ETSI TS 103 849 V1.1.1 (2022-08)

SmartM2M;
Smart Escalator IoT System

Reference
DTS/SmartM2M-103849

Keywords
interoperability, IoT, IoT platforms, oneM2M,
SAREF, smart escalator, smart lift

ETSI

650 Route des Lucioles
F-06921 Sophia Antipolis Cedex - FRANCE

Tel.: +33 4 92 94 42 00 Fax: +33 4 93 65 47 16

Siret N° 348 623 562 00017 - APE 7112B
Association à but non lucratif enregistrée à la
Sous-Préfecture de Grasse (06) N° w061004871

Contents

Intellectual Property Rights

Essential patents

IPRs essential or potentially essential to normative deliverables may have been declared to ETSI. The declarations pertaining to these essential IPRs, if any, are publicly available for **ETSI members and non-members**, and can be found in ETSI SR 000 314: *"Intellectual Property Rights (IPRs); Essential, or potentially Essential, IPRs notified to ETSI in respect of ETSI standards"*, which is available from the ETSI Secretariat. Latest updates are available on the ETSI Web server (https://ipr.etsi.org/).

Pursuant to the ETSI Directives including the ETSI IPR Policy, no investigation regarding the essentiality of IPRs, including IPR searches, has been carried out by ETSI. No guarantee can be given as to the existence of other IPRs not referenced in ETSI SR 000 314 (or the updates on the ETSI Web server) which are, or may be, or may become, essential to the present document.

Trademarks

The present document may include trademarks and/or tradenames which are asserted and/or registered by their owners. ETSI claims no ownership of these except for any which are indicated as being the property of ETSI, and conveys no right to use or reproduce any trademark and/or tradename. Mention of those trademarks in the present document does not constitute an endorsement by ETSI of products, services or organizations associated with those trademarks.

DECT™, **PLUGTESTS™**, **UMTS™** and the ETSI logo are trademarks of ETSI registered for the benefit of its Members. **3GPP™** and **LTE™** are trademarks of ETSI registered for the benefit of its Members and of the 3GPP Organizational Partners. **oneM2M™** logo is a trademark of ETSI registered for the benefit of its Members and of the oneM2M Partners. **GSM**® and the GSM logo are trademarks registered and owned by the GSM Association.

Foreword

This Technical Specification (TS) has been produced by ETSI Technical Committee Smart Machine-to-Machine communications (SmartM2M).

At the origin of the present document, there is a study [i.3] developed with the collaboration of Smart Lift stakeholders and in particular with EFESME [i.1] and ELA [i.2] association.

Modal verbs terminology

In the present document "**shall**", "**shall not**", "**should**", "**should not**", "**may**", "**need not**", "**will**", "**will not**", "**can**" and "**cannot**" are to be interpreted as described in clause 3.2 of the ETSI Drafting Rules (Verbal forms for the expression of provisions).

"**must**" and "**must not**" are **NOT** allowed in ETSI deliverables except when used in direct citation.

1 Scope

The present document specifies the IoT communication aspects for escalators and moving walkways (i.e. the Escalators System). For the rest of the present document the term escalator will be used to indicate both proper escalators and moving walkways. The present document defines the elements involved in such communications and their relations, from the central cloud level to the Smart Escalator Installations, including the integration with administrative information, the integration of Smart Escalator Systems not conformant to the present document (non-standard and legacy installations), and the integration of application targeting human users.

The present document is intended to enable the similar use cases in ETSI TR 103 546 [i.3] and more in general aiming to support all the major use cases and requirements in the context of smart escalators. It deals with the architectural aspect of the communication and the set of information that is needed to assure interoperability across installations and platforms but does not specify the specific applications that are using this information. These applications are left to the market together with the extended set of information that are specific of each technology and may differ amongst providers.

The Smart Escalator System communication relies on existing specification that are referenced in the present document (i.e. the oneM2M standard suite), but the definition of the element and the information to be exchanged is kept independent from underlaying communication framework and technology, to minimize the impact of the evolution of the communication framework on the information managed by the smart escalator.

This approach allows also the delegation of basic important functionalities (e.g. security, management, use of different IT and telecommunication means, platforms and semantic interoperability support) to the underlaying communication framework, to evolve and adapt to the technology evolution without impacting directly the present document.

2 References

2.1 Normative references

References are either specific (identified by date of publication and/or edition number or version number) or non-specific. For specific references, only the cited version applies. For non-specific references, the latest version of the referenced document (including any amendments) applies.

Referenced documents which are not found to be publicly available in the expected location might be found at https://docbox.etsi.org/Reference.

NOTE: While any hyperlinks included in this clause were valid at the time of publication, ETSI cannot guarantee their long-term validity.

The following referenced documents are necessary for the application of the present document;

[1] ETSI TS 103 264: "SmartM2M; Smart Applications; Reference Ontology and oneM2M Mapping".

NOTE: See also https://saref.etsi.org.

[2] ETSI TS 118 111: "oneM2M; Common Terminology (oneM2M TS-0011)".

[3] ETSI TS 118 102: "oneM2M Requirements (oneM2M TS-0002)".

[4] ETSI TS 118 101: "oneM2M; Functional Architecture (oneM2M TS-0001)".

[5] ETSI TS 118 104: "oneM2M; Service Layer Core Protocol Specification (oneM2M TS-0004)".

[6] ETSI TS 118 103: "oneM2M; Security solutions (oneM2M TS-0003)".

[7] ETSI TS 118 105: "oneM2M; Management Enablement (OMA) (oneM2M TS-0005)".

[8] ETSI TS 118 106: "oneM2M; Management Enablement (BBF) (oneM2M TS-0006)".

[9] ETSI TS 118 109: "oneM2M; HTTP Protocol Binding (oneM2M TS-0009)".

[10] ETSI TS 118 120: "oneM2M; WebSocket Protocol Binding (oneM2M TS-0020)".

[11] ETSI TS 118 112: "oneM2M; Base Ontology (oneM2M TS-0012)".

[12] ETSI TS 118 115: "oneM2M; Testing Framework (oneM2M TS-0015)".

[13] ETSI TS 118 113: "oneM2M; Interoperability Testing (oneM2M TS-0013)".

[14] ETSI TS 118 122: "oneM2M; Field Device Configuration (oneM2M TS-0022)".

[15] ETSI TS 118 116: "oneM2M; Secure Environment Abstraction (oneM2M TS-0016)".

[16] ETSI TS 118 132: "MAF and MEF Interface Specification (oneM2M TS-0032)".

[17] ETSI TS 118 126: "3GPP Interworking (oneM2M TS-0026)".

[18] ETSI TS 118 130: "oneM2M; Ontology Based Interworking (oneM2M TS-0030)".

[19] oneM2M TS-0031: "Feature Catalogue".

[20] oneM2M TS-0033: "Interworking Framework".

[21] oneM2M TS-0034: "Semantics Support".

[22] ETSI TS 103 410 (all parts): "SmartM2M; extension to SAREF".

NOTE: See also https://saref.etsi.org.

[23] ETSI TS 103 548: "SmartM2M; SAREF consolidation with new reference ontology patterns, based on the experience from the SEAS project".

[24] ISO 8601:2019 (all parts): "Date and time -- Representations for information interchange ".

[25] EN 627:1995: "Specification for data logging and monitoring of lifts, escalators and passenger conveyors", (produced by CEN).

[26] Recommendation ITU-T E.212: "The international identification plan for public networks and subscriptions".

[27] ETSI TS 145 008: "Digital cellular telecommunications system (Phase 2+) (GSM); GSM/EDGE Radio subsystem link control (3GPP TS 45.008)".

