SLOVENSKI STANDARD
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Omrežje gospodinjskih aparatov in povezljivost mreže - 1. del: Splošne zahteve, modeliranje rodovnih podatkov in nevtralna sporočila

Household appliances network and grid connectivity - Part 1: General requirements, generic data modelling and neutral messages

Netzwerk- und Stromnetz-Konnektivität von Haushaltsgeräten - Teil 1: Allgemeine Anforderungen, allgemeine Datenmodellierung und neutrale Meldungen

Appareils domestiques connectés au réseau et réseau intelligent - Partie 1: Exigences générales, modélisation de données génériques et messages neutres génériques

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Household appliances network and grid connectivity - Part 1: General requirements, generic data modelling and neutral messages

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European foreword

This document (EN 50631-1:2023) has been prepared by WG 7 “Smart Household Appliances” of CLC/TC 59X “Performance of household and similar electrical appliances”.

The following dates are fixed:

• latest date by which this document has to be implemented at national level by publication of an identical national standard or by endorsement	(dop)	2024-02-07
• latest date by which the national standards conflicting with this document have to be withdrawn	(dow)	2026-02-07

This document supersedes EN 50631-1:2017 and all of its amendments and corrigenda (if any).

EN 50631-1:2023 includes the following significant technical changes with respect to EN 50631-1:2017:

— Simplified adoption of the series of standards through logical partitioning of the document structure;

— Ensured interoperability through more precise, neutral definition of information and sequences to be exchanged;

— Neutralization of requirements and description of information to be exchanged on a generic level, permitting mapping to different data models and languages;

— Extension of use cases and data models to Heating, Ventilation, Cooling devices for a holistic approach regarding energy management at home / on premises;

— Definition of possible transport protocols to ensure more complete interoperability;

— Primary focus on energy management;

— Preparation for further developments.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CENELEC shall not be held responsible for identifying any or all such patent rights.

Any feedback and questions on this document should be directed to the users’ national committee. A complete listing of these bodies can be found on the CENELEC website.

Introduction

Energy management systems will more and more become necessary due to change from fossil and nuclear to renewable production and the associated decentralization. Since an appropriate standard for a home and building management is in preparation, this document specifies how sets of products from multiple manufacturers can exchange information with Home and Building / Customer Energy Management Systems, located in a home network or in the cloud.

This document focuses on interoperability of household appliances and describes the necessary control and monitoring. It defines a set of functions of household and similar electrical appliances. The functions in this document cover next to energy-management main remote-control and – monitoring use cases.

This document does not deal with safety and security requirements. Safety requirements have been set in the EN 60335 series [2].

The EN 50631 series will provide interoperability on information exchange among various appliances in the home. The EN 50631 document series will be re-arranged regarding the further development and will be split into 6 parts:

EN 50631-1, *Household appliances network and grid connectivity — Part 1: General Requirements, Generic Data Modelling and Neutral Messages*

EN 50631-2, *Household appliances network and grid connectivity — Part 2: Product Specific mappings, details, requirements and deviations*

EN 50631-**3-x**, *Household appliances network and grid connectivity — Part 3: Specific Data Model Mapping*

EN 50631-**4-x**, *Household appliances network and grid connectivity — Part 4: Communication Protocol Specific Aspects*

EN 50631-5, *Household appliances network and grid connectivity — Part 5: General Test-Requirements and -Specification*

EN 50631-6, *Household appliances network and grid connectivity — Part 6: SPINE Data Model Toolbox*

Data communication heavily depends on the environment of appliances. Sometimes low bitrate or energy efficient communication puts strict requirements to selected communication technologies. Therefore, popular and de facto standards had been and will be developed by the industry to fulfil such requirements. To not influence common data modelling for appliances because of such restrictions, the standardized data models and neutral message structures need to be applied to communication technologies.

This standard series therefore is intended to separate data modelling and neutral message structure from the attached communication.

Part 1 defines general requirements, generic data modelling and generic neutral messages without relation to any specific communication technology or any product specific layout.

Part 2 lists and specifies product specific requirements and implementation guidance based on the generic data model and generic neutral messages.

Part 3 defines the mapping of neutral messages to examples of typical data models like SPINE, SPINE-IoT, OCF, and so forth. These data models are neither mandatory nor to be seen as complete spectrum of data models.

