ETSI TS 103 410-11 V1.1.1 (2021-07)

TECHNICAL SPECIFICATION

**SmartM2M;
Extension to SAREF;
Part 11: Lift Domain**

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Foreword

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

The present document is part 11 of a multi-part deliverable covering the SmartM2M; Extension to SAREF, as identified below:

Part 1: "Energy Domain";

Part 2: "Environment Domain";

Part 3: "Building Domain";

Part 4: "Smart Cities Domain";

Part 5: "Industry and Manufacturing Domains";

Part 6: "Smart Agriculture and Food Chain Domain";

Part 7: "Automotive Domain";

Part 8: "eHealth/Ageing-well Domain";

Part 9: "Wearables Domain";

Part 10: "Water Domain";

Part 11: "Lift Domain".

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 presents SAREF4LIFT, an extension of SAREF for the Smart Lifts domain.

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 (V3.1.1): "SmartM2M; Smart Applications; Reference Ontology and oneM2M Mapping".

[2] EN 81-31:2010: "Safety rules for the construction and installation of lifts - Lifts for the transport of goods only - Part 31:Accessible goods only lifts" (produced by CEN).

[3] EN 81-72:2020: "Safety rules for the construction and installation of lifts - Particular applications for passenger and goods passenger lifts - Part 72: Firefighters lifts" (produced by CEN).

[4] EN 81-20:2020: "Safety rules for the construction and installation of lifts - Lifts for the transport of persons and goods - Part 20: Passenger and goods passenger lifts" (produced by CEN).

[5] EN 81-41:2010: "Safety rules for the construction and installation of lifts - Special lifts for the transport of persons and goods - Part 41: Vertical lifting platforms intended for use by persons with impaired mobility" (produced by CEN).

[6] IETF RFC 3966: "The tel URI for Telephone Numbers".

[7] EN 81-28:2018+AC:2019: "Safety rules for the construction and installation of lifts - Lifts for the transport of persons and goods - Part 28: Remote alarm on passenger and goods passenger lifts" (produced by CEN).

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

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] ETSI TR 103 546 (V1.1.1): "SmartM2M; Requirements & Feasibility study for Smart Lifts in IoT".

[i.2]   ETSI TS 103 735 (V1.1.1): "SmartM2M; Smart Lifts IoT System".

[i.3]   ISO 16484-5:2017: "Building automation and control systems (BACS) -- Part 5: Data communication protocol".

[i.4]   ETSI TR 103 510: "SmartM2M; SAREF extension investigation; Requirements for Wearables".

3   Definition of terms, symbols and abbreviations

3.1   Terms

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

ontology: formal specification of a conceptualization, used to explicit capture the semantics of a certain reality

3.2   Symbols

Void.

3.3   Abbreviations

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

ASME	American Society of Mechanical Engineers
OWL	Ontology Web Language
OWL-DL	Ontology Web Language - Description Logics
RDF	Resource Description Framework
RDF-S	Resource Description Framework - Schema
SAREF	Smart Applications REFerence ontology
SAREF4LIFT	SAREF extension for the Smart LIFTs domain
SOS	Save Our Souls

NOTE: SOS was chosen to signify a distress signal. In Morse code, SOS is signified by three dots, three dashes, three dots.

STF	Specialist Task Force
UML	Unified Modelling Language
URI	Uniform Resource Identifier

4   SAREF extension for the Smart Lifts domain

The present document is a technical specification of SAREF4LIFT, an extension of SAREF for the Smart Lifts domain. This SAREF extension will be based on a limited set of use cases and existing data models identified within available initiatives that was detailed in previous documents ETSI TR 103 546 [i.1] and ETSI TS 103 735 [i.2]. The work conducted in the present document has been developed in the context of the STF 602, which was established with the goal of creating SAREF extension for the domain mentioned above, i.e. Smart Lifts. This work has been developed in close collaboration with the industrial world and alliances.

One of the tasks of STF 602 consists of specifying and producing the extension of SAREF for the aforementioned domain based on the requirements resulting from previous initiatives. The present document focuses on the extension of SAREF for the Smart Lifts domain. The present document sets the ontological requirements of the stable semantic model resulting in a new SAREF ontology extension for Smart Lifts, called SAREF4LIFT.

The related initiatives and use cases considered for the development of the SAREF4LIFT extension are the ones reported previously in ETSI TR 103 546 [i.1] and ETSI TS 103 735 [i.2]. Such related initiatives and use cases are not repeated in the present document. Hence, the reader can rely on those references for further details.

5   Requirements

The requirements presented in this clause have been derived from the previously presented use cases. Even if not every requirement is useful for every use case, the different categories of requirements taken into account are expected to support at least the use cases described in ETSI TS 103 735 [i.2].

The associated requirements have been grouped in different categories and are presented from Table 5-1 to Table 5-11.

Table 5-1: Requirements for the "Car Signal" category

Id	Competency Question/Statement	Answer
LIFT-1	Which is the car position?	(Floor Number i.e. -2, -1, 0, 1, etc.)
LIFT-2	What is the lift direction?	Upwards, Downwards, Standstill
LIFT-3	Is the car in an unlocking zone?	Yes/No
LIFT-4	Is there a test ride in execution?	Yes/No
LIFT-5	Is there any fault?	Yes/No
LIFT-6	Is the lift overloaded?	Yes/No
LIFT-7	Are there ongoing inspection operations?	Yes/No
LIFT-8	Are there fire operations?	Yes/No
LIFT-9	Is the alarm in the car activated?	Yes/No
LIFT-10	Is the car empty?	Yes/No
LIFT-11	What is the limit load of the lift?	90 kg
LIFT-12	What is the power supply voltage of the lift?	380 volts
LIFT-13	What is the value of the standard power supply of the lift?	12 volts
LIFT-14	How many car stops has the lift?	8
LIFT-15	How many doors are installed in the lift?	2
LIFT-16	How many car services are available in the lift?	8

Table 5-2: Requirements for the "Bidirectional Communication System Signal" category

Id	Competency Question/Statement	Answer
LIFT-17	Signal related to the periodic test run every 24h has been received.	
LIFT-18	The bidirectional communication system signal has been received.	
LIFT-19	Which is the received signal strength/quality?	% of coverage, i.e. 87
LIFT-20	Which is the home network operator of the lift?	289-88
LIFT-21	The types of signals that can be sent by the Bidirectional Communication System are: • timeOfLastPeriodicTest72hAttempt; • timeOfConfirmationOfLastPeriodicTest72hAttempt; • registeredNetworkOperator, networkQualityRSSI; and • networkQualityBER.	
LIFT-22	Examples of network technologies supported by the Bidirectional Communication System of the lift are: Fixed_line, 2G, 3G, 4G or 5G.	
LIFT-23	Which is the telephone number of the lift?	+3975528568888
LIFT-24	Which are the primary emergency numbers of the lift?	+3975528568889
LIFT-25	Which are the secondary emergency numbers of the lift?	+3975528568890, +3975528568891

Table 5-3: Requirements for the "Power Supply Signal" category

Id	Competency Question/Statement	Answer
LIFT-26	Is the emergency power supply signal active?	Yes/No
LIFT-27	Is the standard power supply signal active?	Yes/No
LIFT-28	Which is the voltage of emergency power?	Voltage value, i.e. 330 volts

Table 5-4: Requirements for the "System Status Signal" category

Id	Competency Question/Statement	Answer
LIFT-29	Is the lift out of service?	Yes/No
LIFT-30	Is the lift overloaded?	Yes/No
LIFT-31	Are there ongoing inspection operations?	Yes/No
LIFT-32	Are there fire operations?	Yes/No

Table 5-5: Requirements for the "Fault Signal" category

Id	Competency Question/Statement	Answer
LIFT-33	The lift has a major fault.	
LIFT-34	The lift has a minor fault.	
LIFT-35	The lift has an audio fault.	

Table 5-6: Requirements for the "Statistic Signal" category

Id	Competency Question/Statement	Answer
LIFT-36	How many times the lift has been called during its lifetime?	245
LIFT-37	How many upward travels the lift did during its lifetime?	167
LIFT-38	How many downward travels the lift did during its lifetime?	153
LIFT-39	Which is the total number of floors covered during its lifetime?	94
LIFT-40	How many times have been executed the reset sequence during its lifetime?	26
LIFT-41	How many times the lift adopted the reversal direction during its lifetime?	4
LIFT-42	How many times the door has been opened during its lifetime?	362
LIFT-43	How many times the lift has been called from the floor X during its lifetime?	46
LIFT-44	How many times the fault event X occurred during its lifetime?	12

Table 5-7: Requirements for the "Alarms" category

Id	Competency Question/Statement	Answer
LIFT-45	Alarm button has been pressed for X seconds.	
LIFT-46	Alarm call has been initiated.	
LIFT-47	Alarm voice communication has been activated.	
LIFT-48	Alarm in the well is active.	
LIFT-49	Alarm in the car is active.	
LIFT-50	Flood alarm is active.	
LIFT-51	Emergency power alarm is active.	

Table 5-8: Requirements for the "Commands" category

Id	Competency Question/Statement	Answer
LIFT-52	A command can call the car to a specific floor.	
LIFT-53	A command can set the lift to out of service.	
LIFT-54	The lift is subject to inspection operation.	
LIFT-55	Which is the opening door time?	4 seconds
LIFT-56	Which is the closing door time?	3 seconds
LIFT-57	A command can test the emergency number.	
LIFT-58	A command can test the proper functioning of the lift.	
LIFT-59	A command can start the real time mode.	
LIFT-60	What is the emergency number?	+1-555-1589
LIFT-61	Which is the current absolute counter of operating hours?	1 634 hours
LIFT-62	A command can initiate the board reset.	Yes/No
LIFT-63	There are four emergency battery power status: • good; • warn; • critical; and • insufficient.	

