Digital Twin for OEM

Why and how to make it happen?

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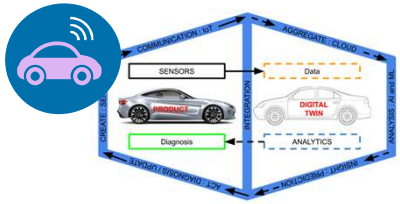
EVP Digital Continuity Group Leader

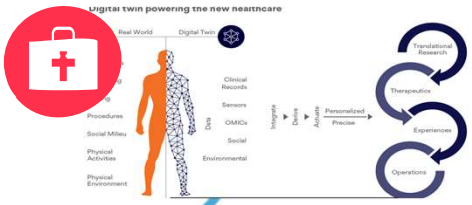
There are multiple types of digital twins

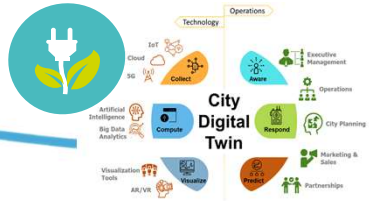
Use of digital twin across different industries…

and steps of value chain

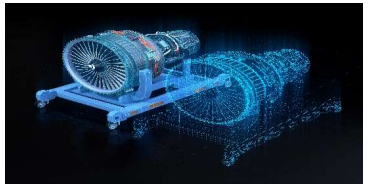
Non exhaustive







Product Development



Supply Chain

Asset in Operations

Services

Digital twins serve **many purposes**; there **no single** digital twin. Different stakeholders interact with digital twins from different perspectives and derive **different types of value**.

Industry market trends

CUSTOMER EXPERIENCE

Sustainability ⟷ Proprietary or shared usages ⟷ TCO optimization

PRODUCT AND SERVICE

Time to Market

Mass Customization / Personalization

From Product to Services to Experiences

FROM DESIGN TO OPERATIONS… TO SERVICES

Intelligent system : From design... to operate

Data - driven and Digital ways of doing

Extended ecosystems

BUSINESS TARGETS OF DIGITAL TWIN

Targeting value of digital twins

AS CxO I WANT TO…

- …operate **new business model**
- … grow a **discipline of operational excellence**
- …**decrease** silos between disciplines

IN ORDER TO …

- …produce **several profitable business model scenarios**
- … create platform services to drive **Market Value Added**

IMPACT ON KVI

Market Added Value

Working Capital

ROCE, Cash Flow

AS BUSINESS I WANT TO…

- … **optimize** use of **invested capacities** and lower operational costs
- …**accelerate the pillars of operational excellence** in connection with business objectives

IN ORDER TO …

- …**propose balancing scenarios** for continuous investment rentability
- …deliver solutions with **Feedback Loop** between strategy and operations

S&OP

Time to Market

ROI

AS OPERATIONS I WANT TO…

- …eliminate waste and **eradication of operations generating non-added value**
- **…reduce disturbances** of operational performance testing quickly integrated user cases

IN ORDER TO

- … reduce Cost of Product and **drive integrated value**
- …support continuous Rentability and Value Chain Improvement

Production efficiency

Flexibility to reply demand variety

Waste reduction

Digital Twin is profitability enabler

"A **Digital Twin** is a virtual representation of **real-world** entities and processes, **synchronized** at a **specified frequency** and **fidelity.**"©

- Experiment with different scenarios by **answering questions "WHAT IS BEST?", "WHAT IF?" and "WHAT NEXT?" .**
- **Evaluate the impact** of each decision **without any real-world risk.**
- Enable **effective decision-making** and helps **determine strategy to maximize profitability and reliability.**

"Before being manufactured a product must be simulated as well as its production processes.
Before being simulated a product must be designed.
To be designed, you have to anticipate **all the experiments in which the product will evolve all along its lifecycle**".

