

INTELLIGENT ASSET MANAGEMENT FOR OPERATION AND MAINTENANCE BY USING DIGITAL TWIN OF RAILWAY SYSTEM

Rail Infrastructure Asset Management Summit

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AIM!

MAKING A RAILWAY SYSTEM DIGITAL TWIN FOR INTELLIGENT ASSET MANAGEMENT



**Digital twin for railway
asset management.**

1

STEP 1

Setting the requirements to make a digital twin of railway system for operation and maintenance sectors.

2

STEP 2

Architecture of infrastructure network's system digital twin, Making a skeleton of this digital twin and a data model.

3

STEP 3

Data acquisition from different sources and processing.

4

STEP 4

Data visualisation Dashboard for decision-making.

5

STEP 5

Use cases for asset management.

STEP 1

Setting the requirements to make a digital twin of railway system for operation and maintenance sectors.

AMBITION

- Have more train, which arrives on time and safe.
- Carry out asset management for our railway assets.

Design

+ Designers
+ Assets managers
Decide and design the works should be carry out on the infrastructure.

Build

+ Work company
+ Project Manager
Carry out the work to be done on the infrastructure.

Operating

+ Assets managers
+ Operators
+ Maintainers
Ensure system reliability and availability.

Maintenance

+ Assets managers
+ Maintainers
+ Operators
Ensure the maintenance of the railway network.

Short comparing to other phases

Relatively long

Too long

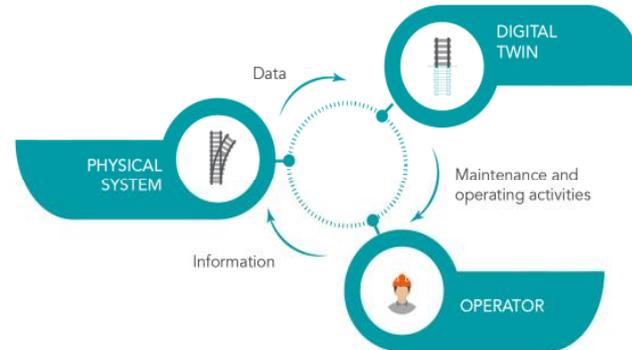
STEP 1 - 1

Setting the requirements to make a digital twin of railway system for operation and maintenance sectors.

DÉFINITION OF THE DIGITAL TWIN

A digital twin is a digital replica of a physical system that connects with railway infrastructure and working practices. Its input comes from the reference databases and sensors fitted in the infrastructure that serve to keep this data up-to-date in real time throughout the system lifecycle.

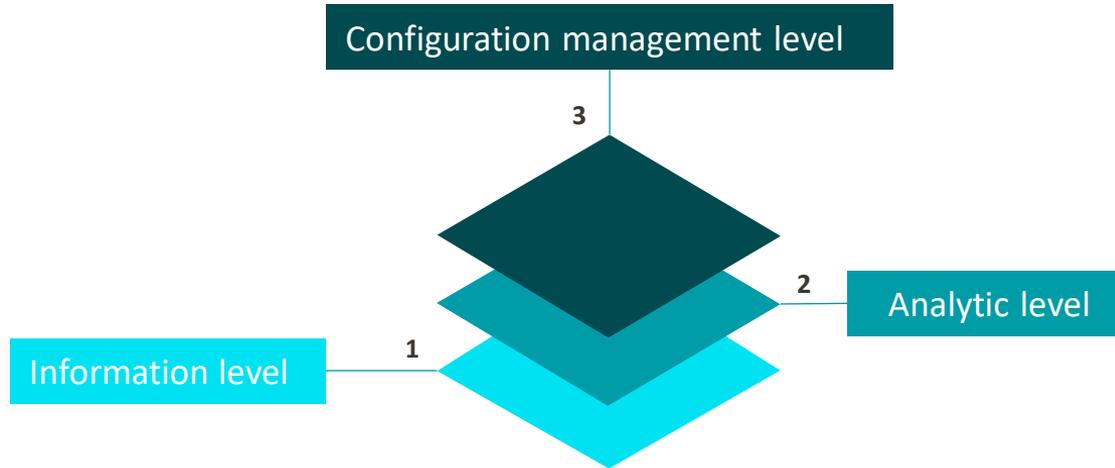
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Interaction between physical system, digital twin and operator.
aims to a global cyber physical system (CPS)

