SLOVENSKI STANDARD
SIST EN 50631-3-1:2023

01-maj-2023

Omrežje gospodinjskih aparatov in povezljivost mreže - 3-1. del: Mapiranje posebnih podatkovnih modelov: SPINE in SPINE-IoT

Household appliances network and grid connectivity - Part 3-1: Specific Data Model Mapping: SPINE and SPINE-IoT

Netzwerk- und Stromnetz-Konnektivität von Haushaltsgeräten - Teil 3-1: Mapping auf spezifische Datenmodelle: SPINE und SPINE-IoT

Appareils domestiques connectés au réseau et réseau intelligent - Partie 3-1: Mapping avec des modèles de données spécifiques: SPINE et SPINE-IoT

Ta slovenski standard je istoveten z: **EN 50631-3-1:2023**

ICS:

97.120	Avtomatske krmilne naprave za dom	Automatic controls for household use

SIST EN 50631-3-1:2023 **en**

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 50631-3-1

March 2023

ICS 97.120

English Version

Household appliances network and grid connectivity - Part 3-1: Specific Data Model Mapping: SPINE and SPINE-IoT

Appareils domestiques connectés au réseau et réseau intelligent - Partie 3-1: Mapping avec des modèles de données spécifiques: SPINE et SPINE-IoT

Netzwerk- und Stromnetz-Konnektivität von Haushaltsgeräten - Teil 3-1: Mapping auf spezifische Datenmodelle: SPINE und SPINE-IoT

This European Standard was approved by CENELEC on 2023-02-13. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN-CENELEC Management Centre or to any CENELEC member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CENELEC member into its own language and notified to the CEN-CENELEC Management Centre has the same status as the official versions.

CENELEC members are the national electrotechnical committees of Austria, Belgium, Bulgaria, Croatia, Cyprus, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Norway, Poland, Portugal, Republic of North Macedonia, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Türkiye and the United Kingdom.

European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

CEN-CENELEC Management Centre: Rue de la Science 23, B-1040 Brussels

Ref. No. EN 50631-3-1:2023 E

Contents

Page

European foreword

This document (EN 50631-3-1:2023) has been prepared by WG 07 “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)	2024-02-13
• latest date by which the national standards conflicting with this document have to be withdrawn	(dow)	2026-02-13

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 [1]. EN 50631 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 maps the generic use case functions and data models defined in EN 50631-1:2023 to specific languages; in this case, SPINE and SPINE-IoT.

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
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.

3.2
Appliance Energy Flexibility
ability of an appliance to change power consumption in response to an external stimulus

3.3
binding
concept for connecting functionally matching features

3.4
classifier
role that specifies whether a message serves to read, reply, write, etc

3.5
client
role that specifies that a node uses data from a “server” or can request for change

3.6
command
functional part of a Message

3.7
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.

3.8
data model
definition of possible data (data structures, values) for the exchange of information (especially for communications systems)

[SOURCE: IEC 60050, IEV] [2]

3.9
Demand Response
DR
action resulting from management of the electricity demand in response to supply conditions

[SOURCE: IEC 60050, IEV] [2]

3.10
Demand Side Management
DSM
process that is intended to influence the quantity or patterns of use of electric energy consumed by end-use customers

3.11
device
<specific node> SPINE node that can include a set of entities

Note 1 to entry: It has a “deviceType”. With regard to the hierarchy of SPINE nodes a device is a root node for all functionalities offered by a device.

3.12
device
<address information> SPINE address part for the (physical) device

Note 1 to entry: The address part shall be written between quotation marks, e.g., “device”.

3.13
deviceType
specific type of physical device (e.g., “WashingMachine”, “HeatPump”, “FridgeFreezer”, etc.)

3.14
discovery
process of finding appropriate partners for communication.

Note 1 to entry: Dependent on the context this can be either finding other devices or examination of a device’s potential functionalities.

3.15
element
item (or “attribute”) of a SPINE function which holds one information (e.g. “timestamp”, “value”, etc.) or contains further sub-elements

3.16
entity
<specific node> SPINE node that can include a set of (sub-)entities or features

Note 1 to entry: It has an “entityType”. With regard to the hierarchy of SPINE nodes an entity is a sub-element of a device.

