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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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Introduction

The present document was drafted by ETSI Technical Committee SmartM2M as a starting point for the development of an extension of the SAREF ontology for the Water domain (SAREF4WATR). The present document includes the first outcomes of a Specialist Task Force (STF) requested by ETSI SmartM2M; it gives insights into the current landscape of initiatives in the Water domain, identifies a set of relevant use cases for such domain, and extracts from those use cases the requirements that should be satisfied by the SAREF4WATR extension.

1 Scope

The present document provides the requirements for an initial semantic model in the Water domain based on a limited set of use cases and from available existing data models. The present document has been developed in close collaboration with different initiatives in the water domain. Further extensions are envisaged in the future to cover entirely the water domain. The associated ETSI TS 103 410-10 [i.1] will specify the extension (i.e. the semantic model) for the water domain based on the requirements and use cases specified in the present document.

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] ETSI TS 103 410-10: "SmartM2M; Extension to SAREF; Part 10: Water Domain".

[i.2] CEN/CLC/ETSI/TR 50572:2011E: "Functional reference architecture for communications in smart metering systems".

[i.3] ETSI TR 103 249 (V1.1.1) (2017-10): "Low Throughput Network (LTN); Use Cases and System Characteristics".

[i.4] ETSI TS 103 264 (V2.1.1) (2017-03): "SmartM2M; Smart Appliances; Reference Ontology and oneM2M Mapping".

[i.5] ETSI TR 103 411 (V1.1.1) (2017-02): "SmartM2M; Smart Appliances; SAREF extension investigation".

[i.6] ISO/IEC 30128:2014: "Information technology - Sensor networks - Generic Sensor Network Application Interface".

[i.7] Recommendation ITU-T F.744: "Service description and requirements for ubiquitous sensor network middleware".

[i.8] M/441 Standardisation mandate to CEN, CENELEC and ETSI in the field of measuring instruments for the development of an open architecture for utility meters involving communication protocols enabling interoperability. European Commission. 12th March 2019.

[i.9] Council Directive 80/778/EEC of 15 July 1980 relating to the quality of water intended for human consumption.

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

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

GHz	Gigahertz
Kbytes	Kilobytes

3.3 Abbreviations

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

3D	3 Dimension
3GPP	3rd Generation Partnership Project
ADE	Application Domain Extension
AI	Artificial Intelligence
AIOTI	Alliance for the Internet of Things Innovation
CEN	Comité Européen de Normalisation (European Committee for Standardization)
DG	Directorates-General
EEA	European Environment Agency
EIP	European Innovation Partnership
EMC	Electromagnetic Compatibility
EPA	Environmental Protection Agency
EU	European Union
FACC	Feature and Attribute Coding Catalogue
FD	Floods Directive
FUOTA	Firmware Updates Over The Air
GEOSS	Global Earth Observation System of Systems
ICT	Information and Communication Technology
IEC	International Electrotechnical Commission
IGN	Instituto Geográfico Nacional (National Geographic Institute)
IMTA	Integrated Multi-Trophic Aquaculture
IoT	Internet of Things
ISO	International Organization for Standardization
ITU-T	International Telecommunication Union - sector Telecommunication
IWA	International Water Association
IWO	ICT for Water Observatory
JPI	Joint Programming Initiative
JTC	Joint Technical Committee
OGC	Open Geospatial Consortium
OWL	Web Ontology Language
PLT	Power Line Telecommunications
SAREF	Smart Applications REFerence ontology
SAREF4WATR	SAREF extension for Water
SC	Subcommittee
SME	Small and Medium Enterprise
SRD	Short Range Device
STF	ETSI Specialist Task Force
SWEET	Semantic Web for Earth and Environmental Terminology
SWQP	Semantic Water Quality Portal
TC	Technical Committee

TR	Technical Report
UNESCO	United Nations Educational, Scientific and Cultural Organization
USN	Ubiquitous Sensor Network
WaWO	Waste Water Ontology
WEF	Water Energy Food
WFD	Water Framework Directive
WG	Working Group
WISE	Water Information System for Europe
WITS	Water Industry Telemetry Standards
WssTP	Water supply and sanitation Technology Platform

4 SAREF extension for the Water domain

SAREF [i.4] is a reference ontology for the IoT that 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.5] 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 the Water domain. 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 (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, and water-related H2020 and EU projects. However, other initiatives coming from the industrial world and alliances have also been investigated.

STF 566 consists of the following two main tasks:

1) to 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, and

2) to specify and produce the extensions of SAREF for each of the aforementioned domains based on these requirements.