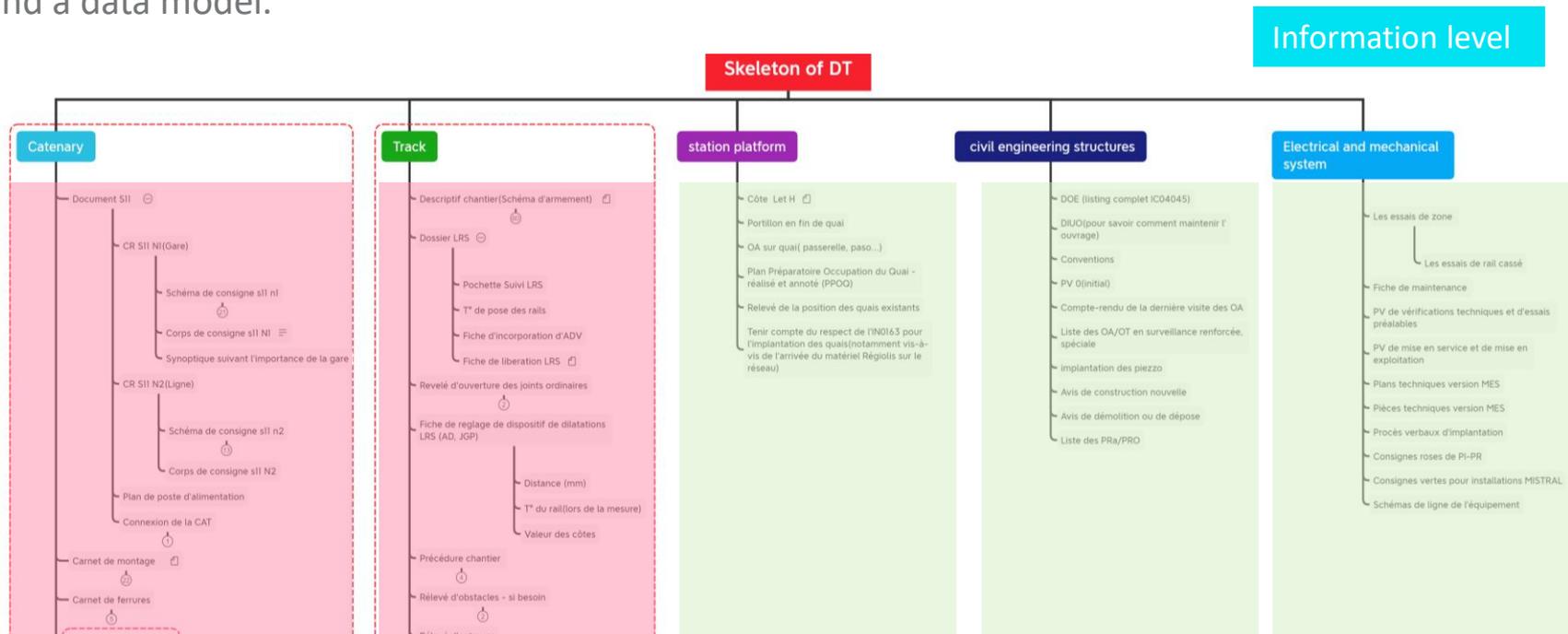
STEP 2

Architecture of infrastructure network's system digital twin, Making a skeleton of this digital twin and a data model.



