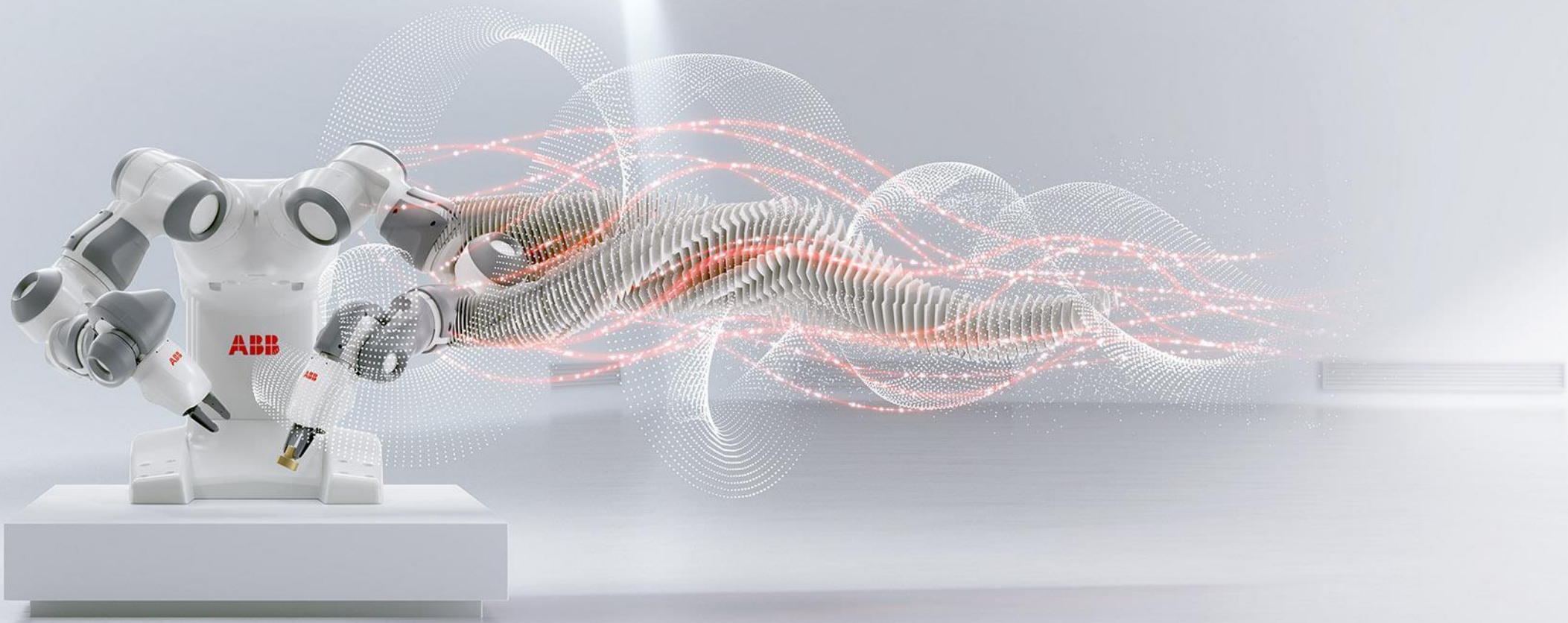


PTC FORUM EUROPE

Digital Twin

An interoperability framework

Dr. Christopher Ganz, Group VP R&D digital lead

Digital Twin

Interpretations of a buzzword in the market

Product lifecycle interpretation

All information available about a piece of equipment can be accessed in a digital twin container:

- Product documentation
- Simulation models

Lifecycle aspects are more in the focus of Industry 4.0 concepts

Real-time data access interpretation

Real-time information is reflected in digital models and simulation and is available for further analysis:

- Digital object behaves exactly as the real one
- Forecasts can be made in the simulation environment

Real-time data integration is more related to Industrial Internet

A digital twin concept that matches customer expectations in all verticals must cover both aspects

