Capgemini

Reflect**IoD**

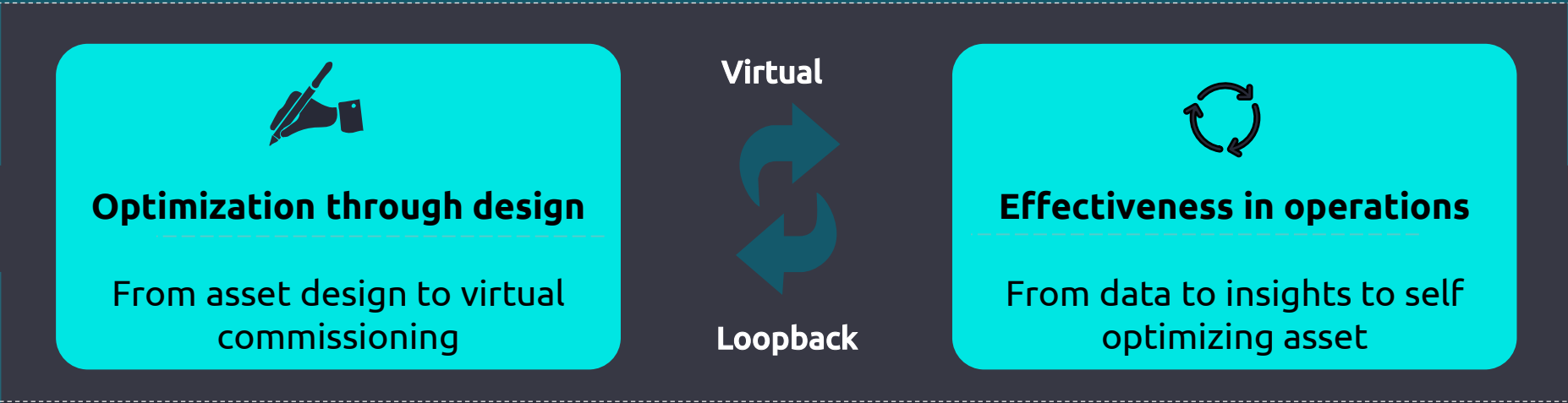Digital Twin for augmented asset operation

2022

Reflect**IoD**

ASSET PERFORMANCE: OPTIMIZATION THROUGH DESIGN AND EFFECTIVENESS IN OPERATIONS WILL DRIVE BENEFITS EQUALLY OVER TIME

Hybrid capabilities and collaborations as close to the ground and the events

Optimization through design

From asset design to virtual commissioning

Virtual

Loopback

Effectiveness in operations

From data to insights to self optimizing asset

Digital platforms and IT-OT convergence to ensure digital continuity and fuel extended collaborations

ASSET MANAGEMENT: ASSET TWINS MUST ADDRESS DIFFERENT NEEDS PER LIFE CYCLE STAGE

	Key Characteristics	Business Issues	Digital Twin value	Digital Twin backbone
Existing assets	Life-time: 20 -70 years Extended operate ecosystem	Output optimization High availability /flexibility TCO optimization	Asset single source of truth Data-centric collaboration Monitor Predict Simulate	Data from multiple sources + **Digital Twin for operators** + PDM Features
New asset generation	Life-time : 25-100 years Design-build-operate Different ecosystems all along the life cycle	Time to operate TCO optimization Asset delivered with its twin	Digital collaboration and continuity all along the lifecycle Simulate Monitor Predict	Engineering tools + **PLM from design to virtual commissioning** + **Twin for operators, from hand-over to operations**

ASSET IN OPERATION : REMOVING SILOES TO FOSTER EFFECTIVENESS

INDUSTRIES	Smart Assets & Infrastructures	Smart Factories	Smart Buildings	Smart Cities & Territories

BUSINESS CHALLENGES

📈 INCREASE
- Workforce efficiency by 10%-30%
- Asset reliability by 10-20%
- Compliance to standard

📉 DECREASE
- Time to find the right data by 35%
- Handover time by 10%-30%
- Maintenance costs by 5-20%

LEGACY ISSUES

Assets produce a **lot of data**, at different times of their lifecycle, in different formats, by different actors, but the data is very often hosted in **IT silos**.
This prevents from **accessing** quickly the **right data** and having a **360° view** of the asset to optimize **operation** and **maintenance**.

SOLUTION

A **cloud–enabled Digital Twin** platform that :
- Integrates and **federates data** from all relevant sources - "hot" and "cold "data as well as descriptive and transactional data – whatever the format
- Offers **augmented** & **collaborative services** from handover to maintenance and asset performance optimization with an **intuitive UX/UI**
- **Ease integration** with other platforms (IoT, …) and is **scalable by design**
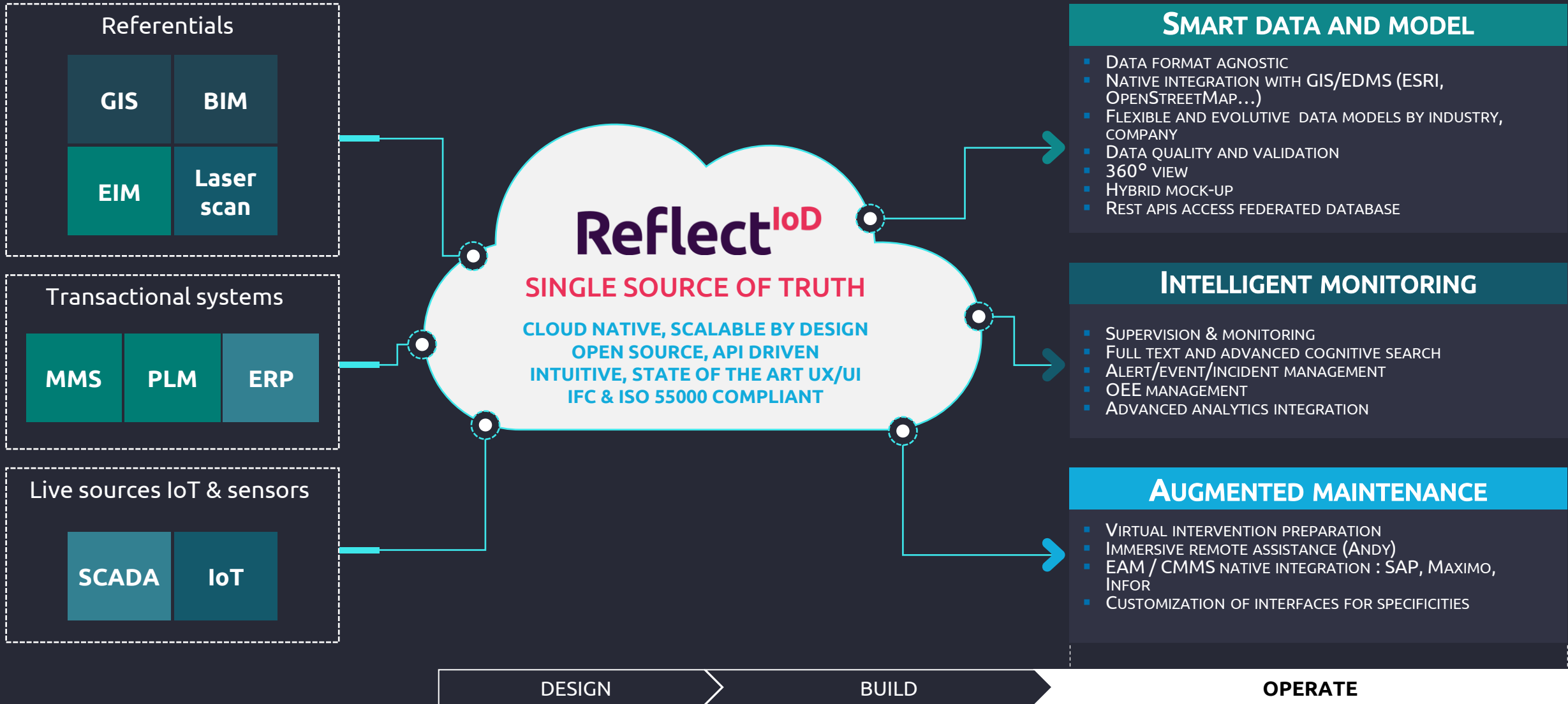
APPROACH

An **incremental use case and data-driven approach** delivering business value from the first months while avoiding fruitless studies and tunnel effects .
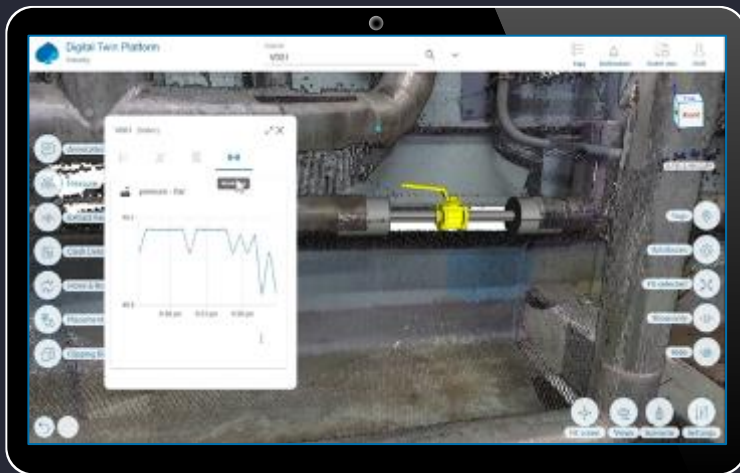
REFLECT[IOD] AT A GLANCE