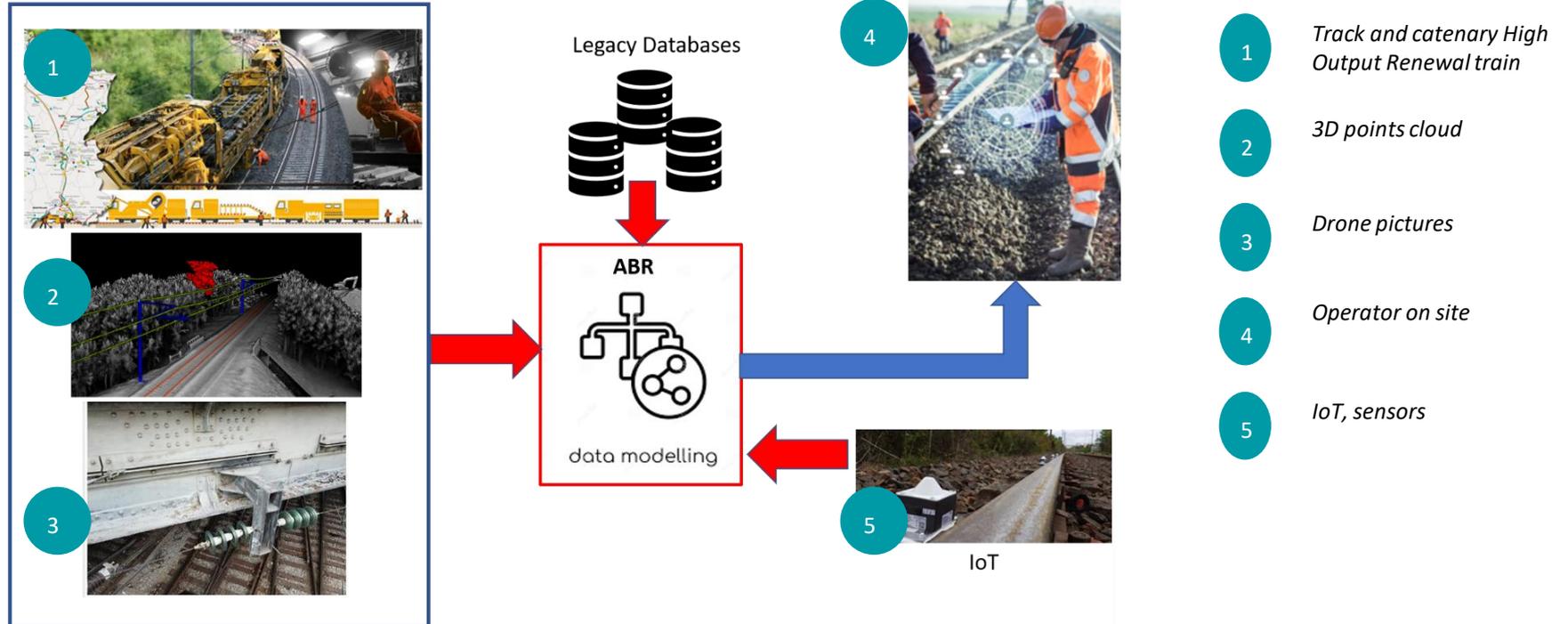
STEP 2 - 2

Architecture of infrastructure network's system digital twin, Making a **skeleton** of this digital twin and a data model.



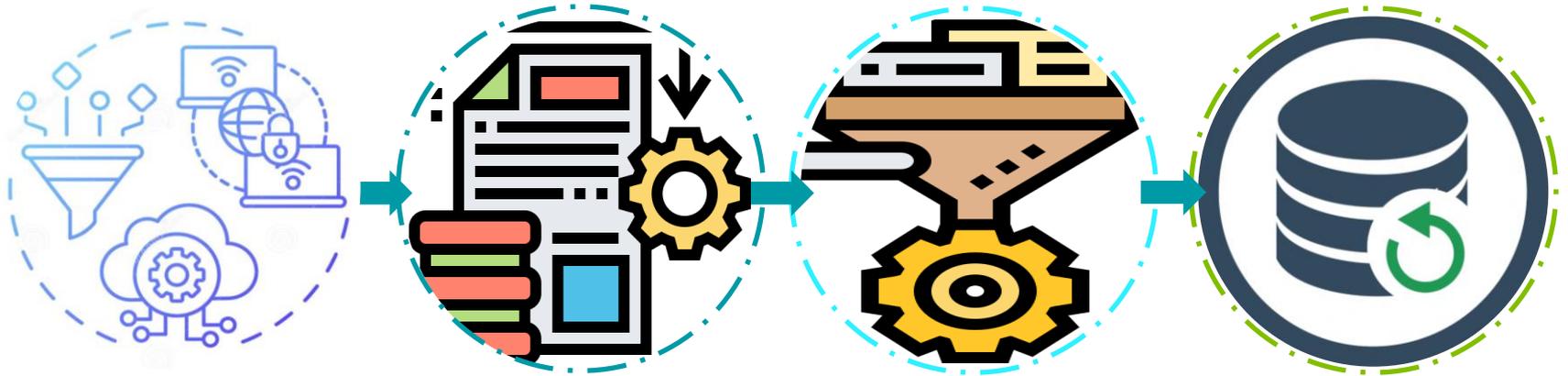
STEP 3

Data acquisition from **different sources** and processing.



STEP 3 - 1

Data acquisition from different sources and **processing**.



Data collection

Collecting different information from different data sources.

Structuring data

Organize data for easier processing.

Processing data

Extract information from raw structured data.