[28] ISO 6709:2008: "Standard representation of geographic point location by coordinates".

[29] Recommendation ITU-T E.164: "The international public telecommunication numbering plan".

[30] EN 115-1:2017: "Safety of escalators and moving walks - Part 1 construction and installation", (produced by CEN).

[31] EN 115-2:2021: "Safety of escalators and moving walks - Part 2: Rules for the improvement of safety of existing escalators and moving walks, (produced by CEN).

2.2 Informative references

References are either specific (identified by date of publication and/or edition number or version number) or non-specific. For specific references, only the cited version applies. For non-specific references, the latest version of the referenced document (including any amendments) applies.

NOTE: While any hyperlinks included in this clause were valid at the time of publication, ETSI cannot guarantee their long term validity.

The following referenced documents are not necessary for the application of the present document but they assist the user with regard to a particular subject area.

[i.1] EFESME association website.

NOTE: Available at www.efesme.org.

[i.2] ELA association website.

NOTE: Available at www.ela-aisbl.eu.

[i.3] ETSI TR 103 546: "SmartM2M; Requirements & Feasibility study for Smart Lifts in IoT".

[i.4] ETSI TR 118 501: "oneM2M Use Case Collection (onem2M TR-0001)".

[i.5] ETSI TR 118 525: "oneM2M; Application Developer Guide (oneM2M TR-0025)".

[i.6] oneM2M TR-0035: "Developer guide of device management".

[i.7] oneM2M TR-0045: "Developer Guide: Implementing Semantics".

[i.8] oneM2M website (open area).

NOTE: Available at www.oneM2M.org.

[i.9] ISO 16484-5:2017: "Building automation and control systems (BACS) -- Part 5: Data communication protocol".

[i.10] oneM2M TR-0008: "Security".

3 Definition of terms, symbols and abbreviations

3.1 Terms

For the purposes of the present document, the terms given in ETSI TS 118 111 [2], ETSI TS 103 264 [1] and the following apply:

NOTE: For the economy of writing and readability in the present document the term Escalator refers to both the following terms (as defined in EN 115-1 [30]).

escalator: power driven inclined continuous moving stairway used for raising or lowering persons in which the user carrying surface (e.g. steps) remains horizontal

moving walk: power driven installation for the conveyance of persons in which the user carrying surface remains parallel to its direction of the motion and is uninterrupted (e.g. pallets belt)

3.2 Symbols

Void.

3.3 Abbreviations

For the purposes of the present document, the following abbreviations apply:

ADN	Application Dedicated Node
AE	Application Entity
API	Application Programming Interface
ASN	Application Service Node
BBF	BroadBand Forum
BCS	Bidirectional Communication System

CSE	Capability Service Entity
EFESME	European Federation for Elevator Small and Medium-sized Enterprises

NOTE: See website at www.efesme.org.

ELA	European Lift Association

NOTE: See website at https://www.ela-aisbl.eu/index.php.

EN	European Norm
EU	European Union
HTTP	Hypertext Transfer Protocol
IN-CSE	INfrastructure Capability Service Entity
IoT	Internet of Things
IP	Internetworking Protocol
IPE	Interworking Proxy Entity
ISO	International Organization for Standardization
IT	Information Technology
ITU	International Telecomunication Union
JSON	JavaScript Object Notation
MCC	Mobile Country Code
MN	Middle Node
MNC	Mobile Network Code
MWA	Mandatory When Available
OMA	Open Mobile Alliance
oneM2M	oneM2M Partnership Project

NOTE: See website at www.onem2m.org.

RTM	Real Time Mode
SAREF	Smart Applications REFerence ontology
SEAPP	Smart Escalator APPlication
SEAS	Smart Escalator Administrative Services
SEAU	Smart Escalator Administrative Unit
SECF	Smart Escalator Communication Framework
SECS	Smart Escalator Core Services
SECSS	Smart Escalator Core Service Support
SEEC	Smart Escalator Edge Component
SEECU	Smart Escalator Edge Control Unit
SEG	Smart Escalator Group
SEI	Smart Escalator Installation
SEIG	Smart Escalator Interoperability Gateway
SES	Smart Escalator System
SESS	Smart Escalator Support Service
SEUS	Smart Escalator User Service
SIM	Subscriber Identity Module
URI	Uniform Resource Identifier
USIM	Universal Subscriber Identity Module
UTC	Coordinated Universal Time
XML	eXtensible Markup Language

4 User roles and use cases

4.1 Overview of user roles

In the Smart Escalator IoT System there are several types of user roles which belong to three main categories:

- The users of the escalator (the passengers).
- The people and companies that work on the lift market.

- The owner of the building or administrator of group of buildings.

4.2 Description of user roles

Building owner

The owner of the building or a group of buildings.

Maintenance companies

The companies that are in charge of the maintenance of the escalators, with the organization to manage every problem that could arise on the escalator.

Maintenance technicians

The technicians of the maintenance companies, they are the people that work often on site to fix problems and perform maintenance-related activities.

Passengers

The standard passenger of the escalator.

Supplier technicians (in particular of the control cabinet)

The control cabinet is the brain of the escalator, all the information is managed by the control cabinet; these are the technicians of the company that manufactured the control cabinet.

Control room operator

People located in a (usually remote) control room, whose task is to supervise and control the operations of escalators or group of escalators.

5 Smart Escalator System IoT architecture and supported configurations

5.1 Smart Escalator System IoT architecture

The Smart Escalator System is the composition of the escalator installations and the entities that supports their remote communication and control within a Smart Escalator administrative domain. The Smart Escalator administrative domain corresponds to a provider of services for the Smart Escalators: a consortium, an association, a maintenance company, a building management company, etc.

The Smart Escalator System shall enable the exchange of information and the sharing of services with other Smart Escalator Systems based on agreements between their respective providers. This functionality is supported via the communication framework and it is enabled by the oneM2M system as specified in clause 8. The Communication framework may be shared by Multiple Smart Escalator Systems.

The present document deals with the IoT communication aspects. It models and specify the components and the exchanges of information required to assure a proper interoperability among the Smart Escalator Systems. It does not intend to specify a detailed model of the whole escalator components, that typically differs based on technology, manufacturer and installation characteristics. To support the IoT related communications related to these aspects, the SES supports means to provide flexible, exchange and historization of information among the SES entities.

Figure 5.1-1 illustrates the Smart Escalator System and the interconnection of its entities.