A PLATFORM AGGREGATING DATA FROM MULTIPLES SOURCES TO BETTER MONITOR, PREDICT AND SIMULATE

Referentials

GIS	BIM
EIM	Laser scan

Transactional systems

MMS	PLM	ERP

Live sources IoT & sensors

SCADA	IoT

Reflect[IoD]

SINGLE SOURCE OF TRUTH

**CLOUD NATIVE, SCALABLE BY DESIGN
OPEN SOURCE, API DRIVEN
INTUITIVE, STATE OF THE ART UX/UI
IFC & ISO 55000 COMPLIANT**

SMART DATA AND MODEL

- Data format agnostic
- Native integration with GIS/EDMS (ESRI, OpenStreetMap…)
- Flexible and evolutive data models by industry, company
- Data quality and validation
- 360° view
- Hybrid mock-up
- Rest apis access federated database

INTELLIGENT MONITORING

- Supervision & monitoring
- Full text and advanced cognitive search
- Alert/event/incident management
- OEE management
- Advanced analytics integration

AUGMENTED MAINTENANCE

- Virtual intervention preparation
- Immersive remote assistance (Andy)
- EAM / CMMS native integration : SAP, Maximo, Infor
- Customization of interfaces for specificities
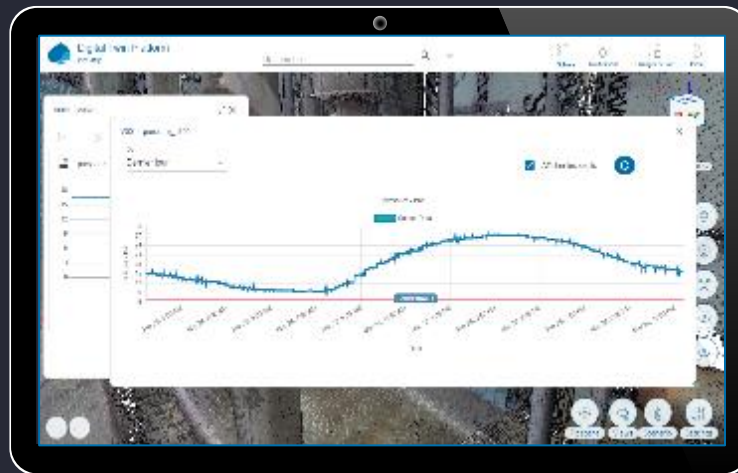
DESIGN ▷ BUILD ▷ **OPERATE**

REFLECT^{IOD} DEMONSTRATION VIDEO

Hypervision, Geographical integration, analytics

Hybrid 3D (BIM & Point Cloud)

IoT/Sensor values

Semantic searches

ASSET DIGITAL TWIN REFERENCES

CLIENT	ASSETS	BENEFITS	APPROACH
suez	60 sites managed Expansion in linear	Federation of data in a Digital Twin of infrastructures, for a better efficiency of operation and maintenance entities, and the creation of new services for managers and citizens.	Capgemini assisted Suez with their roadmap and the implementation of their Digital Twin program for water treatment facilities. The solution is provided as white-label
VEOLIA	2 stations	Digital Twin of the dangerous waste treatment facilities, to monitor and control the environmental impact compliance, and the operations efficiency.	Roadmap and prototype of the Digital Twin (Proof of Value): prioritization of use cases based on accessible data: 3D models, maintenance registers, simulation algorithms.
ALSTOM	Linear infrastructure network	Digital Twin roadmap (Proof of Value) and experimentation with Reflect^{IoD} for to validate Operations & Maintenance use-cases.	Roadmap and prototype of the Digital Twin (Proof of Value): prioritization of use cases based on accessible data: 3D models, maintenance systems, asset documentation. Main use case considered: augmented Supervision and Maintenance.
syctom	Waste treatment facilities	Digital twin of waste treatment facilities in the Paris region, to optimize operations and maintenance.	Roadmap and prototype of the Digital Twin (Proof of Value): prioritization of use cases based on accessible data: GIS data, maintenance systems, operational data. Main use case considered: optimisation of trucks flow vs. plant status.
T.EN TECHNIP ENERGIES	20 offshore sites	TechnipFMC deploys 3D construction methods to facilitate work packaging, construction monitoring and decision making through multiple data visualization on 3D models.	Capgemini industrialized the existing pilot application, defining the scalable and secure architecture for this Autodesk Forge-based application.

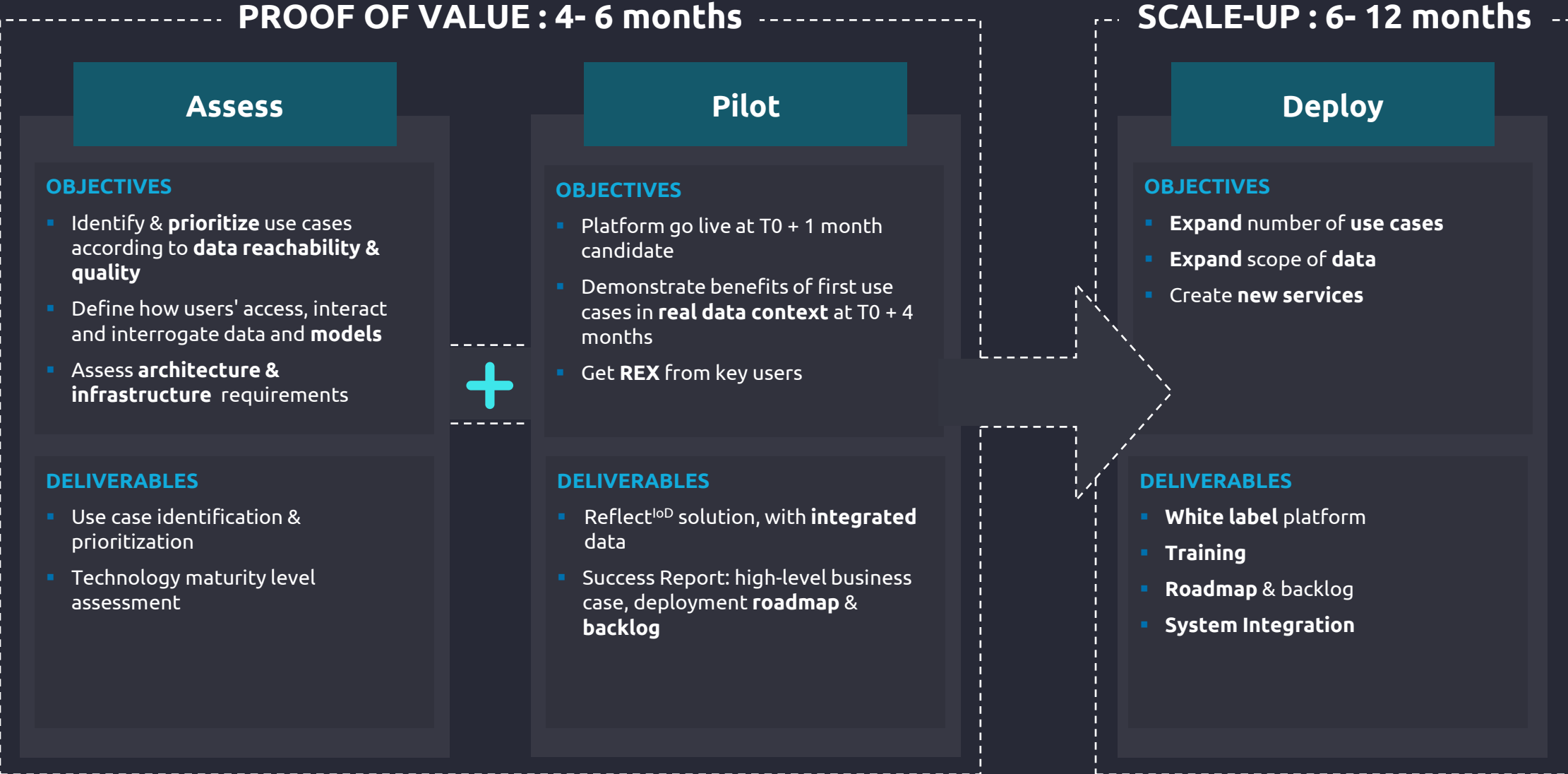# REFLECT IOD : TECHNOLOGICAL PARTNERSHIPS

Microsoft

- Native integration of Azure Digital Twin enabling Semantic Search and Colour Reports

- Integration of Power BI reports, visualization and bi-directional integration with 3D models

- Native integration of real-time video & audio Microsoft APIs

- Native Integration with Azure IoT based Capgemini's Plant Control Tower solution

AUTODESK

- Native integration of Forge APIs

- Develop custom features for tailored solutions, with a modular Forge capacity

- Integrate BIM360 in a broader IT landscape

AN INCREMENTAL DATA AND USE CASE DRIVEN APPROACH

PROOF OF VALUE : 4- 6 months

Assess

OBJECTIVES

- Identify & **prioritize** use cases according to **data reachability & quality**
- Define how users' access, interact and interrogate data and **models**
- Assess **architecture & infrastructure** requirements

DELIVERABLES

- Use case identification & prioritization
- Technology maturity level assessment

Pilot

OBJECTIVES

- Platform go live at T0 + 1 month candidate
- Demonstrate benefits of first use cases in **real data context** at T0 + 4 months
- Get **REX** from key users

DELIVERABLES

- Reflect^{IoD} solution, with **integrated** data
- Success Report: high-level business case, deployment **roadmap** & **backlog**

SCALE-UP : 6- 12 months

Deploy

OBJECTIVES

- **Expand** number of **use cases**
- **Expand** scope of **data**
- Create **new services**

