



The Standards People

IoT Conference 2023

STF 628: Digital Twin Modelling, Interoperability and Standardization Opportunities

Presented by:

Marco Picone – University of Modena and Reggio Emilia

Massimo Vanetti - European DIGITAL SME Alliance

July 06 2023



Specialist Task Force Proposal - STF 628 (Ref. Body TC SmartM2M)

DIGITAL TWINS



Projects Portal

Login

← Back

Description

Who we are

What we do

Why we do it

How we do it

Terms of Reference

Deliverables

Milestones

Useful links



Digital Twins

Ref. Body: SmartM2M - Project No: 628

From 2023-02-01 to 2024-07-31

Open



ToR STF 628 (DIGITAL TWINS) (Ref. Body TC SmartM2M)

Version: 2.1
Author: Enrico Scarrone - Date: 2021-07-20
Last updated by: ETSI Secretariat - Date: 2022-11-07
page 1 of 13

Terms of Reference –Specialist Task Force Proposal
STF 628 (Ref. Body TC SmartM2M)
DIGITAL TWINS

PAGINA 1 DI 22

100%

ETSI Members Support

#	ETSI Member	Supporting delegate
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
7	INRIA	Luigi Liquori
8	Deutsche Telekom AG	Thomas Kessler
9	CNRS	Samir Medjah
10	JK Consulting and Projects	Joachim Koss (ETSI Applicant member)
11	FBConsulting S.A.R.L.	Michelle Wetterwald

Experts Team

AI4 People

European DIGITAL SME Alliance

Exacta GlobalSmart Solution

University of Modena and Reggio Emilia

Gabriele Casalini (Project Leader)

Marco Picone (Expert)

Massimo Vanetti (Expert)

Mauro Dragoni (Expert)

William R. Flynn, IV (Expert)

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

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 – What we do (Some details)

- 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 **01/02/2023**
- 7 Milestones defined
- Work completion scheduled for **31/07/2024**
- Currently in the early stages of work
- **First milestone achieved**

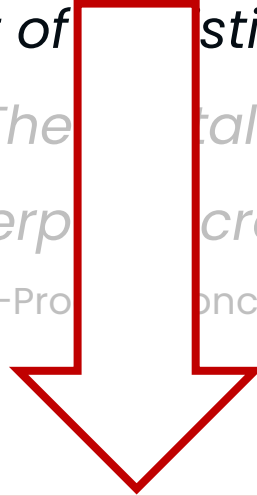


An “Extended” Digital Twin Definition

“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 stochastic 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-Product Concept." *Manufacturing Letters* 15 (2018)



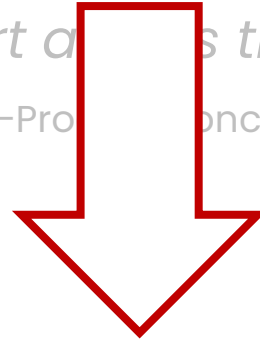
*properties, conditions, **relationships** and behavior(s)*

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.

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-Production Concept." *Manufacturing Letters* 15 (2018)



*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

A Digital Twin is a comprehensive **software representation** of an individual **physical object**

It includes the **properties, conditions, relationships and behavior(s)** of the real-life object

through **models and data**. A Digital Twin is a set of realistic models that can **digitalize** 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**