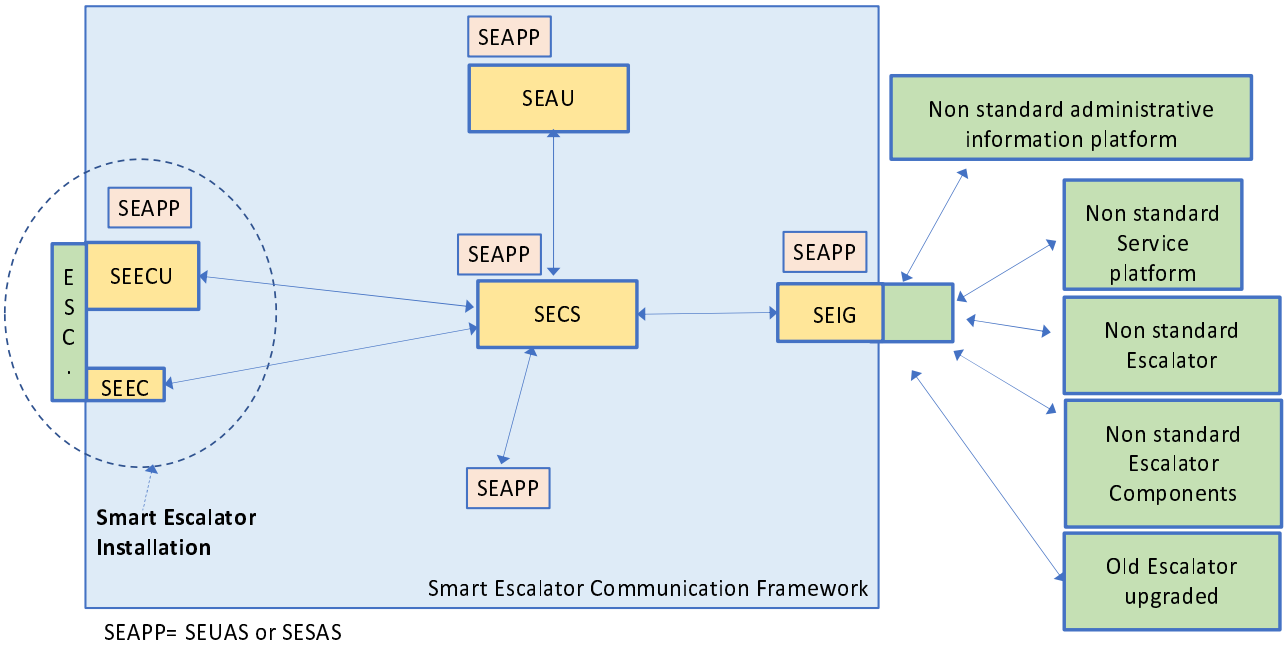

Figure 5.1-1: Smart Escalator Systems IoT Architecture

The **Smart Escalator System (SES)** is composed by:

- The Smart Escalator Installation (SEI), that is composed by:
  - A **Smart Escalator Edge Control Unit (SEECU)**, which is the main element of a SEI and is typically associated with the escalator control cabinet. It hosts the different SEI modules (e.g. the faults signals, the Communication systems, etc). The Smart Escalator Edge Control Unit takes care of interfacing the escalator and communicating with the rest of the Smart Escalator System via the Bidirectional Communication Module. At the level of oneM2M Communication Framework, it maps typically to an ADN (Application Dedicated Node), but it may map also with an ASN (Application Service Node) or a MN (Middle Node) when it hosts additional services or when it shares its communication capabilities with other lift components.
  - The SEI may also include several **Smart** Escalator **Edge Component (SEEC)**, dedicated to the hosting of SEI additional modules in the case that they are not hosted directly in the SEECU. An example could be the case of an additional earthquake sensor added after the escalator deployment and not controlled by the SEECU. At the level of oneM2M Communication Framework it typically maps with an ADN (Application Dedicated Node).
- The **Smart Escalator Administrative Unit (SEAU)**, that copes with smart escalator non-technical information such as the legal owner of the Escalator, the manager of the building where the escalator is installed, the address of installation, etc. At the level of oneM2M Communication Framework, it maps with an Application Dedicated Node (ADN) or an Application Service Node (ASN) with one or more Application Entity (AE(s)).
- The **Smart Escalator Core Service Support (SECSS), that enables the communication, the data management, the data historization and hosting of the core applications**. At the level of oneM2M Communication Framework the SECSS maps with the INfrastructure Capability Service Entity (IN-CSE).

- The **Smart Escalator Interoperability Gateway (SEIG)**, that takes care of interfacing with non-standard solutions (legacy systems). It may collect information and communicate with existing Escalators and administrative units and exchange them with the standard Smart Escalator Systems, allowing the Smart Escalators Systems to provide services in relation to standard smart escalator and non-standard legacy escalators. At the level of Communication Framework. It maps with the Interworking Proxy Entity (IPE) defined by oneM2M, a specialized Application Entity (AE) that allows the oneM2M system to interact with any non-oneM2M system, in a seamless way. The non-standard solutions include non-standard administrative platforms, non-standard service platforms and non-standard escalators. The non-standard escalators include legacy escalators and older retrofitted escalators. Retrofitted escalators include single control unit escalators as well as composed solutions where the supported subset of the signals, alarms, faults, commands and information are detected/actuated separately, sharing only the communication module.
  Each non-standard escalator is seen and treated by the system as a standard Smart Escalator Installation, and the SEG has the task to perform the interworking and hide the composition of the installation.

- The **Smart Escalator Communication Framework (SECF)**, which supports the communication, the security and the management of the Smart Escalator System. It also supports historization of the exchanged information (command, signals, etc.).

- The SES also include **Smart Escalator APPlications (SEAPP**) that concours to provide the services required by the users, that at the level of the communication framework map to Application Entity(s) (AEs). These AEs represent the intelligent services and their clients distributed on the communication framework. Some examples are the predictive maintenance applications, the administrative data applications, the client application in the end of the maintenance operators, etc.
  The present document currently does not specify these applications, but it identifies the following differentiation:

  - The **Smart Escalator Support Services (SESS)** that are the "intelligent" engines that create the services and host the more complicated data elaborations.

  - **The Smart Escalator User Services (SEUS)** that are typically the clients in the hands of the consumers of the services, including both humans and machines users.

The SES includes also the concept of **Smart Escalators Group (SEG)**, by introducing the identification of SEI groups. This is not an architectural element in the architecture, it represents the correlation of multiple SEIs and it is supported by the introduction of a Smart Escalator Group identifier common to each SEI belonging to the same Smart Escalator Group. Such kind of installations usually presents control units connected one to each other to coordinate the movement of the different escalators. In such cases the common commands (e.g. the stop buttons) can be coordinated by master installation or jointly managed by all installations in a peer mood.