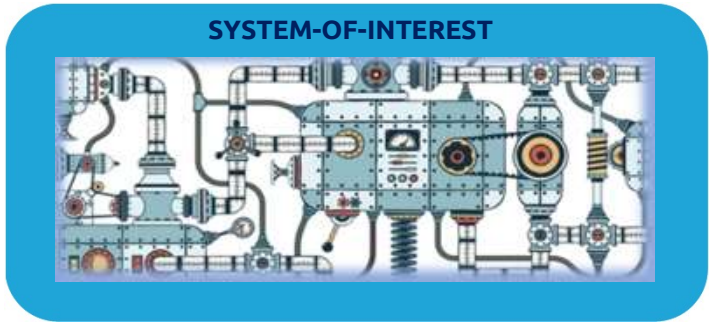
Digital twins evolve traditional PLM

The digital twin offers a virtual representation of how product /asset should be engineered, manufactured and improved throughout the lifecycle, while avoiding costly and time-consuming real-world failures.

PLM evolved…

Traditional Product lifecycle management	New frontier Digital Engineering Lifecycle Management	Value throughout the lifecycle
Concept Concepting is done in silo~~e~~s and takes quite a long time due because it is fragmented.	**Concept** Facilitates more collaboration amongst a wide range of stakeholders for the best approach.	Reduction in time in the concepting phase.
Design Product improvement is driven by constant time consuming iteration and experimentation.	**Design** Simulation enables 'what-if' experimentation so different product ideas can be tested at speed.	Reduction in time to create an accurate product model.
Produce Changes to the PPR requires production to stop which is expensive and risky.	**Produce** Changes to the PPR configuration can be introduced without interrupting production.	Improvement in product performance.
Support Continuous support cam be difficult if changes need to be made or processes are updated.	**Support** Allows for ongoing, agile support that can account for changes as they occur.	Reduction in maintenance costs over the lifecycle.

The main drivers of the Digital Twin for a specific System-of-Interest



A system-of-interest is a **collective set of all elements** of any system managed by a lifecycle & configuration.

This may include both operational or enabling systems.

TIME

- Number of changes of the physical object
  - every minutes, every day, never..
- How many updates of the representation
- Time scale of the usage
  - Every minutes, one a year, 30 years life,..

SPACE/SIZE/CONTEXT

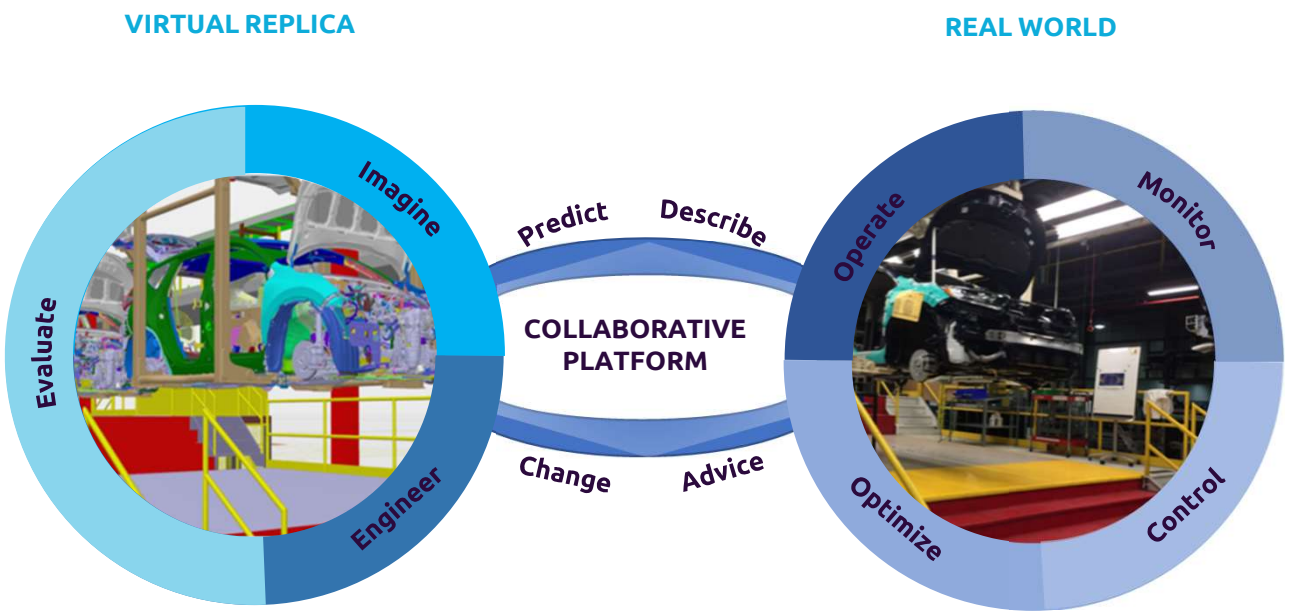
- Micro, small object, big systems
  - *A bicycle, a car, a train, a building, a medicament, a body, etc..*
- Context usage
  - *The diversity of the environment, and the need of the context to understand*

