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Part 2: Environment Domain

**Technical Specification**

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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 2 of a multi-part deliverable covering 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";

Part 12: "Smart Grid 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](https://portal.etsi.org/Services/editHelp!/Howtostart/ETSIDraftingRules.aspx) (Verbal forms for the expression of provisions).

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# 1 Scope

The present document presents SAREF4ENVI, an extension of SAREF for the Environment 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/>.

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The following referenced documents are necessary for the application of the present document.

[1] [ETSI TS 103 264](https://www.etsi.org/deliver/etsi_ts/103200_103299/103264/): "SmartM2M; Smart Applications; Reference Ontology and oneM2M Mapping".

[2] [ETSI TS 103 548](https://www.etsi.org/deliver/etsi_ts/103500_103599/103548/): "SmartM2M; SAREF reference ontology patterns".

[3] [ETSI TS 103 673](https://www.etsi.org/deliver/etsi_ts/103600_103699/103673/): "SmartM2M; SAREF Development Framework and Workflow, Streamlining the Development of SAREF and its Extensions".

## 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 103 410-2 (V1.1.2) (05-2020): "SmartM2M; Extension to SAREF; Part 2: Environment Domain".

[i.2] ETSI TR 103 411: "SmartM2M; Smart Appliances; SAREF extension investigation".

[i.3] ETSI TR 103 781 (V1.1.1) (09-2023): "SmartM2M; Study for SAREF ontology patterns and usage guidelines".

[i.4] Zamorano, J., García, C., González, R, Gallego, J., Pascual, S., Tapia, C., Nievas, M., Sánchez, A., Cardiel, N. Deliverable D4.1: "Photometer sensor (prototype)". STARS4ALL project. March 30th, 2016.

[i.5] "Variación espacial, temporal y espectral de la contaminación lumínica y sus fuentes: Metodología y resultados". Ph.D. thesis. Universidad Complutense de Madrid. February, 2015.

NOTE: Available at <http://eprints.ucm.es/31436/>.

[i.6] ISO 6707-1:2020: “Buildings and civil engineering works — Vocabulary — Part 1: General terms”

[i.7] ISO 24161:2022: “Waste collection and transportation management — Vocabulary”

[i.8] ISO 68606:2013: “Packaging and the environment — Organic recycling”

[i.9] ISO 59004:2024: “Circular economy — Vocabulary, principles and guidance for implementation”

[i.10] ISO 27065:2017: “Protective clothing — Performance requirements for protective clothing worn by operators applying pesticides and for re-entry workers”

[i.11] ISO 5149-1:2014: “Refrigerating systems and heat pumps — Safety and environmental requirements — Part 1: Definitions, classification and selection criteria”

[i.12] ISO 10088:2022: “Small craft — Permanently installed fuel”

[i.13] ISO 8157:2022: “Fertilizers, soil conditioners and beneficial substances — Vocabulary”

[i.14] ISO 8887-1: “Technical product documentation — Design for manufacturing, assembling, disassembling and end-of-life processing — Part 1: General concepts and requirements”

[i.15] Tanenbaum, A. S. (2003). Computer networks, 4-th edition. ed: Prentice Hall.

[i.16] OpenstreetMap Wiki “Proposal:Key:light source”

NOTE: Available at [http://eprints.ucm.es/31436/](http://wiki.openstreetmap.org/wiki/Proposed_features/Key:light_source#Description).

# 3 Definition of terms, symbols and abbreviations

## 3.1 Terms

For the purposes of the present document, the terms given in ETSI TS 103 673 [3] and the following apply:

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

## 3.2 Symbols

Void.

## 3.2 Abbreviations

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

ESCP École Supérieure de Commerce de Paris

OM Ontology of units of Measure

OWL Web Ontology Language

OWL-DL Web Ontology Language Description Logic

RDF Resource Description Format

RDF-S Resource Description Format Schema

SAREF Smart Applications REFerence ontology

TESS Telescope Encoder and Sky Sensor

TR Technical Report

TS Technical Specification

WGS84 World Geodetic System 1984

# 4 SAREF4ENVI ontology and semantics

## 4.1 Introduction

The present document is a technical specification of SAREF4ENVI, an OWL-DL ontology that extends SAREF [1] for the Environment domain.

