

The banner features a central point from which numerous thin, multi-colored lines (blue, purple, pink, yellow) radiate outwards, creating a starburst or fireworks effect. The background is dark, and the right side of the banner transitions into a solid yellow-to-gold gradient.

SAP Leonardo Live

Not just another business conference

SAP Enterprise Asset Management Solution Overview and Strategy in a Nutshell

Dr.-Ing. Achim Krüger, Vice President, Line of Business Asset Management, SAP SE
July 12, 2017

PUBLIC

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SAP Enterprise Asset Management (SAP EAM) solution

Trends in asset management

- **ISO 55001**, ISO 14001, ISO 45001, and the like
- Optimizing **cost, risk, and performance**
- Balancing **OPEX** with **CAPEX**
- Meeting **stakeholder expectations**
- **Empowering practitioners**
- **Facilitating collaboration** among EPCs, OEMs, service providers, and operators

Business challenges

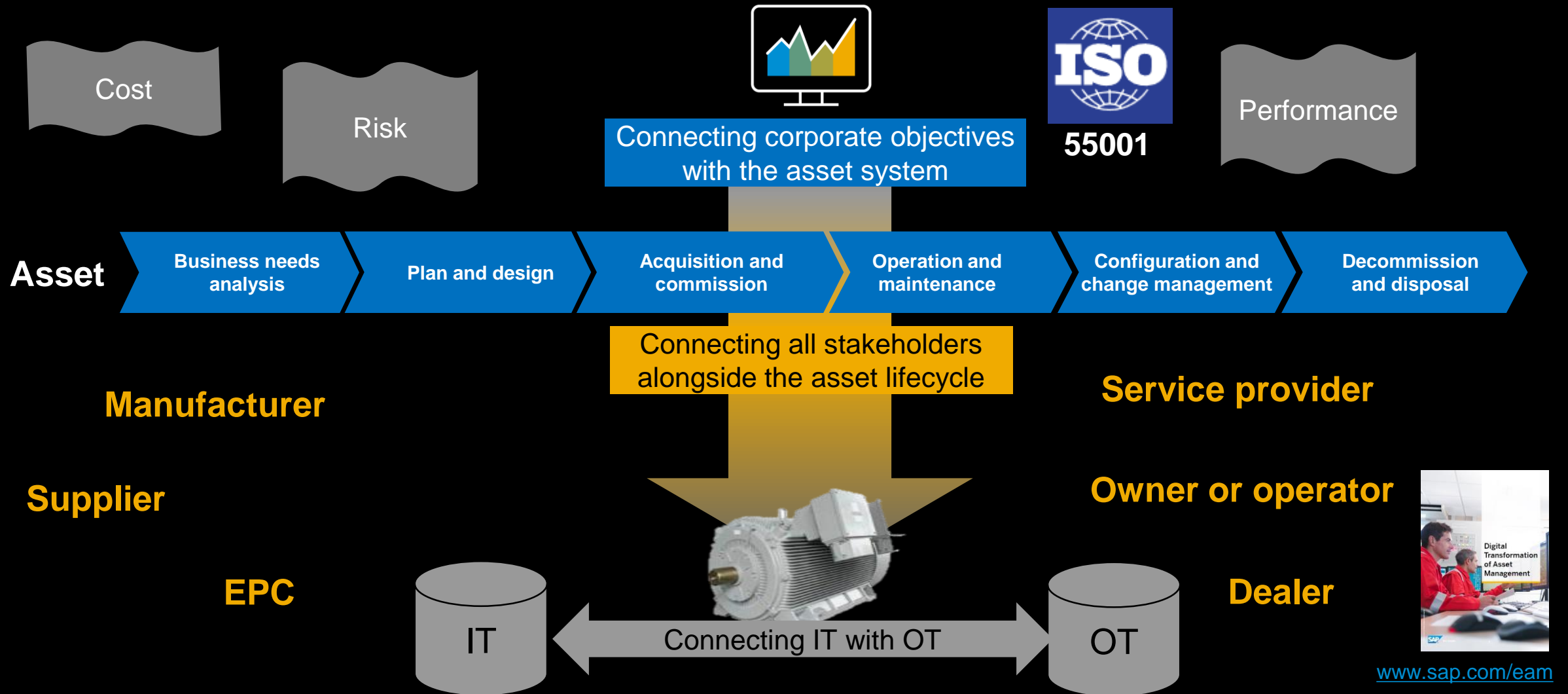


Technology enablers

- **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 business decisions
- **Enterprise mobility** to empower employees
- **Cloud** for collaboration