Table 5-9: Requirements for the "Smart Lift System" category

Id	Competency Question/Statement	Answer
LIFT-64	A Smart Lift Installation is contained into a Smart Lift System	
LIFT-65	A Smart Lift Edge Control Unit hosts the different Smart Lift modules	
LIFT-66	Examples of Smart Lift modules are signals or bidirectional communication systems	

Table 5-10: Requirements for the "Smart Lift identification" category

Id	Competency Question/Statement	Answer
LIFT-67	Each Smart Lift Installation should be globally and uniquely identified	
LIFT-68	Each Smart Lifts Group should be globally and uniquely identified	
LIFT-69	Which is the manufacturing lift company?	Company1
LIFT-70	Which is the installer lift company?	Company2

Table 5-11: Requirements for the "Smart Lift administrative information" category

Id	Competency Question/Statement	Answer
LIFT-71	Which is the maintenance lift company?	Company1
LIFT-72	Who is the building manager of the lift?	Company2
LIFT-73	Who is the legal owner of the lift?	Company3
LIFT-74	A lift is installed in a geographic location	
LIFT-75	The lift geographic location is provided by the geographic location validator	
LIFT-76	Examples of types of use of a lift are: Lift, Goods lift, Goods only lift, or Fireman lift	

6   SAREF4LIFT ontology and semantics

6.1   Introduction and overview

The present document is a technical specification of SAREF4LIFT, an extension of SAREF (ETSI TS 103 264 [1]) for the Smart Lifts domain. Clause 6.1 of the present document shortly introduces a high level view of the envisioned SAREF4LIFT semantic model and modular ontology, with the retained concepts (i.e. classes) and their relations.

SAREF4LIFT has been specified and formalized by investigating related resources in the Smart Lifts domain, as reported in ETSI TR 103 546 [i.1] and ETSI TS 103 735 [i.2]. Therefore, SAREF4LIFT shall both:

- allow the implementation of a limited set of related use cases already identified in [i.1]; and

- fulfil the requirements provided in clause 5, mainly the ontological ones that were mostly taken as input for the ontology specification.

SAREF4LIFT is an OWL-DL ontology. For embedded semantic analytics purposes, SAREF4LIFT shall be designed using the modularity principle and can thus be mainly described by a set of knowledge modules. All these SAREF4LIFT modules are fully detailed in clause 6.2 of the present document.

The prefixes and namespaces used in SAREF4LIFT and in the present document are listed in Table 6.1-1.

Table 6.1-1: Prefixes and namespaces used within the SAREF4LIFT ontology

Prefix	Namespace
s4lift	https://saref.etsi.org/saref4lift/
s4city	https://saref.etsi.org/saref4city/
s4syst	https://saref.etsi.org/saref4syst/
saref	https://saref.etsi.org/core/
dcterms	http://purl.org/dc/terms/
geo	http://www.w3.org/2003/01/geo/wgs84_pos#
geosp	http://www.opengis.net/ont/geosparql#
rdf	http://www.w3.org/1999/02/22-rdf-syntax-ns#
rdfs	http://www.w3.org/2000/01/rdf-schema#
owl	http://www.w3.org/2002/07/owl#
ssn-system	http://www.w3.org/ns/ssn/systems/
vann	http://purl.org/vocab/vann/
voaf	http://purl.org/vocommons/voaf#
xsd	http://www.w3.org/2001/XMLSchema#

6.2   SAREF4LIFT

6.2.1   General Overview

Figure 6.2.1-1 presents the high level view of the envisioned model of SAREF4LIFT ontology. In Figure 6.2.1-1, classes directly imported from SAREF ontology are in light orange, classes directly imported from other SAREF extension ontologies are in green. While, classes developed for SAREF4LIFT are in blue.

s4syst:System

s4lift:SmartLiftEdgeComponent

...

s4bldg:BuildingSpace

s4lift:CarStopSpace

s4lift:SmartLiftCar

s4lift:ElectricPowerSystem

s4lift:SmartLiftInstallation

...

s4syst:Connection

s4lift:NetworkAccess

s4lift:PossibleSmartLiftCarService

s4lift:SmartLiftCarService

s4syst:ConnectionPoint

s4lift:DoorConnectionPoint

s4lift:ElectricalConnectionPoint

s4lift:DirectCurrentConnectionPoint

s4lift:SinglePhaseConnectionPoint

s4lift:ThreePhaseConnectionPoint

saref:Device --saref:hasFunction--> saref:Function --saref:hasCommand--> saref:Command

s4lift:ElectricalDevice

s4lift:HydraulicDevice

s4lift:SmartLiftEdgeComponent

s4lift:SmartLiftEdgeControlUnit

s4lift:MainBoardResetCommand

...

saref:isAbout --> saref:FeatureOfInterest --saref:hasProperty--> saref:Property

saref:Power

s4lift:Load

s4lift:Load

s4lift:Signal --s4lift:conveys--> owl:Thing

s4lift:AlarmSignal

s4lift:FaultSignal

s4lift:StatusSignal

s4lift:StatisticSignal

s4lift:conveys

saref:State

s4lift:AlarmState

...

s4lift:conveys

saref:Measurement

s4lift:StatisticsMeasurement

s4lift:DownwardTravelsStatistics

...

Figure 6.2.1-1: SAREF4LIFT overview

Within Figure 6.2.1-1, as well as within all the figures that are depicted in clause 8 of the present document, the following conventions are used:

- Arrows are used to represent properties between classes and to represent some RDF, RDF-S and OWL constructs, more precisely:

  - Plain arrows with white triangles represent the `rdfs:subClassOf` relation between two classes. The origin of the arrow is the class to be declared as subclass of the class at the destination of the arrow.

  - Dashed arrows between two classes indicate a local restriction in the origin class, i.e. that the object property can be instantiated between the classes in the origin and the destination of the arrow. The identifier of the object property is indicated within the arrow.

- Datatype properties are denoted by rectangles attached to the classes, in an UML-oriented way. Dashed boxes represent local restrictions in the class, i.e. datatype properties that can be applied to the class they are attached to.

- Individuals are denoted by rectangles in which the identifier is underlined.

As already introduced in clause 6.1 of the present document SAREF4LIFT is an OWL-DL ontology and shall be designed using the modularity principle (see ETSI TR 103 510 [i.4]) and can thus be mainly described by the following self-contained knowledge modules:

- **Systems and connections**. This module defines the different systems modelled within a smart lift environment. A system is described as a component virtually isolated from the environment, whose behaviour and interactions with the environment are specifically defined. Systems can be connected to other systems. Connected systems interact in some ways. Systems can also have subsystems. Properties of subsystems somehow contribute to the properties of the supersystem.

- **Devices and commands**. This module defines the devices included within a smart lift. A device is defined as a tangible object designed to accomplish a particular task. In order to accomplish this task, the device performs one or more functions. The root of this branch (`saref:Device`) is inherited directly from the SAREF Core ontology. Also, this module defines commands supported by the defined smart lift. A command is defined as a directive that a device should support to perform a certain function. A command may act upon a state, but does not necessarily act upon a state. For example, the ON command acts upon the ON/OFF state, but the GET command does not act upon any state, it simply gives a directive to retrieve a certain value. The root of this branch (`saref:Command`) is inherited directly from the SAREF Core ontology.

- **States and measurements**. This module defines states that features of interest in a smart lift installation can be found in, and measurements that can be made about features of interest in a smart lift.

- **Signals**. This module describes the types of signals supported by a smart lift. Four type of signals have been identified: car signal (`s4lift:AlarmSignal`), fault signal (`s4lift:FaultSignal`), status signal (`s4lift:StatusSignal`), and statistic signal (`s4lift:StatisticSignal`). Clause 6.2.5 provides a complete taxonomy of supported signals with respect to the ones reported in Figure 6.2.1-1.

Besides the four module described above, the SAREF4LIFT extension defines also two new property types (`s4lift:Load` and `s4lift:Voltage`) defining the load in the smart lift car and the electric voltage of some electric power system.

6.2.2   Systems and connections

This module specializes the SAREF4SYST ontology pattern for the Smart Lift domain.

A Smart Lift system can be defined as a **`s4syst:System`** made by different components. This module defines the subcomponents that are part of Smart Lift. In particular, two subcomponents are denoted: the **`s4lift:SmartLiftEdgeComponent`** and the **`s4lift:SmartLiftEdgeControlUnit`**.
The former is dedicated to the hosting of smart lift additional modules in the case that they are not hosted directly in the **`s4lift:SmartLiftEdgeControlUnit`**. An example could be the case of an additional earthquake sensor added after the lift deployment and not controlled by the **`s4lift:SmartLiftEdgeControlUnit`**.
The latter is the main element of a Smart Lift installation and it is typically associated with the lift control cabinet.

A **s4lift:SmartLiftInstallation** corresponds to a single lift, with all its elements. Such a concept is equipped with the list of properties shown in Figure 6.2.2-1. Seven types of installations are considered relevant for this extension: namely **s4lift:AccessibleGoodsOnlySmartLift** as per EN 81-31 [2], **s4lift: FirefightersSmartLift** as per EN 81-72 [3], **s4lift:GoodsSmartLift**, and **s4lift:MachineRoomLessSmartLift**, **s4lift:PassengerAndGoodsPassengerSmartLift** as per EN 81-20 [4], **s4lift:SmartLiftWithoutEmergencyCallSupport**, **s4lift:VerticalSmartLiftingPlatform** as per EN 81-41 [5]. All these concepts represent a type of smart lift that can be instantiated by the ontology.