The present document focuses on analysing sources, collecting use cases and gathering requirements for an extension of SAREF for the Water domain. The document sets the requirements of an initial semantic model that will result in a new SAREF ontology extension for the Water domain, called SAREF4WATR, that will be published as part of the SAREF extensions technical specifications.

5 Related initiatives

5.1 Standardization initiatives

ETSI STF 534 was launched by ETSI with the goal to create SAREF extensions to the domains of smart cities, smart industry and manufacturing and smart agri-food, turning SAREF into the umbrella that enables better integration of semantic data from and across various vertical domains in the IoT. This STF produced three new extensions of SAREF (SAREF4CITY, SAREF4INMA and SAREF4AGRI) which will be taken into account, along with the other existing extensions, during this work.

CEN/CENELEC/ETSI. Smart Meters Coordination Group. The standardization work under mandate M/441 [i.8] involves different Technical Committees within CEN, CENELEC and ETSI and needs to benefit from existing and on-going standardization activities and deliverables within these committees. To ensure this and to create a common focus on the mandate, four co-ordinating TCs were identified to provide co-ordination of standardization activities as regards smart metering systems: CEN/TC 294: Communications systems for meters and remote reading of meters with liaison with CEN/TC 237 (Gas meters), CEN/TC 234 (Gas infrastructure), CEN/TC 92 (Water meters) and CEN/TC 176 (Heat meters); CENELEC/TC 13: Equipment for electrical energy measurement and load control with liaison with CENELEC/TC 57 (Power systems management and associated information exchange) and IEC SC77A (EMC - Low frequency phenomena); CENELEC/TC 205: Home and Building Electronic Systems with liaison with CEN/TC 247 (Building automation, controls and building management) and CENELEC/TC 57 (Power systems management and associated information exchange); and ETSI SmartM2M: Machine to Machine Communications with liaison with ETSI/SCP (Smart Card Platform), ETSI/MSG (3GPP) (Mobile Standards Group), ETSI/ERM TG28 (EMC and radio spectrum matters on SRD), ETSI/ATTM (Access Terminal Transmission and Multiplexing). TC ATTM incorporated the activities of the closed ETSI TC PLT (Power Line Telecommunications).

CEN/TC 164. Water supply. The European Committee for Standardization created the CEN Technical Committee (CEN/TC) 164 to establish standards for the installation and performance requirements of systems, constructions of components used for the water supply from the production facility, including the treatment of the water, to the taps attached or unattached to a sanitary appliance with the view of maintaining the quality of water as stated in Directive 80/778/EEC [i.9]. Eleven working groups were set up, ranging from external systems and components to security of water drinking supply.

CEN/TC 230. Water analysis. CEN Technical Committee 230 (CEN/TC 230) on water analysis is working on European standards to support the Water Framework Directive with the elaboration of standard test methods for physical, chemical, biochemical, biological, microbiological examination of water quality. Included are as well methods for sampling, quality assurance, and classification aspects.

CEN/TC 294. Communication systems for meters. The work of CEN/TC 294 encompasses standardization of communication systems for meters for all kind of fluids and energies distributed by network and not limited to household meters. The standards of CEN/TC 294 are based on generic descriptions and communication protocol specifications based on a layered communication model ranging from physical to application layer specifications. These standards should guide Member States in the implementation of their national smart metering programmes taking into account distinctions between battery and mains-powered meters and differences between architectures that are linked to the particularities regarding the distribution in Member States. CEN/TC 294 is also responsible for the support of secure communication covering data privacy as an inherent property, providing a scalable mechanism for security services, data integrity, authentication and confidentiality.

OGC. The Open Geospatial Consortium has defined WaterML 2.0, an information model for the representation of water observations data, with the intent of allowing the exchange of such data sets across information systems (https://www.opengeospatial.org/standards/waterml). Moreover, the latest version of WaterML 2.0 (part 3) includes the informational model called HY_FEATURES that is focused on representing hydro-science and water network topology. Complementing this information, the OGC also offers CityGML ADE, for the representation of utility networks in 3D city models (http://www.citygmlwiki.org/index.php/CityGML_UtilityNetworkADE).

ISO. Different Technical Committees inside ISO are relevant for this work. ISO/TC 224 deals with the standardization of the management concepts for service activities relating to drinking water supply, wastewater and stormwater systems; ISO/TC 282 deals with standardization of water reuse of any kind and for any purpose, covering both centralized and decentralized or on-site water reclamation, and direct and indirect reuse applications, taking into consideration the potential for unintentional exposure or ingestion; ISO/TC 30 deals with standardization of rules and methods for the measurement of fluid flow in closed conduits.