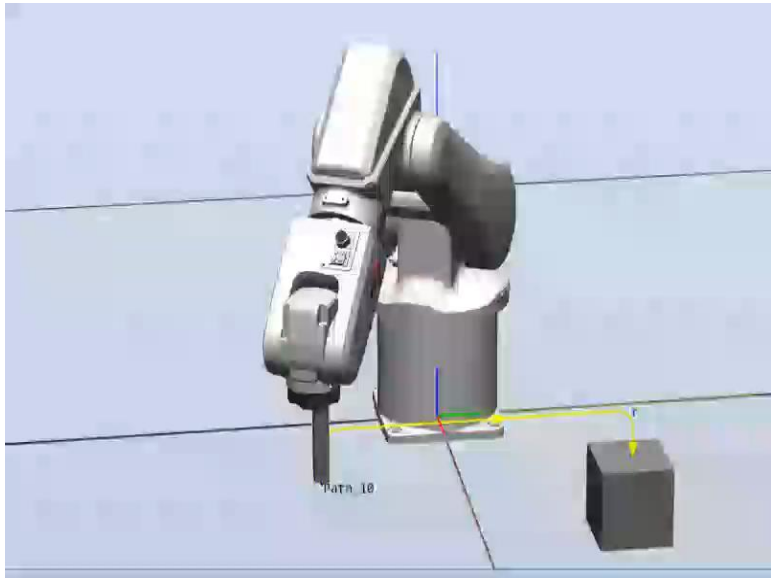
Digital twin components in ABB

Examples implementing aspects of digital twin

PLM information used for AR

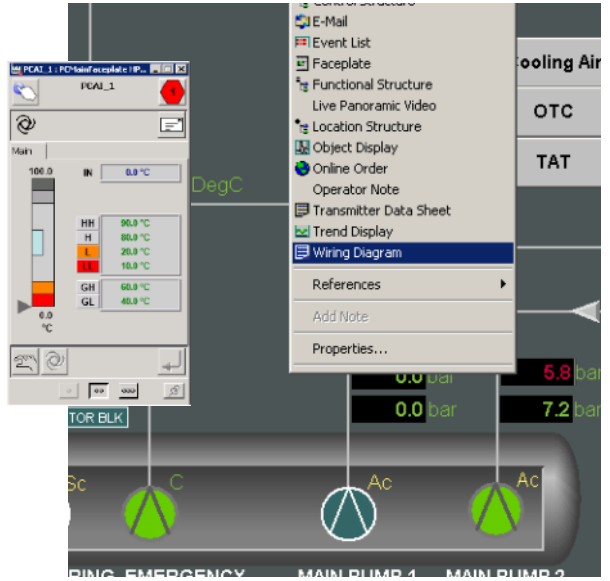
PLM data is made available for AR applications and matched with the real world object.

RobotStudio



RobotStudio allows commissioning in digital space, programming the ‘digital twins’

