

# Towards a SAREF extension for Automotive

Presented by: **TNO & Netellany on  
behalf of ETSI STF 566**

For: **W3C Workshop on Data Models  
for Transportation,  
Palo Alto, California**

12.9.2019

# Outline

- ✓ Motivation
- ✓ SAREF4AUTO in ETSI STF566 project
- ✓ Use cases considered for requirements
- ✓ Examples of requirements
- ✓ Next steps

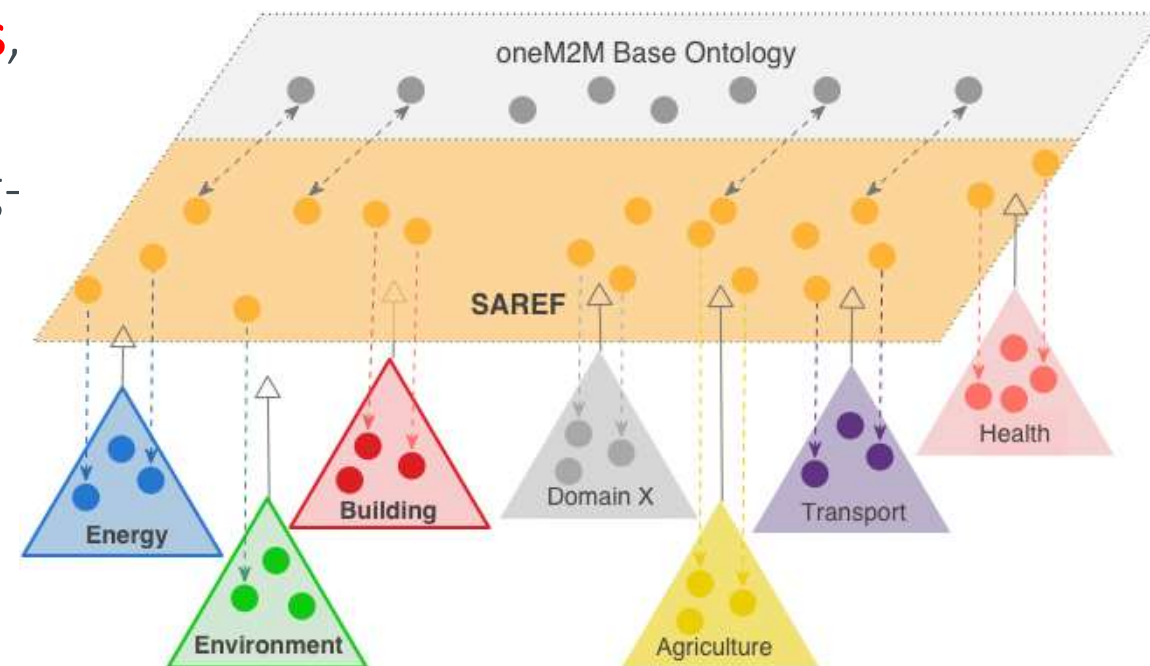


# Motivation as part of IoT systems

- ✔ IoT systems are made of networked devices (often from **different vendors**)
- ✔ Need for **open and standardized interfaces** among these devices
- ✔ Need to **abstract from specific details** of individual standards and **create an abstraction layer** based on a commonly agreed semantics. For example in the automotive domain:
  - ✔ Formal standards definition (e.g. CDD) is helping but not sufficient
  - ✔ Several standards for IoT, V2X, infrastructure (DATEX-II)
  - ✔ Still subject to manual interpretation and often requires translation between the different standards (e.g., SENSORIS <-> ETSI ITS)
  - ✔ Different implementers might have different interpretations on the equivalence on data fields between these standards
- ✔ Need for high level model - a **reference ontology** - that defines recurring concepts in the **smart appliances** domain without having to know specifics of the various standards
- ✔ The **Smart Appliances REference ontology (SAREF)** as “interoperability language”

