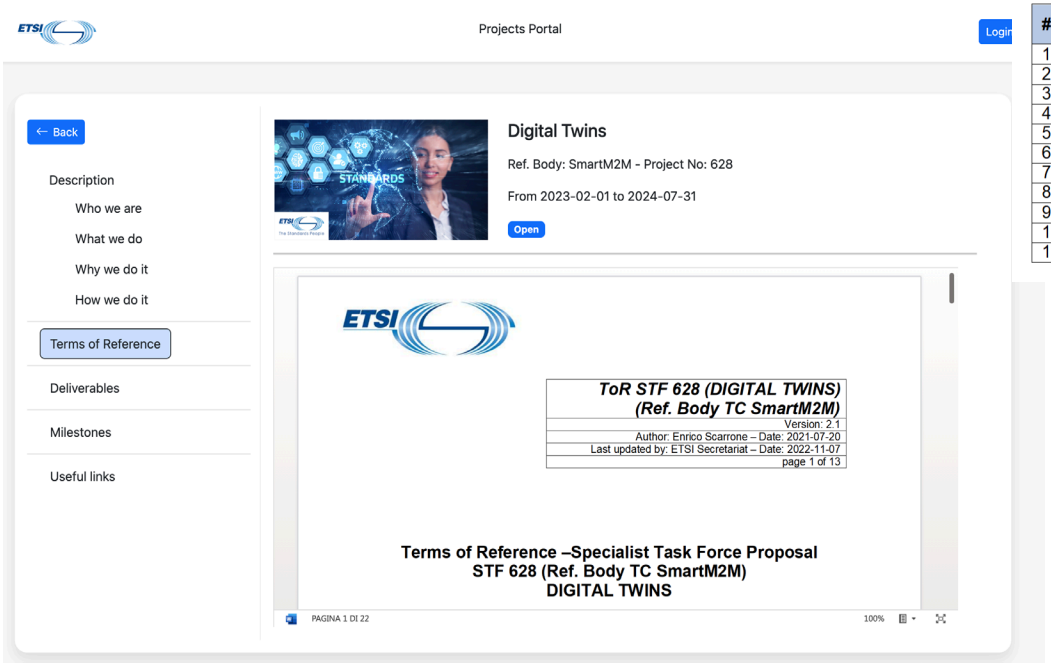
Modelling the Physical World: Interoperability and Standardization Opportunities

Massimo Vanetti

Open IoT Industry Day, Tokyo 2023-12-06

ETSI STF 628 - at a Glance

Ref. Body: TC SmartM2M



https://portal.etsi.org/XTFs/#/xTF/628

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1	TELECOM ITALIA S.p.A.	Enrico Scarrone
2	HUAWEI Technologies Sweden AB	Francisco da Silva
3	Facultad de Informatica	Raul Garcia Castro (UPM)
4	Futurewei	John Strassner
5	FBK	Mauro Dragoni (Fondazione Bruno Kessler)
6	SBS aisbl	Massimo Vanetti
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9	CNRS	Samir Medjiah
10	JK Consulting and Projects	Joachim Koss (ETSI Applicant member)
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Experts Team

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Gabriele Casalini (Project Leader)
Marco Picone (Expert)
Massimo Vanetti (Expert)
Mauro Dragoni (Expert)
William R. Flynn, IV (Expert)

ETSI STF 628 - What we do

STF 628, financed entirely by ETSI, has been tasked to cover the missing key elements of modelling and making uniform the communication concept IoT Digital Twins and their blueprint communication reference architecture

- Identify use cases and deployments where IoT Digital Twins can be effectively adopted in order to identify all the requirements and specifications associated to the definition of their functionalities and specifications
- Derive requirements and guidelines towards a horizontal cross-domain interoperability and standard, with the specification of minimum requirements for usability of professional and general public IoT services
- Based on these use cases, requirements and guidelines, map IoT Digital Twins within the oneM2M framework
- Contribute to ISO/JTC1/SC41 through the definition of a set of new specifications in order to both embrace new functionalities and to effectively exploit the existing features (e.g., discoverability, security, modularity, etc.)