3.17
entity
<address information> SPINE address part for the (logical) entity

Note 1 to entry: The address part shall be written between quotation marks, e.g., “entity”.

3.18
EntityType
specific type of logical device (e.g. “Freezer” is one logical part of a physical device “FridgeFreezer”)

3.19
feature
<specific node> SPINE node that can include a set of functions (of a class)

Note 1 to entry: It has a “featureType”. With regard to the hierarchy of SPINE nodes a feature is a sub-element (i.e. “child”) of an entity.

3.20
feature
<address information> SPINE address part for one feature

Note 1 to entry: The address part shall be written between quotation marks, e.g., “feature”.

3.21
FeatureType
type that defines optional or mandatory rules and a general behaviour of the underlying Class (standard or complex)

3.22
function
smallest structure to model “actual data” (“functional data”), i.e. functions usually consist of child elements that each hold an information (e.g. “timestamp”, “value”, etc.)

Note 1 to entry: Information between communication partners is exchanged via the exchange of a function (as part of a so-called “payload”).

3.23
message
one SPINE transfer from a sender to a receiver

3.24
namespace
XML namespace
set of names that provides a simple method for qualifying element and attribute names used in XML documents by associating them with namespaces identified by URI references [3]

3.25
neutral message
information exchange that is independent of any specific communication solution

Note 1 to entry: This document describes the mapping of neutral messages to examples of typical communication protocols.

3.26
node
common term for a SPINE instance that has a SPINE address

Note 1 to entry: Dependent on the situation a node can be either a device or an entity (of a specific device) or a feature (of a specific device-entity).

3.27
payload
SPINE Payload, containing the functional SPINE data

3.28
power sequence
expected power consumption over time (i.e., represented as a “curve” of power over time) including options on its flexibility

3.29
RMS
<electricity measurement> Root Mean Square of a set of numbers

3.30
role
each Feature has a functional role, usually either “server” (data owner) or “client”

Note 1 to entry: For some special features (e.g. NodeManagement) the role “special” is defined.

3.31
scope type
feature type that defines scope types for identifying specific functionalities unambiguously (e.g., outsideAirTemperature)

3.32
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).

3.33
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.

3.34
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.

3.35
SPINE
Smart Premises Interoperable Neutral-message Exchange

3.36
SPINE-IoT
Smart Premises Interoperable Neutral-message Exchange for Internet of Things

3.37
SPINE Data Model
data model which describes the concepts and data model to ensure information exchange between devices like Smart Appliance and CCM, including

1) SPINE Protocol, defining a neutral message structure and neutral message exchange

2) SPINE Feature Types, describing the specific information to be exchanged

3.38
subscription
concept that enables the receiving of messages of interest from another device without polling it

3.39
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, e.g. "A CCM shifts the energy usage of a washing machine"

3.40
Use Case Functions
Functions which group basic functionalities that had been derived from use cases

Note 1 to entry: These functions provide the entire information exchange required to implement the considered use cases and user stories.

3.41
XML
Extensible Markup Language
simple, very flexible text format derived from SGML (ISO 8879)

Note 1 to entry: See [3]. Extensible Mark-up Language (XML) defines a set of rules for encoding documents in a format that is both human-readable and machine-readable, enabling multiple publishing options and other applications for a variety of different purposes. Used to model SPINE messages.

3.42
XSD
XML Schema Definition
schema to define and describe a class of XML documents by using schema components to constrain and document the meaning, usage and relationships of their constituent parts: datatypes, elements and their content and attributes and their values, see [3]

Note 1 to entry: The SPINE data model is defined in XSD and supplementary documents (as not every rule can be specified with XSD only). Other formats than XML can be derived from an XSD, too (e.g. JSON).

3.43
YAML
YAML Human-Readable Data-Serialization Language
schema to define and describe a class of XML documents by using schema components to constrain and document the meaning, usage and relationships of their constituent parts: datatypes, elements and their content and attributes and their values

Note 1 to entry: The SPINE-IoT data model is defined in YAML and supplementary documents (as not every rule can be specified with YAML only). Other formats than YAML can be derived from an YAML, too (e.g. JSON).