ABB Aspect Object in 800xA

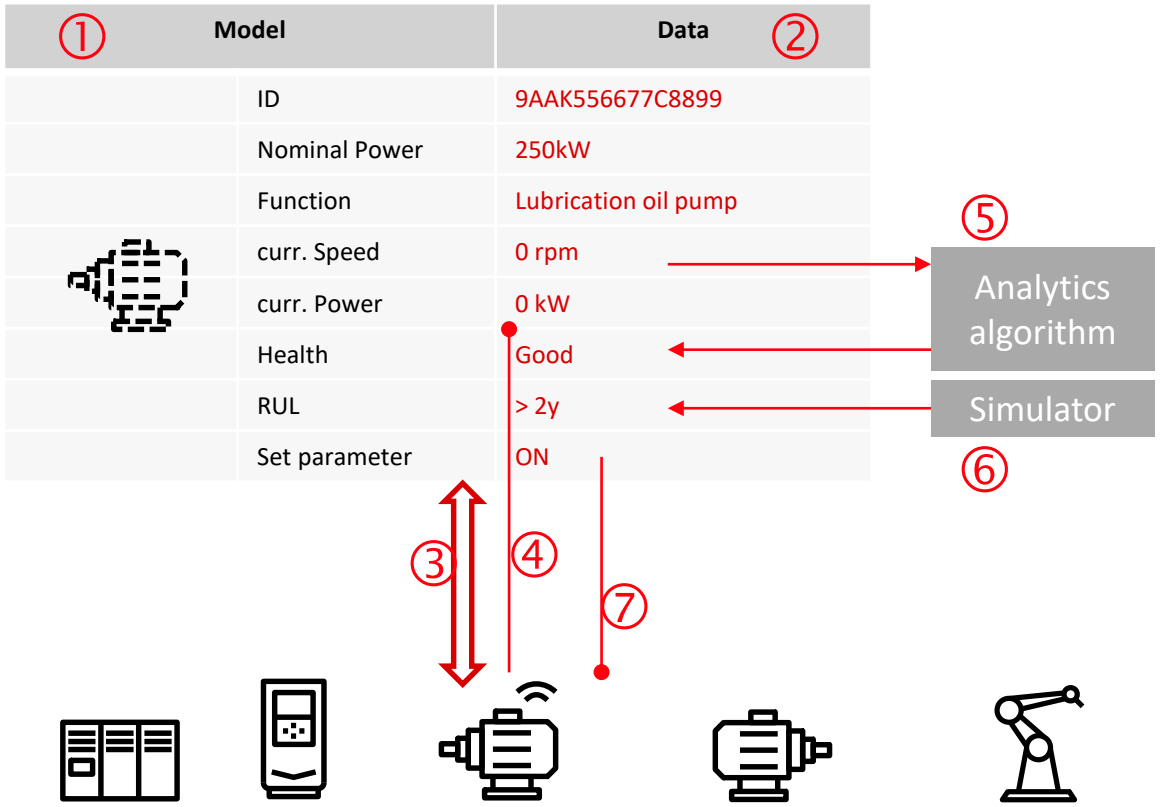


Digital twin implementation in the 800xA automation platform.

Characteristics of a Digital Twin

What it means

Required	1) Model	Model that can reflect its data and behavior
	2) Data	Available information (real-time or off-line)
	3) Uniqueness	1:1 relation to one physical installation
	4) Monitor	Access to equipment state
Optional	5) Analytics	Algorithms to analyze the data of a DT
	6) Control	Ability of the to influence the physical object
	7) Simulation	Simulate the object under different conditions



Digital Twin in real-time data exchange

Object representation in operation

Automation system operator display and faceplates

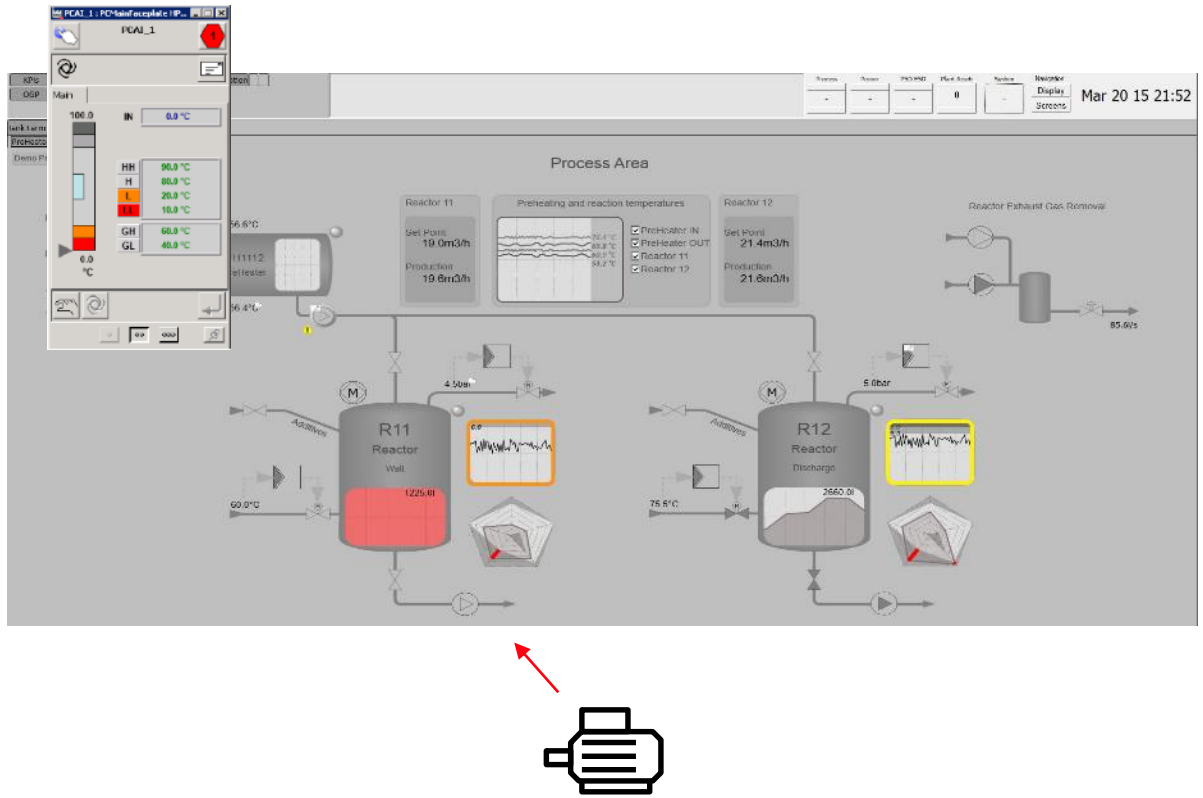
Display of real-time information in the context of an object as part of the operator station displays