ETSI STF 628 – Why we do it

ETSI has determined that:

- There is the concrete need to support a **cross-domain and cross-vendor DT interoperability** in order to **avoid closed siloes solutions**. It is not reasonable to think that each country, company or service will design a new and different DT by creating a plethora of heterogeneous implementations, thus opening the way to lack of interoperability. **oneM2M** and **SAREF** already provide a good basis for that, but **the peculiarity of DT requires specific additional work** to complete the interoperability framework offered by standardization.
- Nevertheless, DTs interoperability potential is still underexplored and represents a relevant opportunity to design a new and shared approach aiming to achieve the **seamless integration of data and services in heterogeneous IoT edge deployments**. Through a last-mile DT digitalization it will be possible to handle physical heterogeneity as close as possible to the devices and to simplify the interaction and cooperation with upper layers

ETSI STF 628 – Goals

- The technical work is developed in 2 technical tasks, covering:
  - Analysis, Use Cases and Requirements for Digital Twins in IoT
  - Standardization of functionalities, communication reference architecture and guidelines for Digital Twins

- These tasks will provide a general solution as Digital Twins reference architecture. The **instantiation** of such general solution in the **oneM2M** context is also included. So that these tasks also include the preparation of the technical solution to be exported in oneM2M.

- A third task covers the **dissemination** towards oneM2M and other associations/fora representing potential stakeholders of the proposed standard.

ETSI STF 628 – Timeframe

- Work Started on **2023-02-01**
- 7 Milestones defined
- Work completion scheduled for **2024-07-31**
- Currently, the first two milestones have been achieved
- Work on the third is underway

An "Extended" Digital Twin Definition

"A Digital Twin is a comprehensive software representation of an individual physical object. It includes the ***properties, conditions, and behavior(s)*** *of the real-life object through models and data. A Digital Twin is a set of realistic models that can* ~~***simulate***~~ *an object's behavior in the deployed environment. The Digital Twin represents and reflects its physical twin and remains its virtual counterpart across the object's entire lifecycle. [1]"*

S. Haag, and R. Anderl. "Digital Twin–Proof of concept." Manufacturing Letters 15 (2018)

properties, conditions, ***relationships*** *and behavior(s)*

DTs may also be responsible to model and characterize existing relationships in the physical world in order to map them also in the digital world.