REPRESENTATION

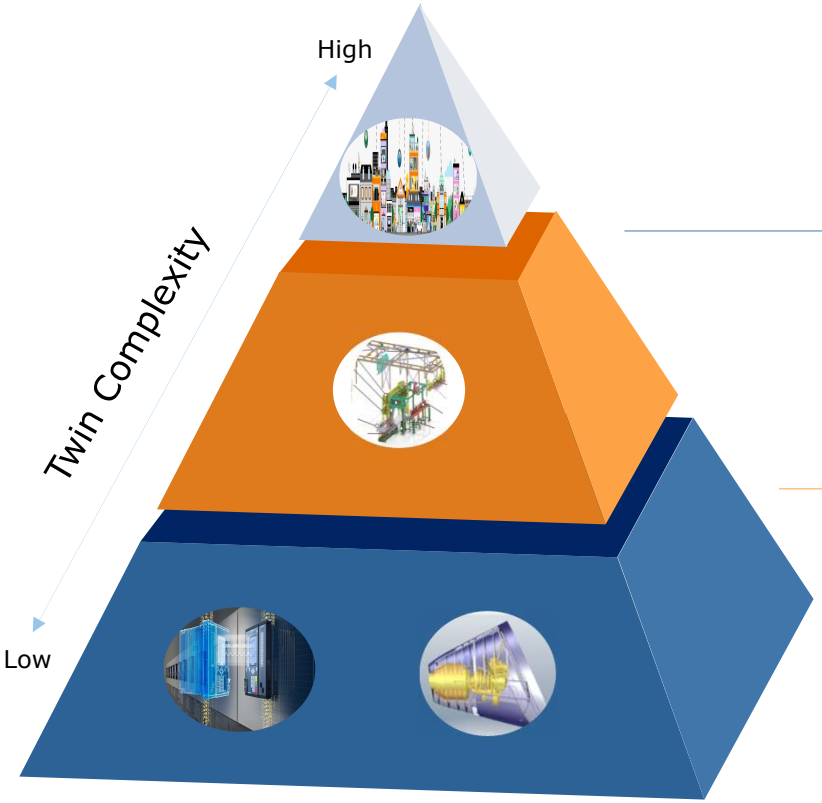
- Type of configured models
  - *3D Models, 2D Drawings, text description, etc..*
- Fidelity versus the reality
  - *all details, approximations, light context*