DELIVERABLES

- **White label** platform
- **Training**
- **Roadmap** & backlog
- **System Integration**

YOUR SOLUTION

Foreground IP of the solution belongs to you

No recurring license fee but cloud and other specific subscriptions

Technology access fee after the pilot

3 years joint maintenance and support

TEAM

Global offer

Thomas PERPÈRE
Head of Reflect^{IoD}

Business development & industry 4.0
INSEAD graduate, 11 years abroad (US, China, UK)

Amine BOUZIR
Product Owner Reflect^{IoD}

9 y experience in Digital Asset Management
Build & Run of digital twin platforms

North America

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APPENDIX

Technical Architecture

Detailed Feature

PoV approach and deliverables

INTEGRATED DATA MODELS : MUST ADDRESS DIFFERENT NEEDS PER LIFE CYCLE STAGE

"GREENFIELD" + CENTRAL FUNCTIONS

- Site Management
- Requirements
- Configuration
- Virtual Commissioning

- Design and build ecosystem Portal
- Plant
- Product
- Process

- Enterprise Content Management
- HSE
- Security

Virtual commissioning

OPERATE

- Physical Commissioning
- Operate

As Is

SITE 3

SITE 2

SITE 1

| PLM Backbone : Efficiency by design

| From design to virtual commissioning

| Digital twin Backbone : Effectiveness in operations

| From hand-over to operations

TECHNICAL ARCHITECTURE

Authentication & Routing

Application gateway

API management

Azure AD B2C

Relect IoD Static Website

Availability Set

Proxy 1

Proxy 2

APIs

Asset API	Project API	Catalog API	File API
Forge API	User API	Search API	IoT API
Notification API		Media API	Import API

Cold sources import

File upload storage

1D
2D/3D
Media

Master process

COLD SOURCES

CAD
BIM
GIS
EAM
ASM
DMS

External services

OPEN CASCADE

A 3D Remote

SAP

GeoServer

IBM maximo

Modeling and Digital Twin

Azure Digital Twins

Audio & Video

Azure Media Services

Databases

Azure Cosmos DB

Azure Search

Azure Table

HOT SOURCES

IoT
Scada
Others

Hot sources import

Event hub

IoT Hub

Media stream

Iot Edge

Camera

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ReflectIoD

KEY FUNCTIONS

- Multiformat collection capability
- Configure your own data model and semantic
- Create your Digital Twin
- Hypervision & Monitoring
- Diagnosis & Resolution
- Prepare field interventions
- Alerts Management
- Immersive remote assistance integration

- Data Quality & Validation
- Data exposition
- Improved handover
- Commissioning
- Asset Revamping
- Hybrid mockup
- Virtual training enablement
- SAP integration
- 3D color reports
- IOT and OEE integration

MULTIFORMAT COLLECTION CAPABILITY

FLEXIBLE & EVOLUTIVE DATA MODEL
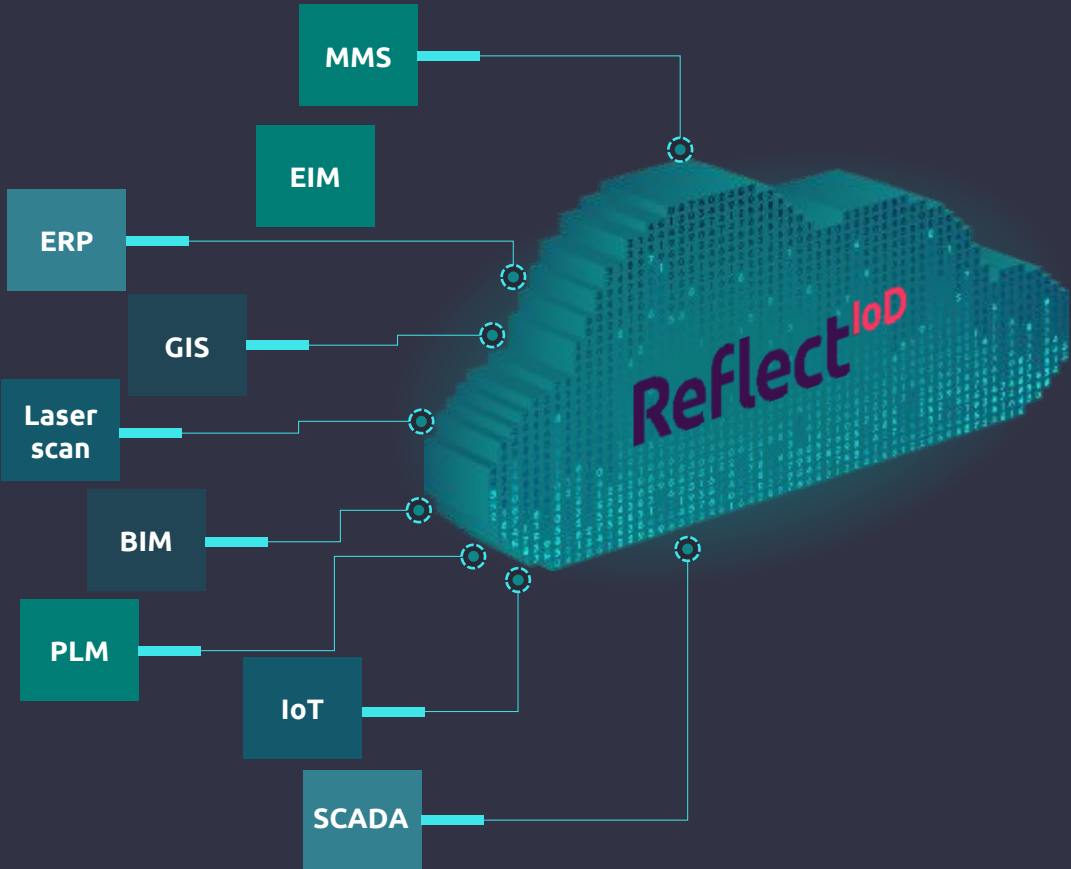
Data is **collected** from authoring and live source systems, whatever the **data formats**
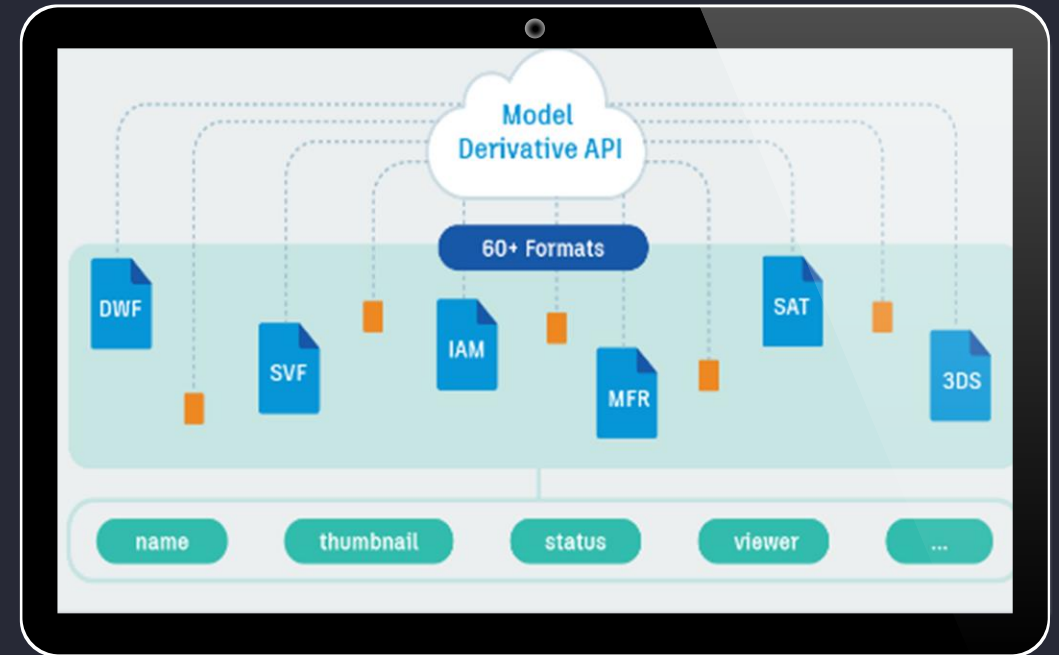
CONFIGURE YOUR OWN DATA MODEL AND SEMANTIC