# Cross-domain interoperability

- SAREF roadmap addresses a multitude of **specific vertical domains** such as **Smart Cities**, Smart AgriFood, Smart Industry & Manufacturing, **Automotive**, eHealth/Ageing-well and Wearables, to enable **better integration of semantic data** from various vertical domains in the IoT
- SAREF becomes “Smart **Applications** REFerence ontology”



# STF566 - SAREF4AUTO

- ✓ STF 566 Project description (December 2018 - June 2020) :
  - ✓ A **Specialist Task Force** funded by ETSI to create **4 new SAREF extensions** for Automotive, eHealth/Ageing-well, Wearables and Water
  - ✓ STF web page: <https://portal.etsi.org//STF/STFs/STFHomePages/STF566>
- ✓ The SAREF **extension for Automotive (SAREF4AUTO)** is part of the STF 566
  - ✓ Experts involved: NETELLANY / FBConsulting (Michelle Wetterwald) and TNO (Ramon S. Schwartz, Laura Daniele, Miodrag Djurica)
- ✓ **Tasks**
  - ✓ Task 2: **determine the requirements from the automotive**, collect use cases and identify available existing data models/standards
    - ✓ Result: ETSI Technical Report (TR 103 508), publication planned in September 2019
  - ✓ Task 3: **create the specification of SAREF4AUTO** extension based on these requirements
    - ✓ Result: ETSI Technical Report (TS 103 410-7) , publication planned in June 2020

# STF566 Task 2: Requirements

---

- ✓ Deliverable
  - ✓ ETSI TR 103 508 : "SmartM2M; SAREF extension investigation; Requirements for Automotive"
- ✓ Take stock of related initiatives for close collaboration with stakeholders from the automotive domain:
  - ✓ **Standardization initiatives and associations** (such as AIOTI, OneM2M, ETSI TC ITS, DATEX-II, Sensoris, W3C Automotive Ontology Group)
  - ✓ **Selected European projects** (such as H2020 Autopilot, H2020 SINCHRONICITY, ENSEMBLE, TransAID)
- ✓ **Collect the use cases** for which the SAREF4AUTO ontology has to be used
  - ✓ Platooning
  - ✓ Automated Valet Parking (AVP)
  - ✓ Cooperative Perception Service (CPS)
  - ✓ Vulnerable Road Users (VRUs)
- ✓ **Define the SAREF4AUTO requirements**

# Use case: platooning

- ✓ Inputs from Autopilot and ENSEMBLE H2020 projects
- ✓ Vehicle is automatically following another vehicle at a relatively close distance:
  - ✓ Inter-vehicle communications to anticipate timely on maneuvers of other vehicles in the platoon
  - ✓ Benefits:
    - ✓ Improvement of traffic throughput and homogeneity
    - ✓ Enhancement of traffic safety due to small speed variations and relative low impact velocities in collisions
    - ✓ Reduction of fuel consumption and emissions due to lowering the air drag



# Use case: Cooperative Perception Service

- ✓ Vehicles share perception data to reduce the uncertainty about its environment
- ✓ Relevant scenarios:
  - ✓ Detection of Non-Connected Road Users
  - ✓ Detection of Safety-Critical Objects
  - ✓ Increasing Awareness using a Road Side Equipment





# Examples of SAREF4AUTO requirements (vehicles)

Id	Competency Question/Statement	Possible answer
AUTO-1	Vehicle is the main object of interest in the automotive domain	Automotive domain also considers other road users such as - pedestrians, cyclists, skaters, ..., with or without an electrical engine, - as well as road side units - and control & monitoring centres
AUTO-2	What type of vehicles are there?	Example of type of vehicles are passenger car, truck, bus, motorcycle, tractors, etc. (see ETSI TS 102 894-2 spec for full list of vehicles, which are type of “stations”), but also SENSORIS data model
AUTO-3	What other objects are relevant in the automotive domain?	All types of Stations, which can be personal, vehicles, road side unit or central stations (as defined in ETSI EN 302 665)
AUTO-4	A vehicle has dimensions	
AUTO-5	What are these dimensions?	Length, width, height
AUTO-6	What type of properties related to vehicles can be monitored, measured or controlled?	Position, speed, direction (heading), acceleration, light status, etc.
AUTO-7	A vehicle has a role	
	What role can a vehicle play in the traffic?	publicTransport, specialTransport, dangerousGoods, roadWork, rescue, emergency, safetyCar, agriculture, commercial, military, roadOperator, taxi
AUTO-8	A vehicle has a position	
AUTO-9	What type of position are relevant?	- Absolute position, when expressed in terms of global coordinates (lat, long, alt), e.g., according to WGS 84 - Relative position, when expressing coordinates of a detected vehicle in the surrounding (e.g., a car is x,y,z in front of the ego-vehicle) - Position with respect to road topology (e.g., road, segment or lane)
AUTO-10	What is an ego-vehicle?	An ego-vehicle is a vehicle used in automotive as reference point for expressing relative measurements (e.g., position with respect to x,y,z = 0,0,0 or speed)