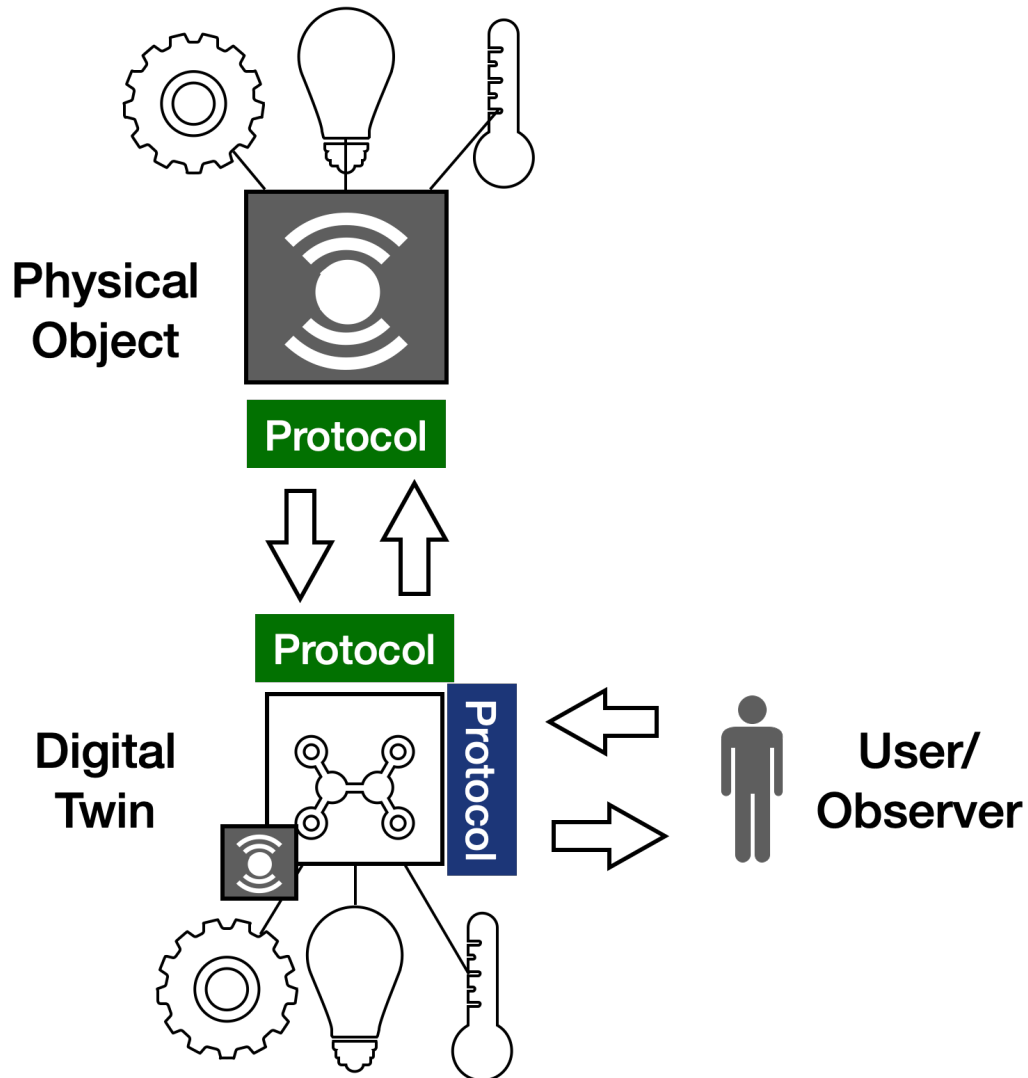
Data Processing
& Model

Description
Language

Cyber-Physical
Lifecycle

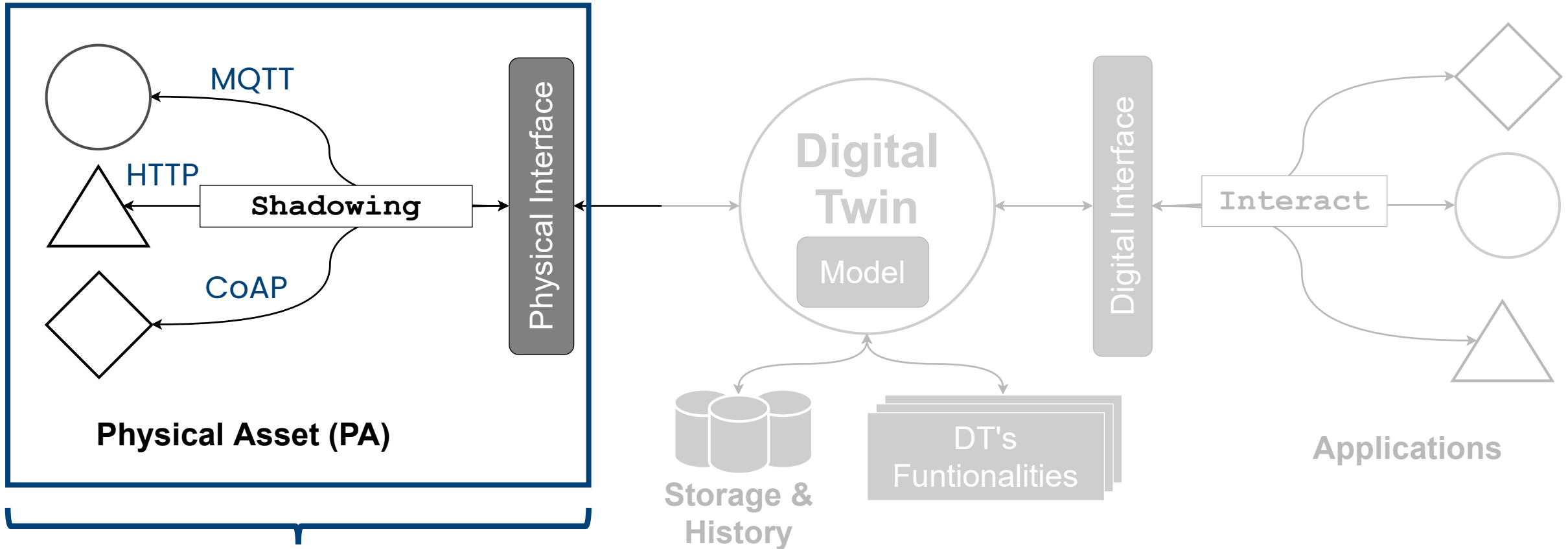
Digital
Communication

Internet of Things & Digital Twins



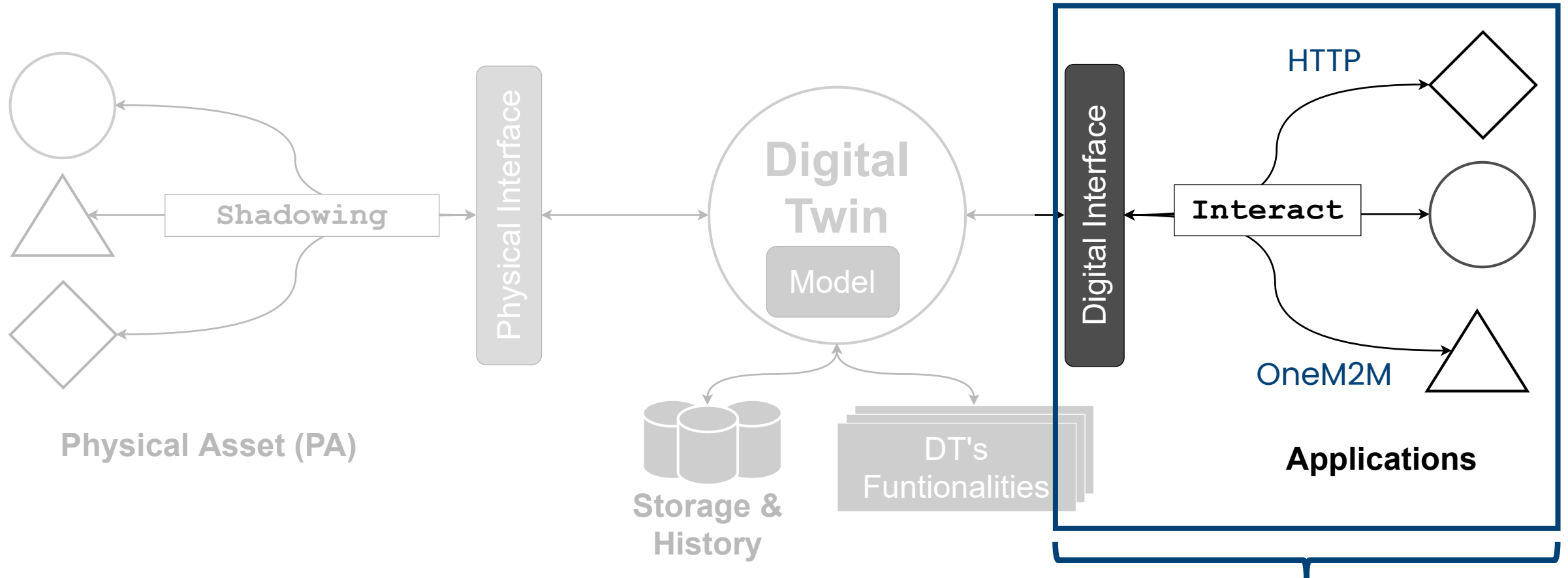
- It's only thanks to the Internet of Things that the idea of **Digital Twins has become cost-effective** to implement thanks to the possibility to “easily” communicate with a physical connected device
- **IoT** technologies represent the strategic enablers to design and **build DT's physical interfaces** allowing twins to talk 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

