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# Foreword

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

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# Modal verbs terminology

In the present document "**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 provides requirements for an initial semantic model extending SAREF for eHealth/Ageing-well. This initial SAREF extension is based on a limited set of use cases and existing data models identified within available initiatives that are summarized in dedicated clauses of the present document. The conducted work is expected to be developed in close collaboration with in particular ETSI (in particular EP eHealth and TC SmartBAN), oneM2M, AIOTI (in particular WG 05 "Smart Living Environment for Ageing Well"), and the H2020 Large Scale Pilots (ACTIVAGE project). Other initiatives coming from eHealth/Ageing-well industrial/medical world and alliances (e.g. HL7, PCHAlliance) will also be investigated. Further extensions are envisaged in the future for entirely covering the eHealth/Ageing-well domain.

# 2 References

## 2.1 Normative references

Normative references are not applicable in the present document.

## 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] European Commission and TNO: "Smart Appliances REference ontology (SAREF)", April 2015.

NOTE: Available at <http://ontology.tno.nl/saref>. SAREF is now extended to Smart Applications REference ontology.

[i.2] European Commission and TNO: "D-S4 Final Report - SMART 2013-0077 - Study on Semantic Assets for Smart Appliances Interoperability", March 2015.

NOTE: Available at <https://sites.google.com/site/smartappliancesproject/documents>.

[i.3] ETSI TS 103 264 (V2.1.1): "SmartM2M; Smart Appliances; Reference Ontology and oneM2M Mapping".

NOTE: Available at [https://www.etsi.org/deliver/etsi\\_ts/103200\\_103299/103264/02.01.01\\_60/ts\\_103264v020101p.pdf](https://www.etsi.org/deliver/etsi_ts/103200_103299/103264/02.01.01_60/ts_103264v020101p.pdf).

[i.4] ETSI TR 103 411 (V1.1.1): "SmartM2M; Smart Appliances; SAREF extension investigation".

[i.5] IEEE 802.15.6 "Standard in wireless Body Area Networks (BAN) from a healthcare point of view"..

NOTE: Available at <https://ieeexplore.ieee.org/document/7581523>.

[i.6] ETSI TR 103 477: "eHEALTH; Standardization use cases for eHealth".

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- [i.7] ETSI TS 103 378 (V1.1.1): "Smart Body Area Networks (SmartBAN) Unified data representation formats, semantic and open data model".
- NOTE: Available at [https://www.etsi.org/deliver/etsi\\_ts/103300\\_103399/103378/01.01.01\\_60/ts\\_103378v010101p.pdf](https://www.etsi.org/deliver/etsi_ts/103300_103399/103378/01.01.01_60/ts_103378v010101p.pdf).
- [i.8] ETSI TS 103 327 (V1.1.1): "Smart Body Area Networks (SmartBAN); Service and application standardized enablers and interfaces, APIs and infrastructure for interoperability management".
- NOTE: Available at [https://www.etsi.org/deliver/etsi\\_ts/103300\\_103399/103327/01.01.01\\_60/ts\\_103327v010101p.pdf](https://www.etsi.org/deliver/etsi_ts/103300_103399/103327/01.01.01_60/ts_103327v010101p.pdf).
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- NOTE: Available at <http://www.snomed.org/>.
- [i.10] ETSI TS 118 112 (V2.0.0): "oneM2M; Base Ontology (oneM2M TS-0012 version 2.0.0 Release 2)".
- NOTE: Available at [https://www.etsi.org/deliver/etsi\\_ts/118100\\_118199/118112/02.00.00\\_60/ts\\_118112v020000p.pdf](https://www.etsi.org/deliver/etsi_ts/118100_118199/118112/02.00.00_60/ts_118112v020000p.pdf).
- [i.11] Continua Design Guideline description.
- NOTE: Available at <https://www.pchalliance.org/continua-design-guidelines>.
- [i.12] HL7 FHIR<sup>®</sup> Specification 3 document.
- NOTE 1: Available at <http://hl7.org/fhir/index.html>.
- NOTE 2: FHIR<sup>®</sup> is an example of an existing eHealth standard. This information is given for the convenience of users of the present document and does not constitute an endorsement by ETSI of this standard.
- [i.13] CareWare ITEA3 project, CareWare deliverable: D1.1. Use cases manual. 2016.
- NOTE: See <https://itea3.org/project/careware.html>.
- [i.14] Philips<sup>®</sup> HealthSuite.
- NOTE: Available at <https://www.usa.philips.com/healthcare/innovation/about-health-suite>.
- NOTE 2: Philips<sup>®</sup> HealthSuite is an example of a suitable product available commercially. This information is given for the convenience of users of the present document and does not constitute an endorsement by ETSI of this product.
- [i.15] A. Haller, K. Janowicz, S. Cox, D. Le Phuoc, K. Taylor, M. Lefrançois, R. Atkinson, R. García-Castro, J. Lieberman, C. Stadler: "Semantic Sensor Network Ontology". W3C Recommendation, 19 October 2017.
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[i.21] ETSI TS 103 410-8: "SmartM2M; Extension to SAREF; Part 8: eHealth/Ageing-well Domain".