The present document is a major revision of SAREF4ENVI ontology extension, developed in the context of the STF 641, using updated reference ontology patterns specified in ETSI TS 103 548 [2] to solve the harmonization needs identified in ETSI TR 103 781 [i.3], with updated development framework and tools defined in ETSI TS 103 673 [3].

ETSI TS 103 410-2 (V1.1.2) [i.1] was created in collaboration with domain experts in the field of light pollution that worked in the STARS4ALL European H2020 project (<http://www.stars4all.eu/index.php/lpi/>). The STARS4ALL project was composed of partners such as Universidad Politécnica de Madrid, Universidad Complutense de Madrid, ESCP Europe, Leibniz Institute of Freshwater Ecology and Inland Fisheries, Instituto de Astrofísica de Canarias, University of Southampton, Europan Crowdfunding Network, and CEFRIEL (Società Consortile a Responsabilita Limitata). As such, SAREF4ENVI V1.1.2 focused on extending SAREF for photometers to solve the lack of interoperability between sensors that can measure and share information about light pollution. Such extension involves the following use cases (more details can be found in ETSI TR 103 411 [i.2]):

* **Use case 1:** Monitor light pollution in a city, through the data collected by photometers about the magnitude of the light emitted in a given area.
* **Use case 2:** Adjust lampposts light intensity due to high pollution, after identifying the most contaminating lampposts and therefore the areas where more energy is being thrown away.
* **Use case 3:** Register a photometer, in which a new collection of photometers is incorporated into an existing sensor network.

Added in the present document is the covering of the waste management domain, as a collaboration between IMT - Mines Saint-Étienne and the company Ecovalim, specialized in source separation, bio-waste collection, processing and recovery of food waste. New use cases are supported by the present version of SAREF4ENVI:

* **Use case 1:** Describe knowledge about a territory and its offer in terms of waste producers and waste containers.
* **Use case 2:** Describe knowledge about waste collection points, depots, and waste collection journeys that may be made by diffent kinds of vehicles, allowing to minimise the total CO2 emission.
* **Use case 3:** Describe knowledge about waste processing sites and waste processing devices, offering different waste processing functions that consume different kinds of resources and possibly emit byproducts.

The intention of SAREF4ENVI includes:

* to be the basis for enabling the use of SAREF in the environment domain,
* to exemplify how to enable interoperability between environmental devices in cooperation.

As all the SAREF ontologies, SAREF4ENVI is a dynamic semantic model that is meant to evolve over time. Therefore, the stakeholders in the Environment domain are invited to use, validate and provide feedback on SAREF4ENVI, collaborating with the SAREF ontology experts to improve and evolve SAREF4ENVI in an iterative and interactive manner, so that changes and additions can be incorporated in future releases of the present document.

The prefixes and namespaces used in SAREF4ENVI and in the present document are listed in Table 1.

Table 1: Prefixes and namespaces used within the SAREF4ENVI ontology

|  |  |
| --- | --- |
| Prefix | Namespace |
| s4envi | <https://saref.etsi.org/saref4envi/> |
| saref | <https://saref.etsi.org/core/> |
| geo | [http://www.w3.org/2003/01/geo/wgs84\_pos#](http://www.w3.org/2003/01/geo/wgs84_pos) |
| owl | [http://www.w3.org/2002/07/owl#](http://www.w3.org/2002/07/owl) |
| rdf | [http://www.w3.org/1999/02/22-rdf-syntax-ns#](http://www.w3.org/1999/02/22-rdf-syntax-ns) |
| rdfs | [http://www.w3.org/2000/01/rdf-schema#](http://www.w3.org/2000/01/rdf-schema) |
| xsd | [http://www.w3.org/2001/XMLSchema#](http://www.w3.org/2001/XMLSchema) |
| skos | <http://www.w3.org/2004/02/skos/core#> |
| foaf | <http://xmlns.com/foaf/0.1/> |
| org | <http://www.w3.org/ns/org#> |
| time | <http://www.w3.org/2006/time#> |
| vcard | <http://www.w3.org/2006/vcard/ns#> |

For all the entities described in the present document, it is indicated whether they are defined in the SAREF4AUTO extension or elsewhere by the prefix included before their identifier, i.e. if the element is defined in SAREF4AUTO, the prefix is s4auto, while if the element is reused from another ontology, it is indicated by a prefix according to Table 1. Colour codes also help to distinguish the provenance of entities.