A **s4lift:SmartLiftGroup** represents the correlation of multiple Smart Lifts Installation and it is supported by the introduction of a Smart Lift Group identifier common each Smart Lifts Installation belonging to the same Smart Lift Group. Such kind of installations usually presents control units connected one each other to coordinate the movement and position of the different lifts, where the common commands (e.g. the call buttons) are given to one of these control units that acts as a principal master and coordinates the other installations or is composed by peer installations that coordinates one each other.

A **s4lift:SmartLiftCar** represents the car of a Smart Lift. A **s4lift:SmartLiftInstallation** usually contains different **s4lift:CarStopSpaces** serving different spaces of different floors at **s4lift:Smart LiftCarService**. A **s4lift:SmartLiftCar** can connect to some **s4bldg:BuildingSpace** through some **s4lift:SmartLiftCarService** at some **s4lift:DoorConnectionPoint**.

A **s4lift:Network** is the class of communication networks. Systems can connect to other networks through a potential **s4lift:NetworkAccess** connection.
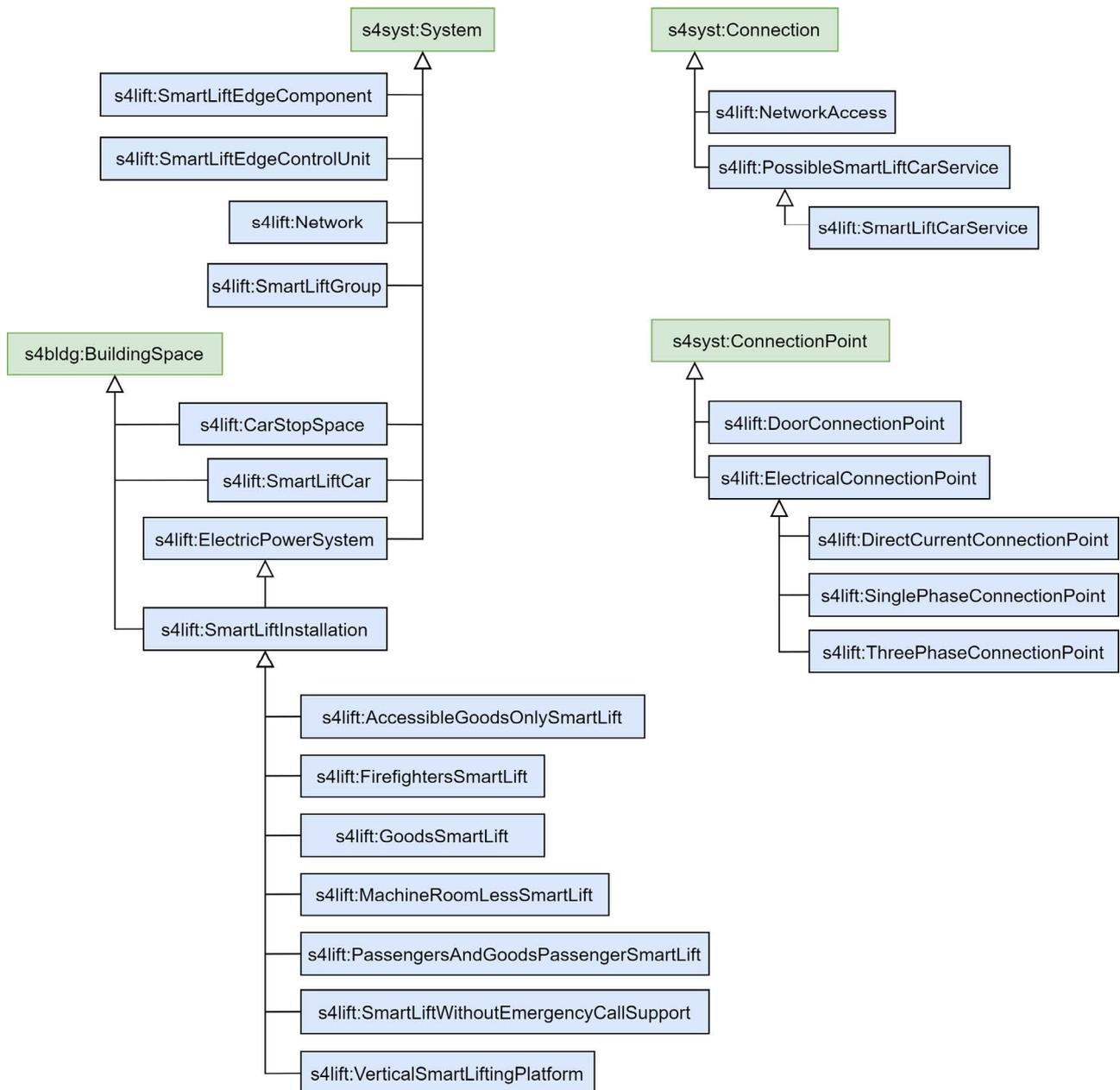
Figure 6.2.2-1: Systems and connections model

6.2.3   Devices and commands

This model specifies the list of commands that is considered relevant for the smart lift domain. Six new defined commands are subsumed by the **saref:Command** concept that can be triggered, in turn, by a **saref:Function** as presented in Figure 6.2.3-1:

- **s4lift:MainBoardResetCommand** defines the command for resetting the main board of a smart lift;

- **s4lift:SendCarToSpecificServiceCommand** defines the internal command for sending the car to a specific service;

- **s4lift:SetOutOfServiceCommand** defines the command for putting the smart lift in out of service mode;

- **s4lift:SetRealTimeModeCommand** defines the command for putting the smart lift in out of service mode;

- **s4lift:TestEmergencyNumberCommand** defines the command for testing if the emergency number is working;

- **s4lift:TestRideCommand** defines the command for performing a test ride of a smart lift.
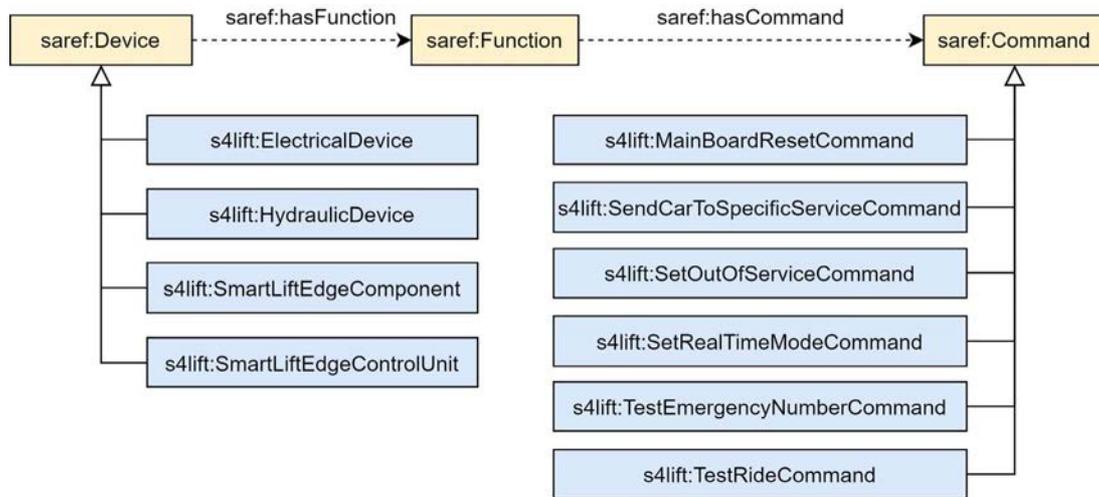
Figure 6.2.3-1: Command model

