

DIGITAL TWINS

ESTABLISHING LINE OF SIGHT IN AN INTERCONNECTED WORLD

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Liverpool, June 24th, 2019



REAL. WORLD. EXPERIENCE.

NORTH AMERICA

ASIA PACIFIC

EMEA



WHO IS ACHIM KRÜGER



der Bundeswehr
Universität München
Aerospace Engineering

 **FernUniversität in Hagen**
Economics



SAP® Recognized Expertise
in Asset Management

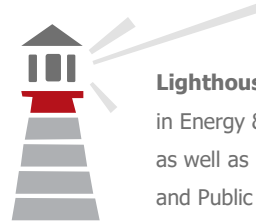
WHO IS VESTA PARTNERS

Global focus on...



**SAP
ENTERPRISE
ASSET
MANAGEMENT**

PARTNERSHIP WITH SAP:



Lighthouse partner
in Energy & Natural Resources Industries
as well as in Travel & Transportation
and Public Sector



- SAP Services Partner
- SAP Select Consulting Partner
- SAP Value Added Reseller
- SAP Education Channel Partner
- 2015 Oil & Gas Operational Integrity Strategic Partner
- 2015 SAP Travel and Transportation IBU Global Strategic Partner



A global team with over **250** EAM professionals...

... successfully completed **1000+** projects of all sizes...



... supporting over **320** satisfied customers worldwide

ACHIEVEMENTS & AWARDS:



- CIO Review 20 Most Promising EAM Solution Providers 2015
- Consulting magazine's Seven Small Jewels of 2015 Award
- Voting member of US Technical Advisory Group helping to define the ISO 55000 standard

Real. World. Experience.



ASSET MANAGEMENT TRENDS

ISO 55001, ISO 14001,
ISO 45001,...