Updating databases

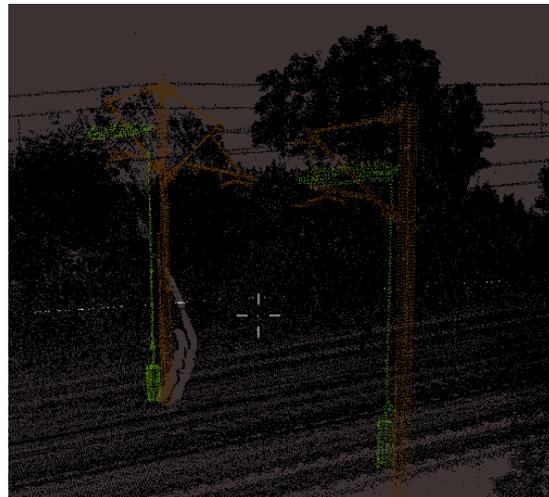
Update the digital twin databases.

STEP 3 - 2

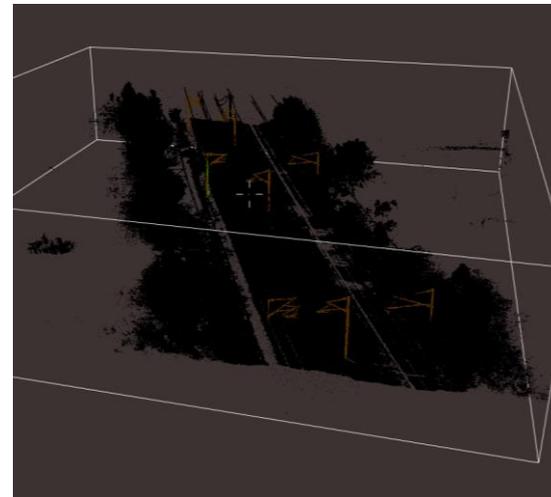
Data acquisition from different sources and **processing**.



Interrupting device



Tensioning equipment



Catenary pole

Example of 3D point cloud data processing

Deep Learning for Object Detection in Point Clouds

STEP 4

Data visualisation Dashboard for decision-making.

The dashboard is divided into several functional areas:

- Geoservices:** A top navigation bar with a 'Geoservices' button.
- Project Information:** A section for 'Acciona' with a link to 'Voir la fiche projet'.
- Données disponibles:** A section with '2D' selected and '3D' deselected.
- Recherche:** A search bar with a list of data layers including 'Panoramas', 'Nuages de Points', 'nuage', 'lobeznos', 'Cartographie', 'ortho lobeznos', 'dtm lobeznos', 'dsm lobeznos', and 'Éléments Vectoriels'.
- Télécharger des données / Téléverser des données:** Buttons for data upload and download.
- Analysis tools:** A central map area with a 'Cartographical interface' label.
- Project name:** A label for the current project.
- 2D/3D visualisation:** A label for the map's current state.
- Available data:** A label for the data layers available in the project.
- Upload and download:** A label for the data management buttons.
- Measurement tools:** A toolbar on the right side of the map.
- Image Gallery:** A panel on the right showing a list of images (1887 total, 2 selected) with thumbnails and search options.
- 3D View:** A top-right inset showing a 3D perspective view of the railway tracks.
- 3D Data List:** A panel on the left of the 3D view listing 'Support' items with IDs like 'Support 6 04a 6 04k'.

STEP 5

Use cases for asset management.

Asset Management covers all the activities of an organization which contribute to **optimize the risks, the costs, and the performances of physical assets**, regarding its strategic and business objectives.

The asset manager, based on the digital twin updated may have several possible services depending on its needs.

STEP 5

Use cases for asset management.

Data collection



Data structuring



Data processing



Update the DT



Before work

During work

After work

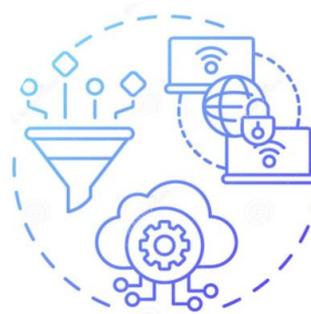
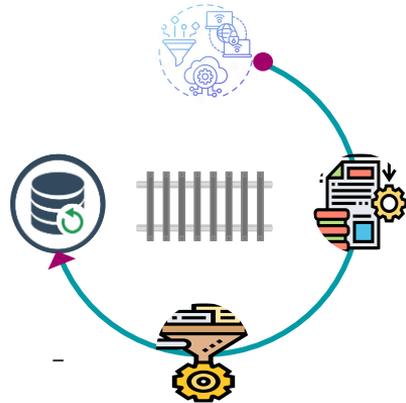


AS IS

AS Build

DT for IAM

The asset manager can see all new changes after construction and compare them with what was designed at the beginning.



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