4 Reader's guide

4.1 Reading the graphics

4.1.1 General

This document contains several graphical representations based on plantUML [4], especially in Clause 6 and later. In order to facilitate their interpretation by readers unfamiliar with UML, the following provides an introduction.

4.1.2 Hierarchy diagram

Within the "Actor [...] overview" diagrams in the "Actors" sub-sections the complete functionality of this Use Case is provided. The Actor MAY have more functionality implemented than needed for this Use Case.

For the following Actor overview example (see Figure 1), a brief description of the graphical symbols will be described.

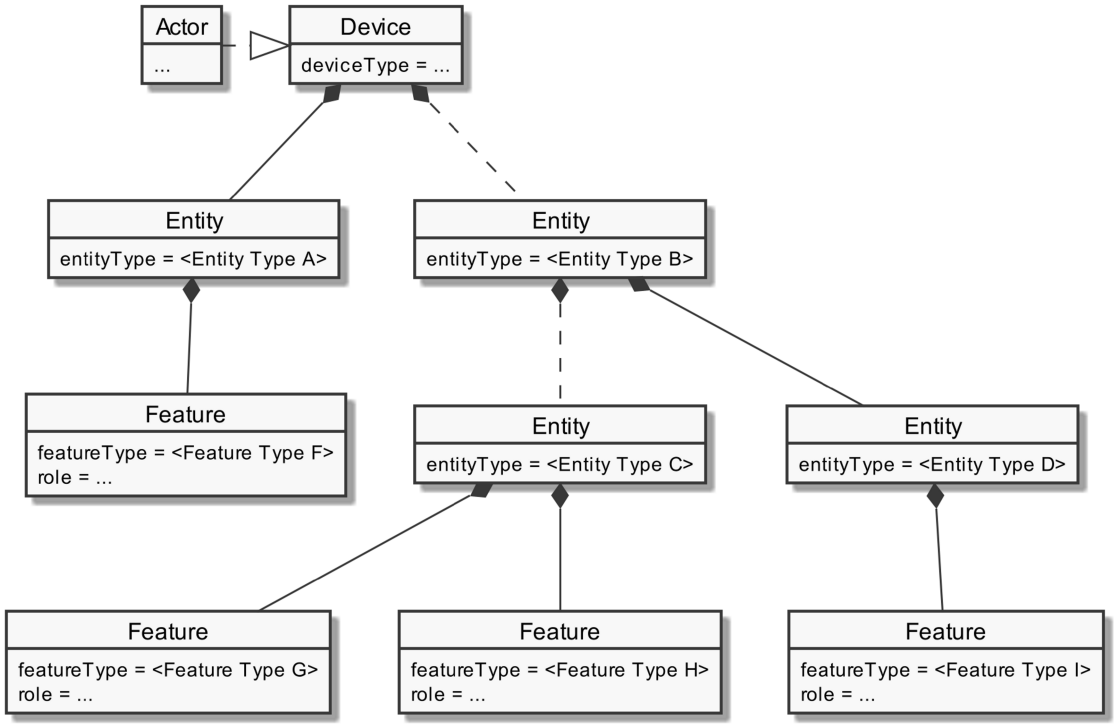

Figure 1 — Actor overview example

The solid lines in the figure represent an immediate parent-childhood relation: The Entity with “<Entity Type A>” is a direct child of “Device”. The Entity with “<Entity Type D>” is a direct child of the Entity with “<Entity Type B>”. All Features are immediate child of the respective Entity.

The dashed lines in the figure express that there MAY be additional Entities between the shown Entities: A vendor's implementation MAY have one or more Entities between “Device” and the Entity with “<Entity Type B>”. Likewise, a vendor's implementation MAY have one or more Entities between the Entity with “<Entity Type B>” and the Entity with “<Entity Type D>”.

The entityType “DeviceInformation” with the featureType “NodeManagement” is required by the SPINE protocol and therefore SHALL be supported. Both types are added in the figure for completeness but are not directly linked to the Use Case.