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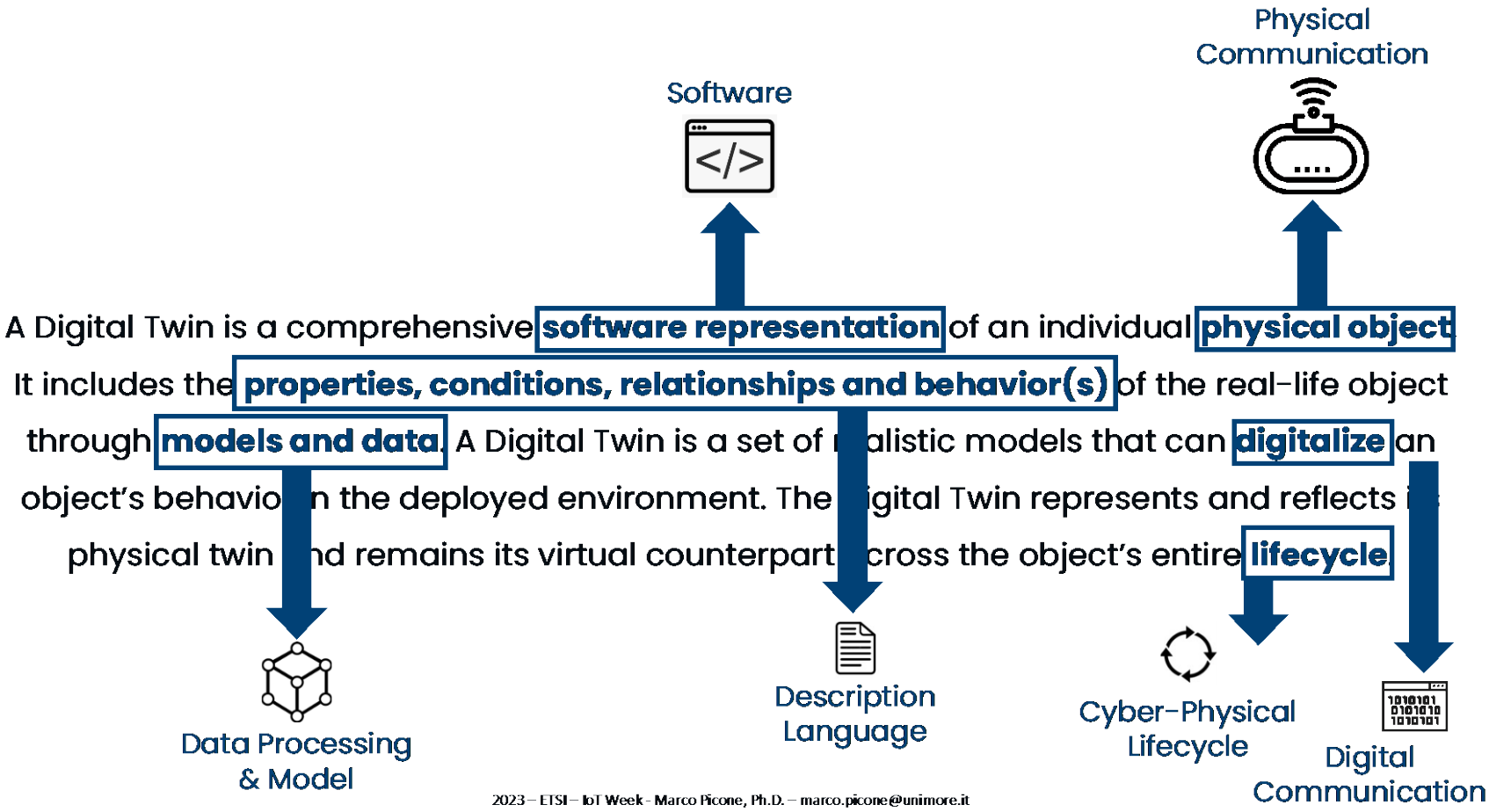
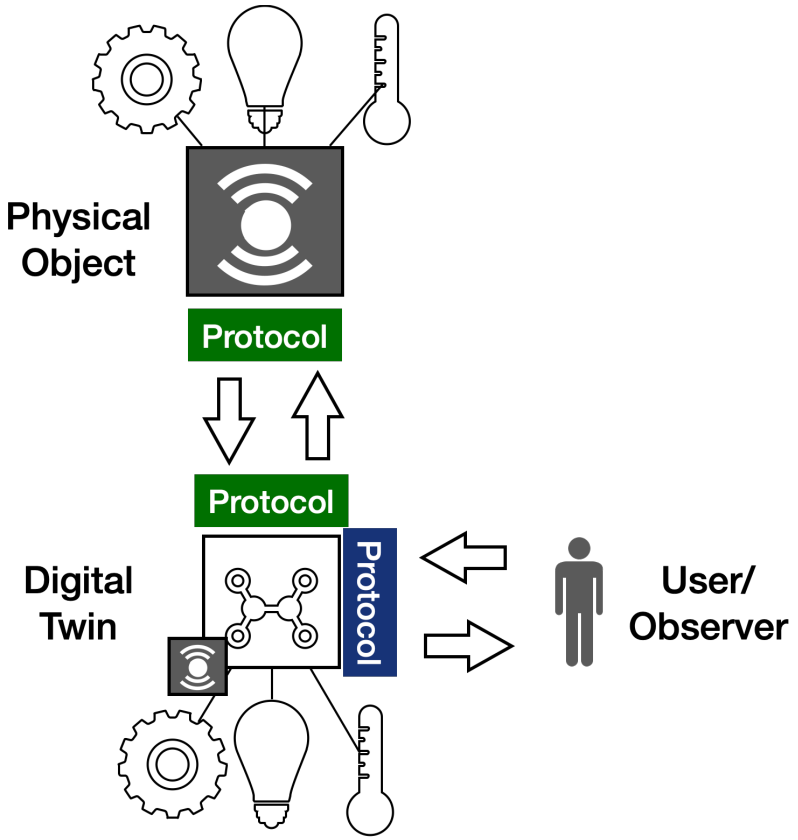
A Digital Twin is a set of realistic models that can ***digitalize*** *an object's behavior in the deployed environment.*

