

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



TECHNICAL SPECIFICATION

## SmartM2M; Smart Escalator IoT System

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# 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.

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# 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).

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# 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 underlying 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 underlying communication framework, to evolve and adapt to the technology evolution without impacting directly the present document.

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## 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).  
<https://standards.iteh.ai/catalog/standards/sist/4fa1a7a2-45ff-4512-9da4->
- [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](http://www.efesme.org).

[i.2] ELA association website.

NOTE: Available at [www.ela-aisbl.eu](http://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](http://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".

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## 3 Definition of terms, symbols and abbreviations

### 3.1 Terms

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

<https://standards.iteh.ai/catalog/standards/sist/4fa1a7a2-45ff-4512-9da4->

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](http://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 Telecommunication 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](http://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

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## 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.

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# 5 Smart Escalator System IoT architecture and supported configurations

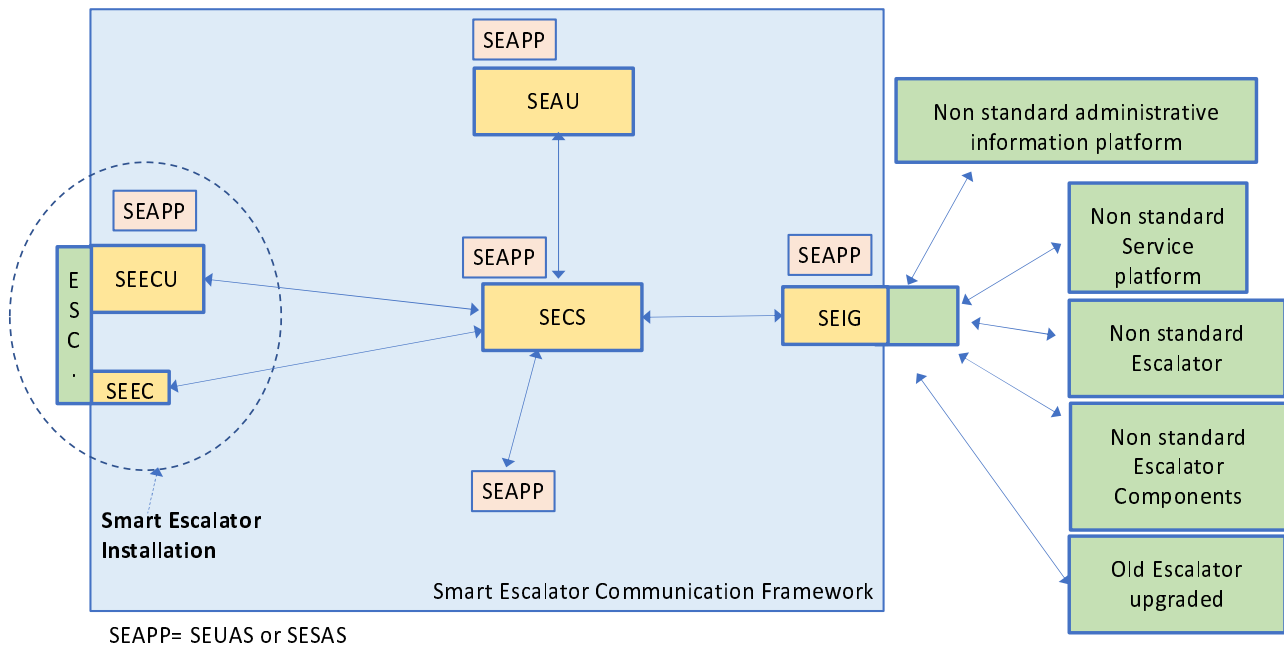
## 5.1 Smart Escalator System IoT architecture

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 concurs 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.