NOTE: Available at [https://portal.etsi.org/webapp/WorkProgram/Report\\_WorkItem.asp?WKI\\_ID=51404](https://portal.etsi.org/webapp/WorkProgram/Report_WorkItem.asp?WKI_ID=51404).

## 3 Definition of terms, symbols and abbreviations

### 3.1 Terms

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

**metadata:** data about data

**ontology:** formal specification of a conceptualization

NOTE1: It can be viewed as the extension of metadata with the data environment view.

NOTE 2: It is used to explicitly capture the semantics of a certain reality.

**semantic:** meaning of data

### 3.2 Symbols

Void.

### 3.3 Abbreviations

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

AAL	Ambient Assisted Living
AHA	Active and Healthy Ageing
AIOTES	ACTIVAGE IoT Ecosystem Suite
AIOTI	Alliance for the Internet of Things Innovation
API	Application Programming Interface
ARIB	Association of Radio Industries and Businesses
ATIS	Alliance for Telecommunications Industry Solutions
AVPU	Alert, Verbal, Pain, Unresponsive
BAN	Body Area Network
BP	Blood Pressure
bpm	beats per minute
BSN	Body Sensor Network
CCSA	China Communications Standards Association
CPS	Cyber-Physical System
DAM	Daily Activity Monitoring
DICOM	Digital Imaging and COmmunications in Medicine
DUL	DOLCE+DnS UltraLite
ECG	ElectroCardioGram
EHAW	eHealth/Ageing-Well
EHPAD	Etablissement d'Hébergement pour Personnes Agées Dépendantes
EHR	Electronic Health Record
EIP	European Innovation Partnership
EMT	EMergency Trigger
EP	ETSI Project
ETSI	European Telecommunications Standards Institute
EU	European Union
EWS	Early Warning System

EXP	EXercise Promotion
FHIR	Fast Healthcare Interoperability Resources
GDPR	General Data Protection Regulation
GEN	GENeral
HL7	Health Level Seven international
HR	Heart Rate
HTTP	HyperText Transfer Protocol
ICT	Information and Communication Technology
IHE	Integrating the Healthcare Enterprise
IoT	Internet of Things
JSON	JavaScript Object Notation
LE	Low Energy
LSP	Large Scale Pilot
MAC	Medium Access Control
MDP	Mental Decline Prevention
MOH	Monitoring Outside Home
NASA	National Aeronautics and Space Administration
OGC	Open Geospatial Consortium
OHS	Office d'Hygiène Sociale
ONT	ONTological category
OWL	Ontology Web Language
PCHAlliance	Personal Connected Health Alliance
PHD	Personal Health Device
PSI	Prevention of Social Isolation
QoL	Quality of Life
QUDT	Quantities, Units, Dimensions and Types
RDF	Resource Description Framework
REST	Representational State Transfer
SAO	Stream Annotation Ontology
SAREF	Smart Appliances REference ontology
SAREF4EHAW	SAREF extension for eHealth/Ageing-Well
SDO	Standards Development Organization
SEMIOTICS	Smart End-to-end Massive IoT Interoperability, Connectivity and Security
ShEx	Shape Expressions
SIL	Semantic Interoperability Layer
SNOMED CT <sup>®</sup>	SNOMED Clinical Terms
SOSA	Sensing, Observation, Sampling and Actuation
SPARQL	SPARQL Protocol and RDF Query Language
SSN	Semantic Sensor Network
STF	Special Task Force
STM	Support for Transportation and Mobility
SWE	Sensor Web Enablement
TC	Technical Committee
TIA	Telecommunications Industry Association
TR	Technical Report
TS	Technical Specification
TSDSI	Telecommunications Standards Development Society India
TTA	Telecommunications Technology Association
TTC	Telecommunication Technology Committee
TV	TeleVision
UCC	Under Chronic Conditions
USA	United State of America
VoID	Vocabulary of Interlinked Datasets
W3C	World Wide Web Consortium
WG	Working Group