SHAPING PHYSICAL WORLD

Driving convergency of understanding and action across enterprise



Different complexity of Twins



Multi Twins

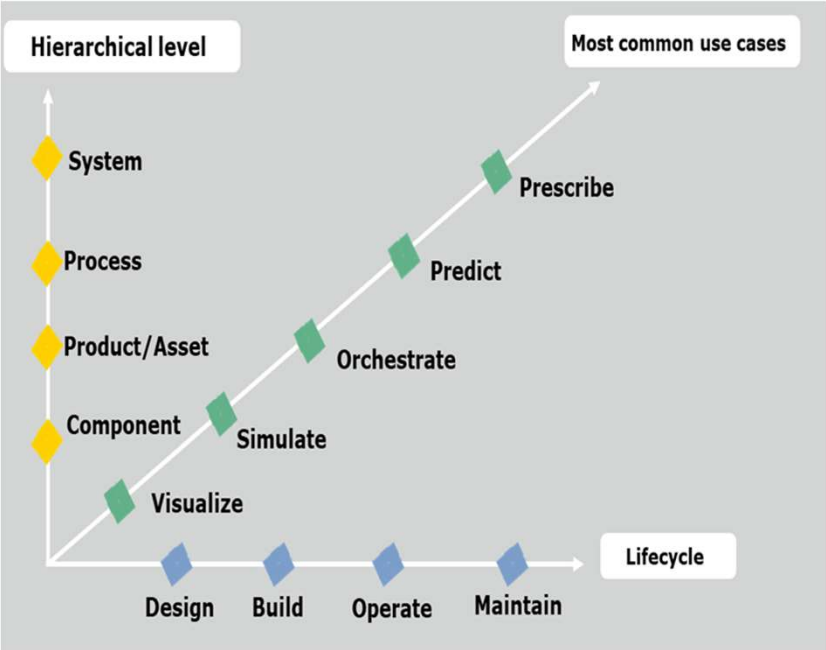
Multi types of simulations
Multi sources type of Ios

Multi types of simulations
Multi sources type of Ios
Mono Twin

Mono type of simulation
Single source type of Ios
Mono Twin

Shaping the physical world at different complexity levels

- Example of Focus area will be done on the Digital Twin as a Service , in order to deliver Quick Wins to the customer and help him to monetize service to reduce time of Return of Investments.
- Scale up of different partnerships in order to increase solutions library and expand geography of proposals.
- Continuous Development of internal Platform Solutions helping to speed up data interoperability across Digital Twin Life Cycle.



Digital twins and digital twin methodologies apply to all phases of the lifecycle.
The earlier that a project starts with digital twins in mind, the richer the data and insights.

Digital Twin dimensions

ACCESIBILITY

- Evolution of Digital Twin functions from Stand Alone capabilities to Platform as a Services solution.

ARCHITECTURE

- Digital continuity provided by collaborative platforms is a key enabler for your end to end architecture shared with the eco-systems.