FLEXIBLE & EVOLUTIVE DATA MODEL

MMS
EIM
ERP
GIS
Laser scan
BIM
PLM
IoT
SCADA
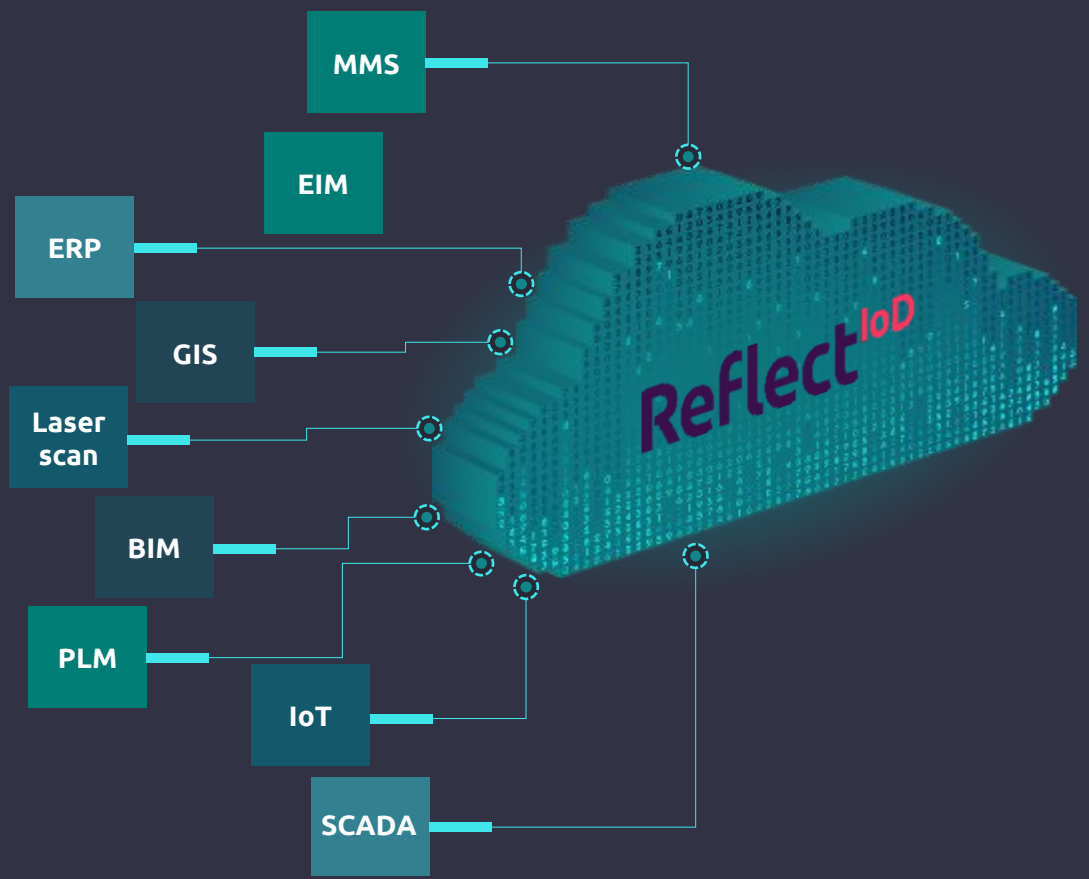
Reflect^{IoD}

Data is aggregated according to a flexible data model that represents the business semantic, leveraging graph database capabilities.

CREATE YOUR DIGITAL TWIN

FLEXIBLE & EVOLUTIVE DATA MODEL

MMS

EIM

ERP

GIS

Laser scan

BIM

PLM

IoT

SCADA
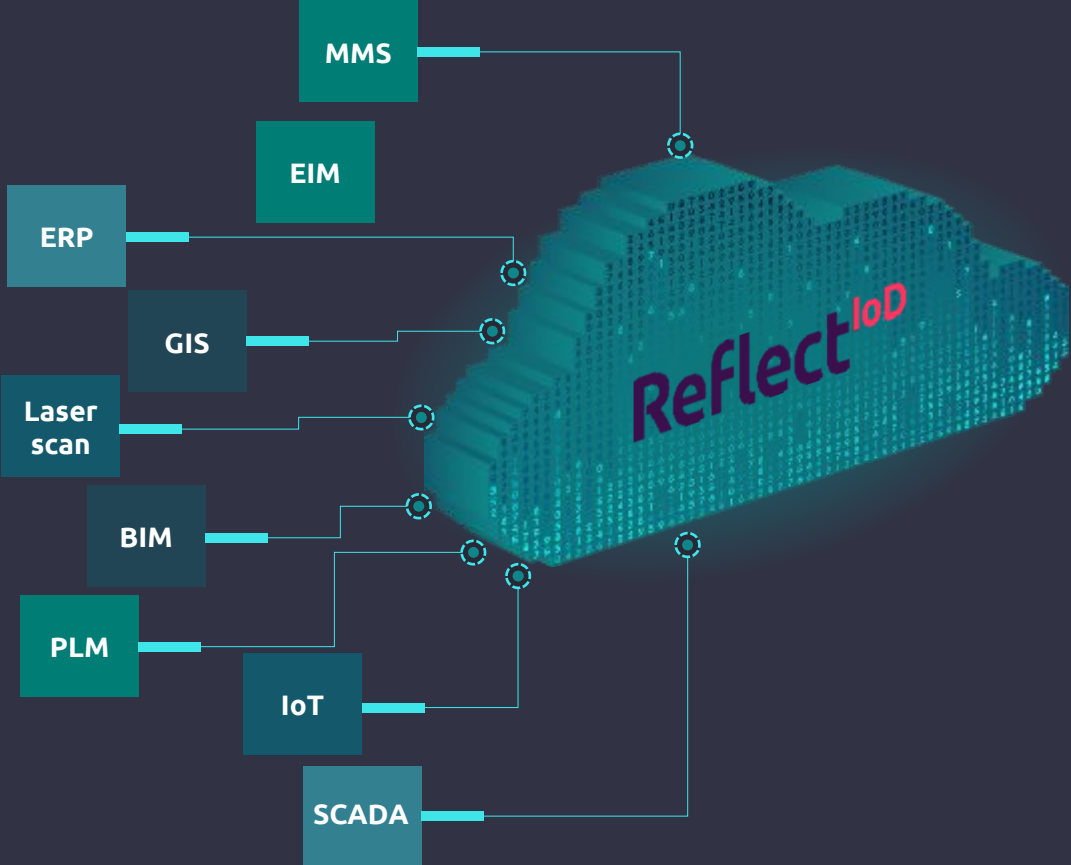
Reflect^IoD

ReflectIoD therefore creates the Single Source of Truth of your Buildings and Infrastructures : your Digital Twin.

HYPERVISION & MONITORING
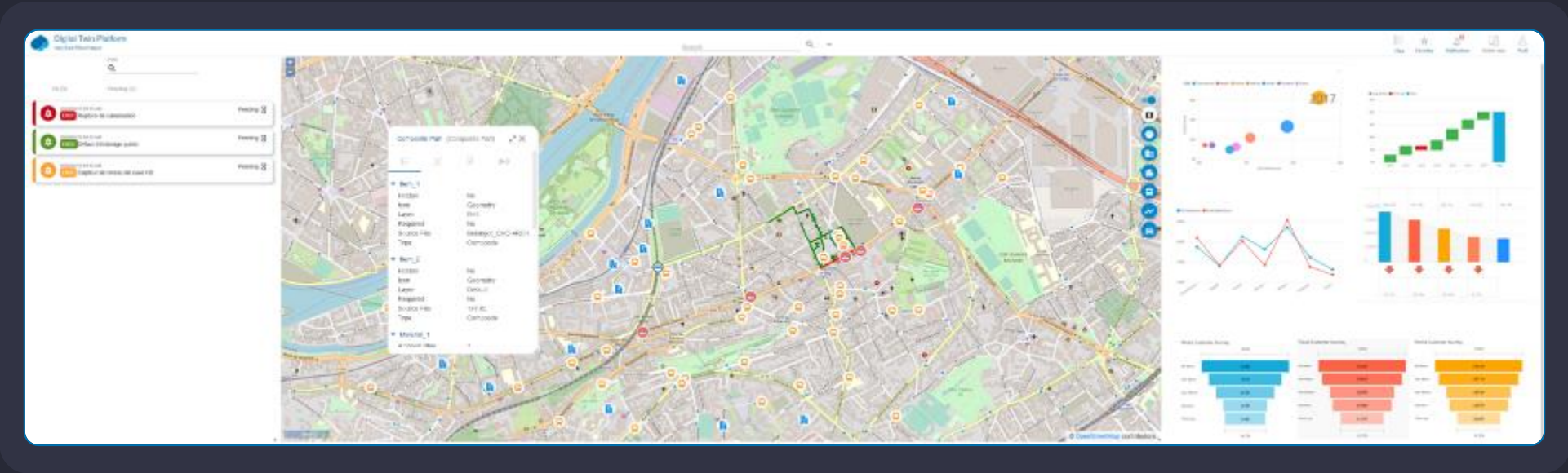
Hypervise the buildings, assets and territories, 360° view of their near real time status :

- Notifications and alerts on 2D / 3D views

- Split views 2D / 3D

- Event management with lifecycle and default operation procedures by event type

DIAGNOSIS & RESOLUTION

Enable automatic or manual pairing of IoT / sensors to equipment.

Define alerts on sensor values:

- Threshold conditions
- Simple rule engine conditions
- Machine learning
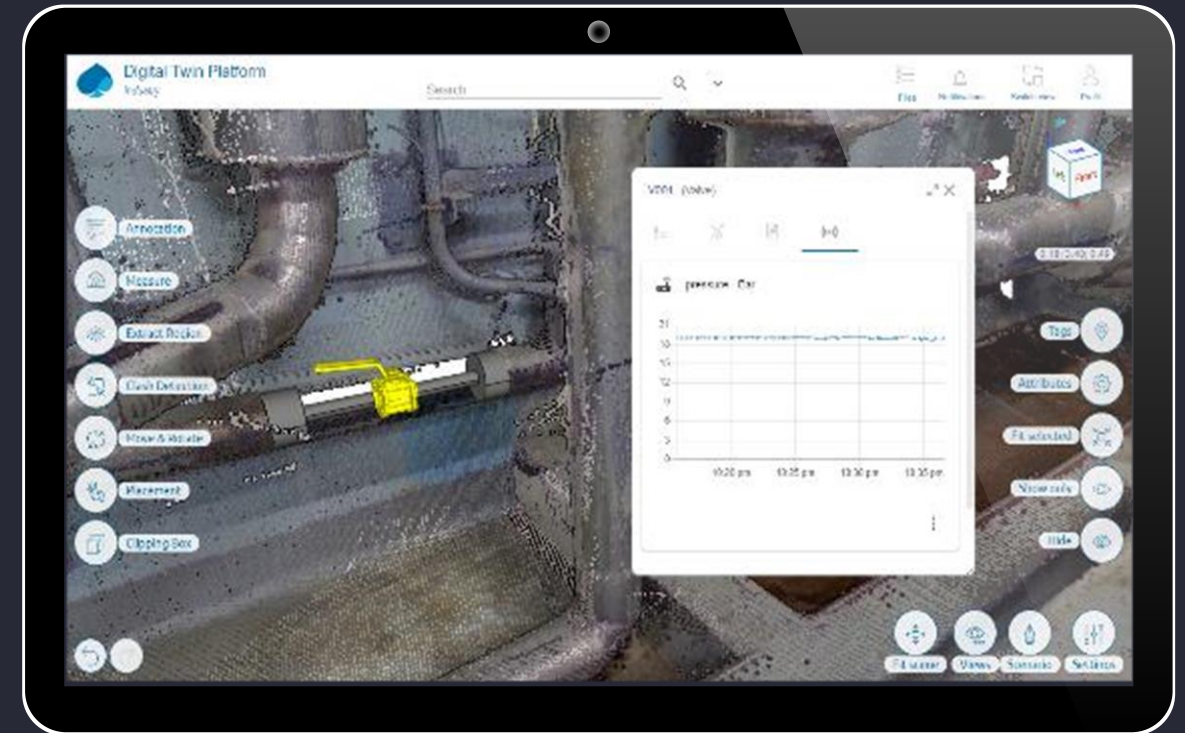
PREPARE FIELD INTERVENTIONS