4.1.3 Sequence diagram

Communication sequence diagrams visualize the messages sent between actors as part of a Use Case function or scenario, as shown in this example in Figure 2:

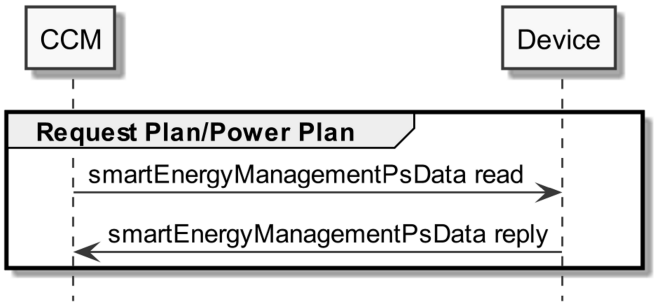

Figure 2 — Example communication sequence diagram

The participating actors are represented by rectangles with their names at the top of the diagram (and optionally at the bottom), as well as by a connecting vertical line.

Horizontal arrows indicate the types of messages sent as well as their direction. In the above example, the first message is a read command of the data structure called “smartEnergyManagementPsData” initiated by the CCM and sent to the Device; the second message is the Device’s reply. Note that time always flows from top to bottom.

4.2 Finding the right information

The Use Case Functions are described in Clause 5. Each Use Case Function is documented in detail as a SPINE and SPINE-IoT reference solution.

5 Use Case Function (UCF) details

5.1 General

In the following, the mapping of the Use Case functions from EN 50631-1 to SPINE and SPINE-IoT is described.

This document defines the mapping of neutral messages to examples of typical data models like SPINE, and SPINE-IoT. Specifically, it describes SPINE-Resources and SPINE-IoT-Resources mapped from the the high-level Use Case Functions as shown in Figure 3.

