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Life Cycle Modelling: Examples of DT Usage in Design, Production and Operations

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## Some Basic Concepts

There are many definitions of Digital Twin. For our purposes, we use a very simple and common one

*A DT is a digital replica of a set of physical assets, systems or processes  
that allows to monitor, analyze and optimize their performances in real-time*

We learn very basic, but important, concepts from this definition:

- “Digital Twin” is not just about modeling physical objects: we are interested in how those objects interact (system view) and how they carry on business-related activities (process view)
- Our objective is not limited to make sure that the «actual twin» is working fine, but we aim to improve and evolve it
  - We are not only interested to as-is, but we focus to to-be (design) and
  - We take care of what happens during the transformation

A new «view» comes out, the life-cycle view → we expect our DT to support us along the whole life cycle



## Some Basic Concepts

Digital Twin is not one software. You cannot go on the market and buy a “Digital Twin”

The Digital Twin is the way you arrange (a part of) your digital assets to be compliant with the principles stated in the previous slide

Noone starts a Twin from scratch (well, nearly no one). A Digital Twin is usually the result of a Program that takes your existing legacy data and applications, transform and integrates them to satisfy the Digital Twin principles

There is another important principle that is hidden, but of capital importance, in what stated above: to be effective, open to multiple stakeholders, durable in time a Digital Twin MUST be based on open data formats





## DT as an Integrator

We found out that a Digital Twin is, first of all, an integrator

→ quite straightforwardly: integrates different objects, different data, different technologies

→ less trivially: integrates different views of the «actual twin», its present and future (and past), different stakeholders and their legitimate interests

...and (moreover)

→ the Digital Twin must offer to each stakeholder the view(s) better suited to his role and interests





## Stakeholders

Who are the stakeholders in a port environment?

There are dozens...but let's keep a high-level view and we limit ourselves to:

- The Port Authority
- The Terminal Operators
- Port Users
- The (surrounding) community

Each of them should have its dedicated view(s) in the Twin in order to interact with the “actual” Port

But let's drill down to you, the Port Authorities...





## What Is Needed by a Port Authority?

What are the roles and interests (and duties) of a Port Authority?

Again, dozens, but once again let's limit ourself to:

- Maintain the Port facilities
- Ensure safety and security (physical, cyber, environmental)
- Define the Port evolution strategy and implement it
- Guarantee and balance the interests of all the other stakeholders

So, while you're **Operating** the Port you're **Designing** its future and **Produce** its evolution

...and here we are: you (the Port Authority) must have your **life-cycle view** in the DT





## Elements of the Life-cycle View for a Port Authority

In the next presentations we will show you some state-of-the art technologies and applications that concur in realizing the life-cycle view of a Digital Twin

For schedule tightness we had to choose just a few, the more significative, examples. But many more are available to cover:

- Operations (sensor monitoring, change detection, field operations, impact analysis, ...)
- Production (building site monitoring, environmental risk management, work progress detection, interference management, ...)
- Design (survey, modelling, planning, ...)

The true added value is having an integrated, life-cycle view, of all those puzzle pieces, plus the time dimension





## The Core Integrating Technologies

A Port is a complex, large **territorial infrastructure** (in x, y, z including subsoil and underwater)

GIS and BIM are thus the basic, underlying, integration technologies at the very core of a DT

Those technologies

- allow to represent heterogenous data on the common ground of “infrastructures laid on a territory”
- are capable to extract the added value hidden in the data “territorial-infrastructure relations”
- multiply data effectiveness thanks to algorithms and AI





## From Theory to Practice

The next presentations will give you real examples of DT applications in all the three stages of the life-cycle view

- Imagery
- Drone & AI
- Site environment management (Production)
- Unleash CAD files content toward BIM and GIS
- The Port of SINES Nexus project
- DT supporting naval operations

You will find out how GIS and/or BIM are the constant, underlying technologies



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