Prepare an inspection in context, with 360° awareness of the asset history and live status.

Provide operator on the field with extended knowledge on past operations, asset reference data and behavior.
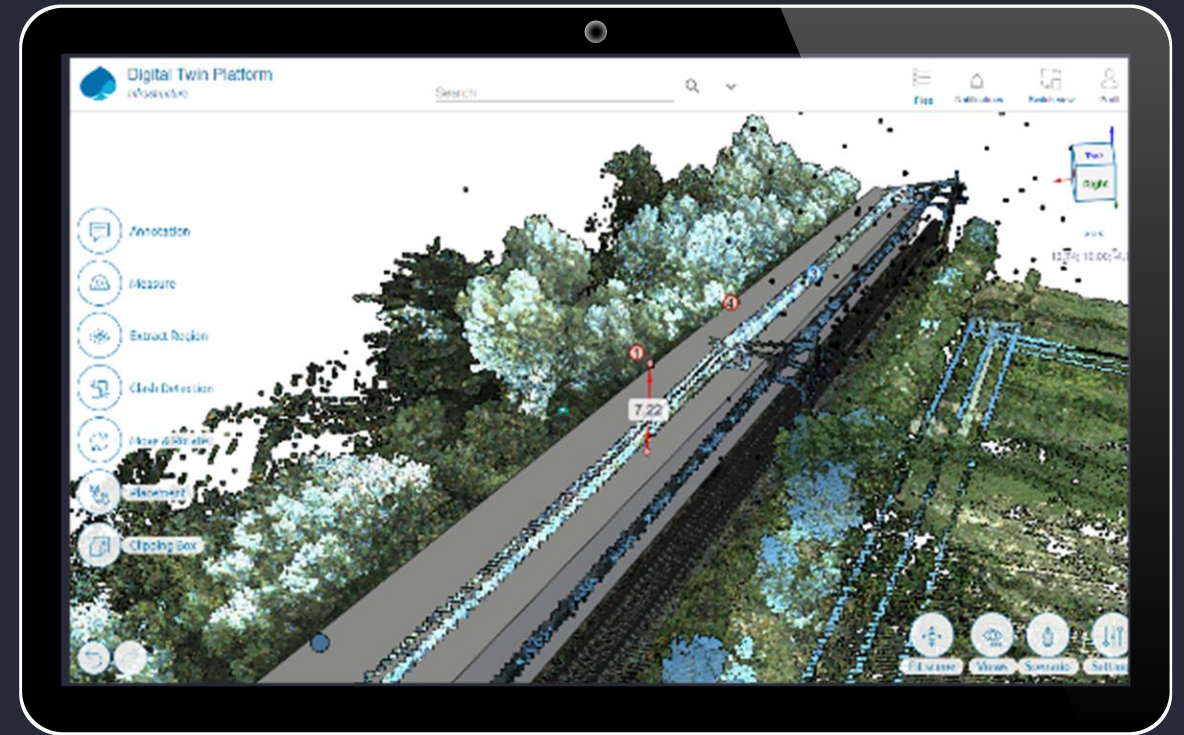
REMOTE ASSISTANCE

Remotely assist a field operator with augmented reality:

- Audio and video live stream
- Chat, digital twin data sharing
- Annotations on operator's or augmented reality tablet or glasses
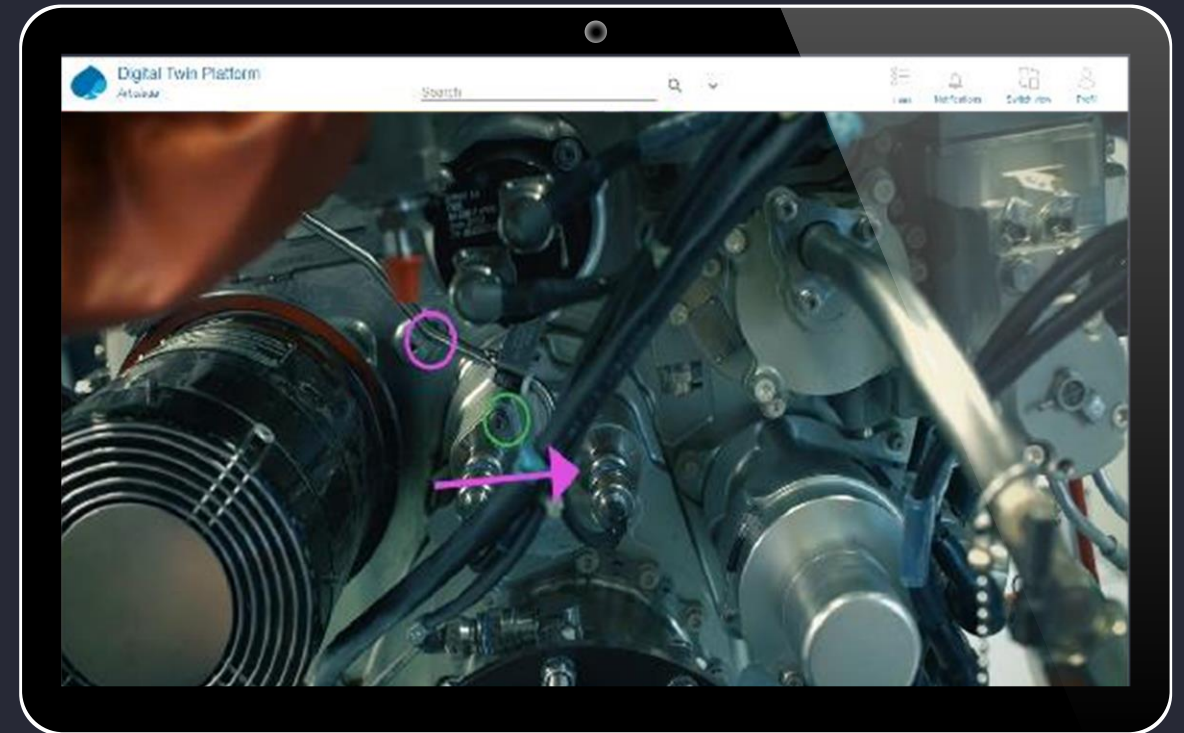
ALERTS MANAGEMENT

Display all the alerts in your asset and create events to manage its resolution workflow in Reflect IoD.

Alert
- Display an alert lists (date/time, asset, alert, description, criticity)
- Create an event attached to an alert and a tag
- Display Alert on 3D

Event
- Event type administration (procedure resolution creation)
- Event as a retractable panel

DATA QUALITY & VALIDATION
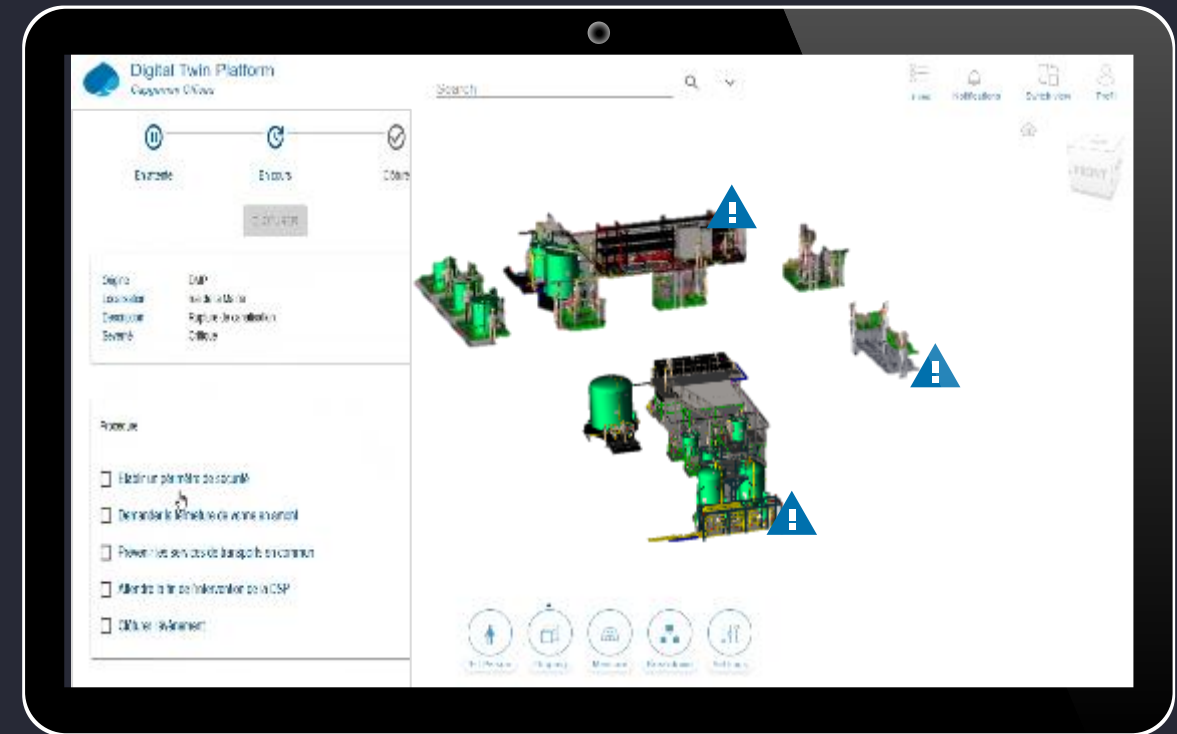
Controlling and improving Data Quality:

- Data quality dashboards

- Data consistency report

- Data Validation workflows

DATA EXPOSITION
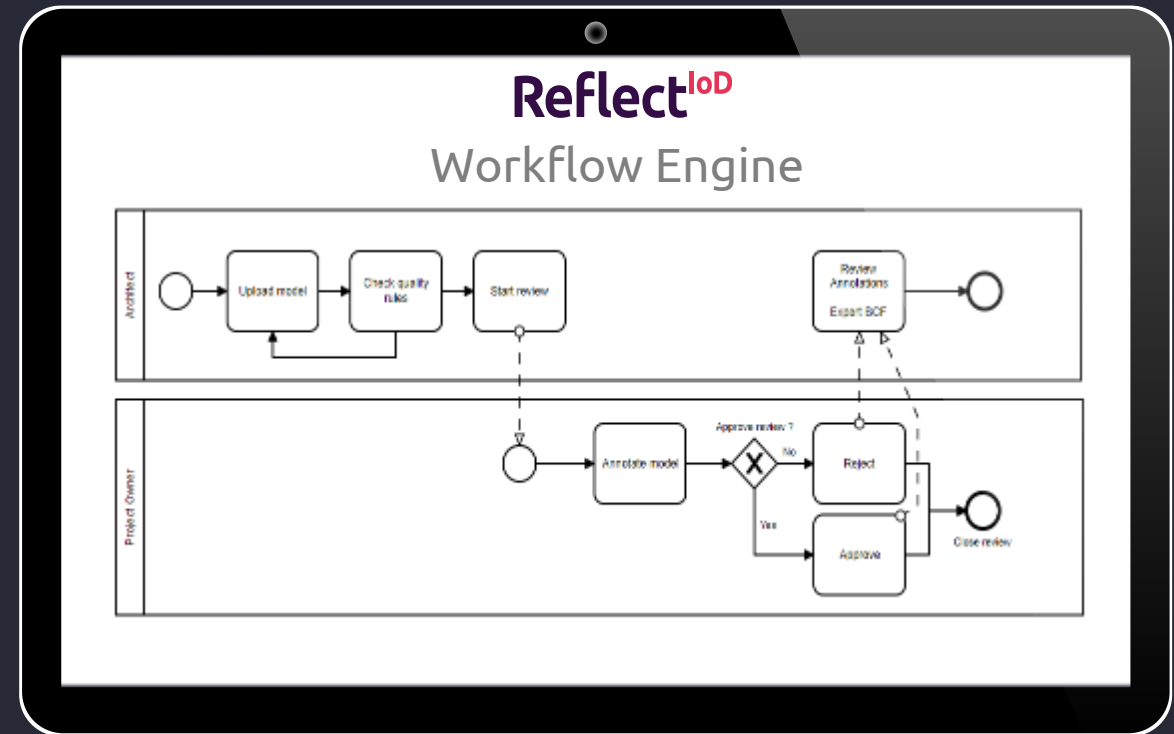
Data is exposed across the extended enterprise, with:

- Profile-based data segregations

- Multiple views and APIs

- Web and Mobile

- Full text and Semantic search
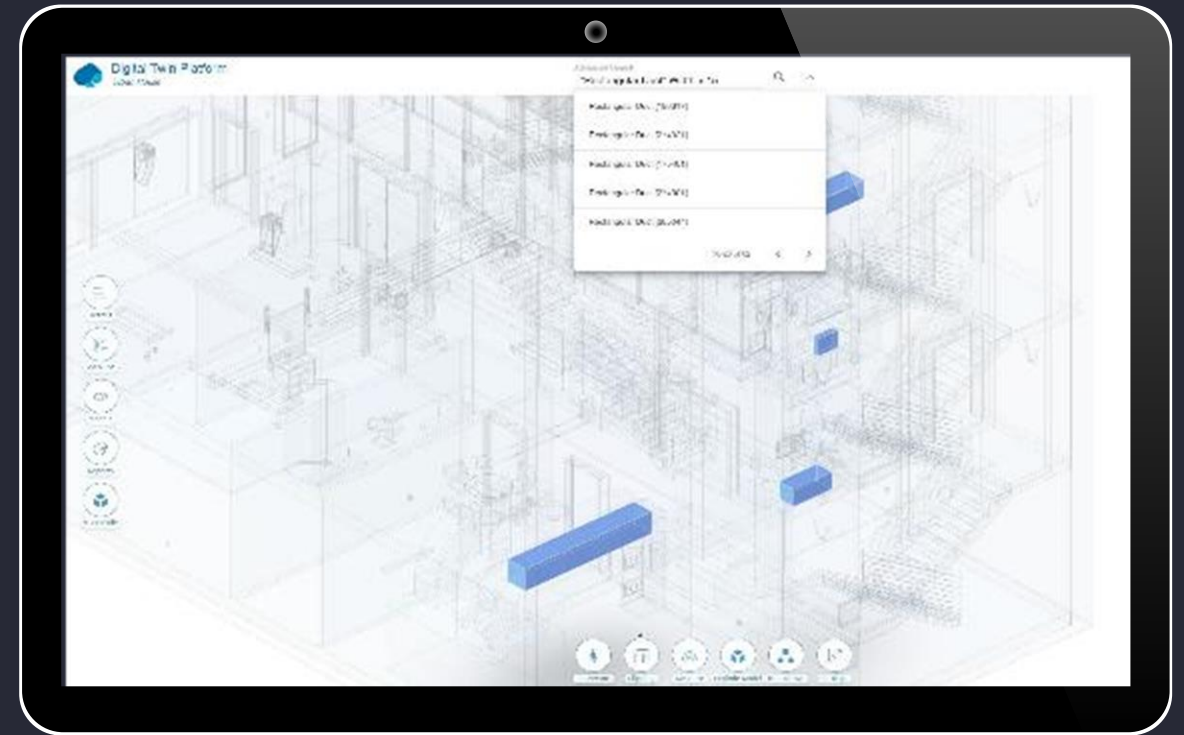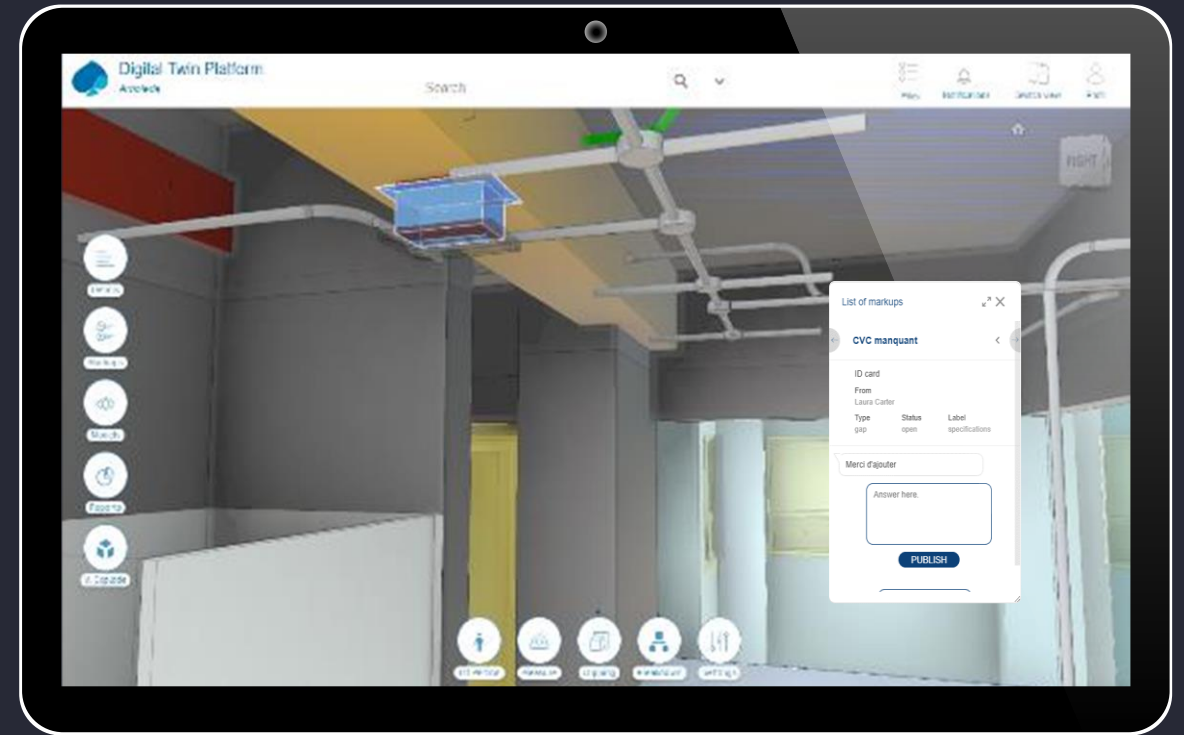
IMPROVED HANDOVER

Monitor asset data completeness during design & construction phases towards operation phase expectations.