6.2.4   States and measurements

This module defines states that features of interest in a smart lift installation can be found in, and measurements that can be made about features of interest in a smart lift.
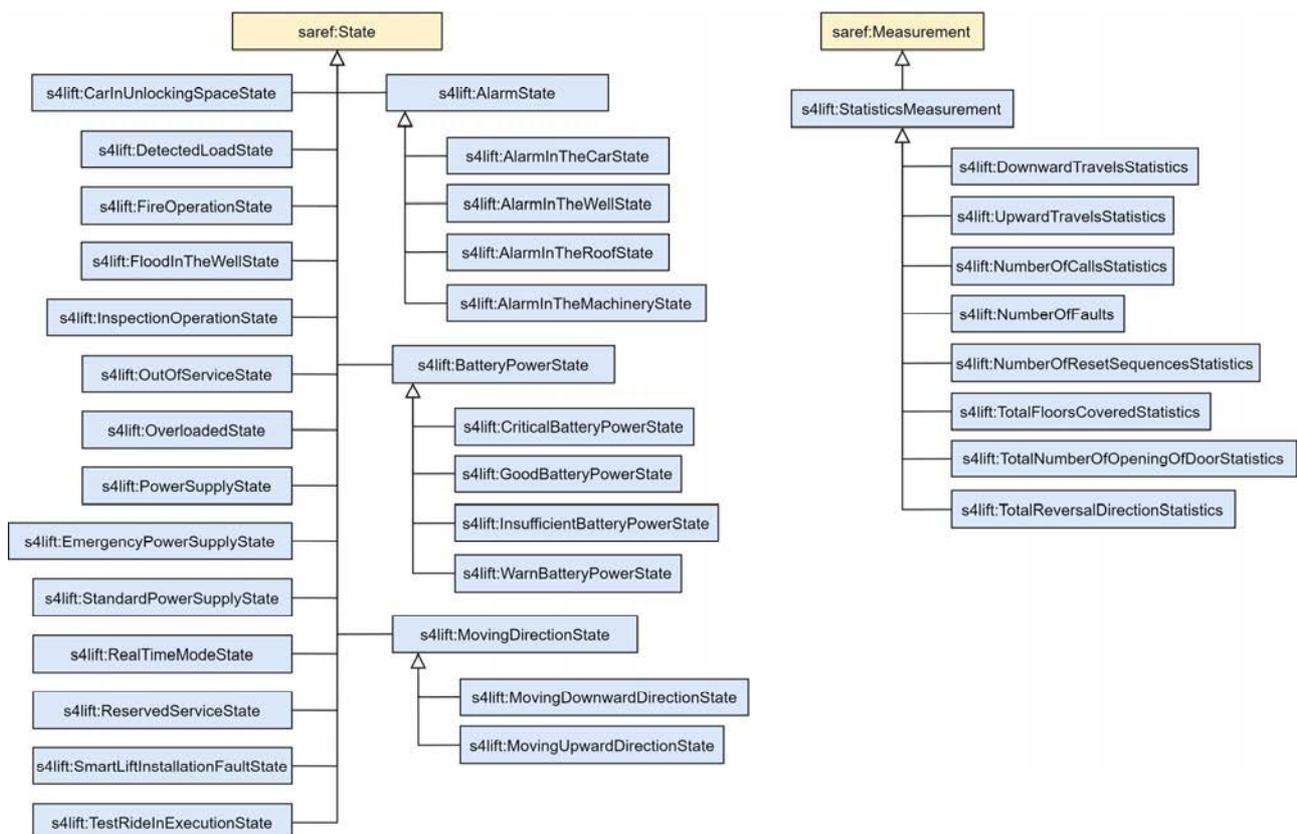
Figure 6.2.4-1: States and measurements model

6.2.5   Signals

This module describes the types of signals that can be read from a smart lift console. Figure 6.2.5-1 shows the taxonomy of the relevant types of signals foreseen within this extension.

It is possible to observe a set of four main types of signals:

- **s4lift:AlarmSignal**: this defines high priority signals used to attract the operator's attention to important deviations or abnormal events in system operation.

- **s4lift:StatisticSignal**: such signals convey (**s4lift:conveys**) a **s4lift:StatisticsMeasurement** about the smart lift usage.

- **s4lift:FaultSignal**: these are the signals sent by the smart lift car about its overall status. This concept subsumes three further concepts grouping likewise car signal types.

- **s4lift:StatusSignal**: these are signals that convey (**s4lift:conveys**) a **saref:State** of a feature of interest.

Descendants of the **s4lift:Signal** inherit the **saref:hasTimestamp**, **saref:isAbout**, and **s4lift:conveys** properties defining the timestamp when the signal has been generated and its value, respectively.
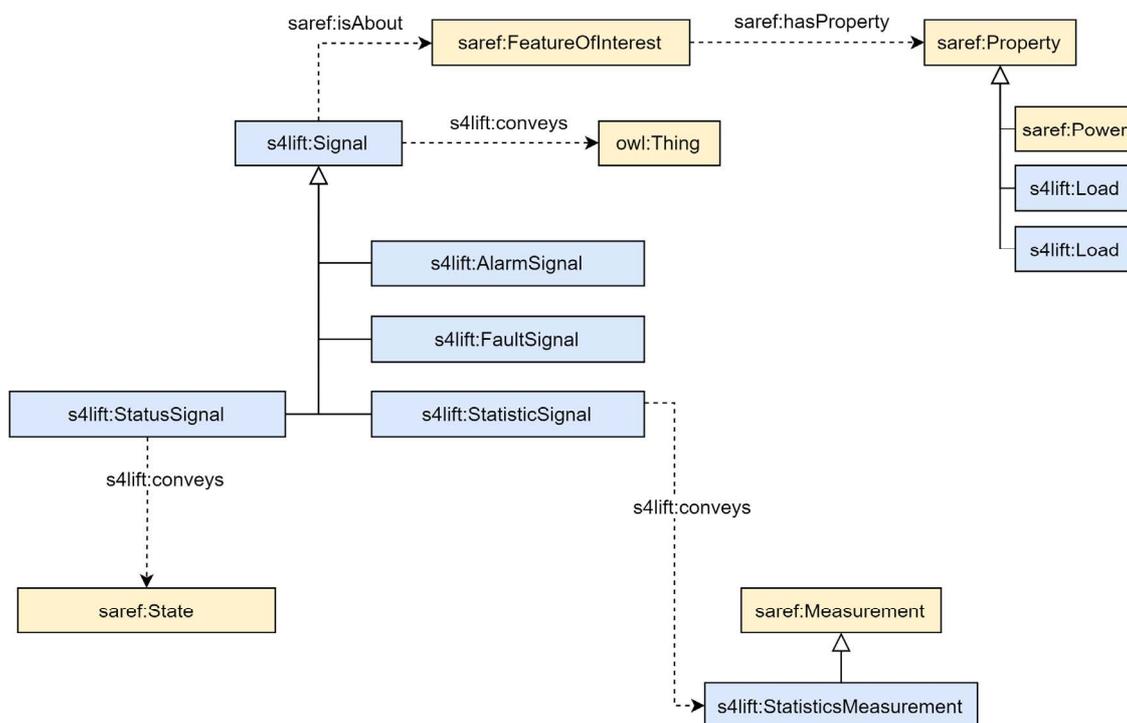
Figure 6.2.5-1: Signal model

6.2.6   Object properties

A list of the object properties defined into the SAREF4LIFT extension is reported in Table 6.2.6-1. For each object property, the name, the domain, the range, and its definition are reported.

Table 6.2.6-1: List of the object properties defined within the SAREF4WEAR extension

Object property	Domain	Range	Definition
saref:hasCommand	saref:Function	saref:Command	Relationship between a function and the related command.
saref:hasFunction	saref:Device	saref:Function	It identifies the function of a device.
s4lift:isGroupedIn	s4lift:SmartLiftInstallation	s4lift:SmartLiftGroup	A relationship specifying the smart lift installations grouped into smart lift groups.

Object property	Domain	Range	Definition
s4lift:isMasterInGroup (sub property of s4syst:containsCar)	s4lift:SmartLiftInstallation	s4lift:SmartLiftGroup	The smart lift installation acts as master for the common capabilities in the smart lift group.
s4lift:isPeerInGroup (sub property of s4syst:containsCar)	s4lift:SmartLiftInstallation	s4lift:SmartLiftGroup	The smart lift installation is part of a smart lift group and composed by peers of smart lift installation respect to the common capabilities.
S4lift:isSecondaryInGroup (sub property of s4syst:containsCar)	s4lift:SmartLiftInstallation	s4lift:SmartLiftGroup	The smart lift installation acts as depends from the master smart lift installation in the smart lift group for the common capabilities.
s4lift:hasAlarmSOSSystem (sub property of s4syst:hasSubSystem)	s4syst:System	s4syst:System	A relationship defining the alarm SOS subsystem of a system.
s4lift:hasCarTemperature (sub property of saref:hasProperty)	s4lift:SmartLiftInstallation	saref:Temperature	A relationship between a smart lift installation and the temperature of the smart lift car.
s4lift:hasChannelBitErrorRate (sub property of saref:hasProperty)	s4lift:NetworkAccess	saref:Property	Channel Bit Error Rate (via AT commands from the module); 0..7 as for RXQUAL defined by ETSI TS 145 008 [8].
s4lift:hasCoverage (sub property of saref:hasProperty)	s4lift:NetworkAccess	saref:Property	Coverage of the network.
s4lift:hasElectricPowerConsumption (sub property of saref:hasProperty)	saref:FeatureOfInterest	saref:Energy	A relationship between a feature of interest and its power consumption. If a property of a s4syst:System, or the property of a s4syst:ConnectionPoint thereof, by convention the power consumption is positive if the electric energy enters the system.
s4lift:hasEngineRoomTemperature (sub property of saref:hasProperty)	s4lift:SmartLiftInstallation	saref:Temperature	A relationship between a smart lift installation and the temperature of the engine room.
s4lift:hasReceivedSignalStrengthIndicator (sub property of saref:hasProperty)	s4lift:NetworkAccess	saref:Property	Received Signal Strength Indicator of the network access. (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.
s4lift:hasShaftTemperature (sub property of saref:hasProperty)	s4lift:SmartLiftInstallation	saref:Temperature	A relationship between a smart lift installation and the temperature of the shaft.
s4lift:hasTimeOfConfirmationOfLastPeriodicTest72hAttempt (sub property of saref:hasProperty)	s4lift:SmartLiftInstallation		A relationship to the time of the confirmation of the last periodic test 72h attempt of a lift. In UE and other applicable countries, the periodic test shall comply with EN 81-28 [7].
s4lift:hasTimeOfLastPeriodicTest72hAttempt (sub property of saref:hasProperty)	s4lift:SmartLiftInstallation		A relationship to the time of the last periodic test 72h attempt of a lift. In UE and other applicable countries, the periodic test shall comply with EN 81-28 [7].
s4lift:hasVoltage (sub property of saref:hasProperty)	saref:FeatureOfInterest	s4lift:Voltage	A relationship defining the voltage of a feature of interest.
s4lift:hasMainPowerSupply (sub property of s4syst:connectsAt)	s4lift:ElectricPowerSystem	s4lift:ElectricalConnectionPoint	A relationship defining the main power supply of an electric power system.
s4lift:hasStandardPowerSupply (sub property of s4syst:connectsAt)	s4lift:ElectricPowerSystem	s4lift:ElectricalConnectionPoint	A relationship defining the standard power supply of an electric power system.