Optimizing **cost, risk, and performance**

Balancing **OPEX** with **CAPEX**

Meeting **stakeholder expectations**

Empowerment of practitioners

Collaboration between
EPCs, OEMs,
service providers,
and operators

Business Challenges



Technology Enablers

Internet of Things (IoT)
to scale connectivity

Big Data for getting insight
from IT and OT

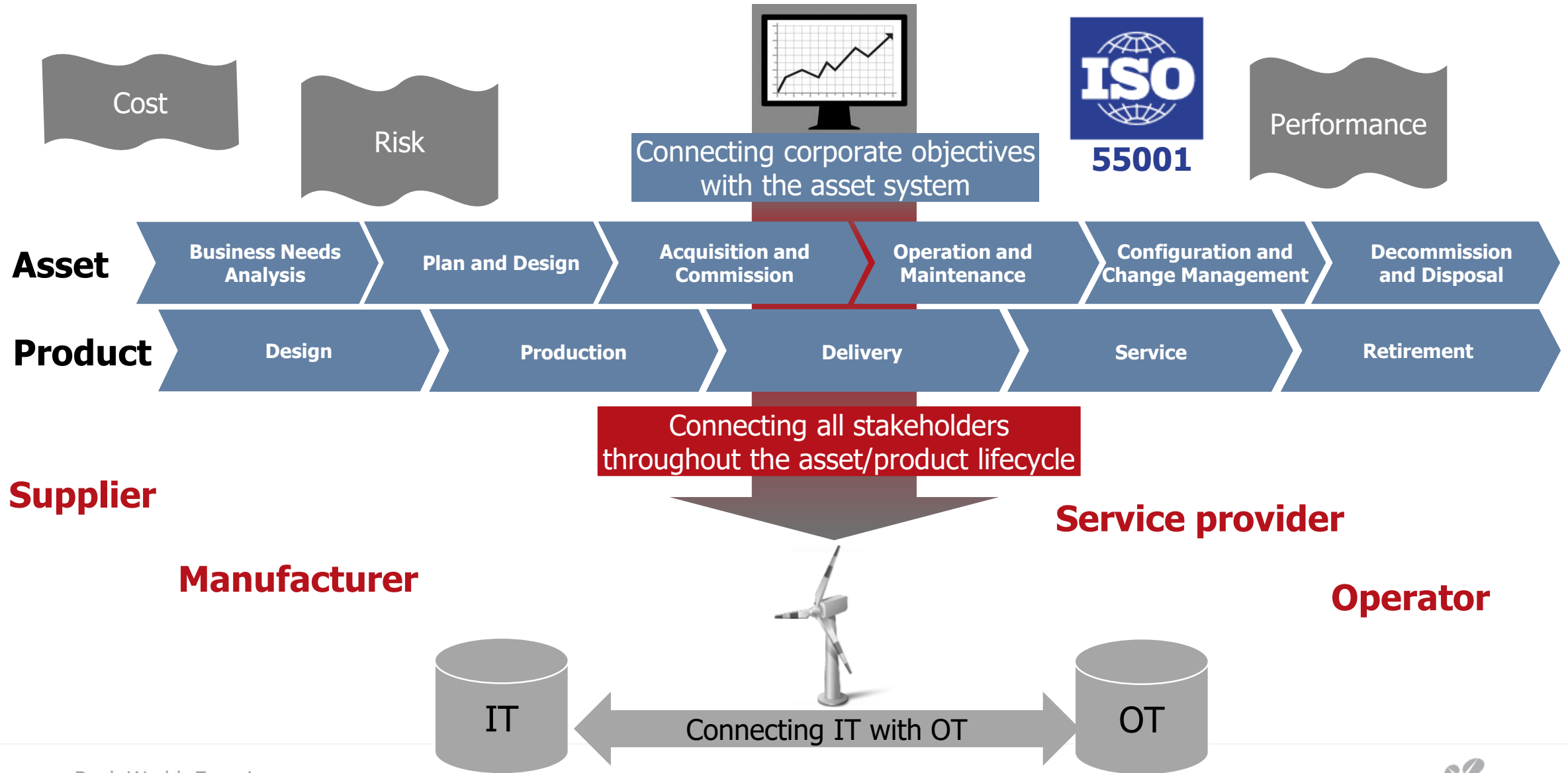
Analytics for prediction
and simulation

Machine Learning
to improve on
business decisions

Enterprise Mobility
to empower employees

Cloud for collaboration

ASSET MANAGEMENT IN AN EVER-MORE-CONNECTED WORLD...



ASSET MANAGEMENT IS ABOUT SHARING INFORMATION



Value

Assets exist to provide value to the organization and its stakeholders.

Alignment

Transform organizational objectives into technical and financial activities, decisions and tasks.

Leadership

Leadership and workplace culture are determinants of value realization.

Assurance

Asset management enables the assets to fulfil their required function.



Information needed, based on purpose and performance



Share **information**, vertically and alongside the value chain

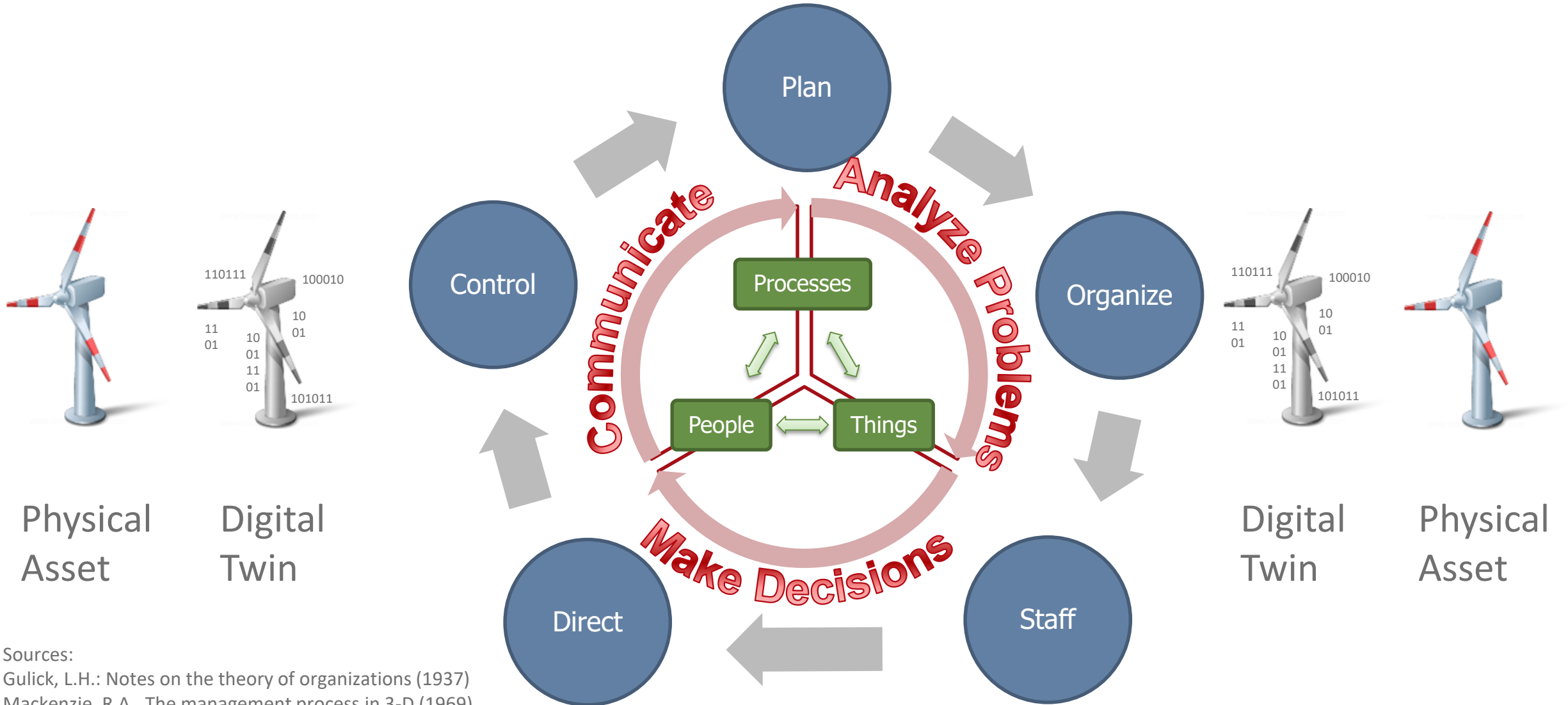


Communicate **information**, in the hierarchy and between departments



Establish governance, have decisions based on accurate **information**

ASSET MANAGEMENT IS A MANAGEMENT DISCIPLINE



Sources:

Gulick, L.H.: Notes on the theory of organizations (1937)

Mackenzie, R.A., The management process in 3-D (1969)

Real. World. Experience.