LIFE CYCLE

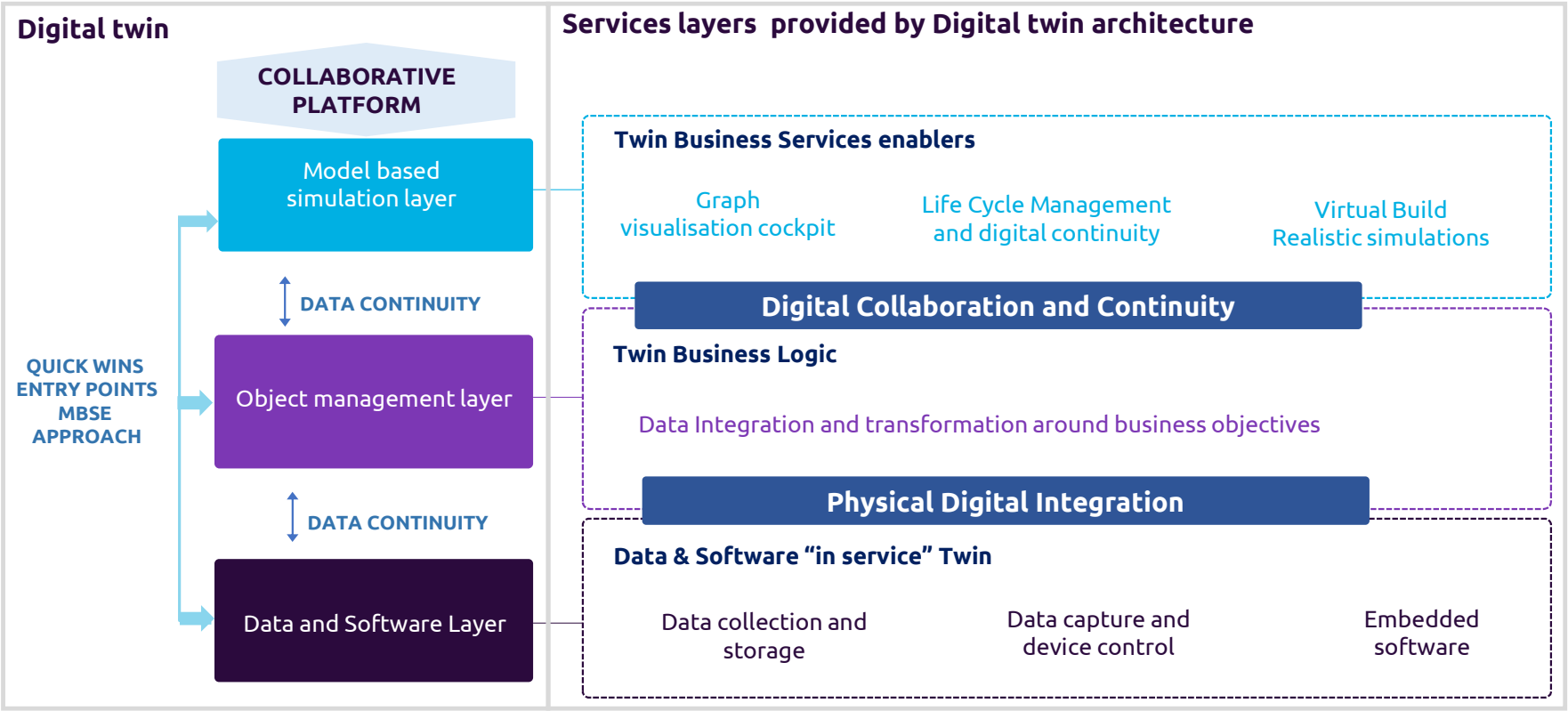
- The digital twin offers several types of services depending on its level of development.

Maturity of digital twins

Data visualization	Data modelling	Performance assessment	Autonomous operations	Monetization
Data reporting	**Static simulations**	**Best practices**	**AI and machine learning**	**Platform-as-a-service**
Measure data to visualize, monitor, and report on observed phenomenon such as pressure, temperature, or energy consumption.	Compare in-service data to theoretical data modelling for design validation, static simulations, and the ability to detect failures.	Assess a physical object's propagation across the digital ecosystem for digital continuity, MBSE, track and trace, etc.	Link data to executable models accessible by everyone, drive smart insights across the value chain, and allow more focus on higher level tasks.	Next generation digital twins focus on use-oriented and results-oriented models delivered via an as-a-service model.

BASIC → **ADVANCED**

High level Digital twin architecture



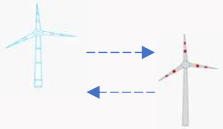
The digital twin types for opportunities

Manual →
Instrumented ←

Manufacturer Production Site | **Customer Site**

Concept & Design → ***Produce*** → ***Operate/Support***

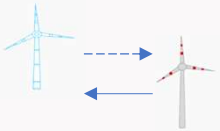
Type 1
Digital Twin As Designed



Design, analyze, and processes to **realize product or an industrial system**. A prototype could exist before there is an actual physical product.

Exemple: design data set sent manually to engineering.

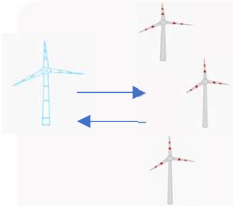
Type 2
Digital Twin AS Built



Digital Twin for each individual product instance once a product or industrial system has been manufactured.

Exemple: System captures data semi-manually and powers engine.

Type 3
Digital Twin Operated & Maintained



Agregation of digital twin data and information to use for the physical product or industrial system analysis, prognostics, and learning.

Exemple: System provides predictions automaticly based on real time data.