The recent shared idea is that DTs can be used not only for simulation purposes but to support and enable any digital services or application

Digital Twin's Pillars

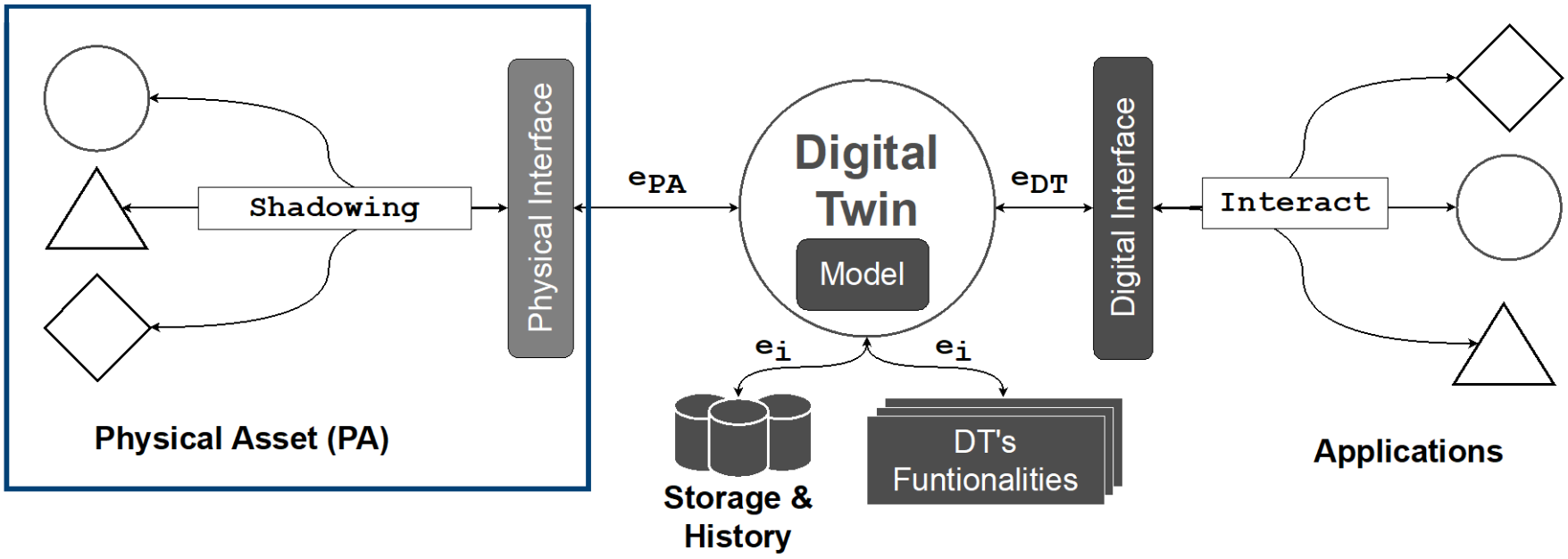


Internet of Things & Digital Twins



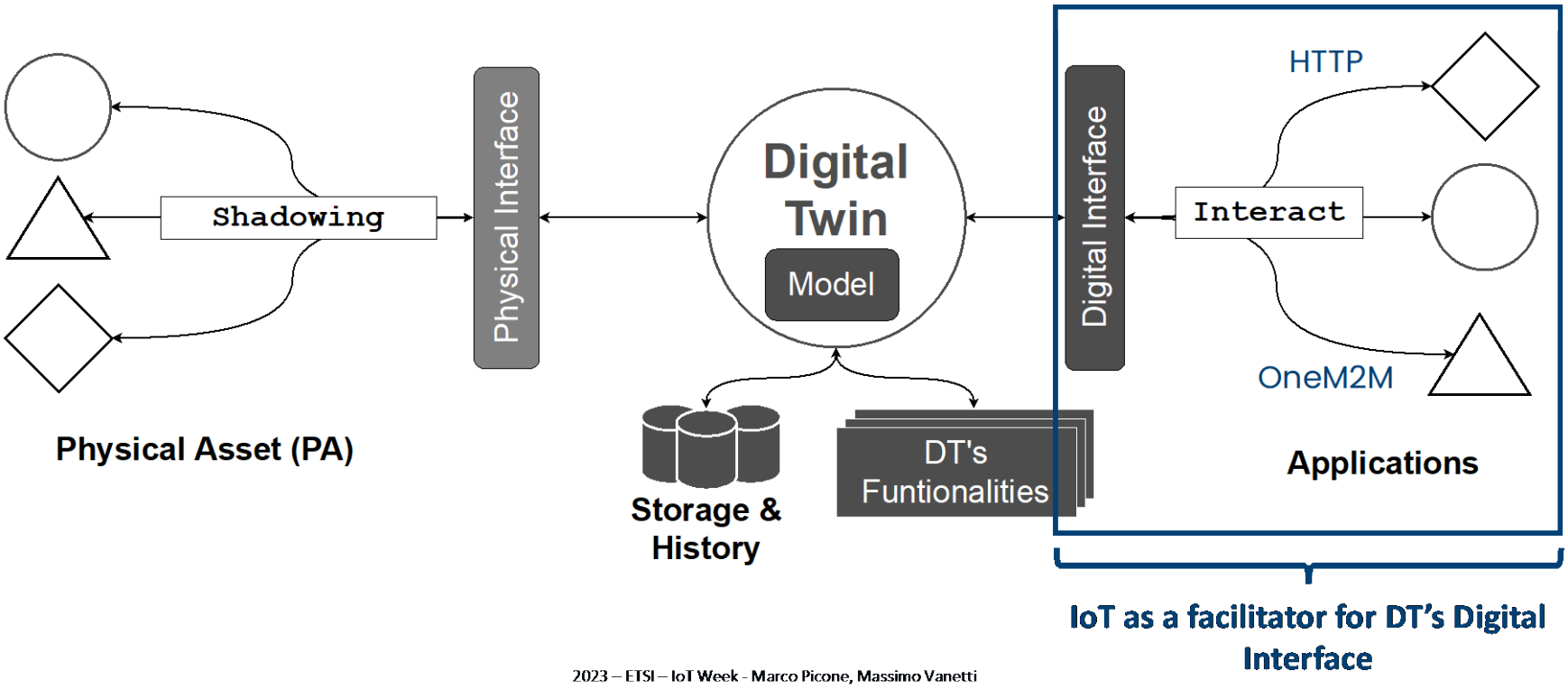
- It's only thanks to the Internet of Things that the idea of **Digital Twins has become cost-effective** to implement thanks to the possibility to "easily" communicate with a physical connected device
- **IoT** technologies represent the strategic enablers to design and **build DT's physical interfaces** allowing twins to talks through multiple languages and data formats with the aim to **read** information, **synchronize** the state, and **interact** with the environment
- At the same time, **DTs** represents an appealing opportunity to **digitalize/softwarize the physical world** (composed by a multitude of heterogeneous assets) and **simplify its complexity** to digital applications