ASSET MANAGEMENT FROM SENSOR TO INSIGHT TO OUTCOME

Sensor

Connected Assets

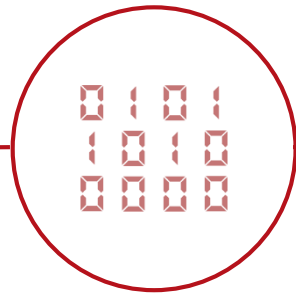
- Onboarding
- Connectivity
- Device management
- Security



Data

IT/OT Convergence

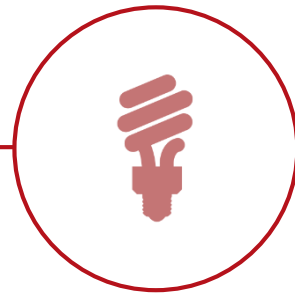
- Big Data ingestion
- Big Data infrastructure
- Merging sensor data with business information



Insight

Data Analysis

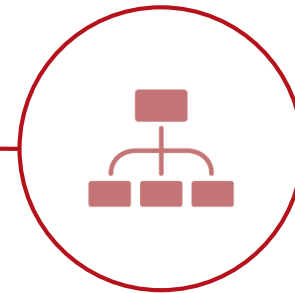
- Root cause analysis
- Asset health monitoring
- Machine learning
- Anomaly detection
- Triggering of corrective actions



Action

Operational Activities

- Prioritized maintenance and service activities
- Optimized warranty and spare parts management
- Prescriptive Maintenance
- Quality improvements



Outcome

Business Value

- Customer experience
- Increased quality
- Lower costs
- Operational efficiency
- R&D effectiveness
- Material procurement