Part 4 defines the mapping of neutral messages to examples of typical communication protocols. These communication protocols are neither mandatory, nor do they provide an exhaustive list of communication protocols.

Part 5 defines testing requirements and testing specifications. This part will be covered in the future by a New Work Item Proposal.

Part 6 provides the technical reference specification for the SPINE data model. This part will be covered in the future by a New Work Item Proposal.

1 Scope

This document defines data models for Interoperable Connected Household Appliances. The data models are derived from a logical decomposition of use cases into functional blocks that themselves were realized by abstract actions on the data model itself.

This document is part of the EN 50631 series, which defines the information exchange between Smart Appliances and management systems in homes and buildings including energy management.

2 Normative references

There are no normative references in this document.

3 Terms and definitions

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

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

3.1
“alternatives” group
grouping of one or more Power sequences over a specified time

3.2
appliance
electrical apparatus intended for household or similar use

EXAMPLES Refrigerators, dishwashers, clothes washers, clothes dryers, air conditioners, water heaters, circulation pumps, heat pumps, etc.

3.3
Appliance Energy Flexibility
ability of an appliance to change power consumption in response to an external stimulus

3.4
client
role that specifies that a node uses data from a “server” or can request for change

3.5
command
functional part of a Message

3.6
CCM
Customer Connectivity Manager
component or set of functions with the capability to:

1. Receive and process Grid Information, Appliance Information and User Instructions, and
2. Manage one or more Smart Appliances

Note 1 to entry: A CCM may be integrated with a Smart Appliance or may be physically separate.

Note 2 to entry: A CCM manages the energy-using behaviour as well as other aspects of device behaviour (e.g. setting of job status like starting, stopping, pausing, parameters like temperature, notifications...) of one or more Smart Appliances.

Note 3 to entry: In other documentation, CCM is often called Customer Energy Manager (CEM) with a dedicated focus on energy management or called Energy Management System (EMS) with a dedicated focus on energy management.

3.7
data model
definition of possible data (data structures, values) for the exchange of information (especially for communications systems)

[SOURCE: IEC 60050, IEV]

3.8
Demand Response
DR
action resulting from management of the electricity demand in response to supply conditions

[SOURCE: IEC 60050, IEV]

3.9
Demand Side Management
DSM
process that is intended to influence the quantity or patterns of use of electric energy consumed by end-use customers

3.10
DHW
Domestic Hot Water

3.11
grid information
information received by a CCM directly from or relating to the electricity grid

Note 1 to entry: Such information may include (but is not restricted to) the following categories:

— current and future energy prices;

— current and future network constraints;

— emissions-intensity of electricity supply;

— level of renewable energy generation;

— requests or instructions for load modification;

— directly sensed information (e.g. frequency and voltage).

3.12
interoperability
property permitting smart appliances and energy management systems in homes and buildings to exchange data together for the purpose of energy management

[SOURCE: IEC 60050, IEV]

3.13
HAN
Home **A**rea **N**etwork

3.14
JWG
Joint Working Group
Joint working Group Use Cases & Requirements is a working group under the roof of IEC/TC 57/WG 21; it is a cross functional working group and develops Smart Grid and Smart Home & Building related user stories and use cases

Note 1 to entry: See IEC/TR 62746-2:2015 Use cases and requirements [1]

3.15
manual operation
operation of a Device under direct user control

Note 1 to entry: Includes operation under the influence of remote controls provided with the appliance or device.

3.16
manual override
return to Normal User Operation that terminates or prevents a period of Smart Operation, that is initiated by the User

3.17
neutral message
information exchange that is independent of any specific communication solution

Note 1 to entry: EN 50631-4-1) describes the mapping of neutral messages to examples of typical communication protocols.

3.18
power sequence
expected power consumption over time (i.e., represented as a “curve” of power over time) including options on its flexibility

3.19
power slot
single step of a Power sequence; each power slot is modelled with at least one constant power value for its duration

3.20
RMS
rms
abbreviation for “root mean square” (used for electricity measurement)

3.21
scope
Scope Type
definition of scope types to allow identification of specific functionalities unambiguously

EXAMPLE outsideAirTemperature

3.22
server
role that specifies that a node offers own data to be read or written by a node with role client

Note 1 to entry: A server can notify its data to other nodes (with role client).