# Examples of SAREF4AUTO requirements (platoon)

Id	Competency Question/Statement	Possible answer
AUTO-40	What is a platoon?	A group of vehicles automatically following each other at a relatively close distance
AUTO-41	A platoon can be at different states	
AUTO-42	Which platoon states are relevant?	Examples of states are: unknown, standalone, assembling, platooning, disengaging, etc.
AUTO-43	A platoon has a destination	
AUTO-44	How is the destination of a platoon defined?	The current platoon leader defines the platoon destination. Following vehicles will share (partially) the route of the leader and can, therefore, have different final destinations.
AUTO-45	A platoon has a route	
AUTO-46	How is the route of a platoon defined?	It is the route of the current vehicle leader in the platoon that other follower vehicles (partially) share
AUTO-47	A platoon consists of one or more vehicles	
AUTO-48	What roles can a vehicle assume in a platoon?	A vehicle can assume roles such as: unknown, leader, follower, ready-for-leading, trailing, etc.
AUTO-49	A vehicle member of a platoon can be at different states	
AUTO-50	What states are relevant for a vehicle in a platoon?	Examples of states are: unknown, standalone, engaging, platooning, disengaging, searching, forming.
AUTO-51	A platoon has a size	
AUTO-52	How is the platoon size defined?	- The total number of vehicles currently in the platoon - Length of the platoon (sum of all vehicles' length + inter-vehicle distance)
AUTO-53	The platoon can have a maximum size	Maximum number of vehicles allowed to join the platoon due to safety requirements.

# Examples of SAREF4AUTO requirements (vehicle environment)

Id	Competency Question/Statement	Possible answer
AUTO-90	What is the vehicle environment?	The vehicle environment is made of entities which are present on the road in the neighbouring area.
AUTO-91	What classes of entities are part of the vehicle environment?	road side equipment, neighbour vehicles, VRUs, critical objects, notified events
AUTO-92	What are neighbouring vehicles?	Neighbouring vehicles are described as in Table 1
AUTO-93	What are the types of neighbouring vehicles?	passenger car, bus, light truck, heavy truck, trailer, special vehicles, tram, emergency vehicle, agricultural
AUTO-94	What are VRUs?	VRUs are vulnerable road users
AUTO-95	What are the types of VRUs?	Pedestrians, light vehicles, e.g. bicycles, motorbikes
AUTO-96	What are the sub-types of a pedestrian VRU?	adult, child, elderly person, pram, animal, blind person guided by a dog, rider off its bike
AUTO-97	What are the sub-types of a light vehicle VRU?	bicycle, wheelchair user, skater, scooter, Segway, mounted horse
AUTO-98	What are critical objects?	small object, medium object, large object
AUTO-99	An entity has dimensions	
AUTO-100	What is the overall shape of an entity?	Sphere, Torus, Cylinder, Cone, Ellipsoid, Cube, Cuboid, Pyramid, Prism, Multiple shapes
AUTO-101	What are these dimensions?	3D: length, height, width
AUTO-102	An entity has a position	
AUTO-103	What types of position are relevant	<ul style="list-style-type: none"> <li>- Absolute position, when expressed in terms of global coordinates (lat, long, alt), e.g., according to WGS 84</li> <li>- Relative position, when expressing coordinates of a detected vehicle in the surrounding (e.g., an entity is x,y,z in front of the ego-vehicle or xyz from the road side sensor)</li> <li>- Position with respect to road topology (e.g., road, segment or lane) and lane characteristics (highway lane, road lane, bicycle lane, pavement, off-road)</li> </ul>