Object property	Domain	Range	Definition
s4lift:canConnectToNetwork (sub property of s4syst:connectedTo)	s4syst:System	s4lift:Network	A relationship between a system and a network it can connect to.
s4lift:connectedToEmergencyBattery (sub property of s4syst:connectedTo)	s4lift:ElectricPowerSystem	s4lift:ElectricPowerSystem	A relationship defining the emergency battery of an electric power system.
s4lift:hasCarService (sub property of s4syst:connectedThrough)	s4lift:SmartLiftInstallation	s4lift:PossibleSmartLiftCarService	A relationship between a system and a car service.
s4lift:hasCarloadLimit	s4lift:SmartLiftCar	s4lift:Load	A relationship defining the limit load to be safely carried by the car, as a design parameter.
s4lift:conveys	s4lift:Signal		A relationship specifying an information (e.g. measurement, state) that is conveyed by a signal.
s4lift:containsCar (sub property of s4bldg:hasSpace)	s4lift:SmartLiftInstallation	s4lift:SmartLiftCar	A relationship between a smart lift installation and its car.

6.2.7   Datatype properties

A list of the datatype properties defined into the SAREF4LIFT extension is reported in Table 6.2.7-1. For each datatype property, the name, the domain, the range, and its definition are reported.

Table 6.2.7-1: List of the datatype properties defined within the SAREF4WEAR extension

Object property	Domain	Range	Definition
s4lift:hasAlarmMonitoringCentre	s4syst:System		A relationship identifying the monitoring centre of the alarms, as per ISO 16484-5: inclusion in Description Property [i.3]. The value is expected to be a string or a string with language tag.
s4lift:hasBuildingManager	s4syst:System		A relationship identifying the manager of the building where a system is located, as per ISO 16484-5: inclusion in Description Property [i.3]. The value is expected to be a string or a string with language tag.
s4lift:hasCarServices	s4lift:SmartLiftInstallation	xsd:integer	The number of car services, taking care of the case where the car has multiple doors that give independent access to different locations on a given floor. It is expected to be greater or equal to the number of Car Stops.
s4lift:hasDoorCloseTime	saref:FeatureOfInterest	xsd:duration	A relationship defining the time spent by an entity (e.g. a lift, a building space, a door) to close its doors.
s4lift:hasDoorOpenTime	saref:FeatureOfInterest	xsd:duration	A relationship defining the time spent by an entity (e.g. a lift, a building space, a door) to open its doors.
s4lift:hasDoors	s4bldg:BuildingSpace	xsd:integer	The number of door connection points in a building space (e.g. a smart lift car)
s4lift:hasGeographicLocationValidator	s4syst:System		Name of who has provided the validation of the correctness of the geographic location of the system. The value is expected to be a string or a string with language tag.

Object property	Domain	Range	Definition
s4lift:hasInspectionAuthority	s4syst:System		A relationship identifying the Authority that is entitled to periodically inspect the system installation and certify its suitability for the intended use, as per ISO 16484-5: inclusion in Description Property [i.3]. The value is expected to be a string or a string with language tag.
s4lift:hasInstallerCompany	s4syst:System		A relationship identifying the installer company of a system (e.g. device), as per ISO 16484-5: inclusion in Description Property [i.3]. The value is expected to be a string or a string with language tag.
s4lift:hasLegalOwner	s4syst:System		A relationship identifying the legal owner of a system, as per ISO 16484-5: inclusion in Description Property [i.3]. The value is expected to be a string or a string with language tag.
s4lift:hasMainEmergencyTelephoneNumber	s4syst:System	xsd:anyURI	Main emergency telephone number to be called in case of emergency. The value is expected to be a URI with the tel: URI scheme as defined in IETF RFC 3966 [6].
s4lift:hasMaintenanceCompany	s4syst:System		A relationship identifying the maintenance company of a system, as per ISO 16484-5: inclusion in Description Property [i.3]. The value is expected to be a string or a string with language tag.
s4lift:hasManufacturingCompanyRepresentative	s4syst:System		A relationship identifying the local representative of the manufacturing company of a system, as per ISO 16484-5: Profile_Name [i.3]. The value is expected to be a string or a string with language tag.
s4lift:hasPlateInformation	s4lift:SmartLiftInstallation	xsd:string	An information usually also inscribed on a plate attached to the lift car.
s4lift:hasSecondaryEmergencyTelephoneNumber	s4syst:System	xsd:anyURI	Secondary emergency number to be called in case of emergency. The value is expected to be a URI with the tel: URI scheme as defined in IETF RFC 3966 [6].
s4lift:hasStops	s4syst:System	xsd:integer	The number of stops by an entity (e.g. a lift).
s4lift:hasTelephoneNumber	s4syst:System	xsd:anyURI	Number corresponding to the lift communication module to be used for call terminated to the lift car. The value is expected to be a URI with the tel: URI scheme as defined in IETF RFC 3966 [6].
s4lift:hasTravelTime	saref:FeatureOfInterest	xsd:duration	A relationship defining the time spent by an entity (e.g. a lift car) to travel between stops.

7   Instantiating SAREF4LIFT

This clause shows different examples of how to instantiate the SAREF4LIFT extension of SAREF.

The example presented in Figure 7-1 demonstrates how to represent information from group name SLIdentification as described in ETSI TS 103 735 [i.2], clause 6.2a.
There are two new global identifiers of respective smart lifts installations defined:
(`mailto:lift.1415@company1.com` and `mailto:lift.1416@company1.com`) and the global identifier of the associated group (`mailto:group.10354@company1.com`). Through the object properties `s4lift:isMasterInGroup` and `s4lift:isSecondaryinGroup` it is possible to define the importance level of each identifier.
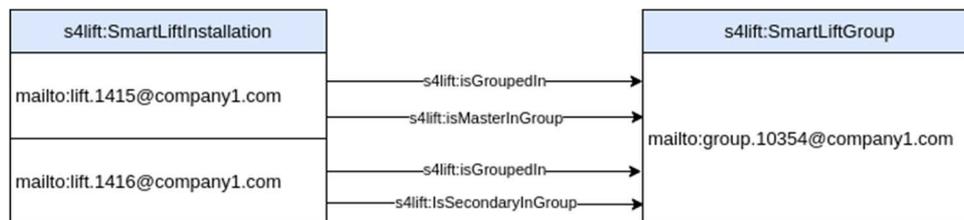
Figure 7-1: Smart Lift installation identification example

The example presented in Figure 7-2 demonstrates how to represent administrative information associated with a `s4lift:SmartLiftInstallation` as described in ETSI TS 103 735 [i.2], clause 6.3.
The individual `mailto:lift.1415@company1.com` is subclass of both `s4lift:SmartLiftInstallation` and `s4lift:PassengerAndGoodsPassengerSmartLift` concepts in order to specify precisely the type of smart lift. Then, data properties describing the installation are provided and associated with it.
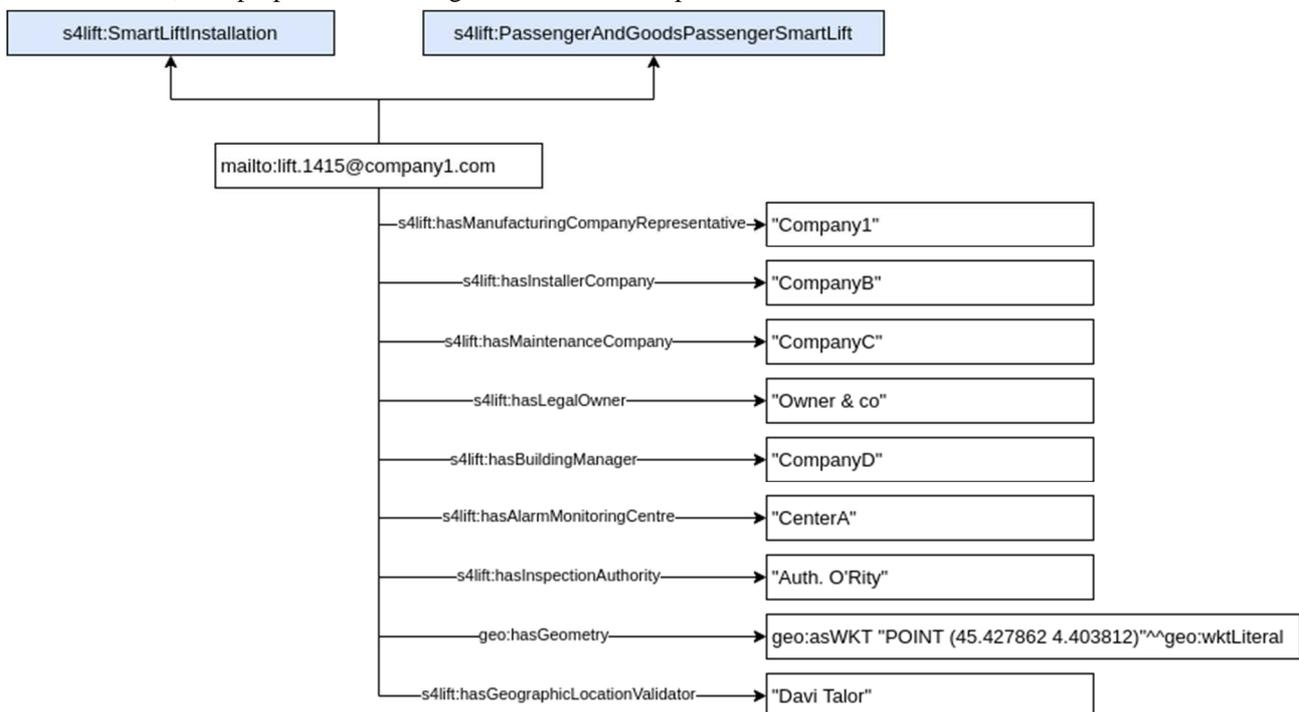
Figure 7-2: Administrative Information example

Finally, the example presented in Figure 7-3 demonstrates how to represent information from group name SLInstallation as described in ETSI TS 103 735 [i.2], clause 6.4.