Internet of Things & Digital Twins



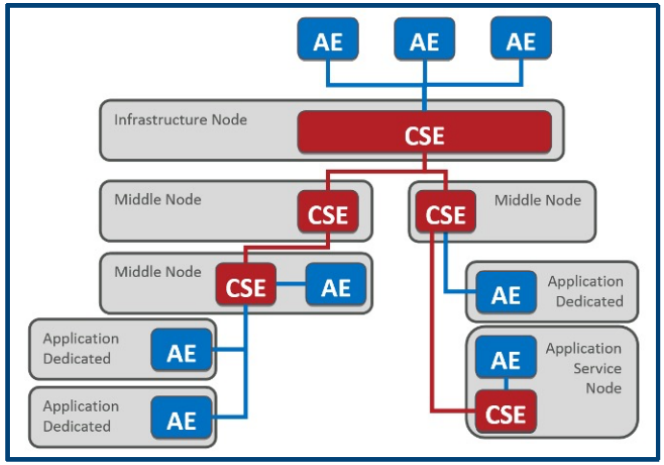
IoT as the enabler for DT's Physical Interface

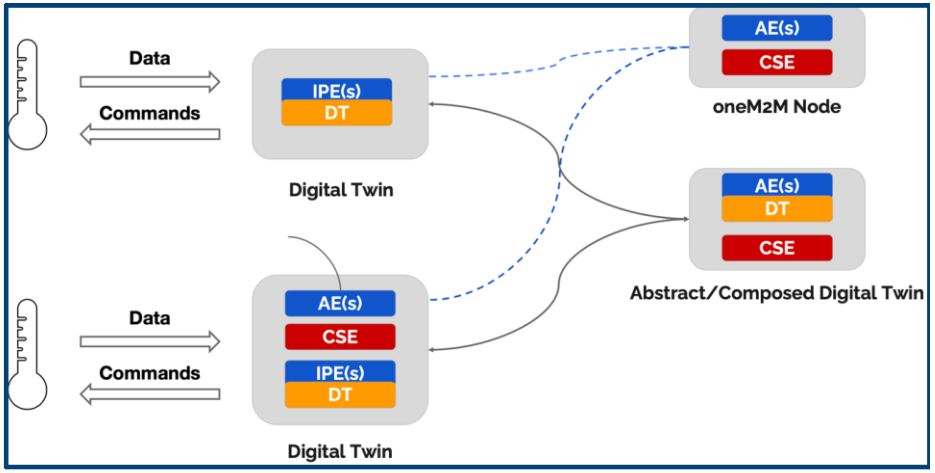
Internet of Things & Digital Twins



2023 – ETSI – IoT Week - Marco Picone, Massimo Vanetti

oneM2M & Digital Twins





oneM2M Architecture ⟷ **oneM2M & Digital Twins Integration**

Standardizing Smart Lifts: The transition to IoT

Massimo Vanetti
Open IoT Industry Day, Tokyo 2023-12-06

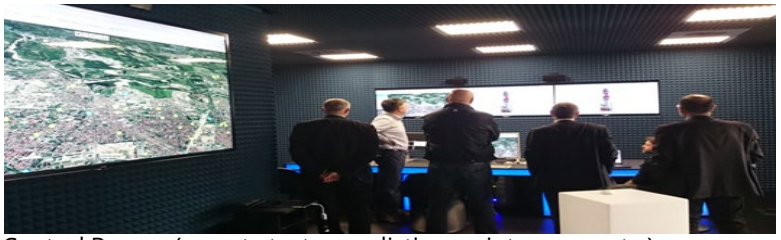
Smart Lifts IoT System

- What are Smart Lifts
- Scope of the standard
- Why is it of interest?
- The recipe
- The timeline
- A few words on oneM2M
- The PoC Project

Smart Lifts IoT Systems

A Glimpse into the Smart Lifts EcoSystem

Communication networks



Control Rooms (remote tests, predictive maintenance, etc.)