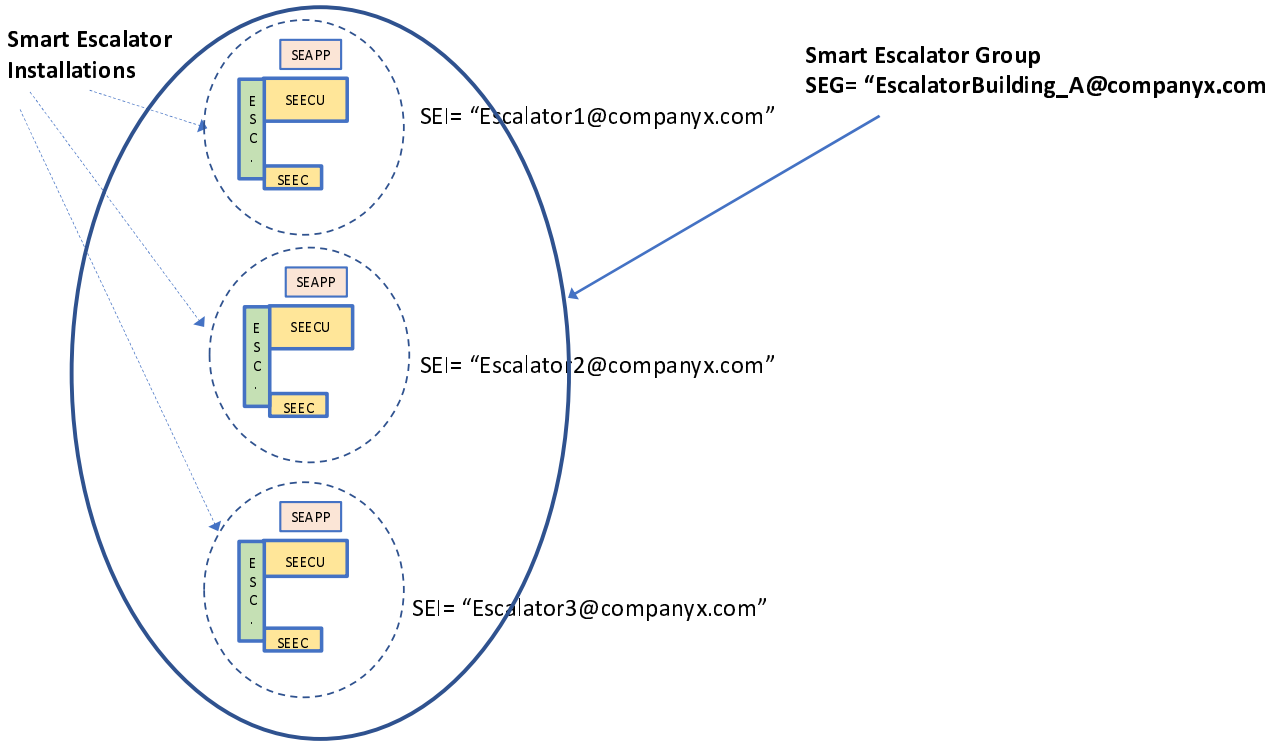

Figure 5.1-2: Smart Escalator Group concept

5.2 Supported deployment configurations and numerosity

As described in clause 5.1, the concept of a SEI in the SES system corresponds to a single escalator, with all its elements. The major element in a SEI, from the point of view of the IoT communication aspects, is the Smart Escalator Edge Control Unit that is typically associated with the control panel of the escalator. As an example, other components may be the alarm management, the power supply system, etc.

Typically, each SEI is connected uniquely with the rest of SES, so that the SEECU and the SEEC share the same connection hosted in the SEECU (usually the Communication System). Other common cases include the one where some SEEC of an escalator communicate directly and independently with the rest of the SES (e.g. the case of additional vibration sensors intended for predictive maintenance or for earthquake detection, installed independently form the control unit).

In the case multiple installations at the same premises (e.g. a building or industrial plant), it is also common the case of a Bidirectional Communication System. SEEC shared among multiple escalators (i.e. multiple SEIs).

From the IoT point of view, it is important to identify the edge endpoints of these communication channels between the SEI and the rest of the SES. In typical installations all the communications go through the Bidirectional Communication Systems. However, as described in the previous paragraphs, there are cases where the SEEC communicates independently. In such case it is introduced the concept of Communication Module to cope with communications that are not managed by the main Bidirectional Communication System.

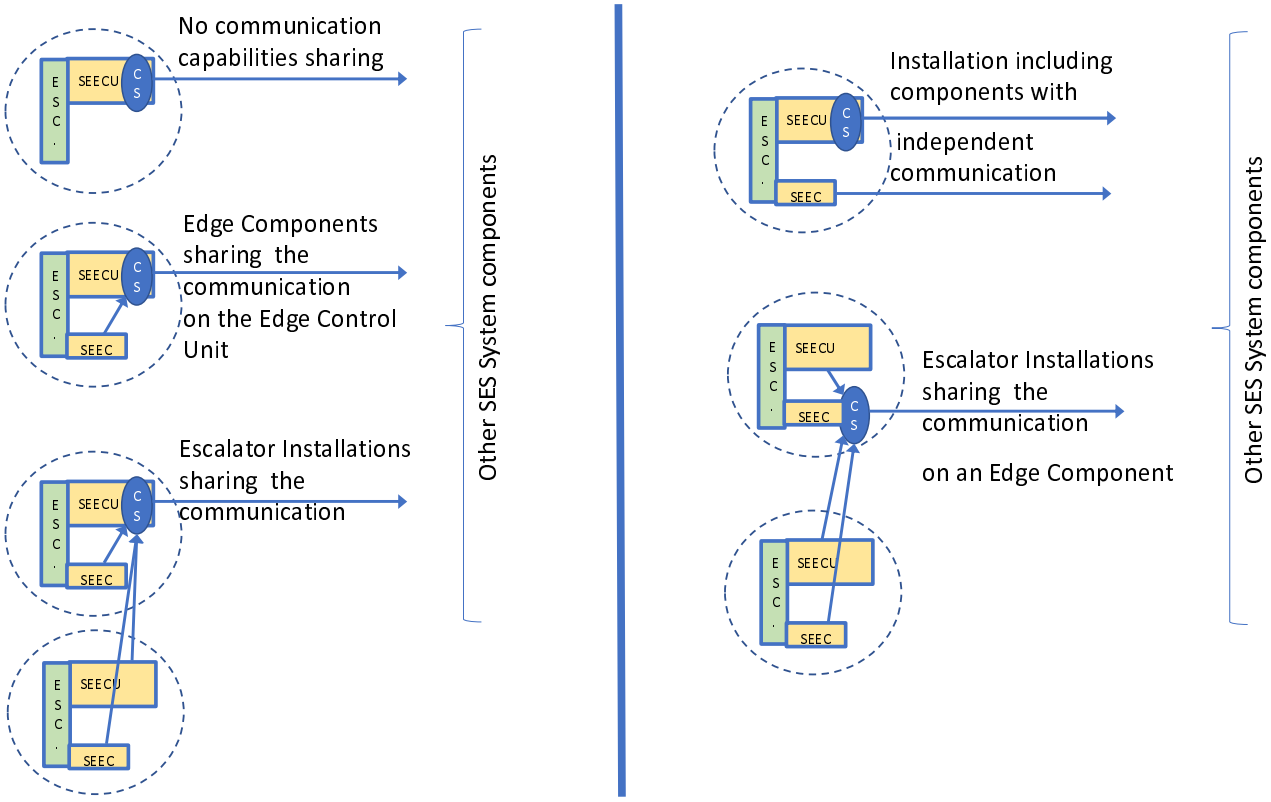

Figure 5.2-1: Smart escalator deployment cases

The concepts of SEI and SEG are not architectural elements and are represented in the SES by identifiers, so they do not correspond to API, they are carried by the SES API to allow the correlation of the information across these concepts.

Table 5.2-1 clarifies the numerosity relation among the SES architectural elements. Such numerosity relations are intended to be mapped on the oneM2M Communication framework to support the related API identification.

Table 5.2-1: SES elements numerosity relations

	SEAPP	**SEEC**	**SEECU**	**SEIG**	**SEAU**	**SECS**	**Non Standard Escalator Installations**
SEAPP			N←→1	N←→1	N←→1	N←→1	
SEEC		Only connectivity	Only connectivity			N←→1	
SEECU			Only connectivity			N←→1	
SEIG						N←→1	Not part of the present document
SEAU					Not part of the present document	N←→1	
SECS						N←→N	
Non Standard Escalators Installations							Not part of the present document

5.3 SES mapping one oneM2M Entity and reference points (API)

The element of the SES make use of oneM2M specification to support communication and interoperability. OneM2M specifications are formally and normatively referenced in clause 8, while more information and tutorials are available on the oneM2M website www.oneM2M.org [i.8]. For a correct understanding of the oneM2M use in the context of the present document, it is recommended to become familiar with the oneM2M architecture and the following oneM2M concepts:

- Nodes: AND, ASN, IN.
- Entities: AE, CSE, IPE.
- Reference points/API: Mca, Mcc, Mcc'.

Figure 5.3-1 provides an example of association between SES elements and the oneM2M Entities with the oneM2M relevant reference points.