As shown in Figure 7-1 and Figure 7-2, the installation labelled as `mailto:lift.1415@company1.com` is associated with the respective group and the related administrative information are defined.

Here is shown how the load capacity is defined through the definition of a the s4lift:carloadlimit property (linked through the s4lift:hasCarLoadLimit object property) that is associated with the related saref:Measurement (s4lift:CarLoadLimitMeasurement).

Then, both the main power supply and the standard power supply are defined.

The s4lift:mainPowerSupply individual instantiates both the s4lift:ElectricalConnectionPoint and s4lift:ThreePhaseConnectionPoint concepts, it is associated with the measure property (s4lift:mainPowerSupplyVoltage) that in turn relates to the saref:Measurement individual s4lift:mainPowerSupplyVoltageMeasurement.

Similarly, the s4lift:standardPowerSupply individual instantiates both the s4lift:ElectricalConnectionPoint and s4lift:SinglePhaseConnectionPoint concepts, it is associated with the measure property (s4lift:standardPowerSupplyVoltage) that in turn relates to the saref:Measurement individual s4lift:standardPowerSupplyVoltageMeasurement.
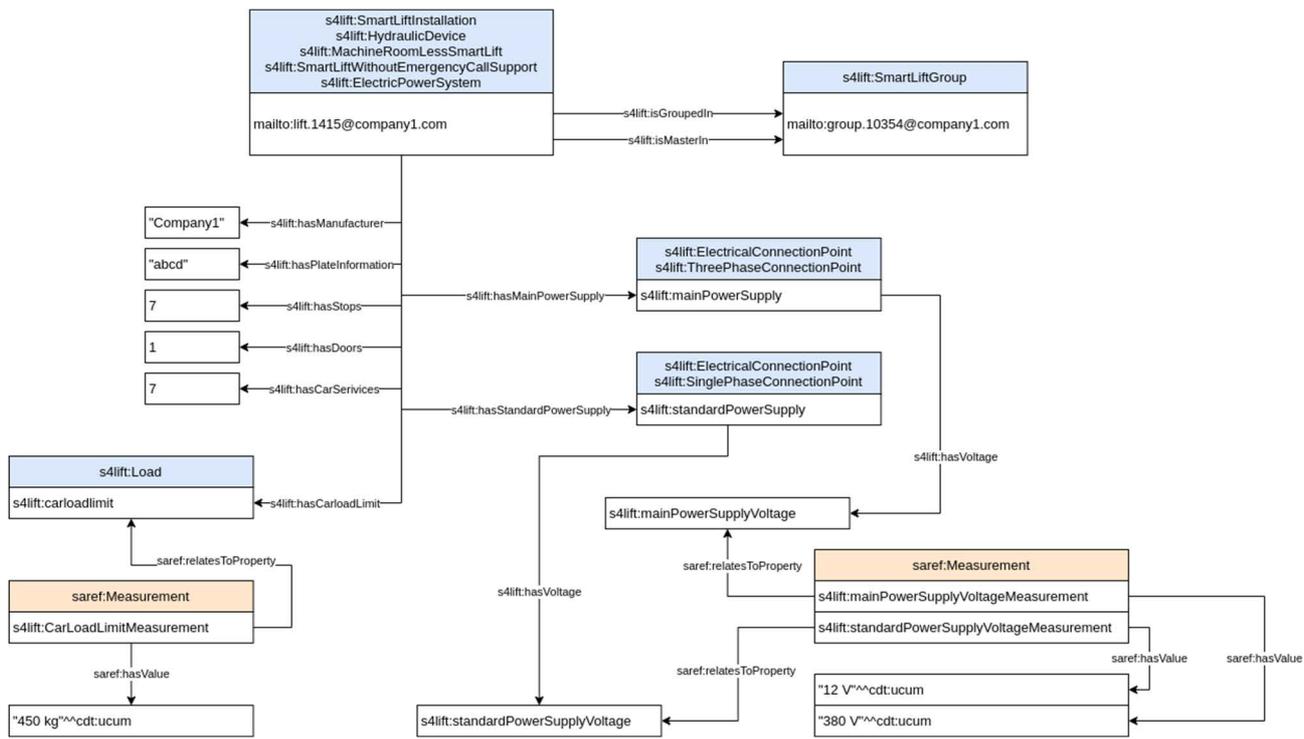
Figure 7-3: Smart Lift Installation example
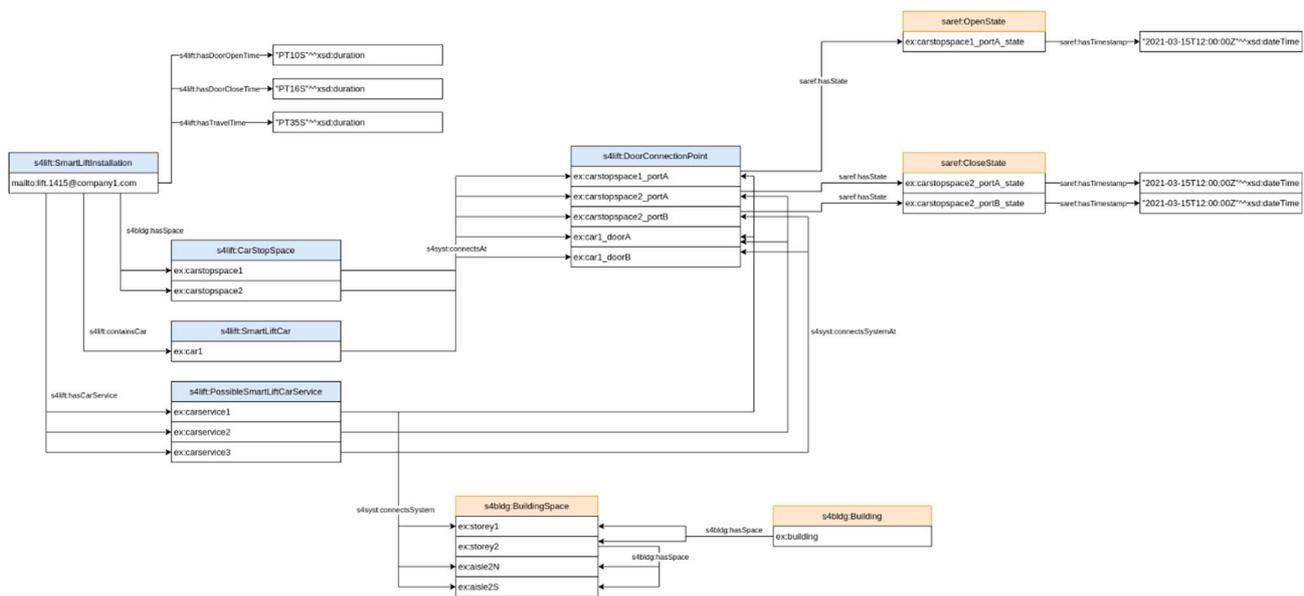
Figure 7-4: Smart Lift General Configuration example
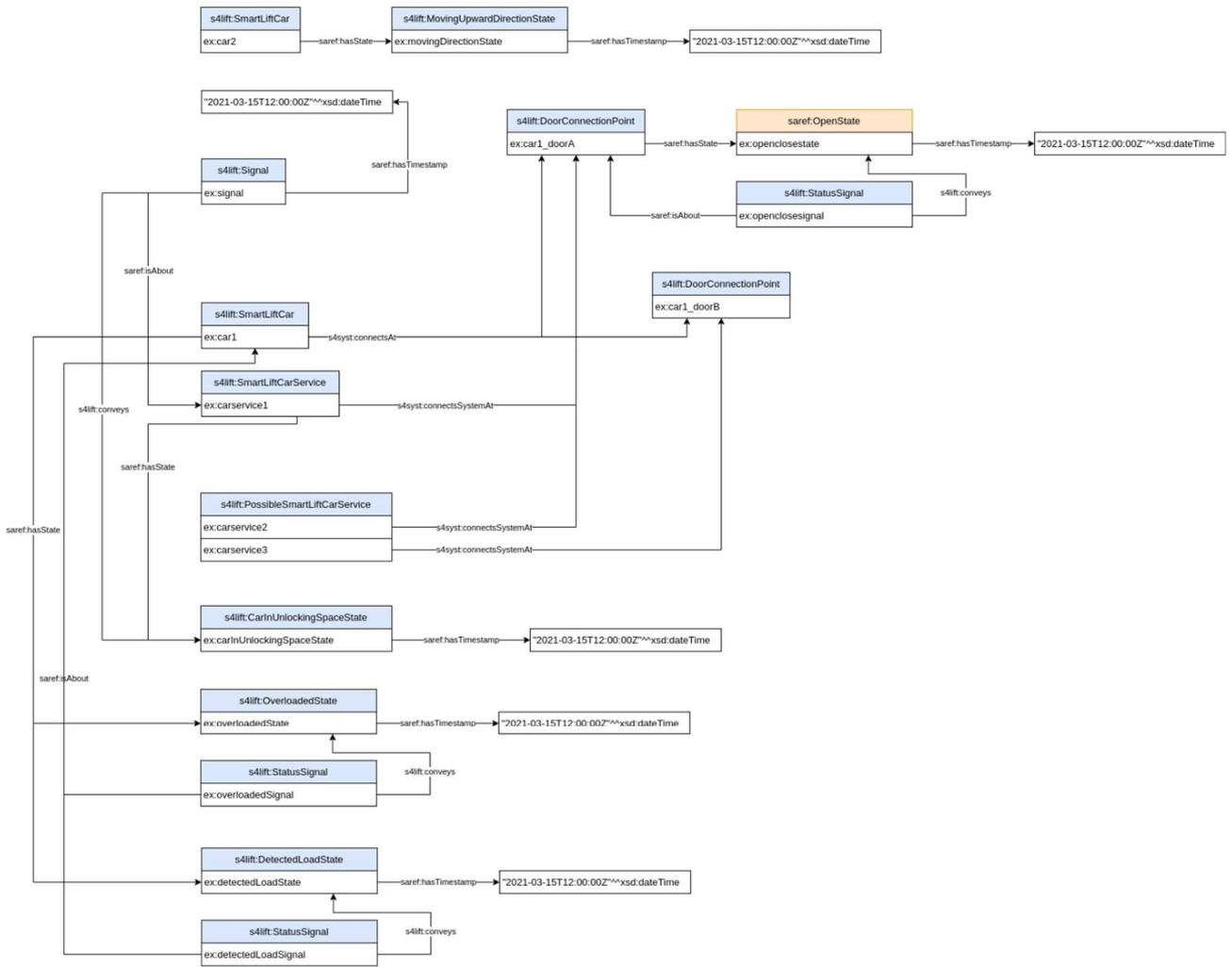
Figure 7-5: General Signals example
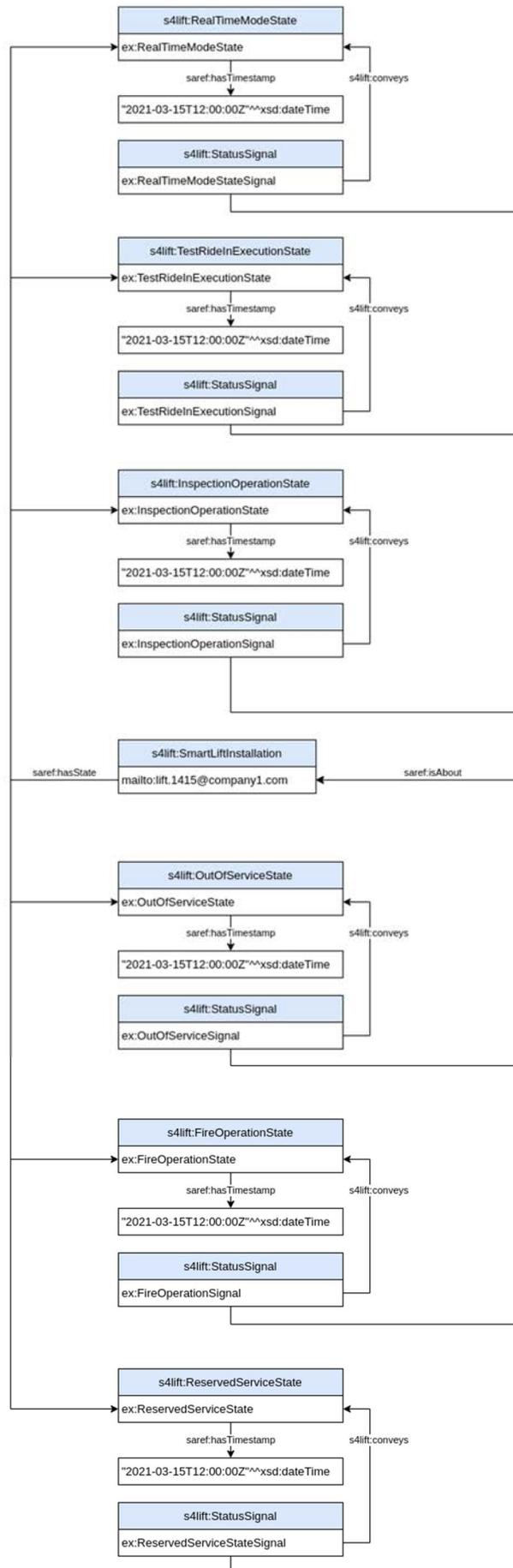
Figure 7-6: Status Signals example