## NEXT STEP - Task 3: create SAREF4AUTO ontology

---

- ✔ Deliverable
  - ✔ ETSI TS 103 410-7 : "SmartM2M; Extension to SAREF; Part 7: Automotive Domain"
- ✔ Create the SAREF4AUTO ontology using the collected requirements
- ✔ Validation of the SAREF4AUTO ontology with stakeholders and domain experts from the automotive domain in a dedicated workshop (date and place TBD)
- ✔ Publish the SAREF4AUTO ontology as ETSI Technical Specification (planned for June 2020)
  - ✔ Especially relevant (as an example of how the SAREF4AUTO will look like) is the SAREF4CITY extension recently published as TS 103 410-4

# Conclusion

---

- ✔ SAREF4AUTO specifies an **extension of the SAREF ontology in the automotive domain**
- ✔ It provides a **data driven model** for this domain
- ✔ As an ontology, it **enables semantic interoperability** between different systems and providers
- ✔ Open Data requires **accurate specification of the data** exchanged: a common semantic
- ✔ SAREF4AUTO provides a **semantic data sharing capability** for open data
- ✔ Latest draft is available at
  - ✔ [SmartM2M-103508v017.docx](#)
- ✔ ETSI ITS WG1 delegates are invited to look at requirement tables in the draft and **provide comments / suggestions**

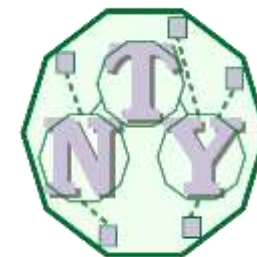
**Thank you for your attention!**

**QUESTIONS  
?**

**Michelle Wetterwald**

NETELLANY / FBConsulting  
Sophia Antipolis, France

Email: [michelle.wetterwald@netellany.fr](mailto:michelle.wetterwald@netellany.fr)  
[michelle.wetterwald@gmail.com](mailto:michelle.wetterwald@gmail.com)