Diagrams are to be interpreted using the Chowlk notation [3], Clause 9.7.2.



























































Figure 1 provides a symbol legend for SAREF4ENVI diagrams.

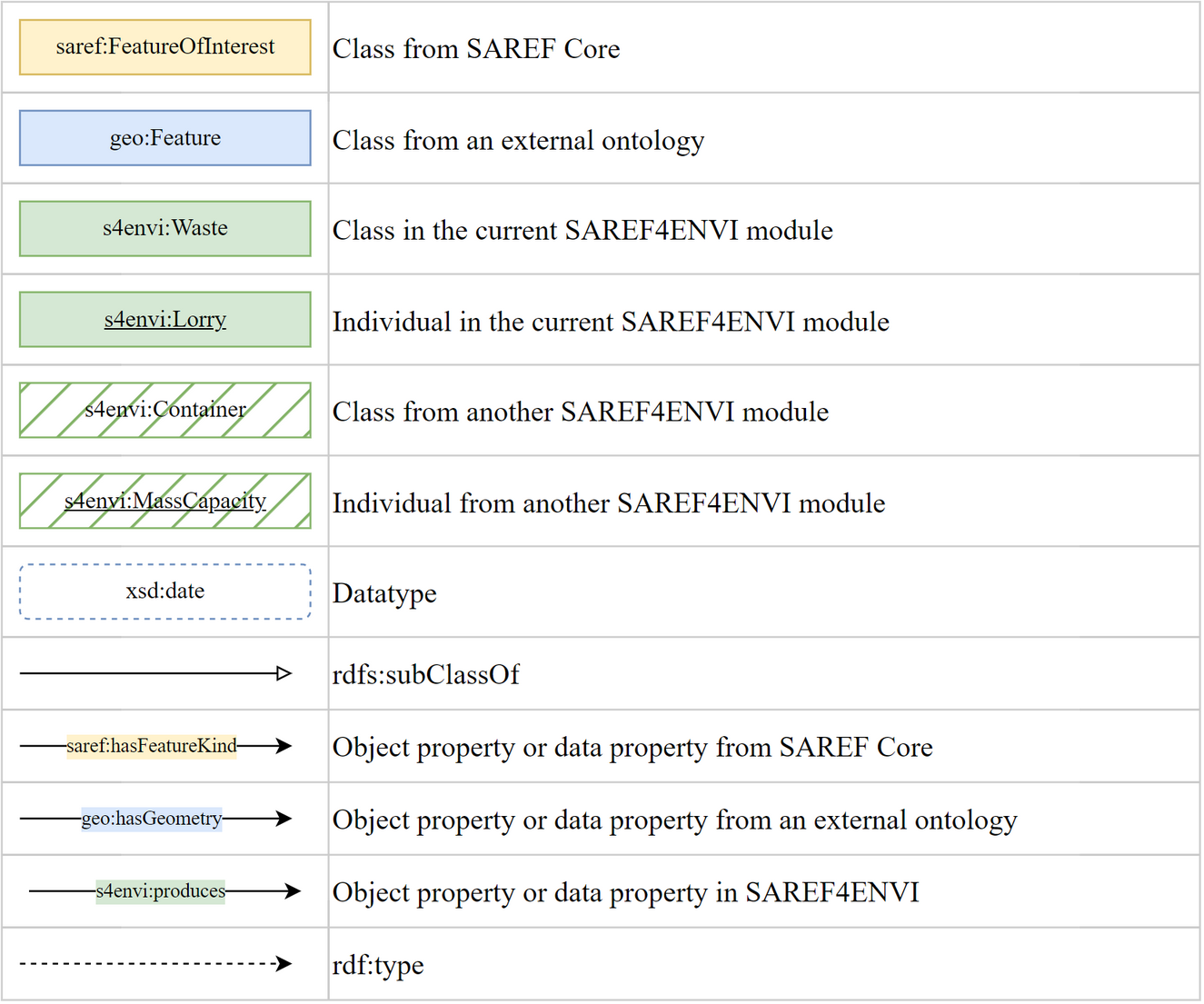


Figure 1: Symbol legend for diagrams in the present document