ETSI TR 103 510 V1.1.1 (2019-10)

SmartM2M;
SAREF extension investigation;
Requirements for Wearables

Reference

DTR/SmartM2M-103510

Keywords

IoT, oneM2M, ontology, SAREF, semantic, wearable

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Sous-Préfecture de Grasse (06) N° 7803/88

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Foreword

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

Modal verbs terminology

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1 Scope

The present document lists the requirements for an initial semantic model extending SAREF for the wearables domain. This initial SAREF extension will be based on both a limited set of use cases and available existing data models. The present document is developed in close collaboration with ETSI activities in the wearables and eHealth domains, SmartM2M/oneM2M, and Wearables related EU projects and H2020 Large Scale Pilots. Further extensions are planned in the future to cover entirely the wearables 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.

[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.

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

NOTE: Available at https://www.etsi.org/deliver/etsi_tr/103400_103499/103411/01.01.01_60/tr_103411v010101p.pdf.

[i.5] IEEE: "P360 - Standard for Wearable Consumer Electronic Devices - Overview and Architecture".

[i.6] IEC 62471 for LED Lighting Products.

[i.7] IEC 62209 (all parts): "Measurement procedure for the assessment of specific absorption rate of human exposure to radio frequency fields from hand-held and body-mounted wireless communication devices".

[i.8] ISO 10993 (all parts): "Biological evaluation of medical devices".

NOTE: Available at https://en.wikipedia.org/wiki/ISO_10993#List_of_the_standards_in_the_10993_series.

[i.9] UL 60601-1: "Medical Electrical Equipment, Part 1: General Requirements for Safety".

[i.10] UL 60950-1: "Information Technology Equipment - Safety - Part 1: General Requirements".

NOTE: Available at https://standardscatalog.ul.com/standards/en/standard_60950-1_2.

[i.11] IEC 60065:2014: "Audio, video and similar electronic apparatus - Safety requirements".

[i.12] IEC 62368-1:2018: "Audio/video, information and communication technology equipment - Part 1: Safety requirements".

[i.13] Natalia Díaz Rodríguez, Stefan Grönroos, Frank Wickström, Johan Lilius, Henk Eertink, Andreas Braun, Paul Dillen, James Crowley, Jan Alexandersson: "An Ontology for Wearables Data Interoperability and Ambient Assisted Living Application Development". WCSC 2016: 559-568.

[i.14] Gregorio Rubio Cifuentes, Estefanía Serral, Pedro Castillejo, José-Fernán Martínez: "A Novel Context Ontology to Facilitate Interoperation of Semantic Services in Environments with Wearable Devices". OTM Workshops 2012: 495-504.

[i.15] Claudia Villalonga, Héctor Pomares, Ignacio Rojas, Oresti Banos: "MIMU-Wear: "Ontology-based sensor selection for real-world wearable activity recognition". Neurocomputing 250". 76-100 (2017).

[i.16] Ahlem Rhayem, Mohamed Ben Ahmed Mhiri, Mayssa Ben Salah, Faïez Gargouri: "Ontology-based system for patient monitoring with connected objects". KES 2017: 683-692.

[i.17] Semantic Smart Sensor Network ontology (S3N).

NOTE: Available at http://w3id.org/s3n/.

[i.18] Jack Hodges, Mareike Kritzler, Florian Michahelles, Stefan Lueder, Erik Wilde: "Ontology alignment for wearable devices and bioinformatics in professional health care".

NOTE: Available at https://pdfs.semanticscholar.org/bdc1/285017f3b09539a0f7034e4c65ab64736c2c.pdf.

[i.19] PwC: "The Wearable Life 2.0".

NOTE: Available at https://www.pwc.nl/nl/assets/documents/pwc-the-wearable-life-2-0.pdf.