Displays optimized for fast understanding of the process situation and operational issues

Operator interaction with process equipment through faceplate windows to operate the plant manually

Quick access to detailed real-time information (alarms, trend displays, etc.) to understand the process situation

Automation software and operator display (display element and faceplate) are built into one consistent library



Digital Twin in real-time data exchange

Data model and IoT engineering

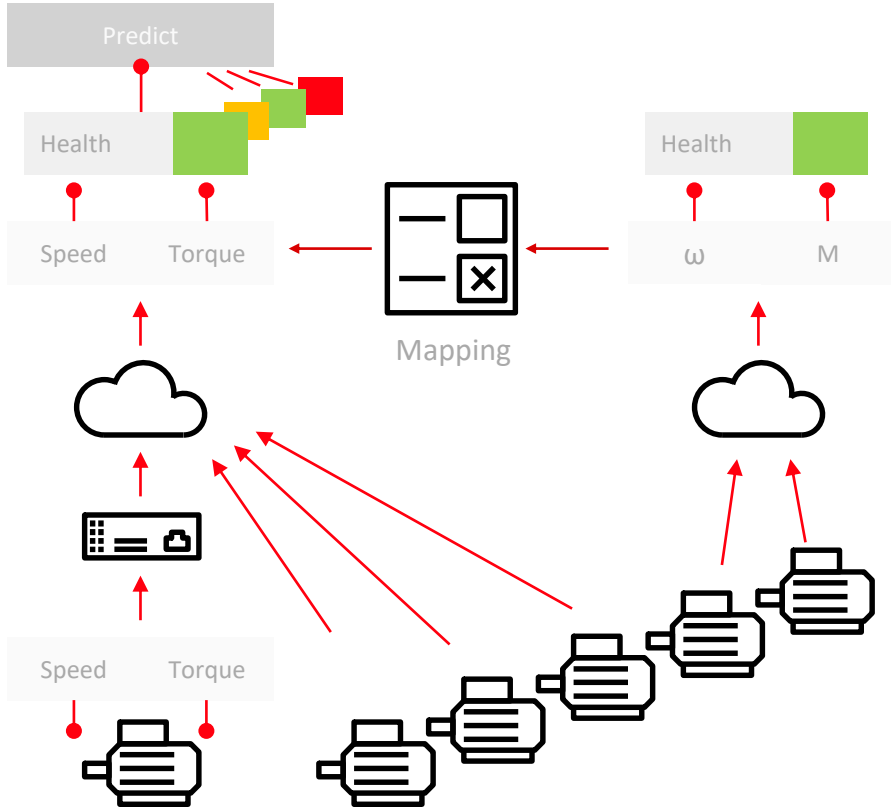
Connect analytics to the field data

Available measurements and analytics input requirements must match (property, unit, etc.)

Connectivity parameters and database entries shall automatically be configured based on the device type information of the equipment connected, engineering effort quickly kills the business case

Common data model across platforms is difficult, a common mapping framework shall therefore be promoted as platform interconnectivity

Extend device data model with information form algorithm results, e.g. device health information. Recursively, algorithm inputs need to match available data (e.g. algorithm results)



Digital Twin

Sources for digital information in context

Information aggregation

Live information

– Operational information from ABB Ability™, through automation system data collection

– Equipment diagnostic information from ABB Ability™, through asset monitoring infrastructure

– Analytics results (e.g. health analysis, performance analysis) from ABB Ability™ and analytics applications