COMMISSIONING

Report commissioning results from the field. Aggregate tests results and punch list to digital twin data for better traceability.

ASSET REVAMPING

Prepare or simulate a revamping or space planning in hybrid 3D with 360° awareness of the asset state and history:

- Measures distances & diameters

- Isolate / move cloud point regions

- Perform clash detection

- Access to maintenance history and live status (IoT)
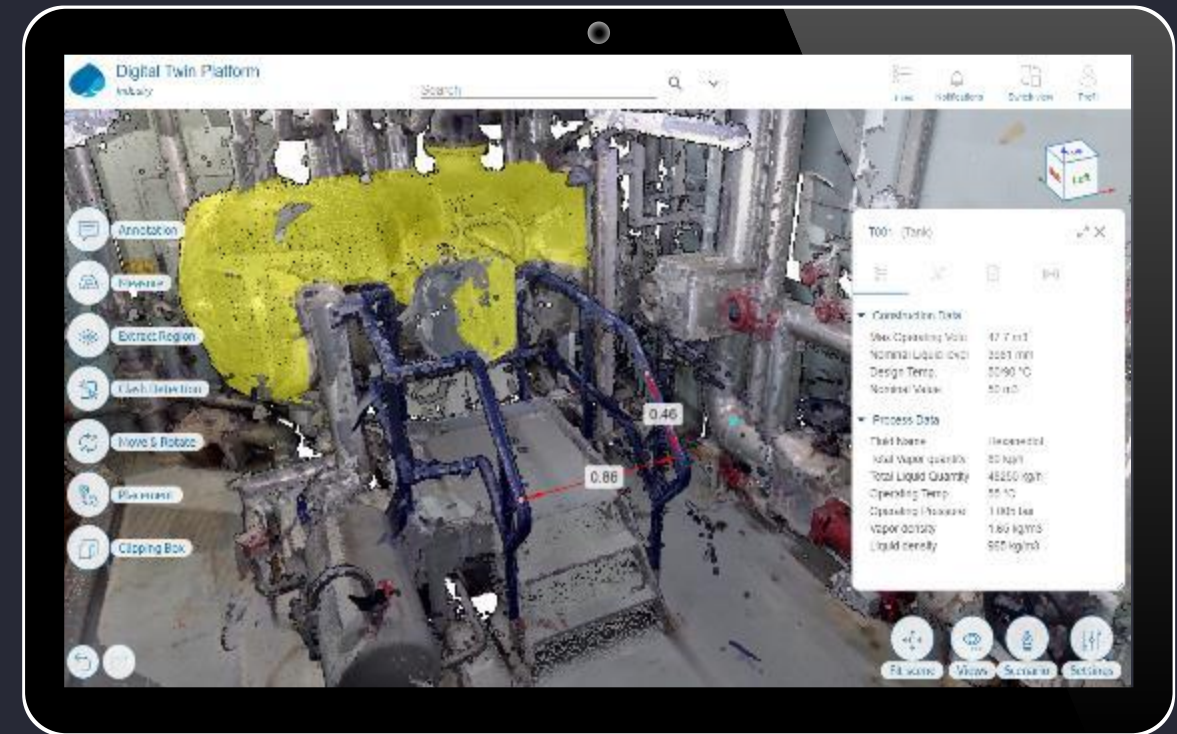
VIRTUAL TRAINING ENABLEMENT

Enable training on real asset data, with 360° asset awareness of past history data (Design, Built and Operation) completed by live status (IoT).

SAP INTEGRATION

- Switch from an asset selected in Reflect IoD to the SAP PM asset page

- Import Asset register from SAP Standard export

- Import WO history from SAP Standard export

Asset register

Work order history

Reflect IoD Db
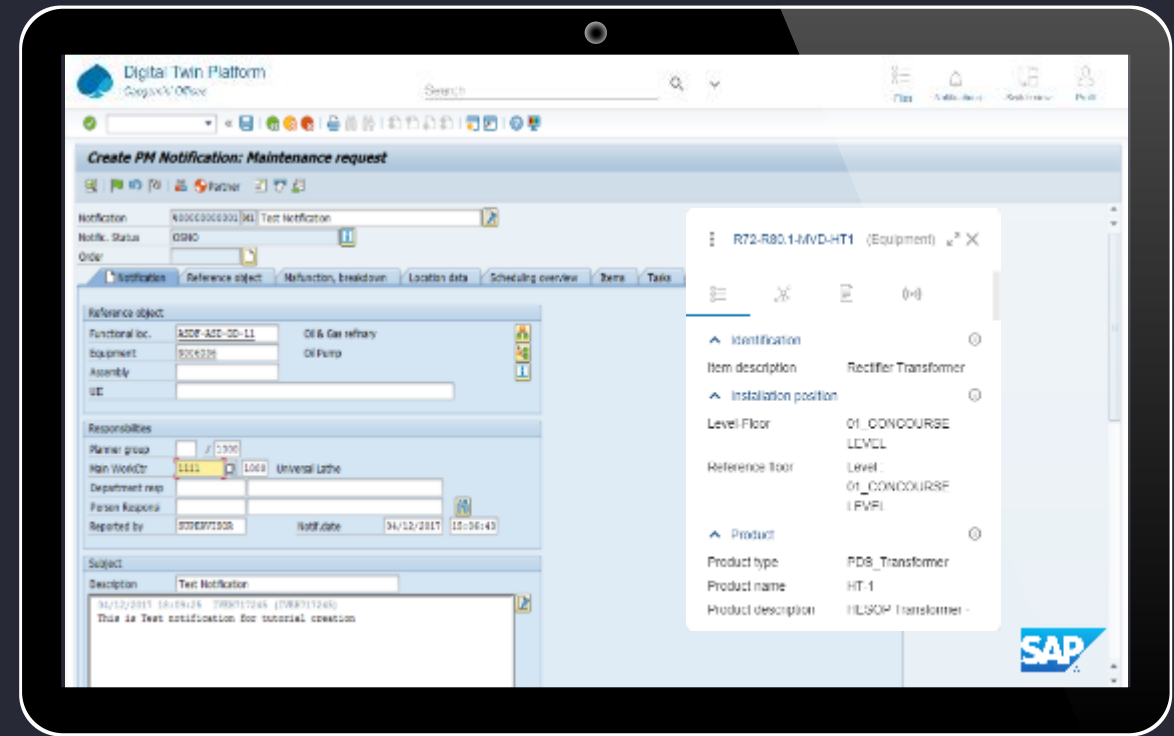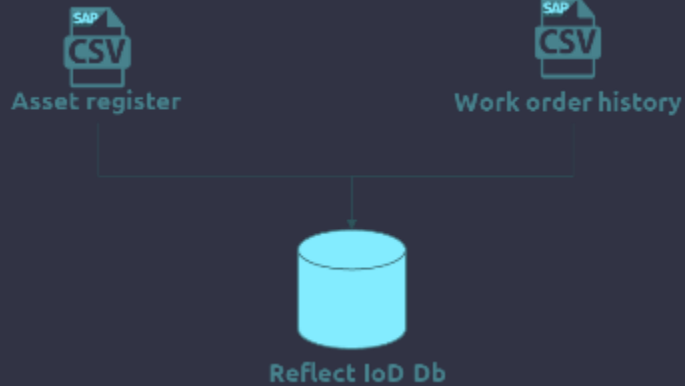
3D COLOR REPORTS

Use the semantic search capabilities on Azure Digital Twin to color the 3D model.
Color reports are transversal, shared by all users, only feature-autorized users can edit/delete.

- Create, define & edit color report (1)
- Apply color report on a 3D model (2)
- List tags on each report category (3)
- Hypervision mode to refresh 3D and tag list (4)
- Create an event associated to a tag (5)