Main contributors along life cycle

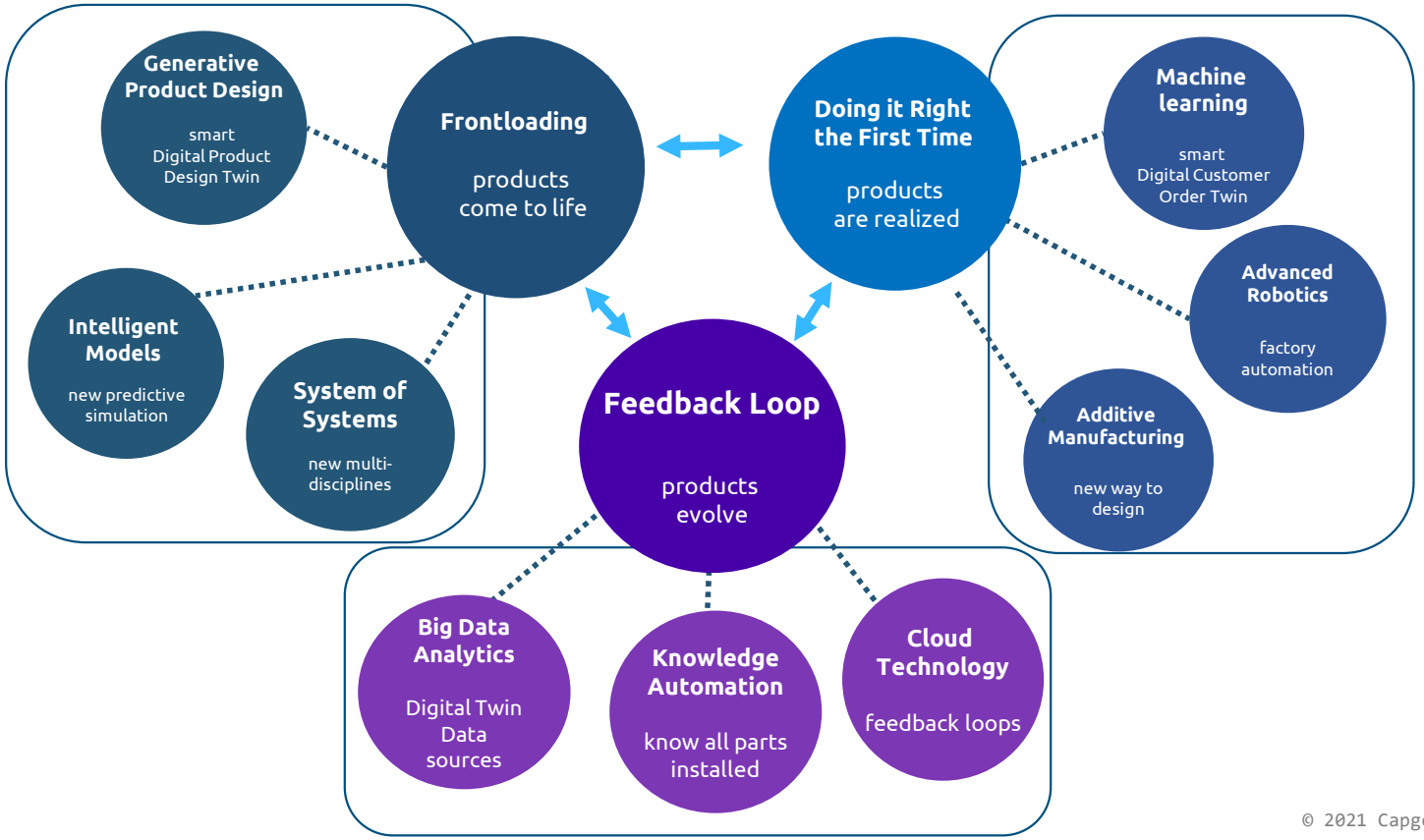
- Digital mockup tools
- Engineering Simulation tools
- Configuration management

- Data capture and transfer
- Integration of planning tools
- Manufacturing Simulation tools
- Configuration Management
- Virtual Build

- Artificial Intelligence and Machine Learning
- Data federation
- Prescription Process management
- New services

BUILDING BLOCKS OF DIGITAL TWIN

Technologies that contribute Digital twin building blocks



How to realize the full value potential of digital twins

Starting point :