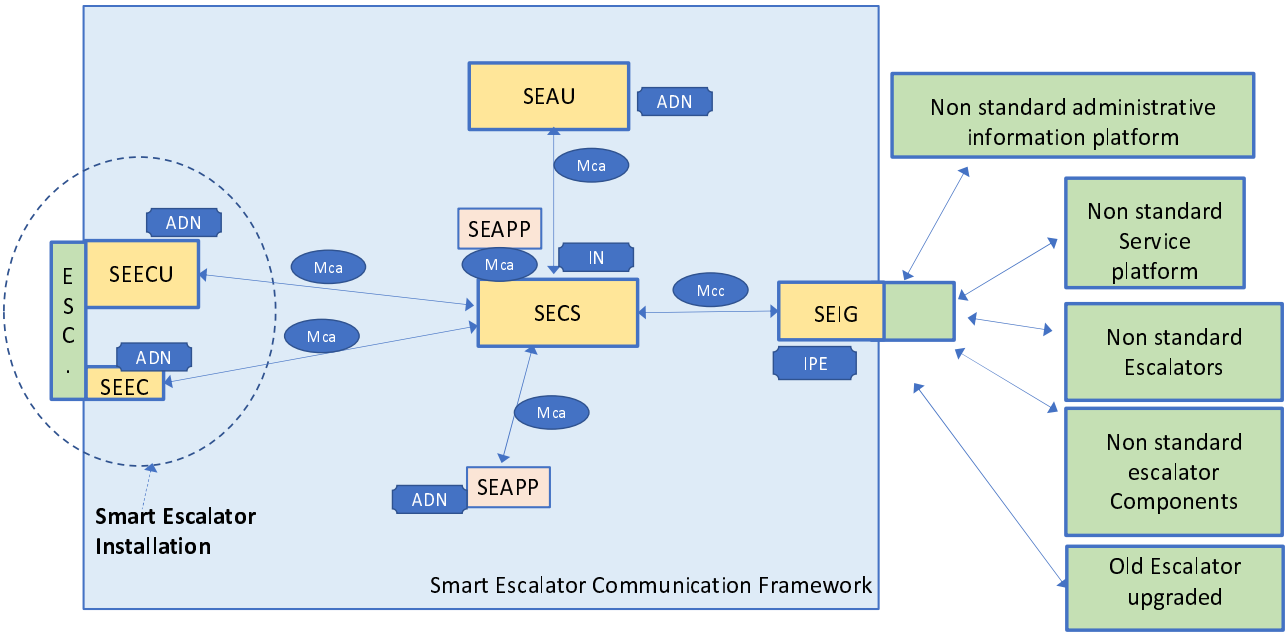

Figure 5.3-1: Smart escalator deployment cases

To assure interoperability, the SES elements shall comply to the mappings identified in the Table 5.3-1. The cells at the crossing of the header rows and header columns indicate the oneM2M reference point to be applied, the header column contains the indication of the SES entity and the corresponding oneM2M node mapping.

Table 5.3-1: Mapping of SES on oneM2M elements and reference points

	SEAPP	SEEC	SEECU	SEIG	SEAU	SECS	Non Standard Escalator Installations
SEAPP ADN			Mca	Mca	Mca	Mca	
SEEC ADN		Only connectivity bridging	Only connectivity bridging			Mca	
SEECU ADN (or ASN)			Only connectivity bridging			Mca (or Mcc for ASN)	
SEIG ADN (or ASN) with IPE						Mca (or Mcc for ASN)	
SEAU ADN (or ASN)						Mca (or Mcc for ASN)	
SECS IN						Mca (intra oneM2M domain) Or Mcc' (inter oneM2M domains)	
Non Standard Escalators Installations							

5.4 Security, privacy and cybersecurity support

The security of the Smart Escalator System is assured by the communication framework (the oneM2M system) referenced in clause 8. The oneM2M system provides a complete solution for modular security (communication, identification, etc.) and flexible granularity of data access control (access control via identifiers, roles, tokens, etc.). Refer to the oneM2M system specifications as identified in clause 8, in particular ETSI TS 118 103 [6]. Additional information about security in oneM2M are available at the oneM2M website [i.8] and some of the security use cases supported are described in oneM2M TR-0008 [i.10].

These capabilities empower the Smart Escalator System with the ability to satisfy privacy and cybersecurity needs from the market and from the regulation authorities.

5.5 Management support

The management of the components of the Smart Escalator System, in particular the remote components at the edges of the systems, is assured by the communication framework (the oneM2M system) referenced in clause 8, with specific attention to ETSI TS 118 106 [8] and ETSI TS 118 105 [7]. Additional information about the management support in oneM2M are available at the oneM2M website [i.8] and in oneM2M TR-0035 [i.6].

The oneM2M system provides a flexible solution for management including functions such as security configurations and software updates.

6 Configuration, signals, alarms, faults, commands and other Smart Escalator information

6.1 Introduction

Clause 6 contains the data to be exchanged by the Smart Escalator System across its components and with external components from other systems. It has been developed to support the escalator industry with a standard capable to provide seamless interoperability among the different escalator solutions, to assure support for sector specific services (e.g. Smart escalator remote diagnostic and predictive maintenance), and to exchange information with services and solutions belonging to other sectors (e.g. with services in the building, with access control and energy monitoring services, with services for the citizens and for impaired people).

The Smart Escalator System makes use of the oneM2M communication framework (see clause 8 of the present document).

The information modules described in all the tables of clause 6 represent sets of information to be exchanged within the SES components. Each SEI information module represents a group of correlated information that model parts of the functional behaviour of the SEI. All together these modules build the digital representation of the SEI in the SES, i.e. the SEI digital twin of the smart escalator in the system. Most of the modules are information that are originated-by or target-to the SEI, some modules (the Administrative information) are originated-by or target-to the Administrative Unit.

With respect to the information modules identified in the tables of clause 6 of the present document:

- the SEI shall provide all the mandatory (M) elements to other components of the SES;
- the SEI shall provide all the Mandatory-When-Available (MWA) elements to the other components of the SES if these elements are available in the SEI;
- the SEI may provide all the optional (O) elements to the other components of the SES;
- the SEAU shall provide all the mandatory (M) elements to other components of the SES;
- the SEAU shall provide all the Mandatory-When-Available (MWA) elements to the other components of the SES if these elements are available in the SEAU;
- the SEAU may provide all the optional (O) elements to the other components of the SES;
- the SEIG shall provide all the mandatory (M) elements to other components of the SES;
- the SEIG shall provide all the Mandatory-When-Available (MWA) elements to the other components of the SES if these elements are available in the SEIG;
- the SEIG may provide all the optional (O) elements to the other components of the SES;
- the SECS shall support all the mandatory (M) elements;
- the SECS should support all the optional (O) elements.

The smart escalator is put in an automation context and it is relevant to consider the interoperability with other correlated systems interacting with the smart escalators. In such a context the interoperability with the building automation system is particularly relevant. Such interworking cases are already partially covered by SAREF [22], [23] specifications Suite and oneM2M interoperability capabilities and may be subject to future extension of the present document (ETSI TS 103 849). Some initial informational indications regarding the semantic mapping of the SES is given with respect to ISO 16484-5 [i.9].

6.2 Smart Escalator Installation identification

The SEECU, the SEEC, the SECS and the SEIG, as well the Smart Escalator Applications, shall be identified by their respective oneM2M identifiers, i.e. the AE and CSE identifiers; the SEI and the SEI group identifiers are specified in Table 6.2-1.