ASSET MANAGEMENT TYPICAL QUESTIONS



**What
happened?**



**What is
happening now?**



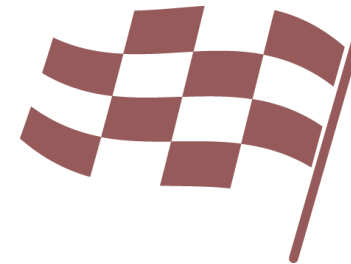
**What will
happen?**



**How and why
did it happen?**



**What is the risk if it does
or does not happen?**



**How do you prevent or
ensure it happens again?**

DEALING WITH BIG DATA CHALLENGES KEEPING THE DIGITAL TWIN UP-TO-DATE

Volume

Explosion in the amount of data

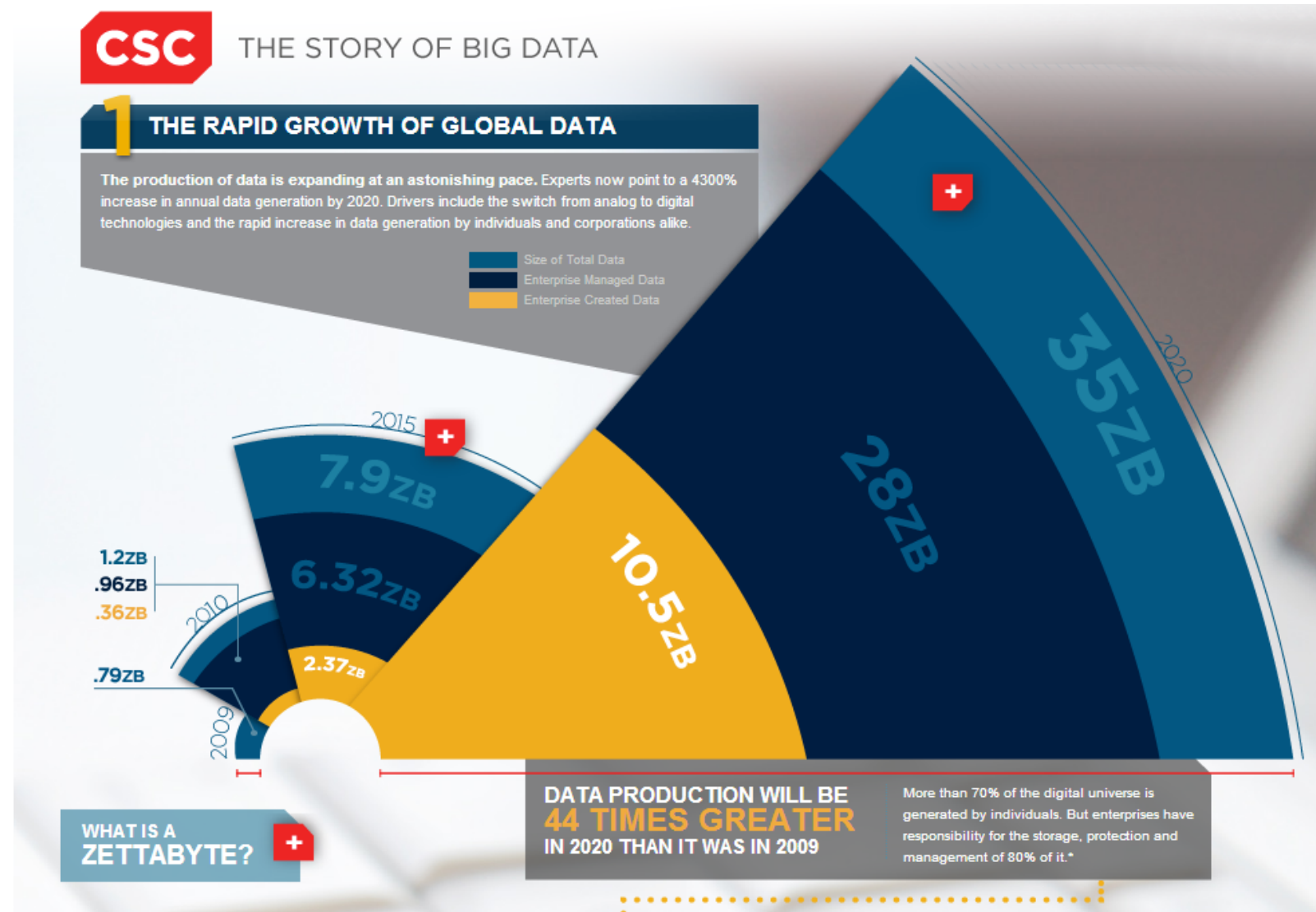
Variety

multiple data formats
(non-structured data boom)

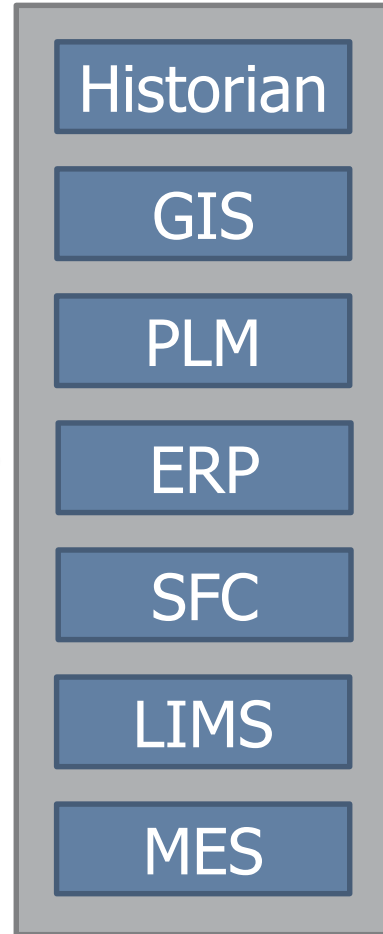
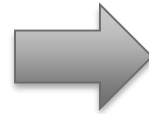
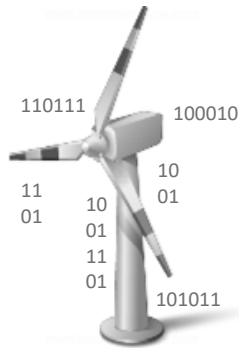
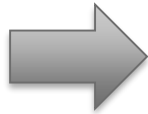
Velocity

Fast collection, processing and consumption

+ 1 zettabyte = 1 Bn terabytes



ASSET MANAGEMENT SUPPORTED BY THE DIGITAL TWIN



Physical Asset
(as-maintained configuration)

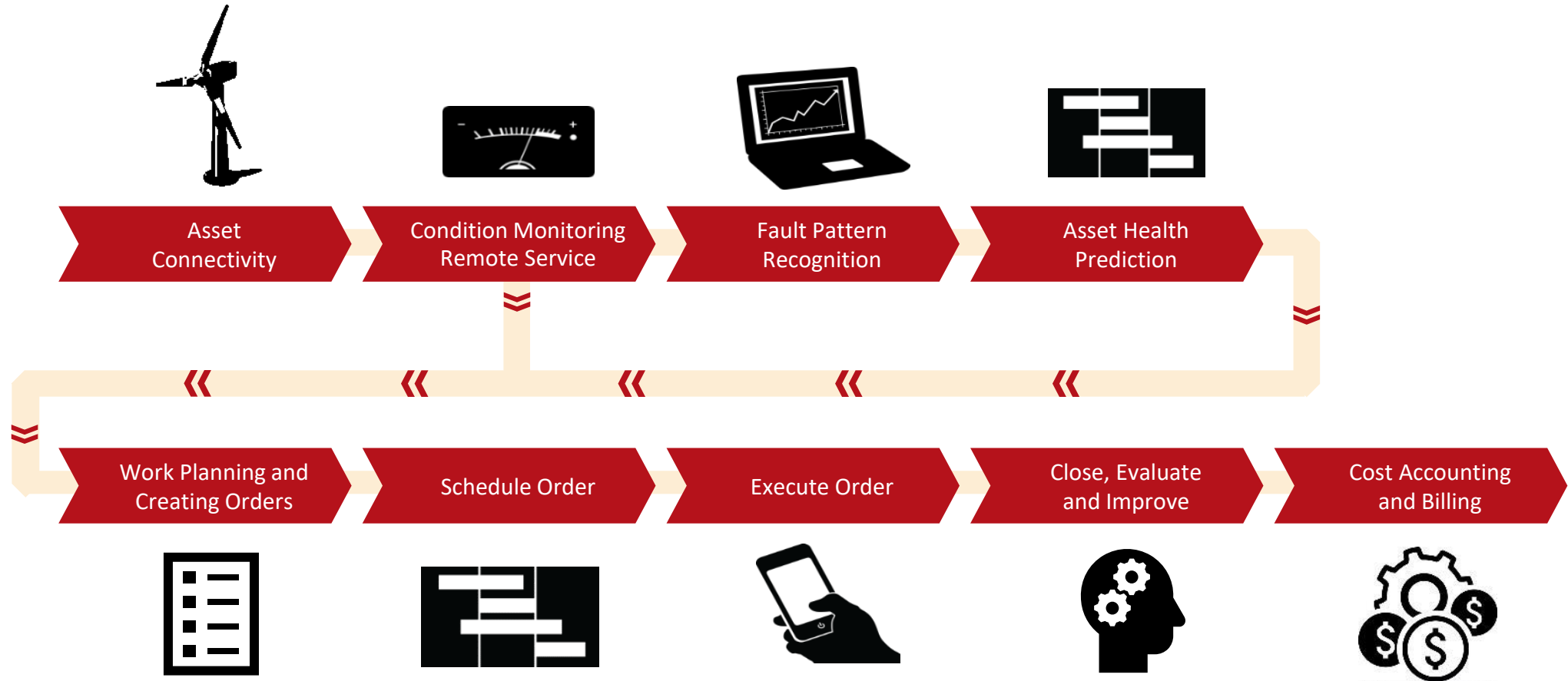
Digital Twin
(representing the asset system)