IOT AND OEE INTEGRATION
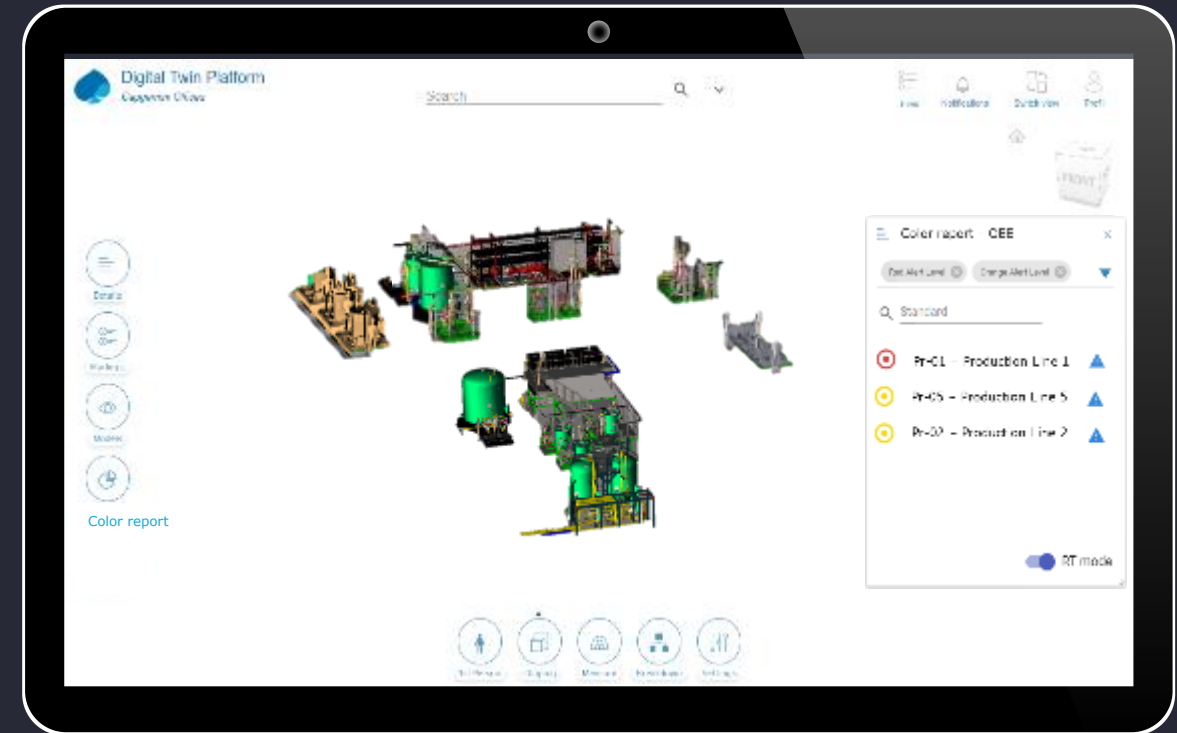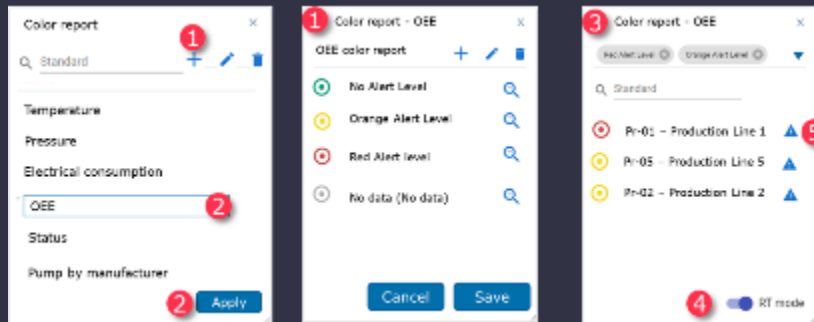
Create an integration with PCT and specific display for OEE and machine status storing the last updated value in Reflect IoD.

- Display OEE, Availability, Quality, Peformance value on 360 view (1)
- Display OEE, Availability, Quality, Performance historical value (2)
- Display Machine status on 360 view (3)
- Display floating value on 3D model (4)
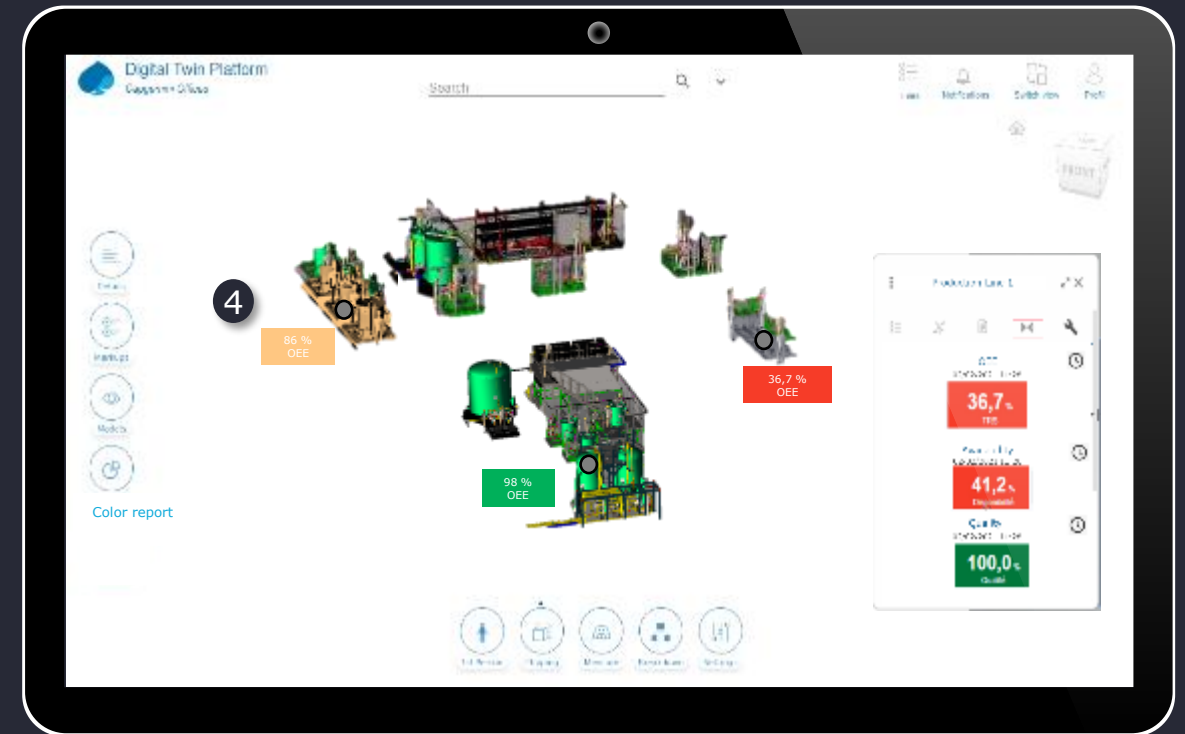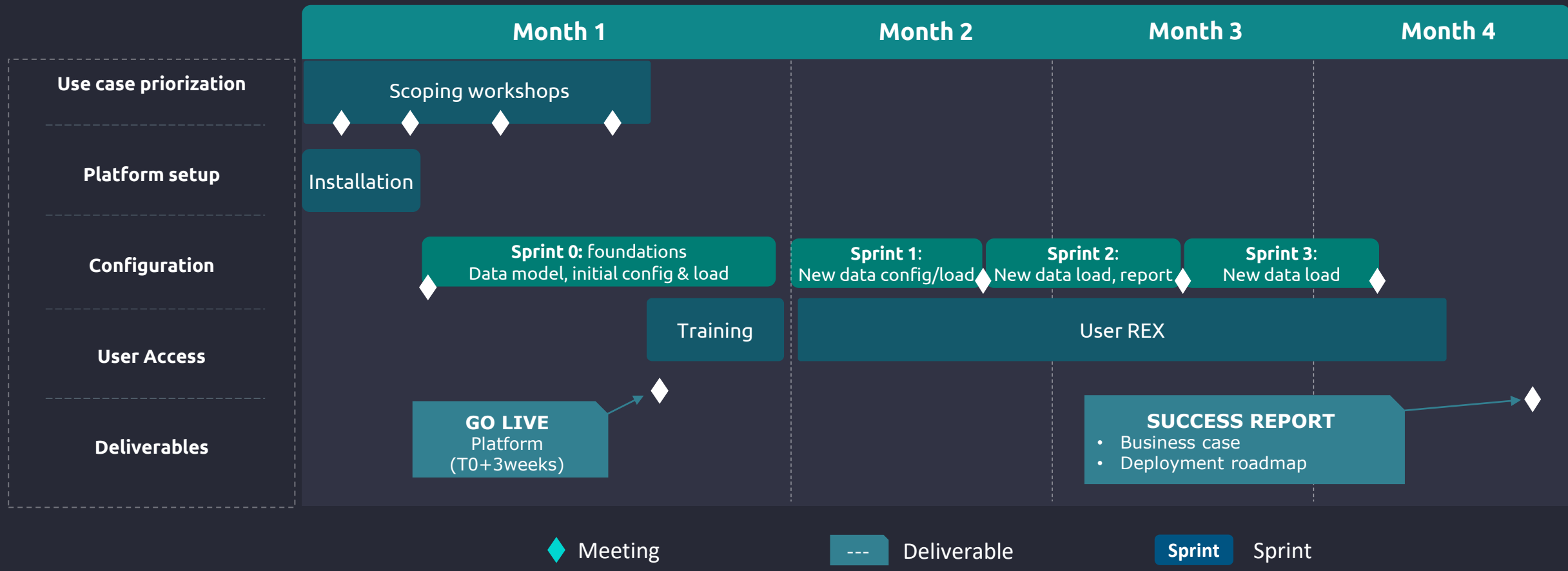
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PROOF OF VALUE ACTIVITIES & DELIVERABLES

	Month 1	Month 2	Month 3	Month 4

Use case priorization

Scoping workshops

Platform setup

Installation

Configuration

Sprint 0: foundations
Data model, initial config & load

Sprint 1:
New data config/load

Sprint 2:
New data load, report

Sprint 3:
New data load

User Access

Training

User REX

Deliverables

GO LIVE
Platform
(T0+3weeks)

SUCCESS REPORT
• Business case
• Deployment roadmap

◆ Meeting   --- Deliverable   **Sprint** Sprint

About Capgemini

Capgemini is a global leader in partnering with companies to transform and manage their business by harnessing the power of technology. The Group is guided everyday by its purpose of unleashing human energy through technology for an inclusive and sustainable future. It is a responsible and diverse organization of 300,000 team members in nearly 50 countries. With its strong 50 year heritage and deep industry expertise, Capgemini is trusted by its clients to address the entire breadth of their business needs, from strategy and design to operations, fuelled by the fast evolving and innovative world of cloud, data, AI, connectivity, software, digital engineering and platforms. The Group reported in 2020 global revenues of €16 billion.

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