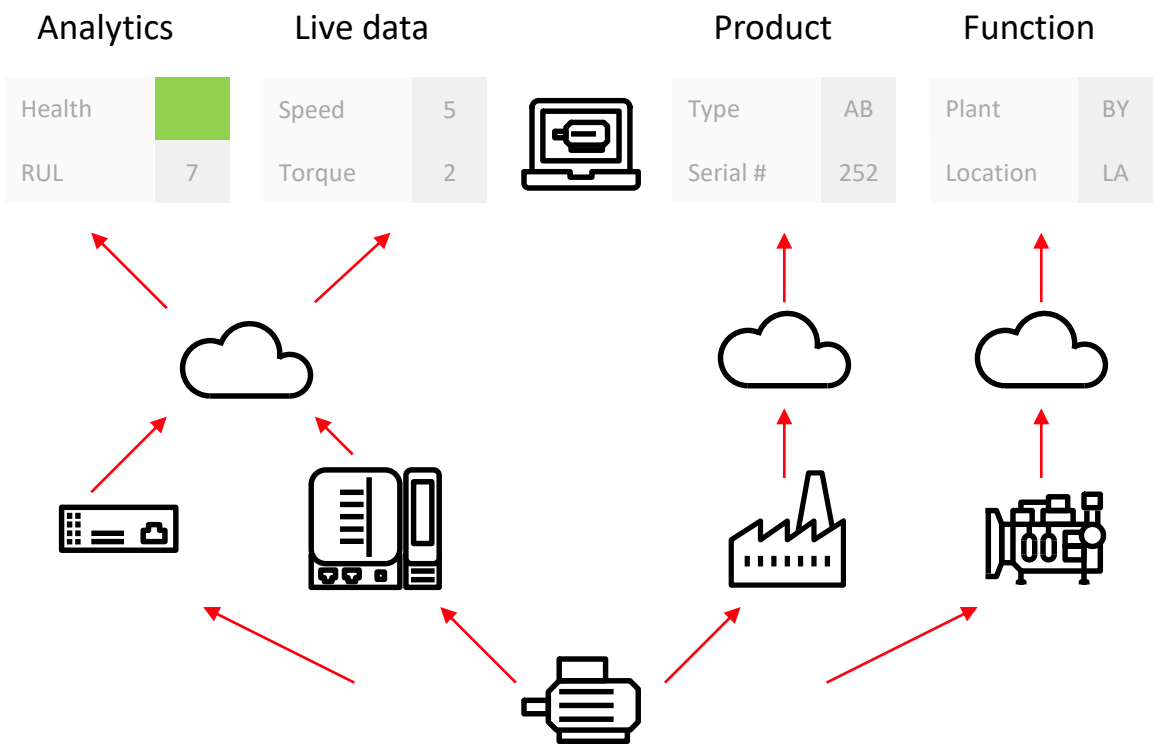
Boilerplate information

– Product and instance information from factory and installed base information

Production inventory

– Plant information, plant section, installation location

– Equipment function, process context



RUL: remaining useful life

Digital Twin manifestations along the lifecycle

Visualization of the digital twin features

Variety of tools and tool suites in use

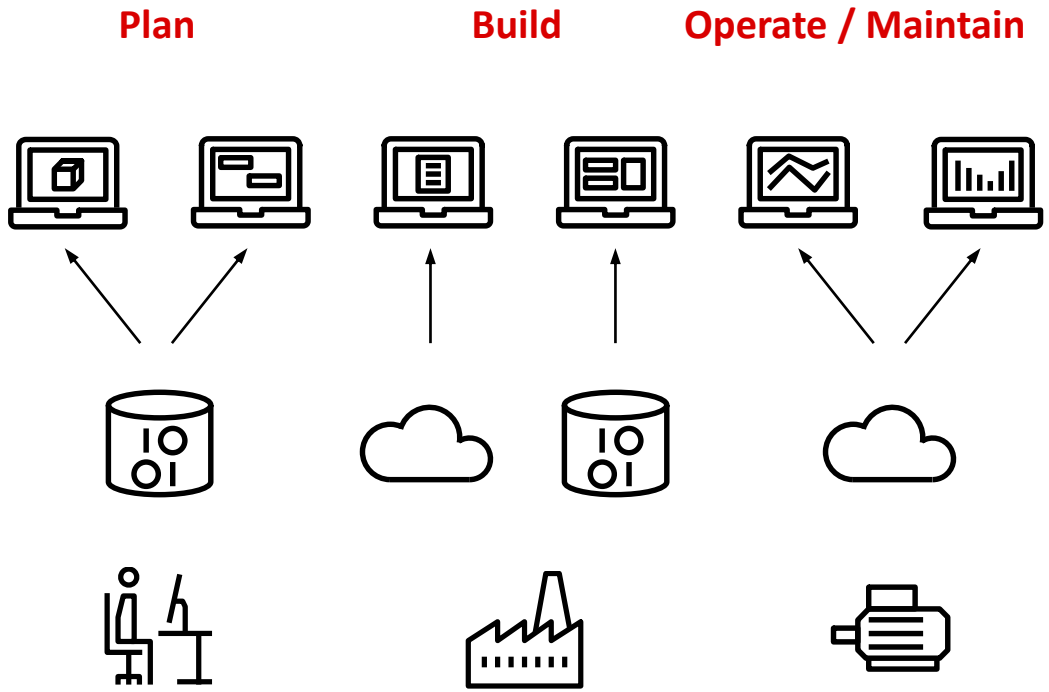
Different tools are used to design different types of products, designing particular aspects may require special tools