Augmented reality for technicians and users

Building Managers

Smart Building

Smart City

Intelligent services for users

Smart Lifts IoT System

Whose Business is it?

People of the trade

- A few big companies, of course, we all know some of their names
- A surprisingly large number of SMEs, operating mainly in maintenance
  but also in areas such as design and construction of lifts,
  and manufacturing of control systems and telemetry devices (what is now called “the edge” in IoT)

And… users!

- Building managers and, in certain cases, managers on an even larger scale, up to the smart city level
- Simple users, like “just us”
- But also users with special needs,
  ranging from impaired people to fire fighters (both in case of emergency and as controllers)
  passing by railway station managers, that must ensure everything is operating correctly before allowing people into the premises

Smart Lifts IoT System

ETSI TS 103 735 Scope

- Smart Lifts IoT devices at the EDGE
- Integration of administrative data management and alarm management systems
- Scalable cloud service with oneM2M:
  from local company cloud, to consortia and association clouds, to cloud services providers (oneM2M compliant)
- Integration of non-standard solutions and platforms via gateway interworking
- Adding novel features and capabilities by augmentation of sensors
  (e.g. addition of earthquake detectors)

- (ETSI deliverables are freely downloadable at ETSI website: www.etsi.org)

Smart Lifts IoT System

Why is this important, or even interesting?

Because it shows that:

- Useful standards, under proper circumstances, can be developed quickly.
  This is particularly true in the case of IoT, as we shall see.
- SMEs can take the lead in developing modern standards,
  (and big companies can even appreciate and follow)

- There is a recipe for obtaining these results.
  Of course, this recipe calls for the right ingredients, and we are going to disclose some of them right now

Smart Lifts IoT System

Key Ingredients, Generally Speaking

- People that know well:
  - the requirements of their business sector (”vertical”)
  - the best practices that are in use
  - the technical aspects of their trade
  - it is not necessary that they are big experts in other areas, like data communications or IoT:
    this knowledge is more horizontal and can be contributed
- A standardisation context that is open to rapid development
  is needed to drive the process to success
- “Something” that can be leveraged,
  - so that the team can focus on the specific aspects of the vertical business under consideration,
  - while still keeping the standard able to follow the evolution of technology without impacting directly the specific document