Systems
(storing master and condition data)

Applications
(supporting decisions and enabling decisive knowledge)

ASSET MANAGEMENT BASED ON A DIGITAL TWIN

TYPICAL CHANGES TO END-TO-END PROCESS FLOWS

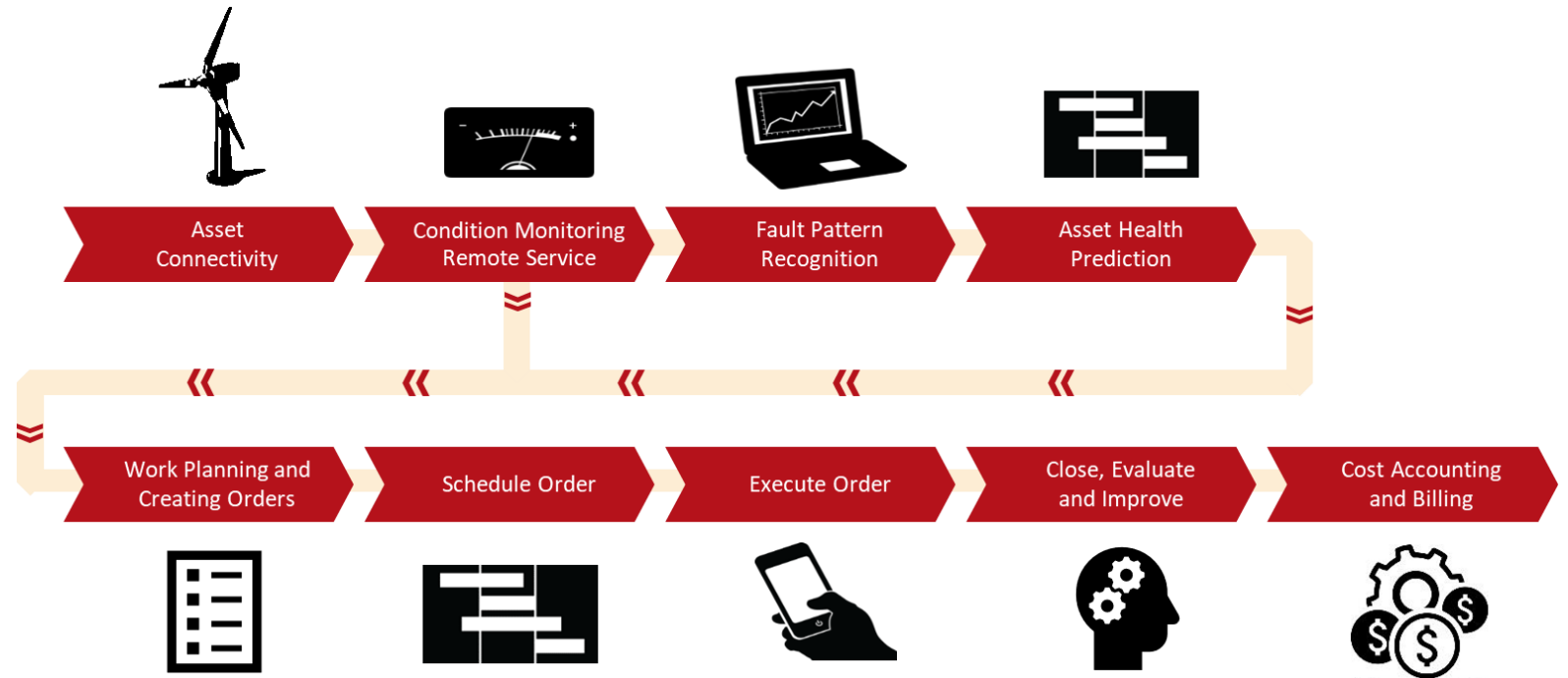


ASSET MANAGEMENT BASED ON A DIGITAL TWIN PREREQUISITES

Prerequisites:

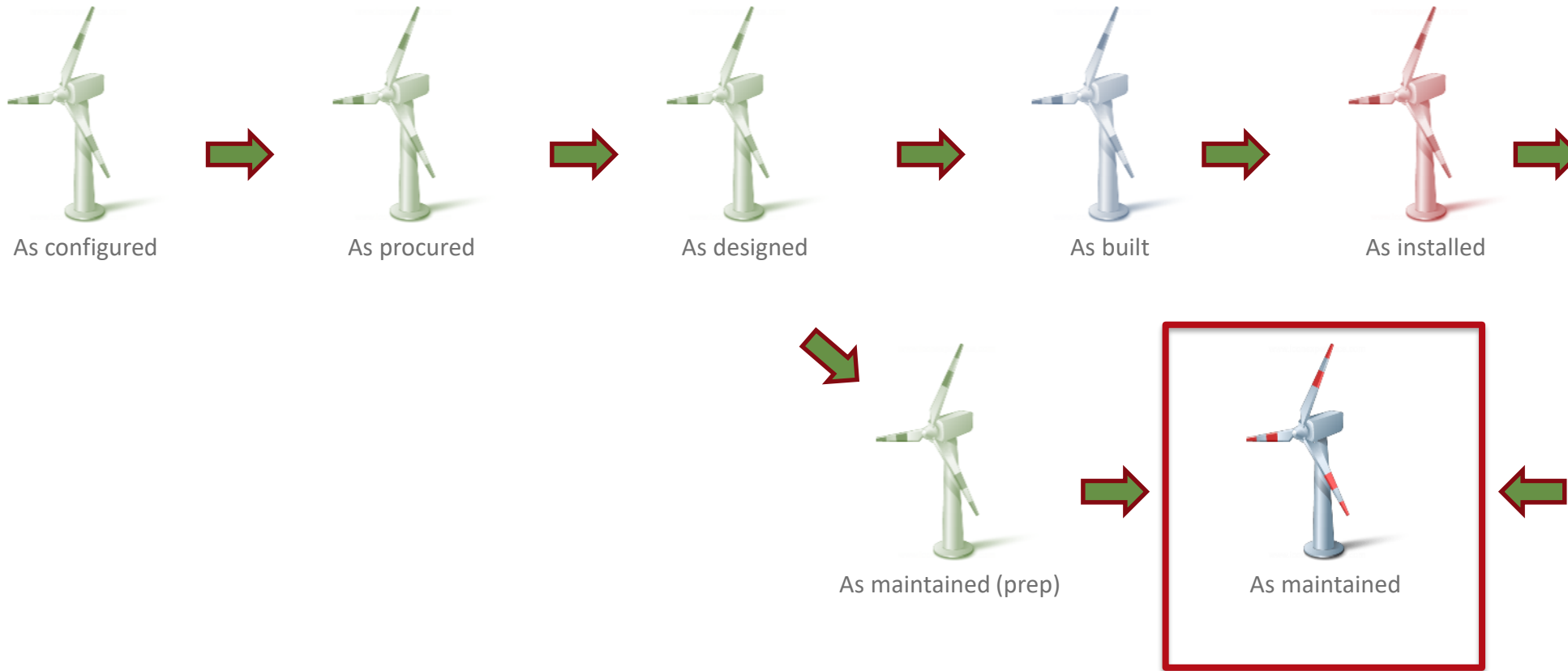
Asset Configuration

Maintenance Strategy



ASSET CONFIGURATION

BUILDING THE DIGITAL TWIN

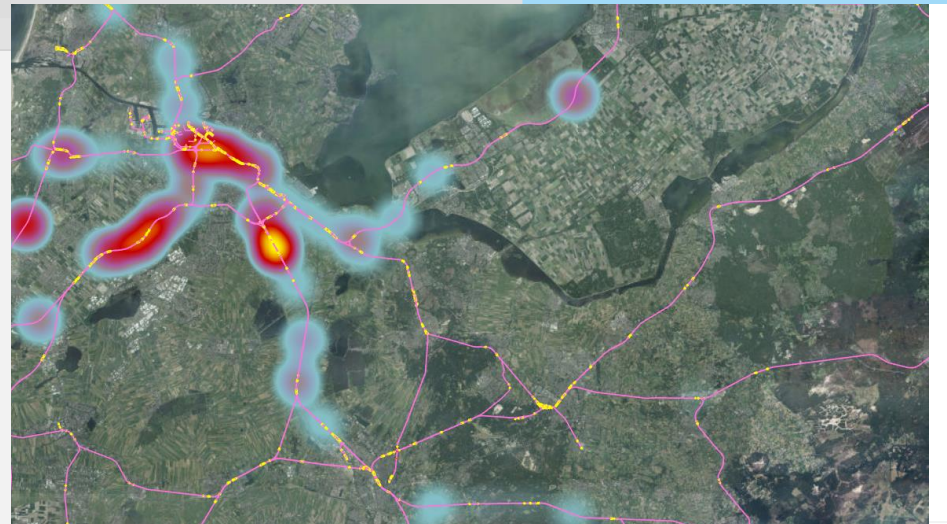
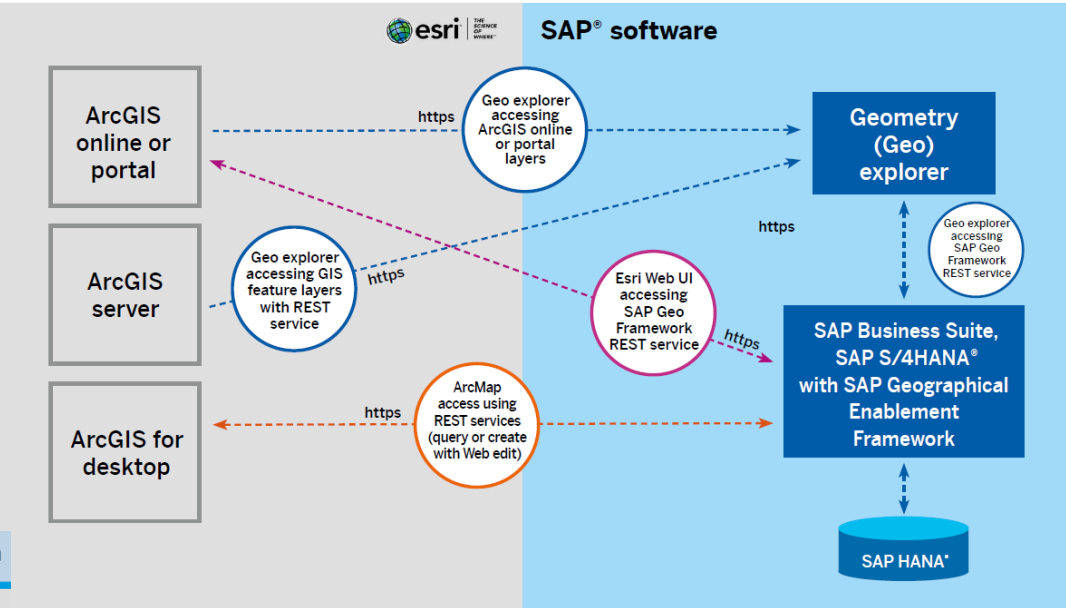