System integration requires level of abstraction (plant design tool / simulator does not need finite element component simulation)

Customers want to make use of digital twin advantages in their own production, using the tools they favor for their use case

Tools have their proprietary information models and data management

How **the equipment reflected depends on the use case**



Digital Twin built on data exchange

Flexibility in digital twin representation requires data exchange concept

Standards-based interoperability

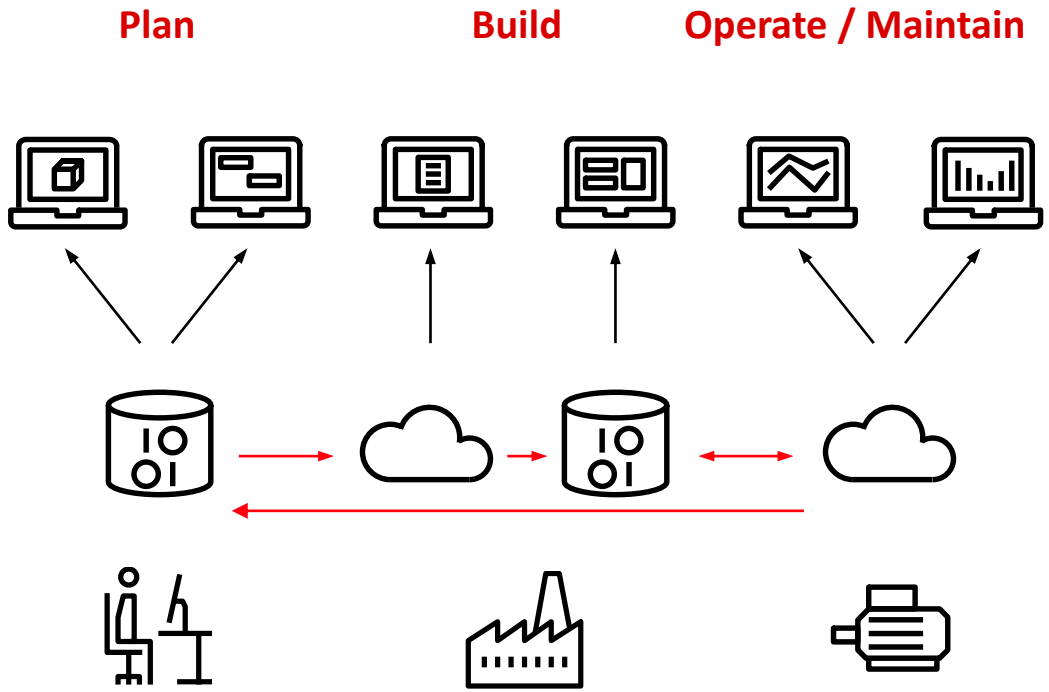
Information from across the tool landscape is required for most use cases

- Context information required for proper real-time data analysis
- Production data required for fleet analytics
- Real-time data for product optimization

The tool landscape comprises internal as well as external tools, moving to one common information model and data base is not possible

A flexible digital twin concept requires exchange of information between tools and platforms

Unified data exchange based on established standards



Digital Twin definition for ABB

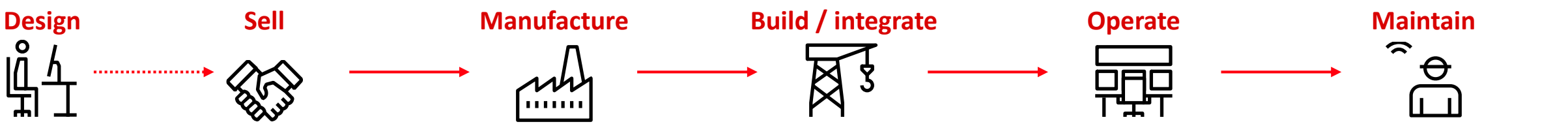
What is a digital twin?