Smart Lifts IoT System

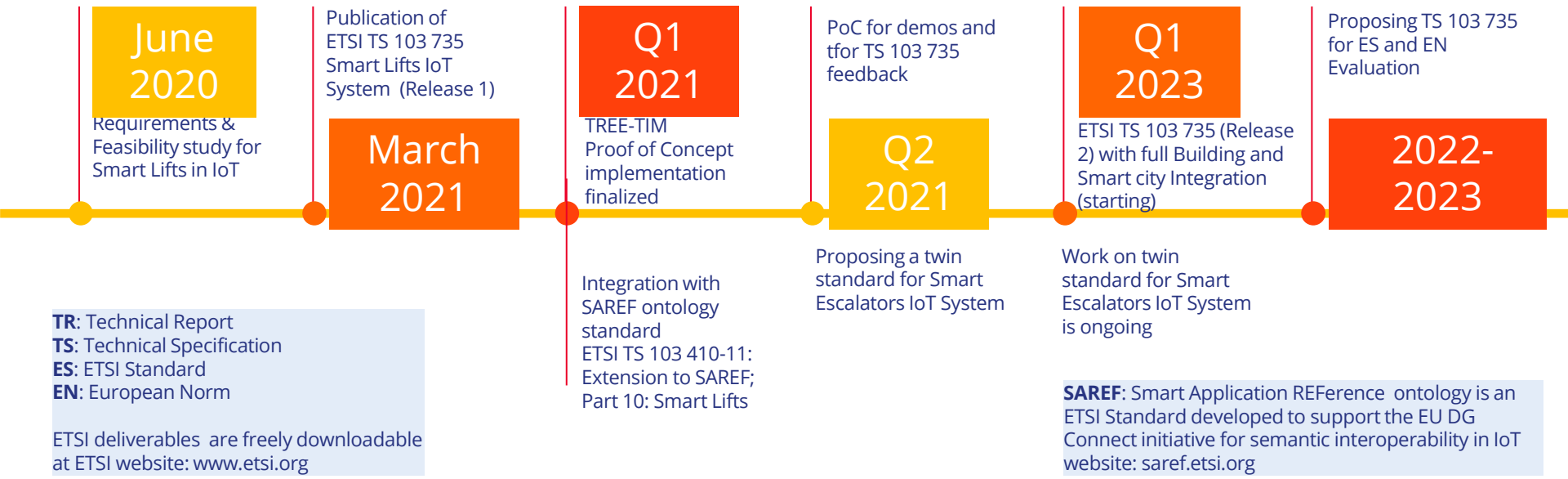
Key Ingredients, in the Case at Hand (ETSI TS 103 735)

- Experts from **EFESME** (European Federation for Elevator Small and Medium-sized Enterprises) and federated associations, including **TR**
- ETSI TC **SmartM2M**, the TC at **ETSI** where historically most IoT standardization has been done
- **oneM2M** the global partnership proje T standardization
- Plus, a pinch of luck (happened at **SBS**)

Smart Lifts IoT System

Standardization and Normative Timeline

- Fast standardization by leveraging oneM2M as the foundation allows focalizing the development on the lift specific aspects!!!



TR: Technical Report
TS: Technical Specification
ES: ETSI Standard
EN: European Norm

ETSI deliverables are freely downloadable at ETSI website: www.etsi.org

SAREF: Smart Application REFerence ontology is an ETSI Standard developed to support the EU DG Connect initiative for semantic interoperability in IoT website: saref.etsi.org

Smart Lifts IoT System

WHY use oneM2M For Smart Lifts?

- THE ONLY IOT STANDARD “DE JURE” dedicated to Ecosystems integration
- SECURE: MULTIPLE SECURITY LEVELS
- DYNAMIC PRIVACY AND ACCESS CONTROL
- EASY DB AND CLOUD INTEGRATION
- DATA MANAGEMENT - DATA HISTORIZATION - INFORMATION SHARING
- STORAGE AND EXPOSURE FOR
  - Historical data
  - Data search and aggregation
  - Context information
  - Dynamic data
  - Real time control and actuation
  - Field device management
  - Network technologies independence

- NATIVE DEVICE MANAGEMENT
- FLEXIBLE DEPLOYMENT adapting to the requirements of the different domains
- SCALABLE
- INTER-PROVIDER NATIVE SUPPORT
- AN INTERWORKING FRAMEWORK FOR
  - Legacy field and core server technologies
  - Other technologies
  - Proprietary solution

  -> Not an additional solution, but a standard to integrate the different solutions
- SEMANTIC ENABLED TO SHARE INFORMATION, NOT ONLY DATA!!!
- INTERNET FRIENDLY FOR HUMAN INTERACTION
- SIMPLE

Smart Lifts IoT System

The PoC Project, now being developed

TREE
Espansione Evoluzione Elevatori

BIT LIFE SOLUTIONS

weLift.it
tecnologia per l'ascensore

TIM

+

oneM2M

Smart Lifts IoT System

TL; DR

IoT is NOT
about selecting a protocol… nor a platform… nor a cloud….

IoT is
**sharing the information and its meaning among different systems,
different applications,
different business sectors !**