Table 6.2-1: Information group name: SEIIdentification

Information	Type	SEI/SEIG	SEAU	SECS	Description
SEIUniversalIdentifier	It is composed by a String build as the concatenation of the following: • the keyword " escalator " • the separator "." • a string representing a unique identifier within the assigning entity • the separator "@" • a string representing the domain of the assigning entity The total maximum length is 64 characters.	M	M	M	Globally unique identifier for the escalator. The assignment is made by an entity responsible for the escalator (e.g. the manufacturer, the installation or the maintenance company, the owner, a consortium, etc.). It is potentially subject to changes during the lifetime of the escalator (e.g. changing of ownership or changing of maintenance company). EXAMPLES: • escalator.1415@company1.com; • escalator.568999@organization1.org; • escalator.A1.buiding.135@company2.com. See note 1.
groupUniversalIdentifier	It is composed by a String build as the concatenation of the following: • the keyword "group" • the separator "." • a string representing a unique identifier within the assigning entity • the separator "@" • a string representing the domain of the assigning entity The Total maximum length is 64 characters.	M when the escalator belongs to an escalator group	M when the escalator belongs to an escalator group	M	Globally unique identifier for the group of SEI. The assignment is made by an entity responsible for the escalator (e.g. the manufacturer, the installation or the maintenance company, the owner, a consortium, etc.). It is potentially subject to changes during the lifetime of the escalator (e.g. changing of ownership or changing of maintenance company). EXAMPLES: • group.1415@company1.com; • group. escalator.568999@organization1.org; • group.escalator.A1.buiding.135@company2.com. See note 2.
Installation date	Installation date String representing time according to ISO 8601 [24] Complete Representation Basic Format as described here: YYYYMMDDThhmmss,ssssss The String shall not include the Time Zone: Time shall be interpreted as being in UTC	M	M	M	Date of equipment installation ** date of put into service

Information	Type	SEI/SEIG	SEAU	SECS	Description
Last modernization date	Last modernization date String representing time according to ISO 8601 [24] Complete Representation Basic Format as described here: YYYYMMDDThhmmss,ssssss The String shall not include the Time Zone: Time shall be interpreted as being in UTC	M	M	M	Definition of "major modification" can be found in Annex L in EN 115-1:2017 [30].
NOTE 1: Peer concept in ISO 16484-5 [i.9]: ObjectIdentifier. NOTE 2: Peer concept in ISO 16484-5 [i.9]: Elevator group which include the escalator group concept					

6.3 Administrative Information

Table 6.3-1: Information group name: AdministrativeInformation

Information	Type	SEIG	SEAU	SECS	Description
escalator ManufacturingCompanyRepresentative	String (max 64 characters)	M	M	M	E.g. the local representative of the manufacturing company. See note 1.
Escalator InstallerCompany	String (max 64 characters)	M	M	M	E.g. the representative of the installer company. See note 2.
Escalator MaintenanceCompany	String (max 64 characters)	M	M	M	E.g. the representative of the maintenance company. See note 2.
Escalator LegalOwner	String (max 64 characters)	M	M	M	E.g. the building owner or the building rental party. See note 2.
buildingManager	String (max 64 characters)	M	M	M	E.g. the building administration. See note 2.
Escalator AlarmMonitoringCentre	String (max 64 characters)	M	M	M	The monitoring centre of the alarms: user alarms and periodic checks of the communication system. See note 2.
inspectionAuthority	String (max 64 characters)	MWA	MWA	M	IF an Authority is entitled to periodically inspect the escalator installation and certify its suitability for the intended use. See note 2.
geographicLocation	String (defined according to ISO 6709 formats [28])	M	M	M	Geographic Location where the escalator is installed. See note 3.
geographicLocationValidator	String (max 64 characters)	MWA	MWA	M	Name of who has provided the validation of the correctness of Geographic Location.
typeOfUse	It is defined by one of the following String values: • ESCALATOR • MOVING WALK	M	M	M	Used according the applicable normative. In EU and other applicable countries shall be one of the following: • EN 115-1:2017 [30] • EN 115-2:2021 (not harmonised) [31] • OTHER: when it the other defined cases do not apply. See note 4.

Information	Type	SEIG	SEAU	SECS	Description
NOTE 1: Peer concept in ISO 16484-5 [i.9]: Profile_Name.					
NOTE 2: Peer concept in ISO 16484-5 [i.9]: inclusion in Description Property.					
NOTE 3: Peer concept in ISO 16484-5 [i.9]: Profile Location.					
NOTE 4: Peer concept in ISO 16484-5 [i.9]: inclusion in Object Type.					

6.4 Smart Escalator Installation

Table 6.4-1: Information group name: SEInstallation

Information	Type	SEI	SEIG	SECS	Description
technologyUsed	It is defined by one of the following String values: • ELECTRICAL • ELECTRICAL MRL - External controller	M	M	M	It provides an indication of the principle of functioning of the escalator. See note 1.
Escalator Manufacturer	String (max 64 characters)	M	M	M	Name of the company that manufactures the escalator. (max 64 characters). See note 2.
plateInformation	String (max 64 characters)	MWA	MWA	M	Usually also inscribed on a plate attached to the escalator. See note 2.
groupConfiguration	It is defined by one of the following String values: • MASTER • SECONDARY • PEER • NOGROUP	O (M in case the SEI is part of a SEG)	O (M in case the SEI is part of a SEG)	M	MASTER: the SEI is part of an SEG and it acts as master SEI for the common capabilities; SECONDARY: the SEI is part of an SEG and depends from the master SEI for the common capabilities; PEER: the SEI is part of an SEG composed by peers SEI; NOGROUP: the SEI is not part of an SEG and composed by peers SEI. See note 3.
Steps or pallets width	Integer (range 0 .. 9999)	MWA	M	M	Steps or pallets width of escalator/moving walk
Inclination	Integer (range 0 .. 9999)	MWA	M	M	Inclination of escalator/moving walk
Step/pallet band speed	Integer (range 0 .. 9999)	MWA	M	M	Step/pallet band speed of escalator/moving walk
Vertical rise	Integer (range 0 .. 9999)	MWA	M	M	Vertical rise of escalator/moving walk
Escalator/moving walk capacity	Integer (range 0 .. 99999)	MWA	M	M	Escalator/moving walk capacity (persons/h)
emergencyCallSupport	Boolean (TRUE/FALSE)	MWA	M	M	TRUE if emergency call support is available on the escalator. Typically mandatory in new Escalators but may be lacking in old installations. Notification to remote monitoring system of the status of escalator/moving walk

Information	Type	SEI	SEIG	SECS	Description
mainPowerSupply	It is defined by one of the following String values: 3-PHASE; 1-PHASE	M	M	M	Set accordingly to the kind of power supply, 3-phase or single-phase.
powerSupplyVoltage	Integer	M	M	M	Measured in Volts. Examples: 380 v, 220 v, 110 v, etc.
valueOfStandardPowerSupply	Integer	M	M	M	Measured in Volts. Examples: 12 v, 24 v, 48 v, etc.
Remote operation	Boolean (TRUE/FALSE)	O	MWA	M	TRUE when the remote operation is available
NOTE 1: Peer concept in ISO 16484-5 [i.9]: Tags. NOTE 2: Peer concept in ISO 16484-5 [i.9]: inclusion in Description Property. NOTE 3: Peer concept in ISO 16484-5 [i.9]: Group_Members.					

6.5 Smart Escalator General Configuration

Table 6.5-1: Information group name: SEConfiguration

Information	Type	SEI	SEIG	SECS	Description
travelTime	Integer (range 1..1000)	O	MWA	M	Time from entering the escalator until leaving it at nominal speed. Measured in seconds. See note 1.
travelTimeAtNominalSpeed	Integer (range 1..1000)	O	MWA	M	Time taken by the user to use the escalator from the activation of the input sensor to the output sensor Measured in seconds. See note 1.
realTimeModeDescriptor	String	O	O	M	HTTP address of publicly available JSON or XML description of the data sent form the SEI or the SEIG to the SECS when the real time mode is activated.
NOTE 1: Peer concept in ISO 16484-5 [i.9]: Time Delay of the elevator object.					