The digital reflection of a physical asset[1]

1) asset as an economic resource. Assets are not only equipment, but also systems or complete plants. Assets in this context are hierarchical

Digital Twin use cases across the lifecycle

Selected use cases



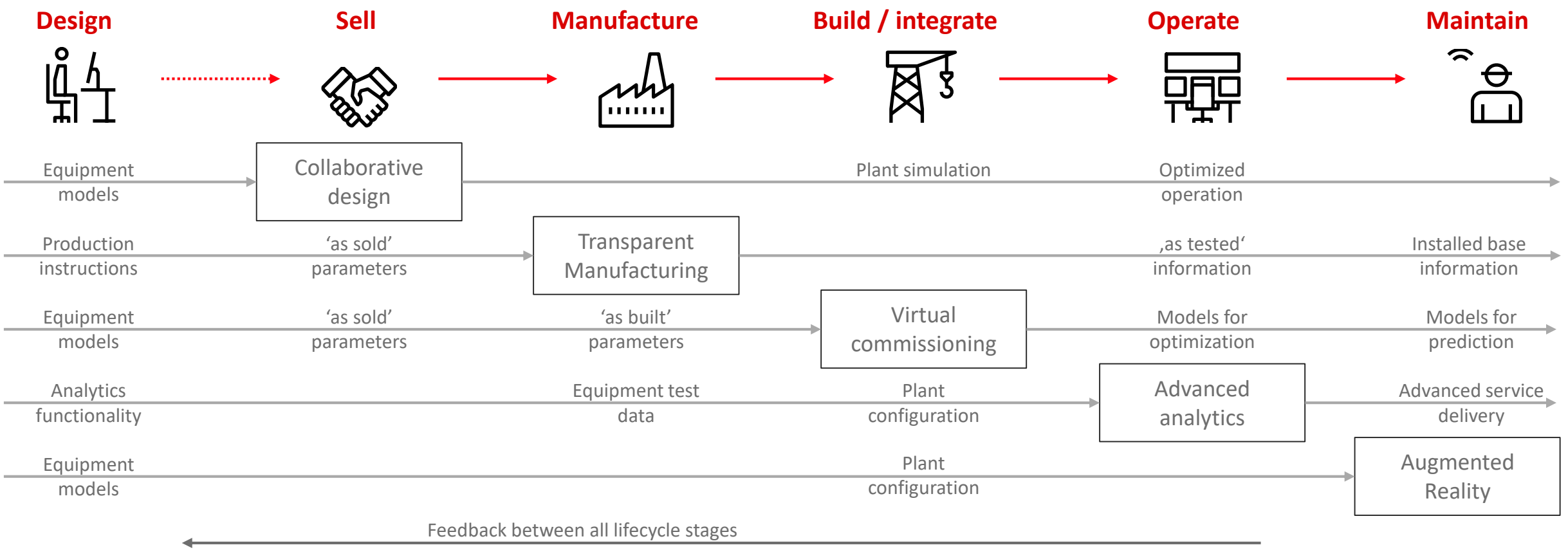
Collaborative design	Transparent Manufacturing	Virtual commissioning	Advanced analytics	Augmented service
Ensure the perfect fit	Initiating the physical twin	Interacting twins	Seamlessly enabled analytics services	Augmented reality for maintenance
Exchange functional models with the customer for optimal offering	Full internal and external transparency into the manufacturing status	program and test the plant in the digital space by connecting digital twins	Providing pre-defined services as part of the twin to be easily enabled	Seamless access to equipment information in the context of the physical device

Key challenge: all use cases exchange data through the digital twin

Type information Instance information

Digital Twin use cases across the product lifecycle

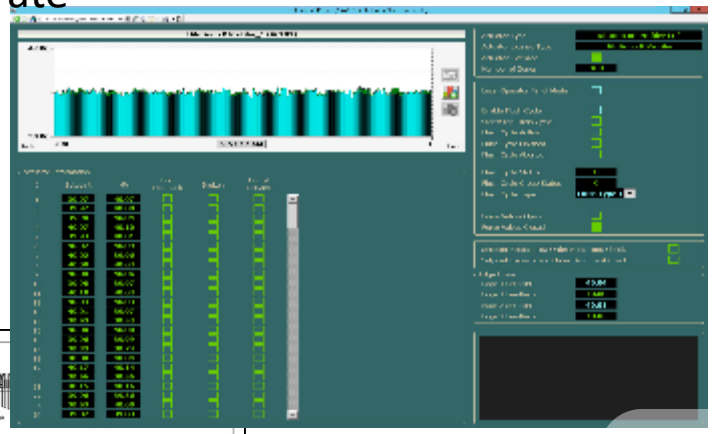
Artefacts and data shared along the value chain