3.23
smart appliance
appliance that is capable of Smart Operation

Note 1 to entry: Notwithstanding the possibly broader concept related to the term “smart appliance”, a smart appliance under the framework of this document needs to be understood as follows:

1) It is an appliance that can respond to an external stimulus initiated by a CCM and/or Remote Agent to provide activities such as

   a. Support Appliance Energy Flexibility

   b. job status related functions such as starting, stopping, pausing,

   c. content or level related functions such as temperature, door status;

2) The appliance will respond when the user sets conditions and its status allows for a response,

3) The response is a change of the appliance’s behaviour like electricity consumption, job status and/or level or content pattern, or a notification thereof;

4) The specific technical smart capabilities need not be activated when the product is placed on the market; the activation can be done at a later point in time by the consumer or a service provider.

Note 2 to entry: Smart appliances in this context can communicate through a Customer Connectivity Manager function processing external signals, such as price information or availability of Renewable Energy Sources (demand response), or direct control signals (demand side management), being able to consider households’ preferences or the behaviour of the other home appliances.

3.24
smart operation
operation of an Appliance where the CCM has been set to modify operation automatically in response to Trigger Criteria

Note 1 to entry: Smart operation may be initiated by a CCM.

3.25
SPINE
Smart **P**remises **I**nteroperable **N**eutral-message **E**xchange

3.26
SPINE-IoT
Smart Premises Interoperable Neutral-message Exchange for Internet of Things

3.27
subscription
functionality that enables the receiving of messages of interest from another device without polling it

3.28
use case
textual description of a re-usable functionality, consisting of one or more messages from one or more participating actors, which may be visualized with a sequence diagram

EXAMPLE “A CCM shifts the energy usage of a washing machine”

3.29
Use Case Functions
functions which group basic functionalities that had been derived from use cases, and which provide the entire information exchange required to implement the considered use cases and user stories

3.30
user story
complete (but specific) business case described from the perspective of a user which can be separated into several use cases

EXAMPLE "The user wants to get the laundry done by 8:00 pm"

4 Process and requirements to enable interoperability

4.1 Introduction

Energy management systems will more and more become a requirement due to the switch from fossil and nuclear to renewable production and the associated decentralization. The success of energy management is highly dependent on interoperability of the smart appliances within the premises, which means that all devices will need a common, manufacturer-independent and brand-independent understanding of messages and data (in a broader perspective, it does not matter if it is an energy-related message, a home management message or an information message); see also [8].

This document specifies how different products from different manufacturers can exchange information with Home and Building / Customer Energy Management Systems located in a home network or in the cloud. It defines a set of functions of household and similar electrical appliances covering energy management, remote control and monitoring.

There exist different networking technologies for interoperability in Homes and Buildings. Regardless of the communication technology, they all have rules or standards (collectively known as protocols) that define the syntax, semantics and synchronization of communication and error recovery methods which have to be taken into account when defining specific protocols used for the scope. EN 50631-4 defines this process.

4.2 Process

The Smart Grid Architecture Model (SGAM) [9], published by the Smart Grid Coordination Group based on EU mandate M/490, defines five interoperability layers representing business objectives and processes, functions, information exchange and models, communication protocols and components.

Figure 1 shows the interoperability layer and the corresponding domains and zones, defined in the SGAM Model.