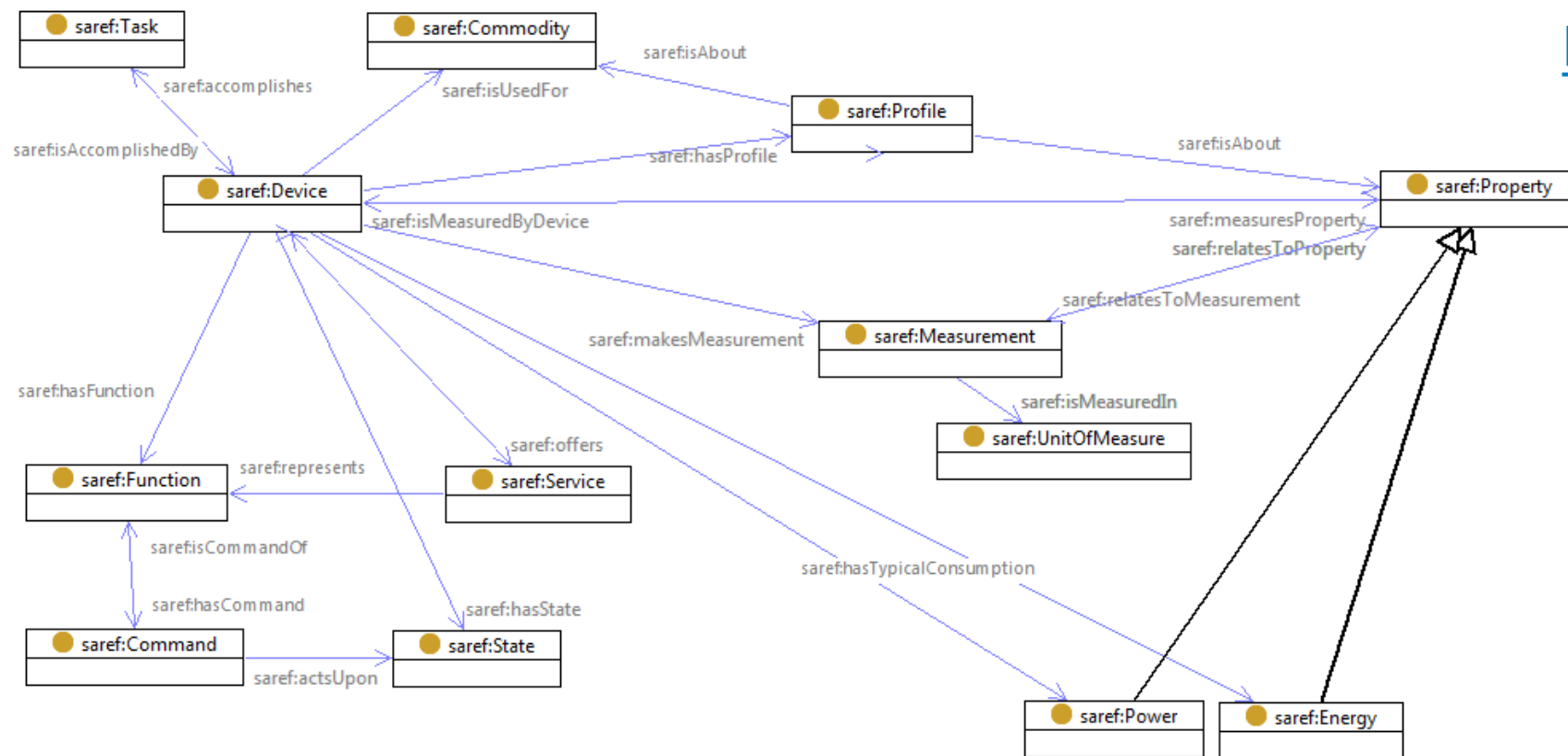


# SAREF History

---

- ✔ In 2013 the European Commission launched a standardization initiative (SMART 2013/0077 study) in collaboration with ETSI TC SmartM2M
- ✔ Goal of the study was to create a commonly agreed language (interoperable concepts) for the smart appliances domain
- ✔ Study conducted by TNO from January 2014 to March 2015
- ✔ [www.sites.google.com/site/smartappliancesproject](http://www.sites.google.com/site/smartappliancesproject)