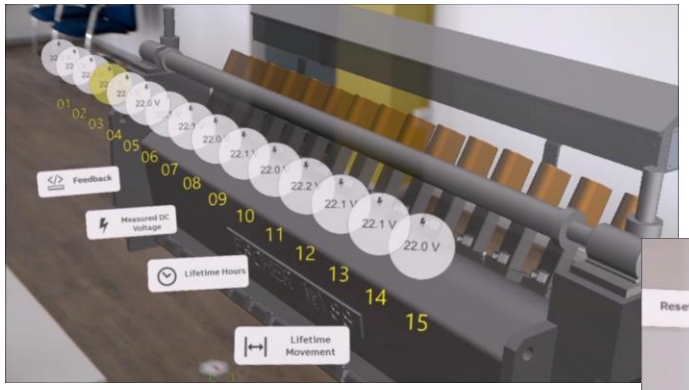
Type information — Instance information

ABB Customer in the Paper Industry: Digital Twin

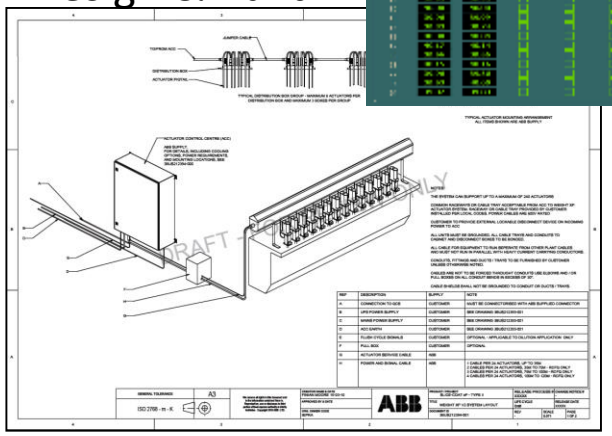
Control & Operate



Analyze & Maintain



Design & Build



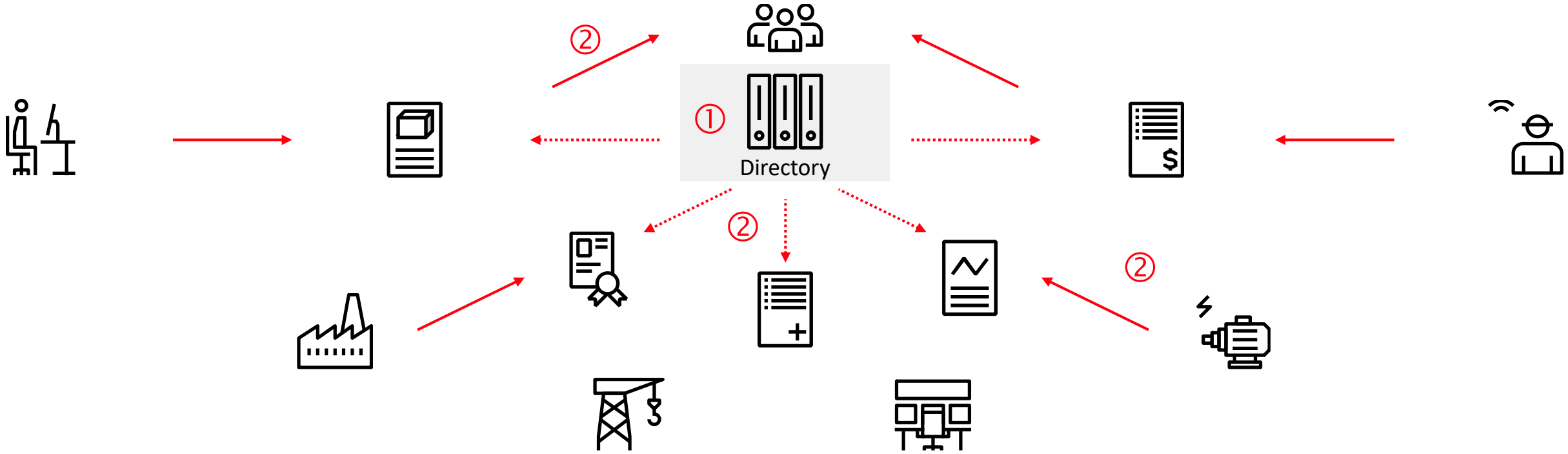
Aspects of digital twin

Papierfabrik Adolf Jass, Fulda, DE

Arjowiggins Creative Papers, Stoneywood, UK

Digital Twin Directory

Directory referring to all data sources that can provide digital twin information



Directory (1) providing access to information through standards-based data exchange (2)

Reference / request

Data flow

Conclusions

Collation of correct, consistent, and complete information about a physical asset is **critical** for a digital twin

The digital twin provides an **intuitive interface** to handling situations by envisioning an asset in its context and allowing interaction in the digital space


ABB