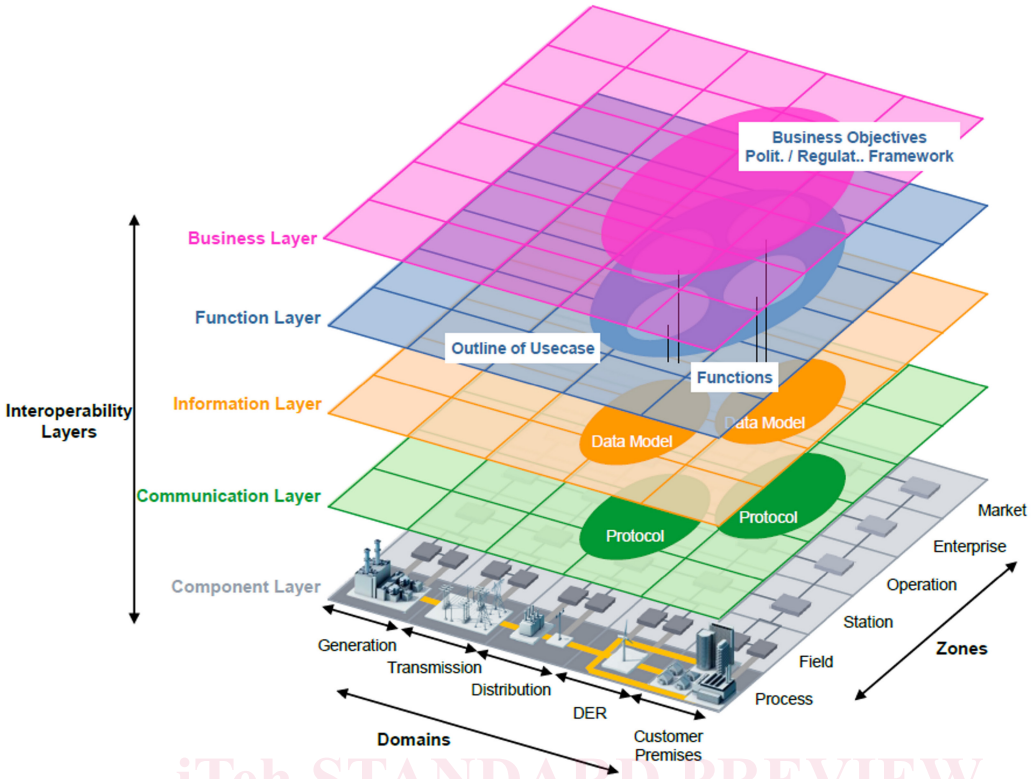

Figure 1 — SGAM Framework (from [9])

In analogy to the SGAM Framework, this series of documents uses a top-down process and sequence of steps to describe an open interface for integrating with Smart Appliances within the Customer Premises SGAM domain (see Figure 2).

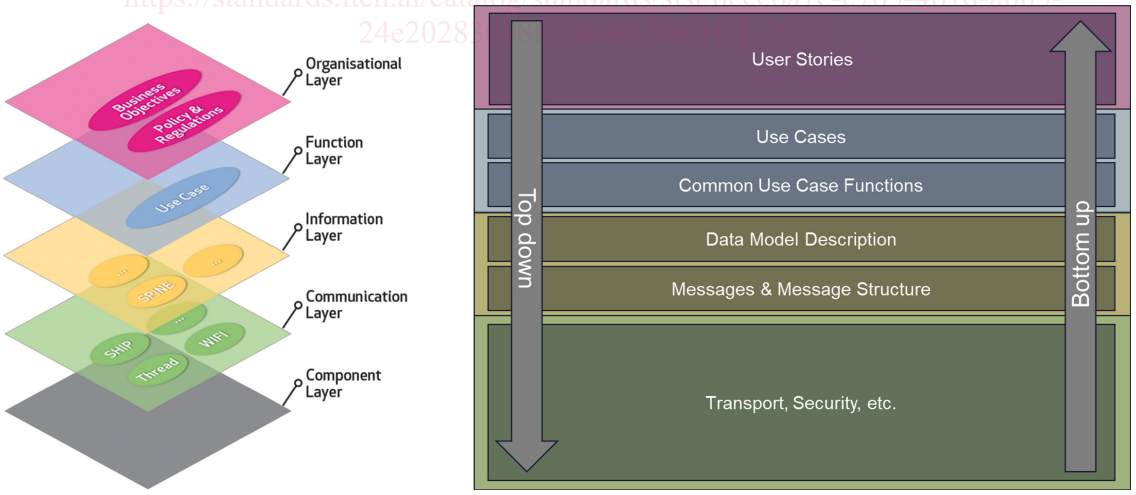

Figure 2 — Process used in this document

User stories and derived use cases are collections of ideas how to use Smart Appliances. User stories and use cases are not binding and describe one possible solution (see Clause 6 and 7). However, they can be used to deduce common Use Case Functions which can be used/referenced in certain use cases.