EXAMPLES

- Shared Digital Twin between GIS and ERP
- Digital Twin combining data from ERP and shop-floor systems
- Finite Element based Digital Twin in an Asset-as-a-Service scenario

EXAMPLE 1

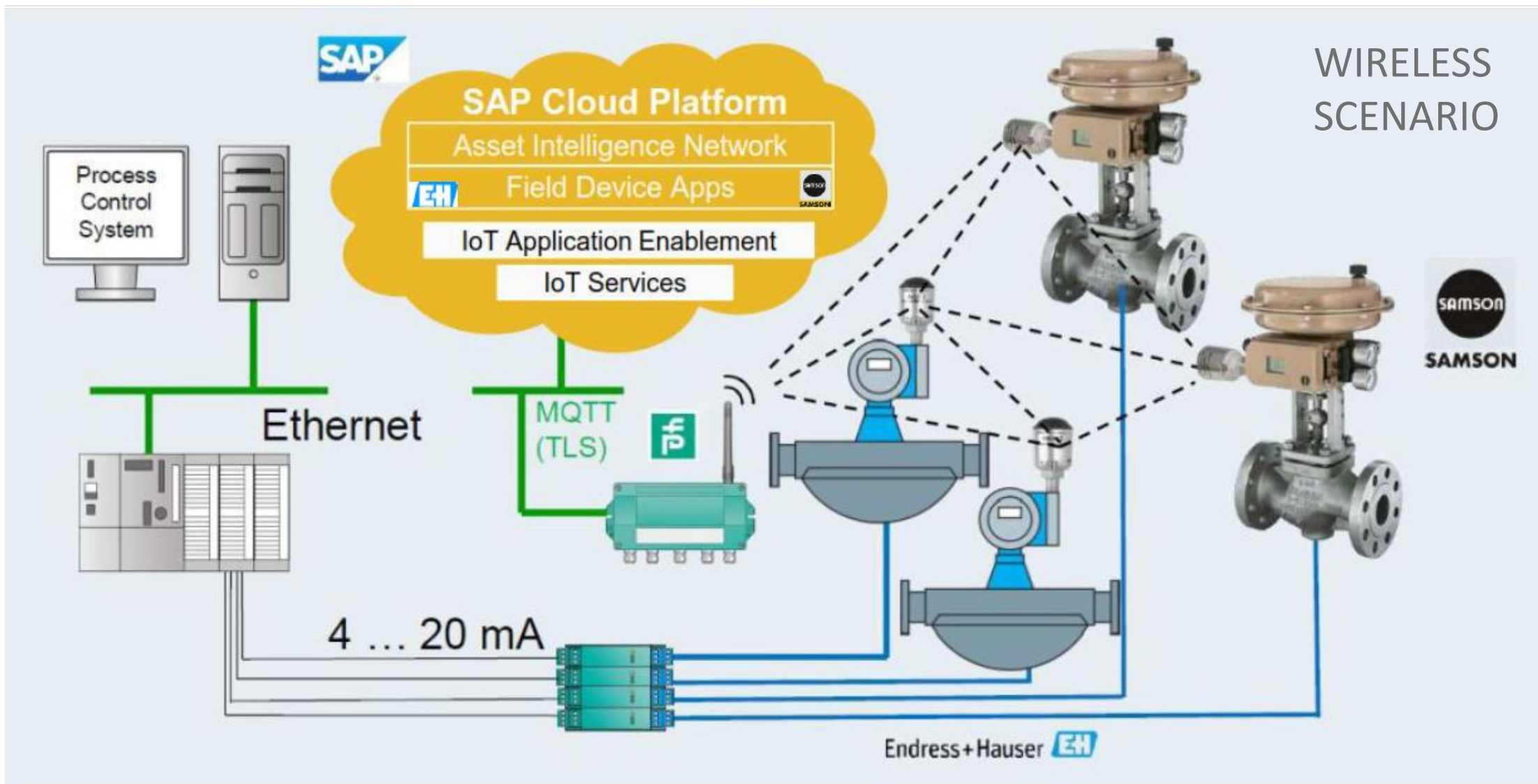
SHARED DIGITAL TWIN BETWEEN GIS AND ERP



Real. World. Experience.