# SAREF main concepts\*



<https://w3id.org/saref>

First ontology standard in the Internet of Things (IoT) ecosystem\*\*

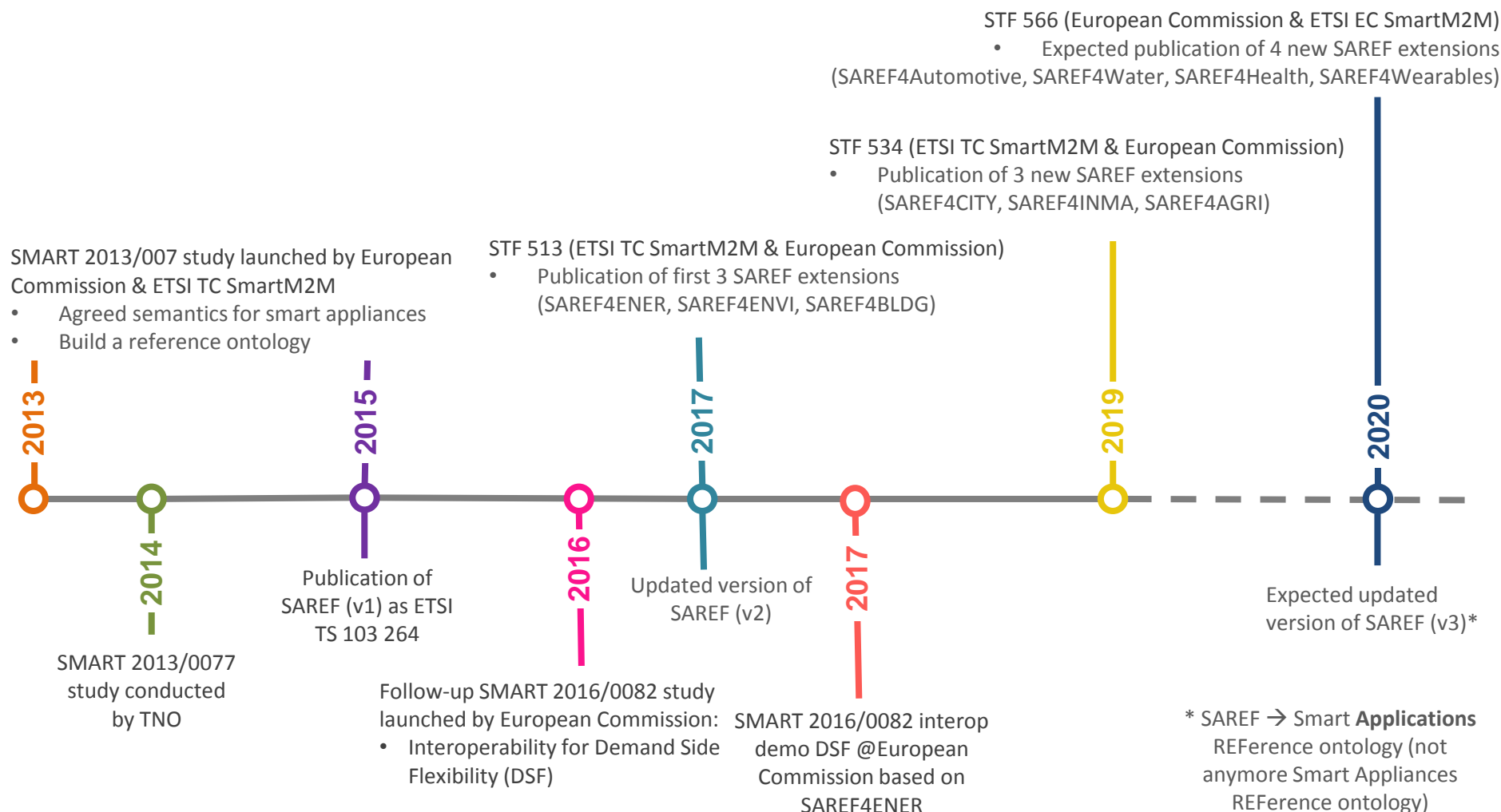
Developed in close interaction with the industry

\*SAREF version 2, available as ETSI TS 103 264 V2.1.1. Note that a SAREF version 3 is currently under development ([https://portal.etsi.org/webapp/WorkProgram/Report\\_WorkItem.asp?WKI\\_ID=57501](https://portal.etsi.org/webapp/WorkProgram/Report_WorkItem.asp?WKI_ID=57501))