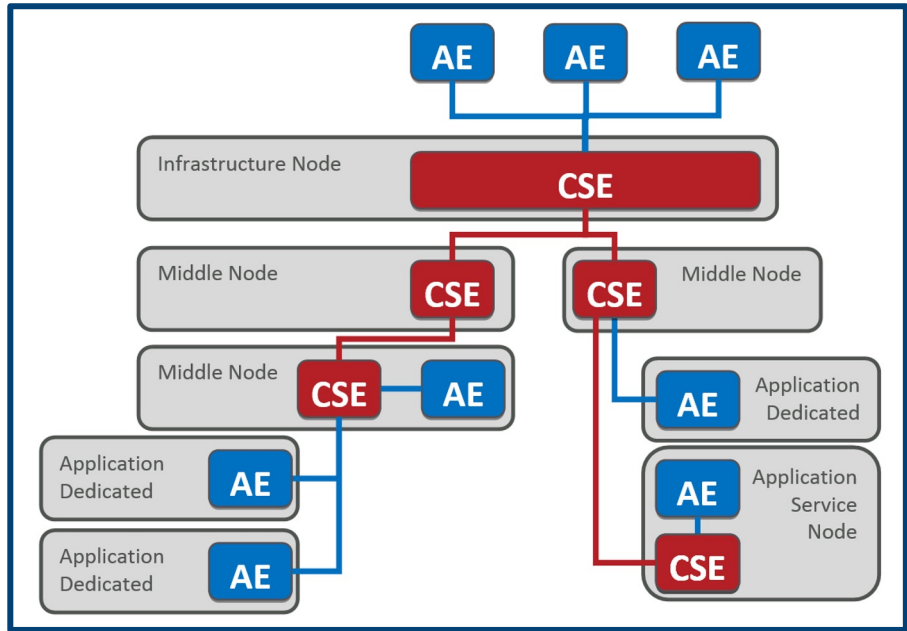


IoT as the enabler for DT's Physical Interface

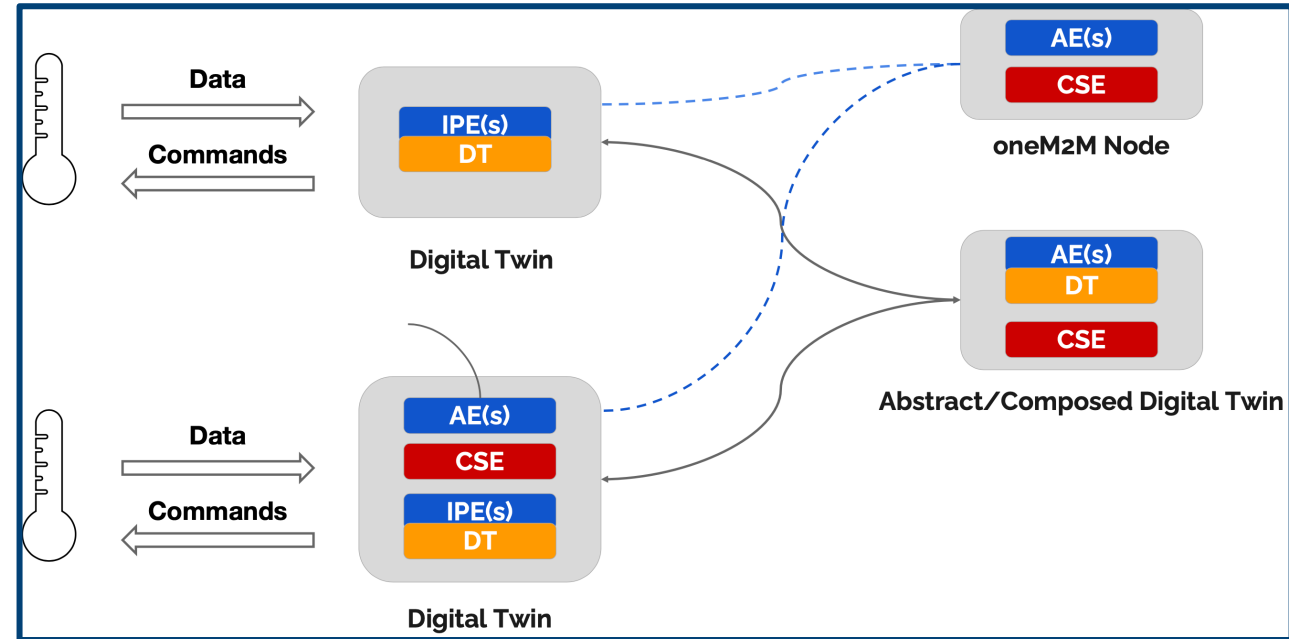
Internet of Things & Digital Twins



oneM2M & Digital Twins Integration Opportunities



**oneM2M
Architecture**



**oneM2M & Digital
Twins Integration**

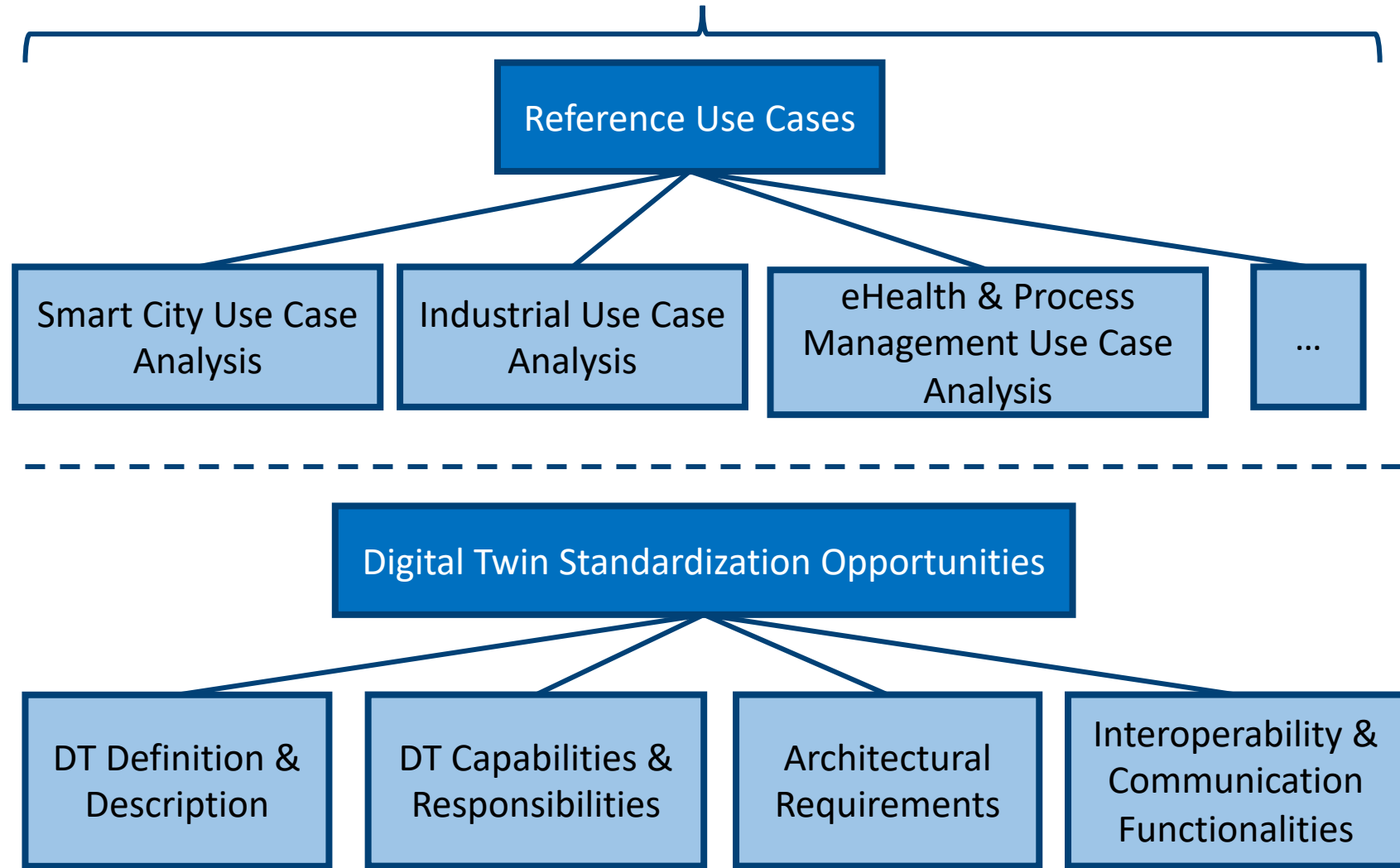
ETSI STF – 628 – (OnGoing) Activity 1 - Overview

ETSI TR 103 844 V0.0.2 (2023-05)



SmartM2M
Digital Twins and Standardization Opportunities in ETSI

SmartM2M DTs Standardization Opportunities in ETSI





The Standards People

IoT Conference 2023

STF 628: Digital Twin Modelling, Interoperability and Standardization Opportunities

Presented by:

Massimo Vanetti - European DIGITAL SME Alliance

Marco Picone – University of Modena and Reggio Emilia

July 06 2023