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

NOTE 1: 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:

4G	fourth generation of broadband cellular network technology
AHA	Active Healthy Ageing
AIOTI	Alliance for the Internet of Things Innovation
API	Application Program Interface
BT	Body Temperature
CBT	Core Body Temperature
CIE	Commission Internationale de l'Eclairage (International Commission on Illumination)
COPD	Chronic Obstructive Pulmonary Disease
DOLCE	Descriptive Ontology for Linguistic and Cognitive Engineering
DUL	DOLCE Ultra Lite
ECG	Electrocardiogram
EN	European Standard
ETSI	European Telecommunications Standards Institute
GPS	Global Positioning System
GPU	Graphical Processing Unit
IEC	International Electrotechnical Commission
IoT	Internet of Things
IP	In Person
ISO	International Organization for Standardization
IT	Information Technology
ITE	Information Technology Equipment
IWHP	Inuheat Wearable Heating Platform
LED	Light-Emitting Diode
LifeWear	Lifestyle with Wearables
MIMU	Magnetic and Inertial Measurement Unit
NB-IoT	Narrowband-IoT
NFC	Near Field Communication
OGC	Open Geospatial Consortium
OWL	Ontology Web Language
PA	Public Address
PA system	Public Address system
RF	Radio Frequency
RGB-D	Red Green Blue-Depth
S3N	Semantic Smart Sensor Network
SAR	Specific Absorption Rate
SAREF	Smart Applications REFerence ontology
SAREF4WEAR	SAREF extension for Wearables
SCI	Spinal Cord Injured
SSN	Semantic Sensor Network
STF	Special Task Force
SWE	Sensor Web Enablement
TR	Technical Report
TRL	Technology Readiness Level
TS	Technical Specification
TSi	Think Silicon S.A.
UI	User Interface
UL	Underwriters Laboratories standard
USB	Universal Serial Bus
UWB	Ultra Wide Band
WEAR	Wearable technologists Engage with Artists for Responsible innovation

4 SAREF extension for the Wearables 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 ETSI TS 103 264 [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 Wearables. 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 (see https://portal.etsi.org/STF/STFs/STFHomePages/STF566.aspx), 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, Wearables related H2020 Large Scale Pilots and EU projects. However, other initiatives coming from Wearables industrial 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 Wearables domain. The present document sets the requirements of an initial semantic model that will result in a new SAREF ontology extension for Wearables, called SAREF4WEAR and to be published in a TS document as part of STF 566 Task 3 SAREF extensions series.

5 Characteristic of Wearables

5.0 Introduction

Wearable devices and services have some common characteristics as the ones listed below. A domain-specific ontology about Wearables has to be able to model such characteristics in order to be deployable within a real-world environment.

5.1 Wearability

Unlike other devices which are agnostic to the users or rarely interact with the users, wearable devices are carried by the users and interact with them all the time. Convenience and comfort are the top considerations. The design of wearable devices needs to be small enough for convenience and portability.

5.2 Personal data protection

Wearable devices and related services collect, transmit, and store lots of personal data. The confidentiality of data is fundamental for wearable services, while data sharing is essential for the mutual interaction of users within a community.

5.3 Limited communication ability

Due to the limitation of size, weight and power supply, wearable devices are not usually equipped with wide-bandwidth network access abilities. Most of them only support narrow-bandwidth connectivity technologies, e.g. Bluetooth®, NFC and NB-IoT.

5.4 Limited storage space

According to use cases, wearable devices have limited storage space.

5.5 Limited power supply

Due to the size and comfort requirements, wearable devices are only equipped with small battery or even use solar or biological energy, which provide limited power supply.

5.6 Intelligence

As wearable devices can be carried by different users and work in different environments, they need adequate intelligence to adjust themselves to different usages.

5.7 Communication capability

Due to the variety of wearable applications, the requirements on data transmission and service quality differs a lot. Corresponding to the requirement of the communication, different wearable centric vertical applications would probably adopt different communication technologies. For instance, wearable applications that transmit multimedia content need to transfer thousands more times of data volume than that of position and biological data. Thus, wide bandwidth communication technology, such as WiFi™, 4G would be adopted by the former, and narrow bandwidth communication technologies such as ZigBee®, Bluetooth®, NB-IoT™ would be adopted by the later.

5.8 Real-time requirement

The requirement on time delay tolerance of service is a critical requirement of wearable centric vertical applications. For fitness and positioning application, several seconds delay still can be tolerant, however in healthcare scenario the latency should be less than 250 ms for non-medical application and less than 125 ms for medical application. IoT edging storage and edging computing technologies could give great help on timely responding and decision making at the edge. However, to thoroughly satisfy different levels of the real-time requirements for particular wearable centric vertical applications, there still needs adaptation on the architecture and detail deployment of the IoT network for real-time services.

5.9 Data precision

Different applications of wearables have different requirements on precision of sensing data. The data precision of wearable devices should conform to corresponding standards related to the application areas. Health monitoring applications ask for high precision of physiological signals. Such high precision needs to be maintained during the data processing and analysis phases.