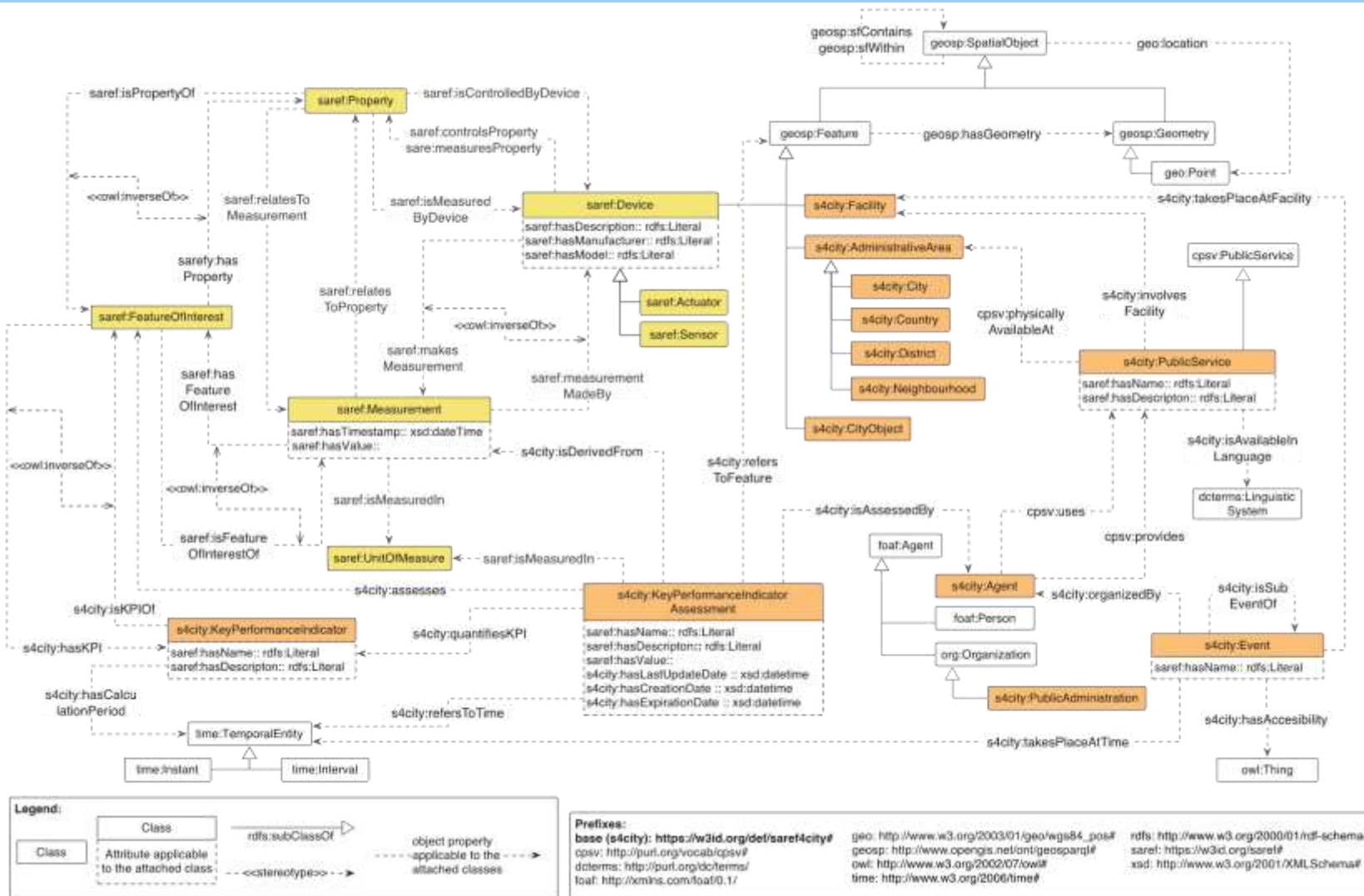
\*\*source: EC Rolling Plan for ICT Standardisation 2017



