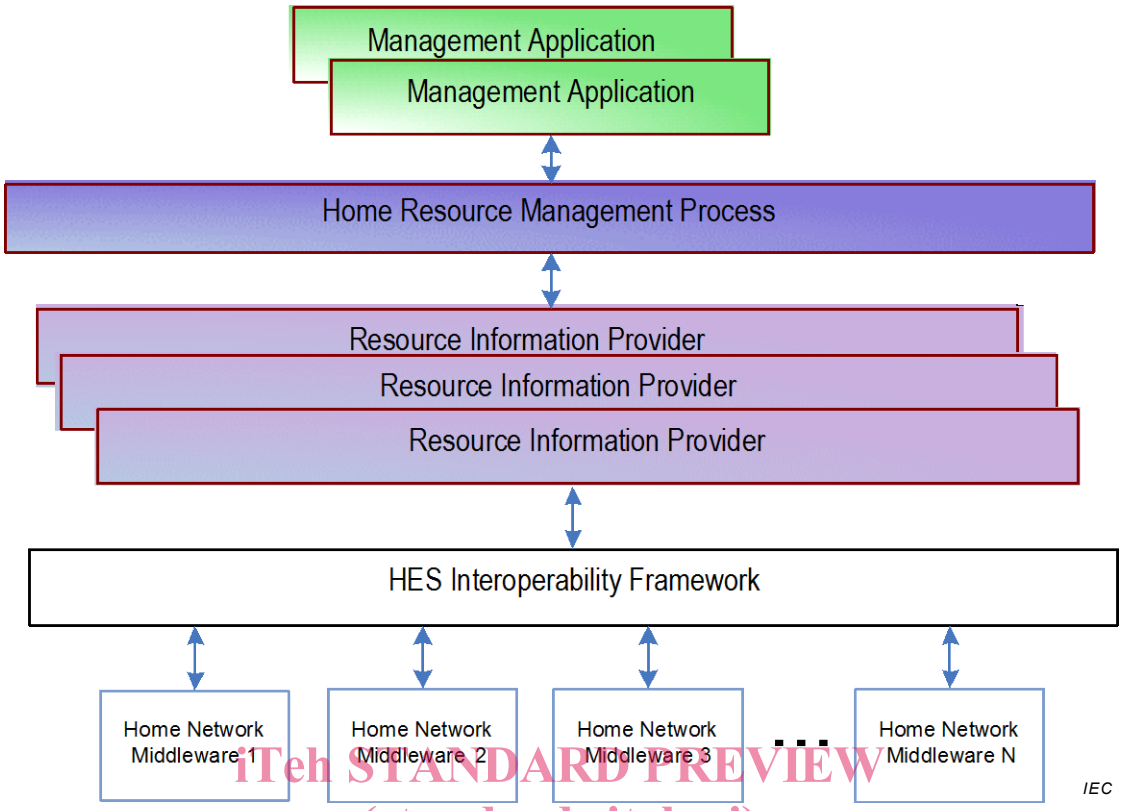

Figure 2 – Overview of the home network resource management architecture

A generic message is sent by the resource information provider to a home application. Devices in a home that implement the application may conform to a variety of home network protocols and applications languages. HES specifies a choice of home network protocols in the ISO/IEC 14543 series. The device developer is responsible for programming the device to translate these generic HNRM messages to device-specific messages conveyed by a home network communications protocol. The tools for this translation are specified by the interworking function in 5.2 of ISO/IEC 18012-2:2012.

ISO/IEC 18012-2 specifies a framework for a common applicaton language using XML structures. A device that is programmed according to ISO/IEC 18012-2 understands this XML-based language in addition to any proprietary application language. This XML language, based on ISO/IEC 18012-2, enables application interoperability among devices. If an application is implemented using a proprietary language, each device or a local proxy for these devices is responsible for translating the XML-based language to any proprietary language. An example of the XML language is provided in Annex A.

The individual device that received the request for device information sends a response message about device information including resource properties, functional capabilities and status to the HES interoperability framework using its specific protocol. When the HES interoperability framework receives the response message from the individual device, it carries out a reverse translation from the specific message to the generic message and sends it to the resource information provider. The translated generic response message in the resource information provider is transmitted to the application through the reverse procedure of that of the request. The application that received device information analyses the information for device control, and then it sends a control request message to the individual device through the same procedure.

An implementation of an application conformant to the HES interoperability framework requires internal management functions to support interoperable application configuration through the interworking function. The internal management functions are described in each device information description. Applications read this device information to determine how to

control the device. The details of internal management functions are specific implementation issues for each application and are outside the scope of this standard.

Thus, interoperability when components from different implementers are combined is achieved with

- a common set of HNRM messages as specified in this standard,
- translation of these HNRM messages using ISO/IEC 18012-2 to a protocol specific for an application that is communicated via a standardised protocol such as one of the HES protocols.

Each implementation depends on the home network protocol and application message set chosen by the developer. A logical connection is established between a remote server and a local device by network management facilities during network configuration, device installation, and service installation. The methods for establishing this connection depend on the home networking protocol chosen.

The overall home resource management architecture consists of four parts, see description in 5.3 to 5.6.

- Resource information provider, see 5.3
- Resource management process, see 5.4
- Management application, see 5.5
- Interface, see 5.6

5.3 Resource information provider

The resource information provider shall collect all data from one or more HES entities on a home network within a single domain (e.g. physical space, service, network and device). The gathered information includes resource properties, functional capabilities and status. Essentially, it requires resource identification, type and name. The information provider transmits collected data to the home resource management process periodically or non-periodically. The communication protocol or exchanging data format follows the standard specifications defined by the HES interoperability framework. In addition, the resource information provider enables direct control of the HES entities, i.e., the home resource management process controls each HES entity via a resource information provider.

As shown in Figure 3, for a single domain, there shall be one or more resource information providers.

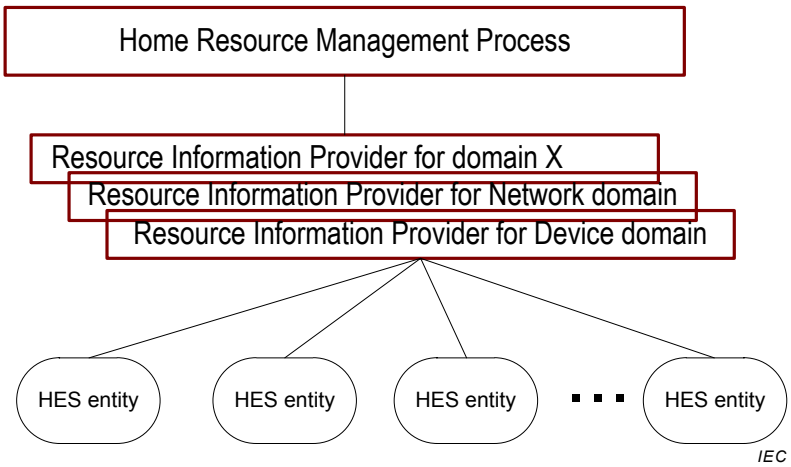

Figure 3 – Resource information provider collects data from one or more HES entities