Figure 7-7: Statistic Signals example

Figure 7-8: Fault Signals example
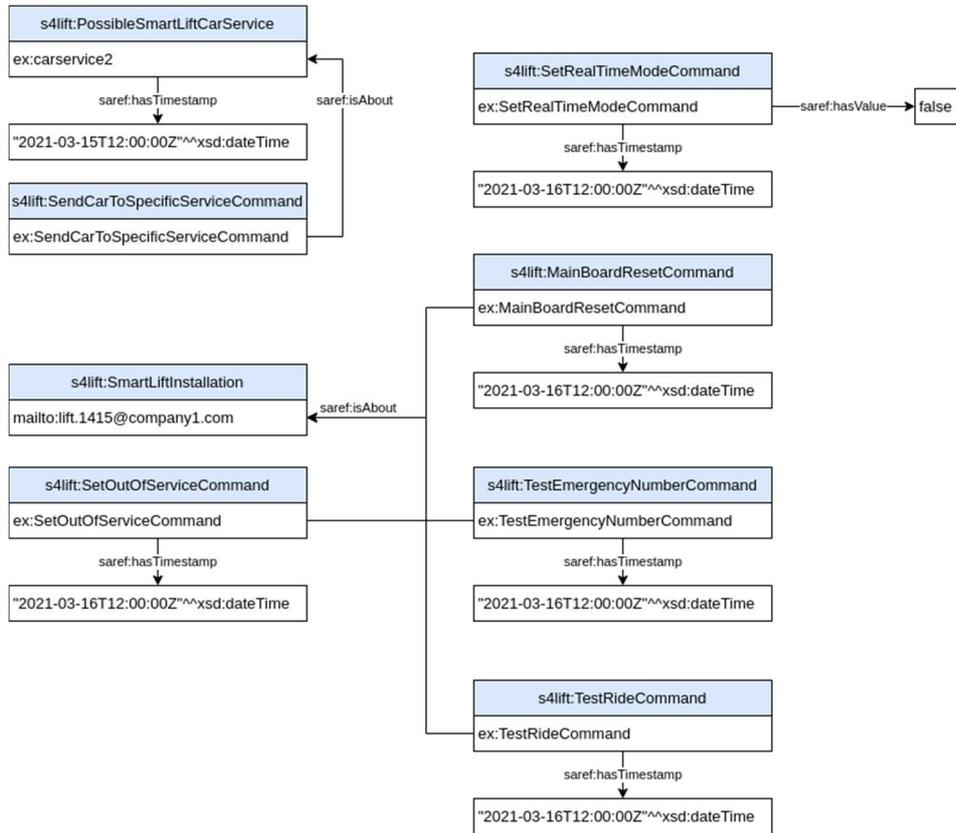
Figure 7-9: General Command example
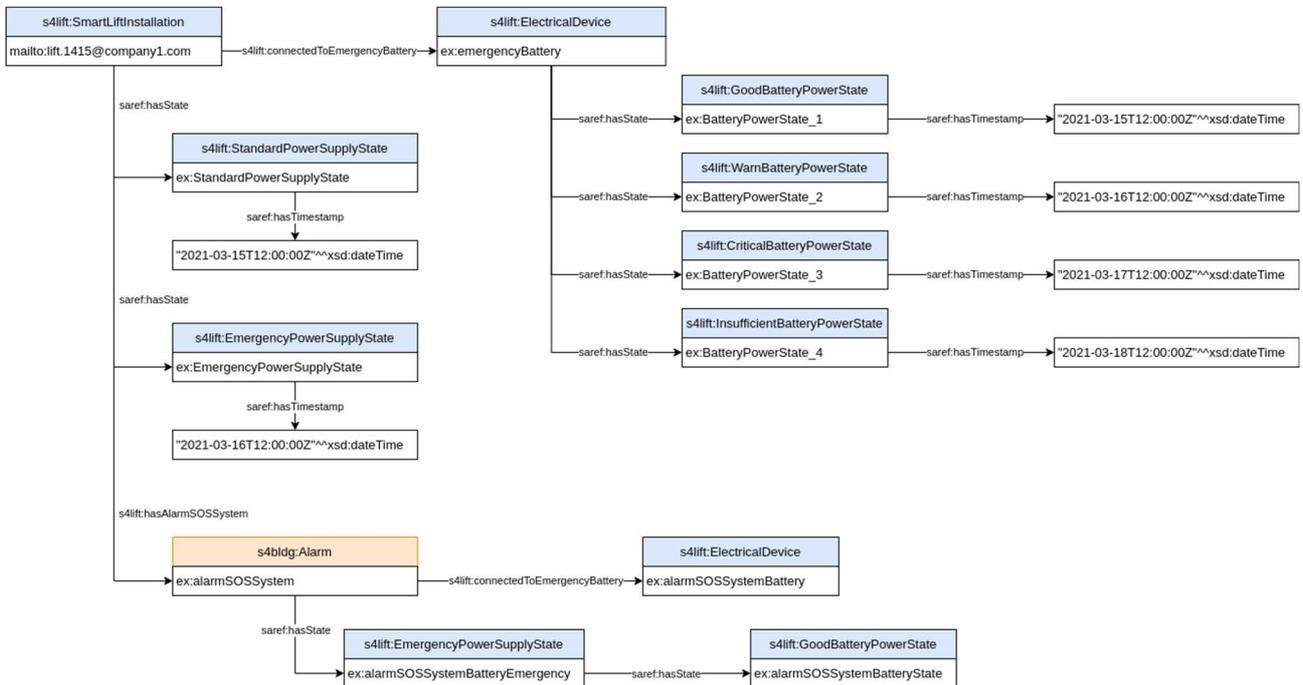
Figure 7-10: Power Supply Signals example
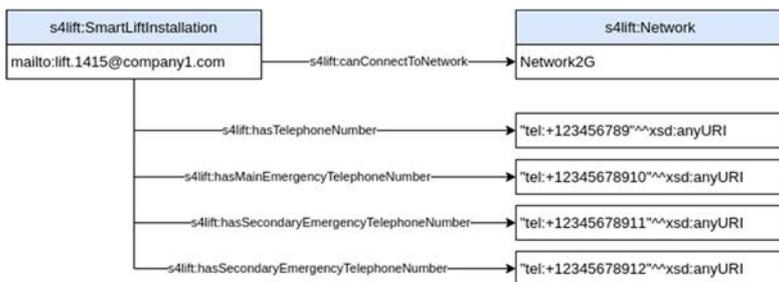
Figure 7-11: Bidirectional Communication System Configuration example
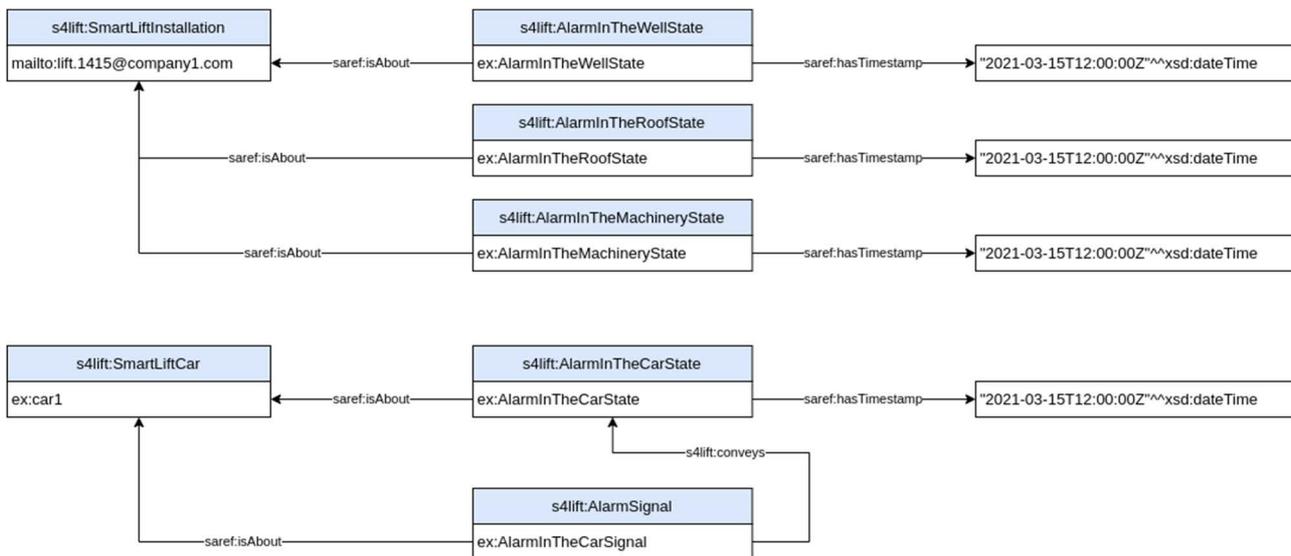
Figure 7-12: Bidirectional Communication System Alarms example
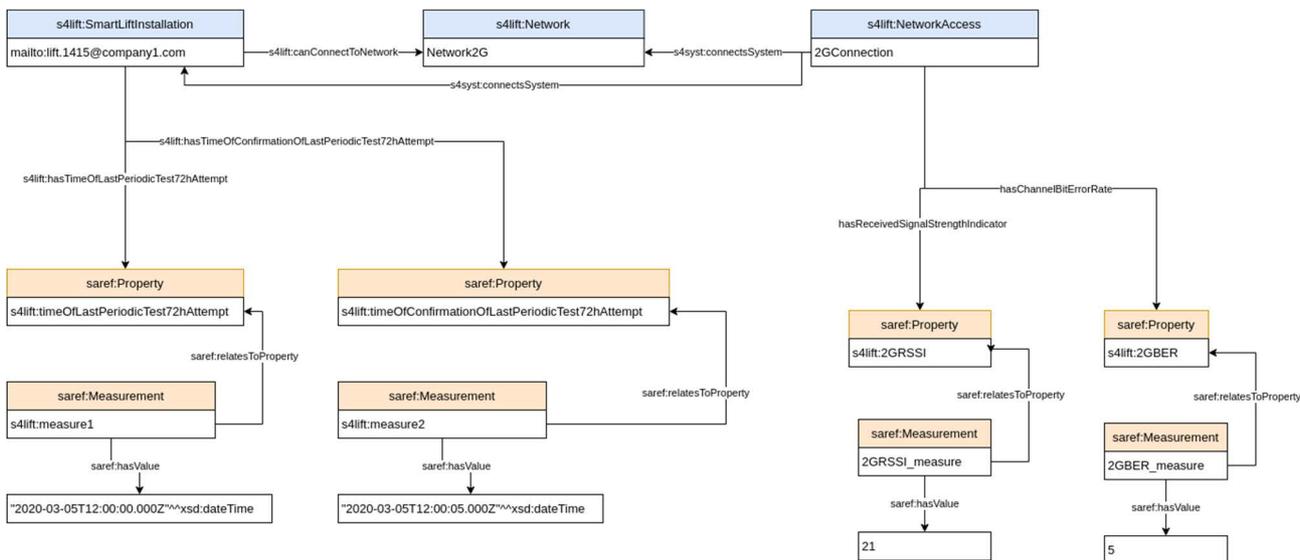
Figure 7-13: Bidirectional Communication System Signals example

8 Observations

In the present clause, several observations about the SAREF4LIFT ontology and its usage are mentioned.

The hierarchies and individuals defined in the extension should not be considered exhaustive, the ontology currently represents those devices described in different relevant standards and directives. It might be needed to extend the hierarchies and lists of individuals for particular use cases, as well as to specialize some of the defined classes.

A last attention point is related to the possibility that this extension will overlap with existing standards related to the smart lifts domain, in particular, people can find on the web the mentions to a standard defined by the American Society of Mechanical Engineers (ASME, see https://www.asme.org/).
However, on the ASME's website people are looking for the standard's documentation, but without succeed.
Hence, people were not able to compare such a standard with the structure of SAREF ontology.

The SAREF4LIFT extends the SAREF core ontology by defining new subclasses of **saref:Device**, **saref:Measurement** and **saref:Property** concepts. Details are reported below:

- saref:Device

    - s4lift:ElectricalDevice

    - s4lift:HydraulicDevice

    - s4lift:SmartLiftEdgeComponent

    - s4lift:SmartLiftEdgeControlUnit