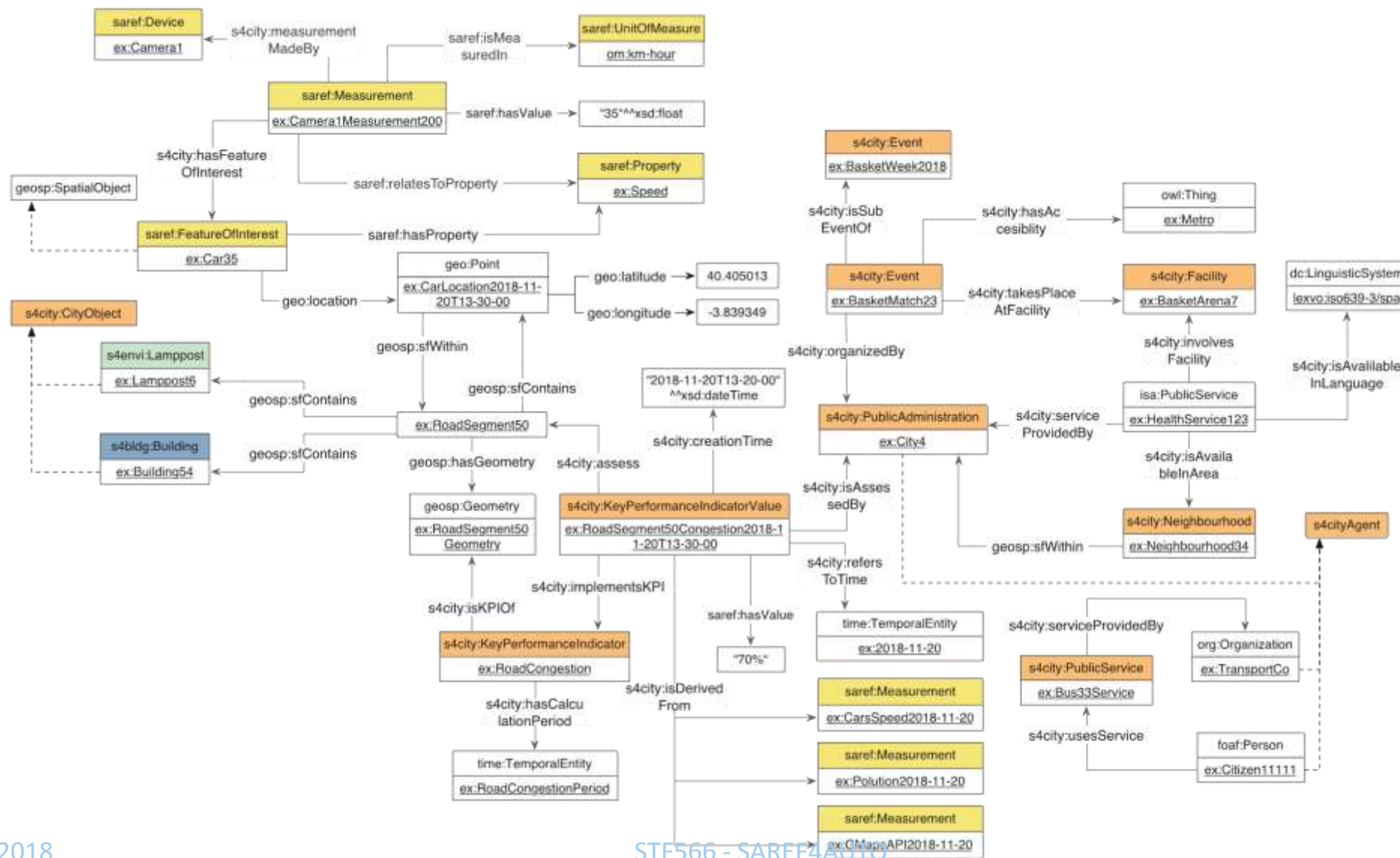
# SAREF evolution



# Example : SAREF4CITY



# SAREF4CITY example instantiation



# ETSI SAREF specifications

- ✔ SAREF version 2 Technical Specification: [TS 103 264 V2.1.1](#)
- ✔ SAREF extension investigation Technical Report: [TR 103 411](#)
- ✔ SAREF for Energy (SAREF4ENER) Technical Specification: [TS 103 410-1](#)
- ✔ SAREF for Environment (SAREF4ENVI) Technical Specification: [TS 103 410-2](#)
- ✔ SAREF for Buildings (SAREF4BLDG) Technical Specification: [TS 103 410-3](#)
- ✔ SAREF for Smart Cities (SAREF4CITY) Technical Specification: [TS 103 410-4](#) and SAREF4CITY Technical Report: [TR 103 506](#)
- ✔ SAREF for Smart Industry & Manufacturing (SAREF4INMA) Technical Specification: [TS 103 410-5](#) and SAREF4INMA Technical Report: [TR 103 507](#)
- ✔ SAREF for Smart AgriFood (SAREF4AGRI) Technical Specification: [TS 103 410-6](#) and SAREF4AGRI Technical Report: [TR 103 511](#)