6.6 General Signals

Table 6.6-1: Information group name: GeneralSignals

Information	Type	SEI	SEIG	SECS	Description
movingUpwardDirection	Boolean (TRUE/FALSE)	M	MWA	M	TRUE when the escalator is moving upward. See note.
movingDownwardDirection	Boolean (TRUE/FALSE)	M	MWA	M	TRUE when the escalator is moving downward. See note.
NOTE: Peer concept in ISO 16484-5 [i.9]: Operation_Direction.					

6.7 Status Signals

Table 6.7-1: Information group name: StatusSignals

Information	Type	SEI	SEIG	SECS	Description
Escalator operation mode	It is defined by one of the following String values: • NOMINAL-SPEED • REDUCED-SPEED • STAND-BY	M	MWA	M	Operation mode of the escalator.
Escalator control command	It is defined by one of the following String values: • LOCAL • REMOTE or remote				Defines whether the escalator is controlled from remote or locally.
Detection of NO users on step band (camera/detection system)	Boolean (TRUE/FALSE)	M	MWA	M	TRUE when the escalator is empty.
outOfService	Boolean (TRUE/FALSE)	M	MWA	M	TRUE when the escalator is in out of service state. See note 1.
inspectionOperation	Boolean (TRUE/FALSE)	M	MWA	M	TRUE when the escalator is subject to inspection operation by the maintenance technician. See note 2.
fireDetection - building fire system or smoke detector	Boolean (TRUE/FALSE)	MWA	MWA	M	TRUE when the building fire system or smoke detector has signalled a fire.
escalator/moving walk water detector in the pit	Boolean (TRUE/FALSE)	MWA	MWA	M	TRUE when the water has been detected in the pit.
realTimeMode	Boolean (TRUE/FALSE)	O	O	M	TRUE when the real time mode is active.
Remote operation active	Boolean (TRUE/FALSE)	O	MWA	M	TRUE when the remote operation is active.
NOTE 1: Peer concept in ISO 16484-5 [i.9]: Out_Of_Service. NOTE 2: Peer concept in ISO 16484-5 [i.9]: Escalator_Mode.					

6.8 Statistic Signals

Table 6.8-1: Information group name: StatisticSignals

Information	Type	SEI	SEIG	SECS	Description
UpwardTravelTime at nominal speed	Integer	O	MWA	M	Total counter from the last reset. See note 1.
UpwardTravelTime at reduced speed	Integer	O	MWA	M	Total counter from the last reset. See note 1
downwardTravelTime at nominal speed	Integer	O	MWA	M	Total counter from the last reset. See note 1.
DownwardTravelTime at reduced speed	Integer	O	MWA	M	Toral counter from the last reset. See note 1.
Operation time	Integer	O	MWA	M	Total operation time (independent of the operation mode)
Stand-by time	Integer	O	MWA	M	Time in which the system remains ready for use but not in motion
Out of service time	Integer	O	MWA	M	Time in which the system remains blocked due to a fault
TravelTimeNominalSpeed	Integer	O	MWA	M	Time in which the system operates at rated speed
TravelTimeReducedSpeed	Integer	O	MWA	M	Time in which the system operates at reduced speed
StopButtonActuationByUser	Integer	O	MWA	M	Number of actions of the stops by users
engineRoomTemperature	String (6 characters) representing 3 digit and two decimals separated by the character "."	O	MWA	M	Measured in Celsius. Expected maximum error ±1 degree Celsius. The temperature shall be reported immediately in case of the detection of unexpected conditions. In case of normal condition, it shall be reported with a periodicity of between 3 and 10 minutes. See note 2.
EngineOvertemperature	Integer	O	MWA	M	How many times has the system stopped due to excess temperature from last reset.
HandrailTemperatureSensor	Integer	O	MWA	M	How many times has the system reported excess temperatures on the handrail from last reset.
MainshaftBearingVibrationSensor	Integer	O	MWA	M	How many times has the system reported excessive vibration from last reset.
three-phasePowerConsumption	Integer	O (M when Three Phase power is present)	MWA	M	Measured in kWh. Total counter from the last reset. See note 3.
single-phasePowerConsumption	Integer	O (M when single Phase power is present)	MWA	M	Measured in kWh. For escalator with both three-phase and single-phase power it provides the power consumption for the services in the escalator (e.g. the lights). See note 3.

Information	Type	SEI	SEIG	SECS	Description
servicesPowerConsumption	Integer	MWA	MWA	M	Measured in kWh. In case of Single-phase power escalators, it provides the power consumption for the services in the escalator (e.g. the lights). See note 3.
realTimeInformation	String	O	O	M	When Real Time Mode is activated, the information provided shall be sent to the SECF. Such information is not specified in the present document, but shall comply with the descriptor provided in the real Time Mode Descriptor.
NOTE 1: Peer concept in ISO 16484-5 [i.9]: historyPeriodic. NOTE 2: Peer concept in ISO 16484-5 [i.9]: Zone_Temp. NOTE 3: Peer concept in ISO 16484-5 [i.9]: Energy_Meter.					

6.9 Fault Signals

Table 6.9-1: Information group name: FaultSignals

Information	Type	SEI	SEIG	SECS	Description
faults	Array of Fault (max 9 999 elements)	M	MWA	M	The index indicates the sequence of the faults from the last reset. See note 1.
FloodInTheWell	Boolean (TRUE/FALSE)	M	MWA	M	TRUE if a flood has been detected (not present in EN 627 [25]). See note 2.
NOTE 1: Peer concept in ISO 16484-5 [i.9]: Fault_Signals. NOTE 2: Peer concept in ISO 16484-5 [i.9]: an instance LIFT_SHAFT_DEVICE_FAULT.					

DEFINITION OF FAULT

Fault is defined by the fault code and the time of recording of the fault on the recording machine in the escalator.

	Elements	Type	Description
Fault	faultCode	In EU and other applicable countries shall be set as defined in EN 627 [25].	E.g.: "61xx" Safety circuit interrupted.
	timeUTC	String representing time according to ISO 8601 [24] Complete Representation Basic Format as described here: YYYYMMDDThhmmss,ssssss The String shall not include the Time Zone: Time shall be interpreted as being in UTC.	Time of the recording machine in the Escalator.

6.10 General Commands

Table 6.10-1: Information group name: GeneralCommands

Information	Type	SEI	SEIG	SECS	Description
setOutOfService	It is defined by one of the following String values: OUT_OF_SERVICE READY	M (the execution of the command may be inhibited in some installations)	MWA	M	OUT_OF_SERVICE to set the escalator in Out of Service mode. The command shall be set to READY at bootstrap and after the execution the command.
mainBoardReset	It is defined by one of the following String values: START READY	M (the execution of the command may be inhibited in some installations)	MWA	M	START to initiate the board reset. The command shall be set to READY at bootstrap completion.
setRealTimeMode	It is defined by one of the following String values: START STOP READY	O	O	M	START to begin the real time mode. STOP to stop the real time mode. The command shall be set to READY at bootstrap and after the execution the command.
Starting of equipment from remote location (only with visibility or full step/pallet band detection)	It is defined by one of the following String values: START STOP	O	MWA	M	Starting of equipment from remote location (only with visibility or full step/pallet band detection).