Ensure proper executive sponsorship and commitment on heavy investment required
(hard & soft costs incl. money, people, time, equipment)

Envision & establish a list of scenarios that could benefit from having a digital twin
The product / systems *shall be valuable enough for the enterprise to invest in building a digital Twin*

Critical Drivers for success :

Quality, availability and interoperability

Modern architecture with fit for purpose business solutions

Transformation of existing roles & creation of new ones

Communication, collaborative expert platform in extended enterprise

DEPLOYMENT

Typical Roadmap for Digital Twin use case journey

BUSINESS TARGET	SET - UP	DESIGN	IMPLEMENT	OPERATE
up to 1 month	*up to 2 months*	*up to 2 months*	*up to 5 months*	*up to 3 months*
OUR RECOMMENDATIONS				
1 **Validation organizational targets for implementation**	2 **Assessment of actual model, prepare roadmap, set-up collaborative governance**	3 **Designing organizational business processes and solution architecture**	4 **Testing and evaluating solutions, transfer to industrial operate**	5 **Digital Twin Services continuous improvement**

CRITICAL PATH (DRIVERS FOR SUCCESS):

Communication activities:

- Align stakeholders (sponsors, process owners, end users etc..) in order to tackle pain points / needs and to align it with enterprise level vision

Rationalization of IT environment:

- Reinforce collaborative way of working
- Capitalize and adhere IT tools in agnostic way
- IT Assessment phase, to gain 40% of time and provide scenarios of budget optimization

Interoperability & data quality:

- Holistic approach in Architecture design
- Reinforcement of data inputs process
- Data Qualification focus
- Strong engagement of Data Officers

Ontology & Value validation:

- In order to faster connect DT solutions into user end tools, ontology process should be run in parallel
- Economic Stewardship activity reinforcement to validate or evaluate features

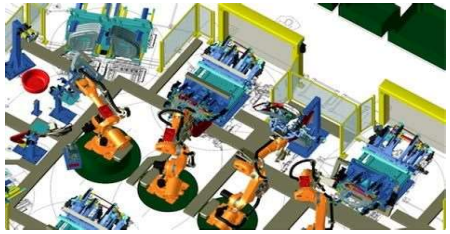
Collaborative Experts Platform:

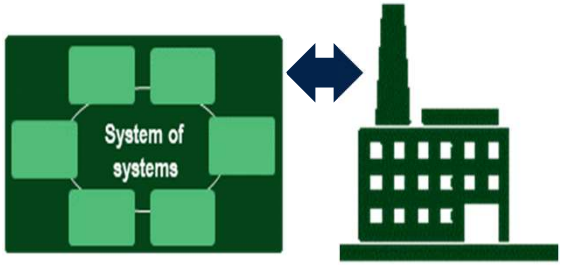
- Constantly enrich and improve DT models by experts' inputs
- Capture Value evaluation in order to Scale Up from operational to strategic level