Use Case Functions (see Clause 8) contain a set of information and instructions to be exchanged between two peers such as CCM and Device, described as a data model.

The data model needs to be placed into a message, combined with rules like addressing scheme, capabilities of addressee and so forth. As this is specific to the protocol(s) at hand, this mapping to specific protocols has been split out of this document into EN 50631-4-x.

4.3 Architecture

In general, a Smart Appliance connects to a CCM, but has in principle three operation modes:

— Standalone: The end user directly controls the Smart Appliance and all its functionality.

— Local: The Smart Appliance is connected to a local CCM via the HAN.

— IoT/Cloud: The Smart Appliance communicates via its cloud representation or directly with an IoT/cloud based CCM.

NOTE As described in 3.6, the CCM manages the energy-using behaviour and may as well manage other aspects of device behaviour. Thus, in Figure 4, it represents a logical component that in reality may be represented by one or more physical and/or logical entities. According to EN 50491-12-x, for example, it might represent the combination of a Customer Energy Manager (CEM) and a Resource Manager. EN 50631 does not prescribe the architecture of the CCM.

This document will describe further in detail the local and IoT/Cloud operation modes. The standalone mode is not described in this document.

Figure 3 describes the application of EN 50631 series for the local and IoT/Cloud based operating modes.

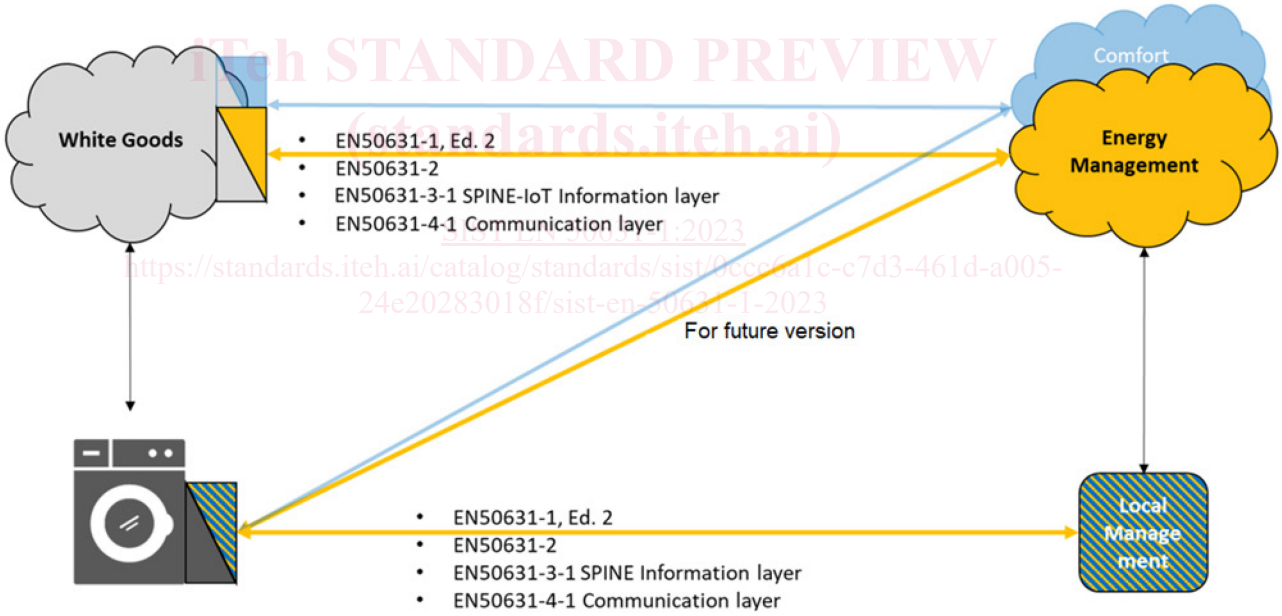

Figure 3 — Application of EN 50631 series for the local and IoT/Cloud based operating modes

As the Use Case Functions are described in a general way without detailing the mapping of the information content to specific protocols, it is possible to refer to these Use Case Functions both in a local Home Area Network (HAN) and in a cloud. While the transport layer may change, the information content shall remain the same. Figure 4 clarifies this concept showing a case of a “HAN-based protocol A” using a specific “transport protocol C” and a “web-based protocol B”.