6.11 Real Time Mode Signals

Table 6.11-1: Information group name: RTMSignals

Information	Type	SEI	SEIG	SECS	Description
realTimeModeSignals	String	O	O	M	This string is deigned to contain information that are not specified in detail in present document, The format shall be accordingly to the realTimeMode Descriptor.

6.12 Power Supply Signals

Table 6.12-1: Information group name: PowerSupplySignals

Information	Type	SEI	SEIG	SECS	Description
standardPowerSupply	Boolean (TRUE/FALSE)	M	MWA	M	TRUE indicates that the standard power supply is currently present.

6.13 Communication System Configuration

Table 6.13-1: Information group name: BCSConfiguration

Information	Type	SEI	SEIG	SECS	Description
homeNetworkOperator	MCC-MNC as defined in Recommendation ITU-T E.212 [26] (5 Digits)	M	MWA	M	The allocation of MCC-MNC codes in the different nations and regions is officially traced by ITU-T that releases periodic updates. The ITU-T list may be not fully up to date. This information is not configurable, it depends on the Home operator active on the SIM/USIM.
supportedNetworkTechnologies	It is defined by the concatenation of one or more of the following String values separated by a space character: FIXED_LINE; 2G; 3G; 4G; 5G; OTHER.	M	MWA	M	List of supported network technologies 2G, 3G, 4G, 5G, fixed, etc.
escalatorTelephoneNumber	String containing a telephone number. The format of the number is according to Recommendation ITU-T E.164 [29] (max 15 digits)	M	MWA	M	Number corresponding to the escalator communication module to be used for calling it.

6.14 Communication System Signals

Table 6.14-1: Information group name: BCSSignals

Information	Type	SEI	SEIG	SECS	Description
registeredNetworkOperator	String containing a MCC-MNC as defined in Recommendation ITU-T E.212 [26] (5 Digits)	MWA	MWA	M	MCC-MNC as defined in Recommendation ITU-T E.212 [26] (5 Digits). The allocation of MCC-MNC codes in the different nations and regions is officially traced by ITU-T that releases periodic updates.
networkQualityRSSI	Integer (values 0..31, 99)	MWA	MWA	M	Received Signal Strength Indicator (via AT commands from the transmission module): 0: -113 dBm or lower quality; 1: -111 dBm; 2..30: -109 dBm .. -53 dBm; 31: -51 dBm or greater; 99: Not Known or non-detectable.
networkQualityBER	Integer (values 0..7, 99)	MWA	MWA	M	Channel Bit Error Rate (via AT commands from the module); 0..7 as for RXQUAL defined by ETSI TS 145 008 [27].

7 Semantic interoperability

The Smart escalator Systems semantic interoperability is based on oneM2M TS-0033 [20], ETSI TS 118 112 [11] and ETSI TS 118 130 [18].

In this context the SAREF standard suite becomes particularly relevant as specified in ETSI TS 103 264 [1], ETSI TS 103 548 [23] and (ETSI TS 103 410 [22] part 1-11: SAREF Extensions). The development of a dedicated extension for smart escalator for potential normative reference in future releases of the present document is under evaluation.

For the current version of the present document:

- Each information group identified in the tables included in clauses 6.2 to 6.14 shall be mapped into a corresponding oneM2M container (one for each information group) named accordingly to the corresponding table title.
- Such container shall contain the elements identified in such table in JSON format.

8 Smart Escalator Communication Framework

8.1 Introduction

The oneM2M specifications define a framework for the communication and sharing of information. The major paradigm is often referred to as "store & share". De facto any object and information is mapped to resources that is shared, discovered and accessed via a resource-oriented architecture and its related protocols.

IP protocols and URI formats are at the basis of the communication and identification, making the solution Internet of Things friendly, so the oneM2M system is a component of IoT.

The following three aspects most characterize the oneM2M solution in the context of smart escalators:

- The mentioned store & share mechanism allows information sharing among multiple services, without consuming the data or explicitly addressing the interested applications. In fact, the use of a communication that allows the storage of the information (on devices, gateways and servers) and its retrieval using application identities, removes the need for end to end routing of the information.
- A separation between security and privacy, where security is based on existing security mechanisms, while privacy is enforced by the system flexibly determined by the service application. The service application may decide to which applications/applications sets and under which conditions they choose to share the information.
- Transparency with respect to the application semantics. Data is stored and retrieved transparently from the point of view of the communication framework, which knows very little or nothing about the nature of the data contained and its format. This implies that to provide a full communication interoperability at the application level the service application needs to share a semantic model or to interwork with a common semantic model. In the case of smart escalators, the common semantics are defined in ETSI TS 103 264 [1].

Everything is then integrated with the required communication feature: among others, security, device management, group managements, location management, communication scheduling, etc., are all part of the oneM2M solution. An intelligent independence from the underlying network: multiple IP based networks can be used, and the M2M System is used to hide (or abstract) the data with respect to the applications. This tries to make conscious & efficient use of the available connectivity means, with the possibility of reusing underlying network functionality where available.

Additionally, the oneM2M Communication Framework allows a flexible deployment. It is designed as a distributed system, where the functionalities and information are to be distributed on devices, gateways and centralized servers, according to the specific service needs and optimizations.

8.2 Smart Escalator Communication Framework

The Smart Escalators Communication Framework shall comply with the following specifications:

NOTE: For oneM2M specifications for which the transposition process by ETSI is still ongoing at the date of the present document, only the oneM2M number is provided.

- ETSI TS 118 111 (oneM2M TS-0011) [2].
- ETSI TS 118 102 (oneM2M TS-0002) [3].
- ETSI TS 118 101 (oneM2M TS-0001) [4].
- ETSI TS 118 104 (oneM2M TS-0004) [5].
- ETSI TS 118 103 (oneM2M TS-0003) [6].
- ETSI TS 118 105 (oneM2M TS-0005) [7].
- ETSI TS 118 106 (oneM2M TS-0006) [8].
- ETSI TS 118 109 (oneM2M TS-0009) [9].
- ETSI TS 118 120 (oneM2M TS-0020) [10].
- ETSI TS 118 112 (oneM2M TS-0012) [11].
- ETSI TS 118 115 (oneM2M TS-0015) [12].
- ETSI TS 118 113 (oneM2M TS-0013) [13].
- ETSI TS 118 122 (oneM2M TS-0022 [14]).
- ETSI TS 118 116 (oneM2M TS-0016 [15]).
- ETSI TS 118 132 (oneM2M TS-0032 [16]).
- ETSI TS 118 126 (oneM2M TS-0026 [17]).
- ETSI TS 118 130 (oneM2M TS-0030 [18]).
- oneM2M TS-0031 [19].
- oneM2M TS-0033 [20].
- oneM2M TS-0034 [21].

The communication framework security may be omitted when reusing an underlying network security (e.g. when the communication is performed on a secure cellular network).

Any proprietary addition/extension to the protocols on Mca, Mcc and Mcc' shall not be included (i.e. no proprietary parameter or resource is admitted on these interfaces). Proprietary extensions may be included by means of specialized applications that operate by associating semantic means to the standard resources (typically application and containers as defined in ETSI TS 118 101 [4]). This acts as plug in on the communication framework without impacting the communication framework interoperability.

These specifications apply to all the entities in the Smart Escalators Communication Framework including the smart escalators themselves.

Additional guideline and information are included in ETSI TR 118 501 [i.4], ETSI TR 118 525 [i.5], oneM2M TR-0035 [i.6] and oneM2M TR-0045 [i.7].

History

Document history		
V1.1.1	August 2022	Publication