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## 4 SAREF extension for eHealth/Ageing-well domain

SAREF [i.1] is a reference ontology for IoT created in close interaction with the industry during a study requested by the European Commission in 2015 [i.2] and subsequently transferred into an ETSI Technical Specification [i.3]. SAREF contains core concepts that are common to several IoT domains and, to be able to handle specific data elements for a certain domain, dedicated extensions of SAREF can be created. Each domain can have one or more extensions, depending on the complexity of the domain. As a reference ontology, SAREF serves as the means to connect the extensions in different domains. The earlier document ETSI TR 103 411 [i.4] specifies the rationale and methodology used to create, publish and maintain the SAREF extensions.

The present document specifies the requirements for an initial SAREF extension for eHealth/Ageing-well. This initial SAREF extension will be based on a limited set of use cases and existing data models identified within available initiatives that will be summarized in dedicated clauses of the present document. The work conducted in the present document has been developed in the context of the STF 566, which was established with the goal of creating SAREF extensions for the following domains: Automotive, eHealth/Ageing-well, Wearables and Water. This work is expected to be developed in close collaboration with ETSI, oneM2M, AIOTI, eHealth/Ageing-well related H2020 Large Scale Pilots and EU projects. However, other initiatives coming from eHealth/Ageing-well industrial/medical world and alliances will also be investigated.

STF 566 consists of the following two main tasks:

- 1) Gather requirements, collect use cases and identify existing sources (e.g. standards, data models, ontologies, etc.) from the domains of interest (Automotive, eHealth/Ageing-well, Wearables and Water) in order to determine the requirements for an initial semantic model for each of the aforementioned domains, based on at least 2 use cases and existing data models (STF 566 Task 2).
- 2) Specify and produce the extensions of SAREF for each of the aforementioned domain based on the requirements resulting of STF 566 Task 2 (STF 566 Task 3).

The present document focuses on STF 566 Task 2 and the extension of SAREF for eHealth/Ageing-well domain. The present document sets the requirements of an initial semantic model that will result in a new SAREF ontology extension for eHealth/Ageing-well, called SAREF4EHAW and to be published in ETSI TS 103 410-8 [i.21] as part of STF 566 Task 3 SAREF extensions series.

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## 5 Related initiatives

### 5.0 Introduction

Within clause 5 of the present document, some of the main related initiatives in term of modelling and standardization in the eHealth/Ageing-well domain are reviewed. Existing efforts range from national or international standards to rather specific models used in certain software solutions provided by industrial/medical world actors. Therefore, the potential stakeholders identified for this SAREF extension might be classified as: public administrations, associations related to the Internet of Things and eHealth/Ageing-well, European projects and Large Scale Pilots, standardization bodies and alliances related to the Internet of Things and eHealth/Ageing-well domain, as well as industrial/medical world and alliances initiatives of the eHealth/Ageing-well domain. For each type of stakeholder, the initiatives that have been taken into account are described next.

### 5.1 Standardization bodies

#### 5.1.1 IEEE

**IEEE 802.15.6 Working Group on Body Area Network [i.5]:** "A communication standard optimized for low power devices and operation on, in or around the human body (but not limited to humans) to serve a variety of applications including medical, consumer electronics/personal entertainment and other." However, only aspects related to radio technologies and Physical and MAC layers are addressed.