ISO/IEC 30128:2014 [i.6]. Defined by the ISO/IEC JTC 1/SC 41 (Internet of Things and related technologies), ISO/IEC 30128:2014 specifies the interfaces between the application layers of service providers and sensor network gateways. The standard covers: description of generic sensor network applications' operational requirements, description of sensor network capabilities, and mandatory and optional interfaces between the application layers of service providers and sensor network gateways.

WITS. The WITS Protocol Standards Association has defined WITS-DNP3, a protocol that defines a standard method to achieve the utility industry telemetry control and monitoring requirements, in particular interoperability between equipment from different manufacturers, and WITS-IoT, a protocol aimed at lower power, less expensive devices that provides an application layer covering standard IoT technology (http://www.witsprotocol.org/).

Recommendation ITU-T F.744 [i.7]. Service description and requirements for ubiquitous sensor network middleware. The purpose of Recommendation ITU-T F.744 is to describe ubiquitous sensor network (USN) services and requirements for ubiquitous sensor network middleware. This is achieved through an intermediate entity (USN middleware) that provides functions commonly required by various ubiquitous sensor network services.

5.2 Associations

AIOTI. The Alliance for Internet of Things Innovation (AIOTI) is a multi-stakeholder platform for inspiring IoT Innovation in Europe that combines together large and small companies, academia, start-ups and scale-ups, end-users, policy makers and representatives of society in an end-to-end approach (https://aioti.eu/). Two of the AIOTI working groups are relevant for this work: WG10 on Smart Water Management and WG3 on IoT Standardization.

WssTP. The Water supply and sanitation Technology Platform (WssTP) was initiated by the European Commission in 2004 for Research and Technology Development in the water industry and was transformed into an independent legal entity under Belgian Law in 2007 (http://watereurope.eu/). The mission of WssTP is to foster collaborative, innovative and integrated European research and technologies development, to ensure the European growth and competitiveness of the water sector, to provide global answers to global challenges for the next generations, and to address the challenges of an integrated and sustainable management of water resources.

EIP Water. The European Innovation Partnership on Water (EIP Water) is an initiative within the EU 2020 Innovation Union that facilitates the development of innovative solutions to address major European and global water challenges (https://www.eip-water.eu/). At the same time, the EIP Water supports the creation of market opportunities for these innovations, both inside and outside of Europe. The EIP Water aims to remove barriers by advancing and leveraging existing solutions. Its implementation has started in May 2013 with the main objective to initiate and promote collaborative processes for change and innovation in the water sector across the public and private sector, non-governmental organizations and the general public.

Water JPI. The Joint Programming Initiative "Water challenges for a changing world" (Water JPI) deals with research in the field of water and hydrological sciences (http://www.waterjpi.eu/). The availability of water in sufficient quantities and adequate quality is indeed a public issue of high priority and addresses a pan-European and global environmental challenge. The Council of the European Union decided to launch the Water JPI December 2011 as a contribution to the reduction of fragmentation of efforts by Member States and mobilization of skills, knowledge and resources, with a view to strengthening Europe's leadership and competitiveness on water research and innovation.

ICT4Water cluster. The ICT4Water cluster is a hub for EU-funded research and innovation projects developing digital innovations for the water sector (https://www.ict4water.eu/). It brings projects together supporting them to: exchange information and best practices, disseminate and exploit project outputs, contribute to defining digital water strategies, and contribute to policy development in digital and water domain.

IWA. The International Water Association (IWA) is an open platform in which both innovators and adopters of new technologies and approaches can generate creative friction; it is a place for diffusion, benchmarking and evidence (https://iwa-network.org/). The IWA develops research and projects focused on solutions for water and wastewater management, organizing events that bring the latest science, technology and best practice to the water sector at large, and working to place water on the global political agenda and to influence best practice in regulation and policy making.

5.3 European projects

H2020-STOP-IT (https://stop-it-project.eu/). Water infrastructures are essential for human society, life and health. They can be endangered by physical or cyber threats with severe societal consequences. To address this, the H2020 funded STOP-IT project works in identifying current and future risks and co-develops an all-hazards risk management framework, for the physical and cyber protection of critical water infrastructures.

H2020-SIM4NEXUS (https://www.sim4nexus.eu/). Water, land, food, energy and climate are interconnected, comprising a coherent system (the "Nexus"), dominated by complexity and feedback. SIM4NEXUS aims to predict society-wide impacts of resource use and relevant policies on sectors such as agriculture, water, biodiversity and ecosystem services through a model-based analysis. This project aims to adapt existing knowledge and develop new expertise on the Nexus; to reduce uncertainty, and to show the implementation by a network of regional and national cases.