From

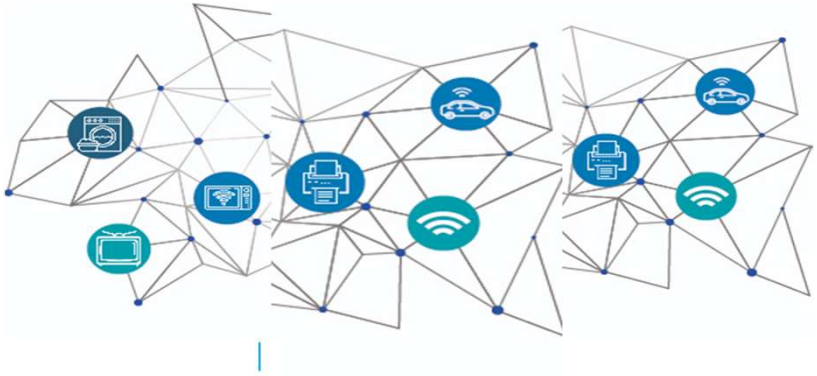
IoT to IoT

From connected product to connected product/process & plant and services

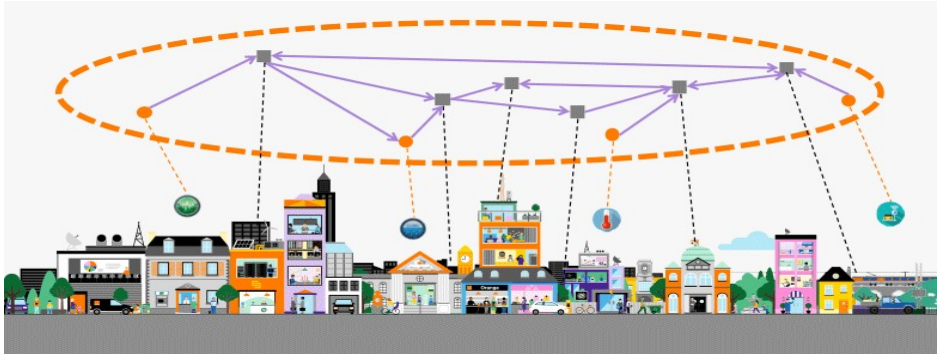




Internet of Things



Internet of Twins



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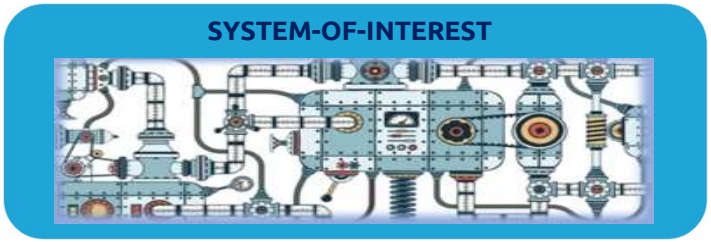

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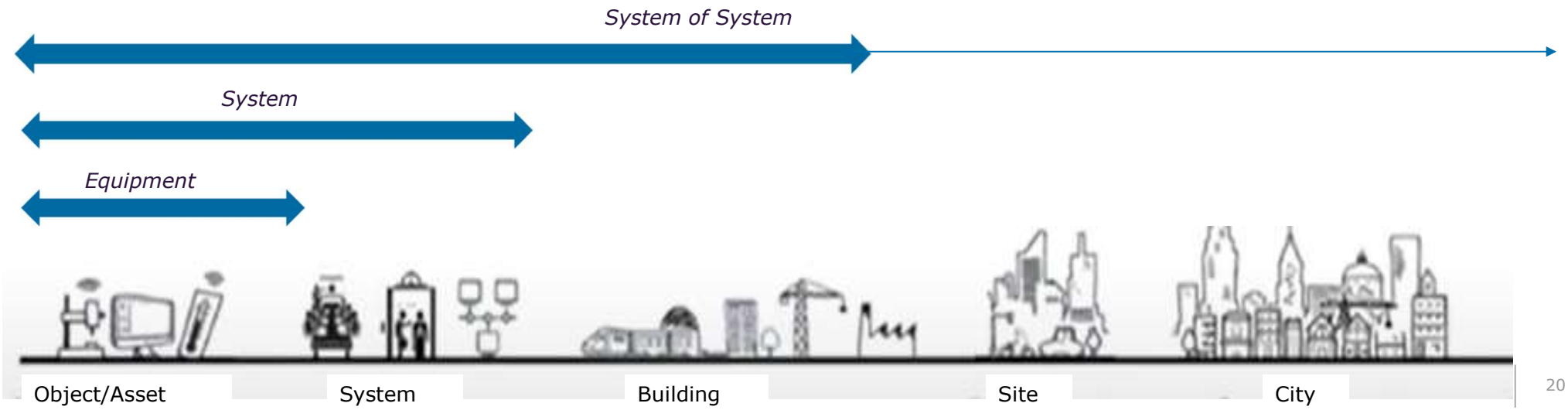
TIME **SPACE/SIZE/CONTEXT** **REPRESENTATION**



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