EXAMPLE 2

DIGITAL TWIN COMBINING DATA FROM ERP AND SHOP-FLOOR

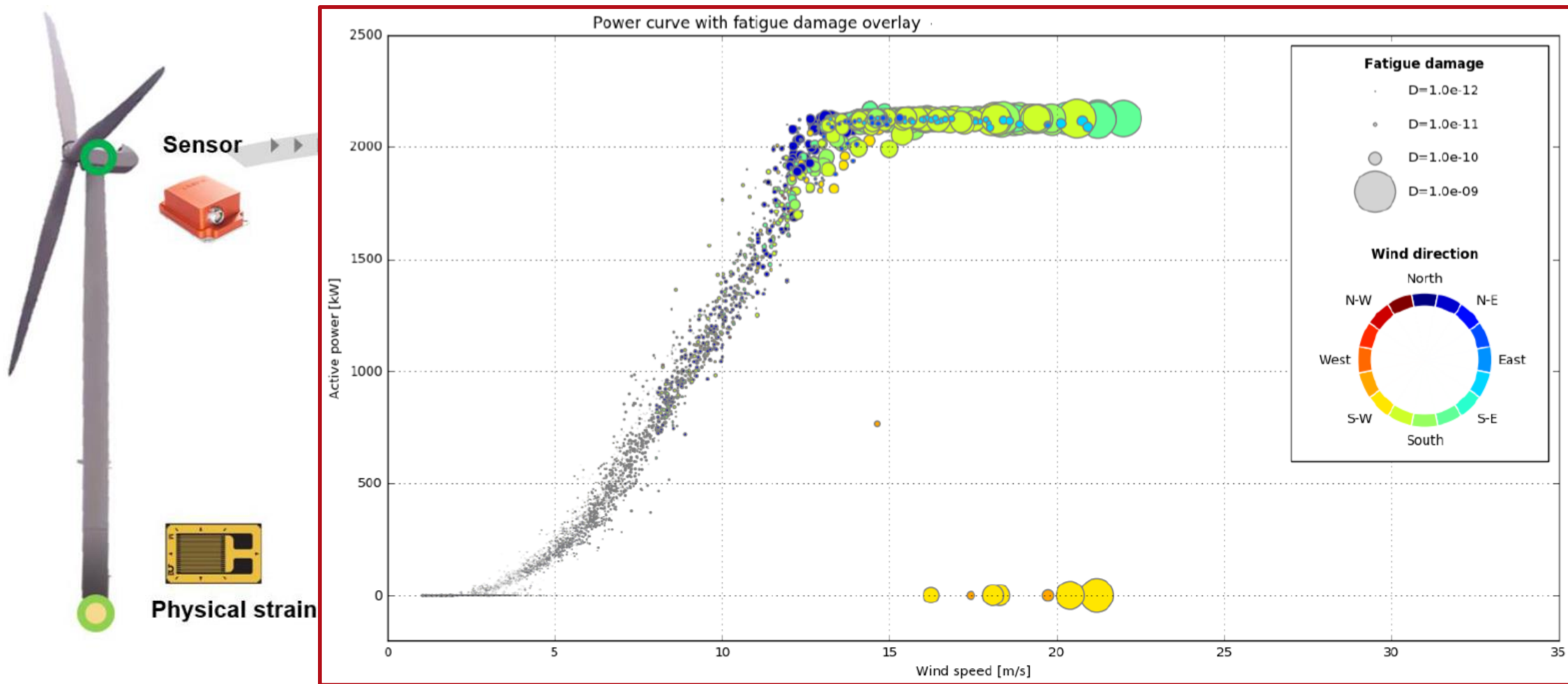


Source:



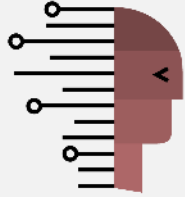
EXAMPLE 3

FINITE ELEMENT BASED DIGITAL TWIN IN AN ASSET-AS-A-SERVICE SCENARIO



Source: SAP at Euromaintenance 4.0, Antwerp, 26.09.2018

DIGITAL TRANSFORMATION IN ASSET MANAGEMENT DRIVEN BY THE DIGITAL TWIN



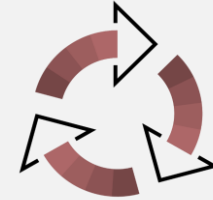
Step 1: **Connect to assets**

Bring together information from operational and business systems (IT/OT convergence), as well as use the IoT for scaling transparency without neglecting existing information sources.



Step 2: **Predict and simulate asset system behavior**

Avoid unplanned downtime and major operational consequences, as well as discover patterns of failure and preserve operational integrity. Blend business IT information with operational (OT) data.



Step 3: **Share asset information and collaborate**

Activate the ecosystem of OEMs, EPCs, service providers, and operators; ensure there's one version of truth on asset information; and use a business network to enable integrated processes in the cloud.

VESTA'S GLOBAL PRESENCE

NORTH AMERICA

ASIA PACIFIC

EMEA



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