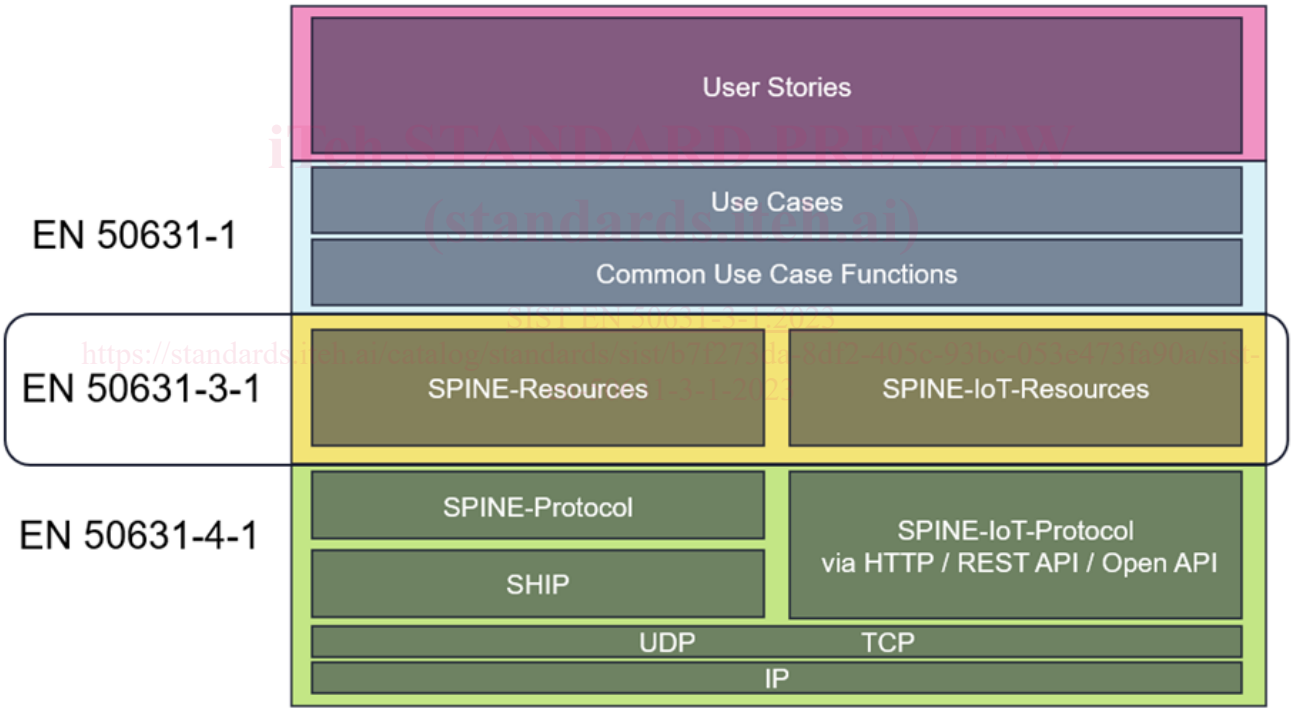

Figure 3 — Description of EN 50631-3

5.2 Mapping to SPINE

5.2.1 Concepts

5.2.1.1 General rules and information

5.2.1.1.1 Underlying technology documents

This technical solution relies on the SPINE Protocol Specification (see EN 50631-4-1) and the SHIP Specification as transport protocol (see EN 50631-4-1).

5.2.1.1.2 Use Case discovery rules

5.2.1.1.2.1 Incentive Table-based Power Consumption Management

Use Case discovery SHALL be supported by each Actor and the following rules SHALL apply:

— The string content for the Element “nodeManagementUseCaseData. useCaseInformation. useCaseSupport. useCaseName” within the Use Case discovery (refer to the SPINE Protocol Specification EN 50631-4-1) SHALL be “incentiveTableBasedPowerConsumptionManagement”. The string content SHALL only be defined by this Use Case (regardless of the Use Case version).

— The string content of the Element “nodeManagementUseCaseData. useCaseInformation. actor” within the Use Case discovery (refer to the SPINE Protocol Specification EN 50631-4-1) SHALL be set to the according value stated within the corresponding Actor's section.

— An Actor A that is implemented to support this Use Case specification SHALL set the Element “nodeManagementUseCaseData. useCaseInformation. useCaseSupport. useCaseVersion” within the Use Case discovery (refer to the SPINE Protocol Specification EN 50631-4-1) to “1.0.0”.

— If an Actor A supports multiple versions of this Use Case with the same major version number, only the highest one SHOULD be set within the Use Case discovery.

— If an Actor A finds a proper counterpart Actor B for this Use Case that supports multiple versions of this Use Case with the same major version number as supported by Actor A, the Actor A SHOULD evaluate from these versions of Actor B only the highest version number.

— If an Actor A supports multiple versions of this Use Case with different major version numbers, for each major version number only the highest version number SHOULD be set within the Use Case discovery.

— If an Actor A finds a proper counterpart Actor B for this Use Case that supports only versions with a major version number not implemented by Actor A, it still might be possible to run the Use Case or parts of the Use Case. Therefore, the Actor A should try to evaluate the Actor B as a valid partner for this Use Case.

5.2.1.1.2.2 Limitation of Power Consumption

Use Case discovery SHALL be supported by each Actor and the following rules SHALL apply:

— The string content for the Element “nodeManagementUseCaseData. useCaseInformation. useCaseSupport. useCaseName” within the Use Case discovery (refer to the SPINE Protocol Specification EN 50631-4-1) SHALL be “limitationOfPowerConsumption”. The string content SHALL only be defined by this Use Case (regardless of the Use Case version).

— The string content of the Element “nodeManagementUseCaseData. useCaseInformation. actor” within the Use Case discovery (refer to the SPINE Protocol Specification EN 50631-4-1) SHALL be set to the according value stated within the corresponding Actor's section.

— An Actor A that is implemented to support this Use Case specification SHALL set the Element “nodeManagementUseCaseData. useCaseInformation. useCaseSupport. useCaseVersion” within the Use Case discovery (refer to the SPINE Protocol Specification EN 50631-4-1) to “1.0.0”.

— If an Actor A supports multiple versions of this Use Case with the same major version number, only the highest one SHOULD be set within the Use Case discovery.

— If an Actor A finds a proper counterpart Actor B for this Use Case that supports multiple versions of this Use Case with the same major version number as supported by Actor A, the Actor A SHOULD evaluate from these versions of Actor B only the highest version number.