- saref:Measurement

    - s4lift:StatisticsMeasurement

        - s4lift:DownwardTravelsStatistics

        - s4lift:NumberOfCallsStatistics

        - s4lift:NumberOfFaults

        - s4lift:NumberOfResetSequencesStatistics

        - s4lift:TotalFloorsCoveredStatistics

        - s4lift:TotalNumberOfOpeningOfDoorStatistics

        - s4lift:TotalReversalDirectionStatistics

        - s4lift:UpwardTravelsStatistics

- saref:Property

    - s4lift:Load

    - s4lift:Voltage

The two new properties, since they are generic and could be used in other extensions, might be included in a future version of the SAREF ontology.

Finally, the list of examples in clause 7 is still under construction. Some examples are reported but others are under development and they will be included in the final draft of the SAREF4LIFT extension.

Annex A (informative):
Change History

Date	Version	Information about changes
2021-02-04	0.0.1	First skeleton.
2021-02-09	0.0.2	First list of requirements.
2021-02-17	0.0.3	Refined list of requirements.
2021-03-09	0.0.4	Finalized clauses 2 and 3. First draft of the extension description.
2021-03-10	0.0.5	Added description of the SAREF4LIFT extensions and diagrams.
2021-03-13	0.0.6	Finalized description of the SAREF4LIFT extensions and diagrams.
2021-04-01	0.0.7	Added examples and observations.
2021-04-10	0.0.8	First stable draft release.
2021-04-28	0.0.9	Added new examples.
2021-05-15	0.1.0	Second stable draft release including fixes discussed during the fourth STF602 meeting.
2021-05-25	0.1.1	Update after ETSI forge merge request #6 March 23.
2021-06-16	1.1.1	Technical Officer review for EditHelp publication pre-processing.
2021-07-05	1.1.1	Final Rapporteur and Technical Officer changes requested by ETSI *editHelp!*

History

Document history		
V1.1.1	July 2021	Publication