SAP Enterprise Asset Management

Asset management in an ever-more-connected world



SAP Enterprise Asset Management

Supporting asset management processes from end to end

Portfolio and project management

Idea management

Portfolio management

Project management

Resource management

Project connectivity

Asset operations and maintenance

Asset strategy and performance

Maintenance planning and scheduling

Maintenance execution

Mobile asset management

Environment, health, and safety

Incident management

Health and safety management

Environment management

Management of change

Maintenance safety and permit to work

Asset network

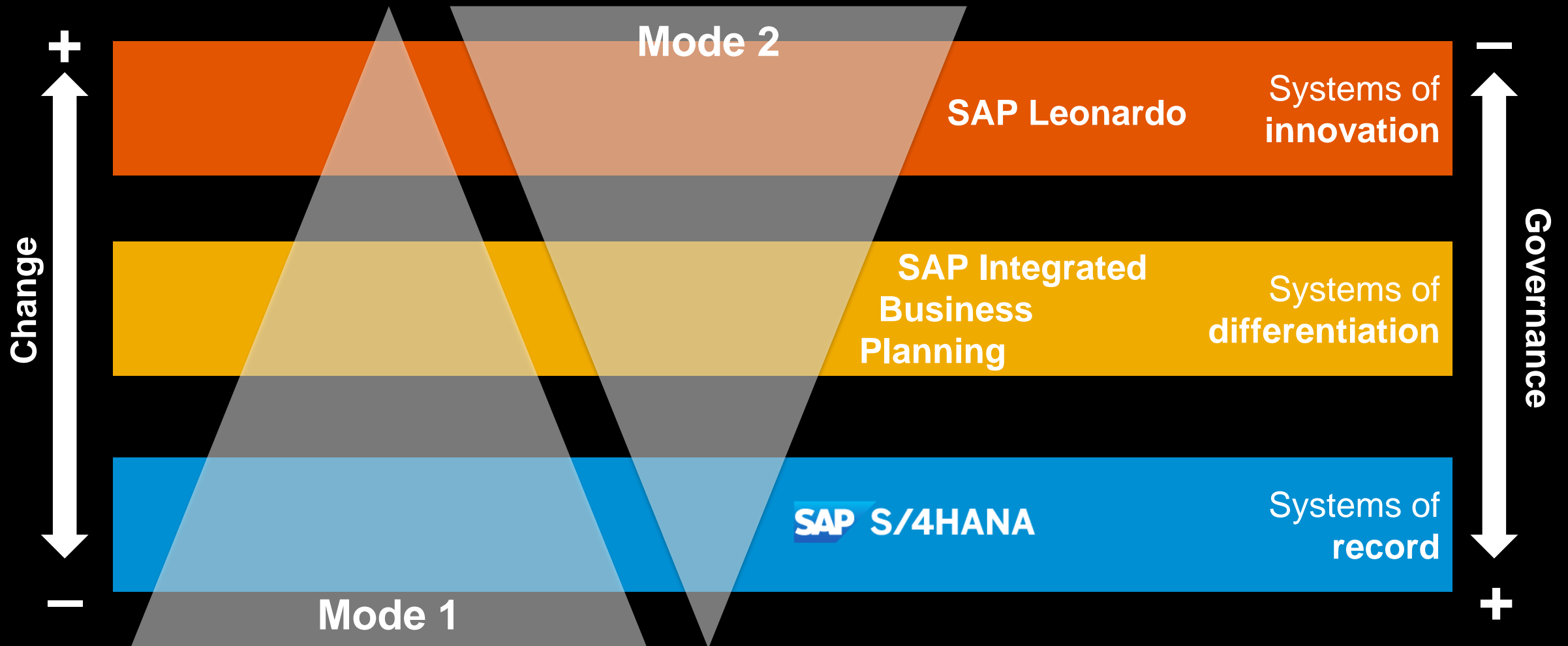
Asset information collaboration

Asset information governance

Predictive maintenance and service

Bimodal IT according to Gartner

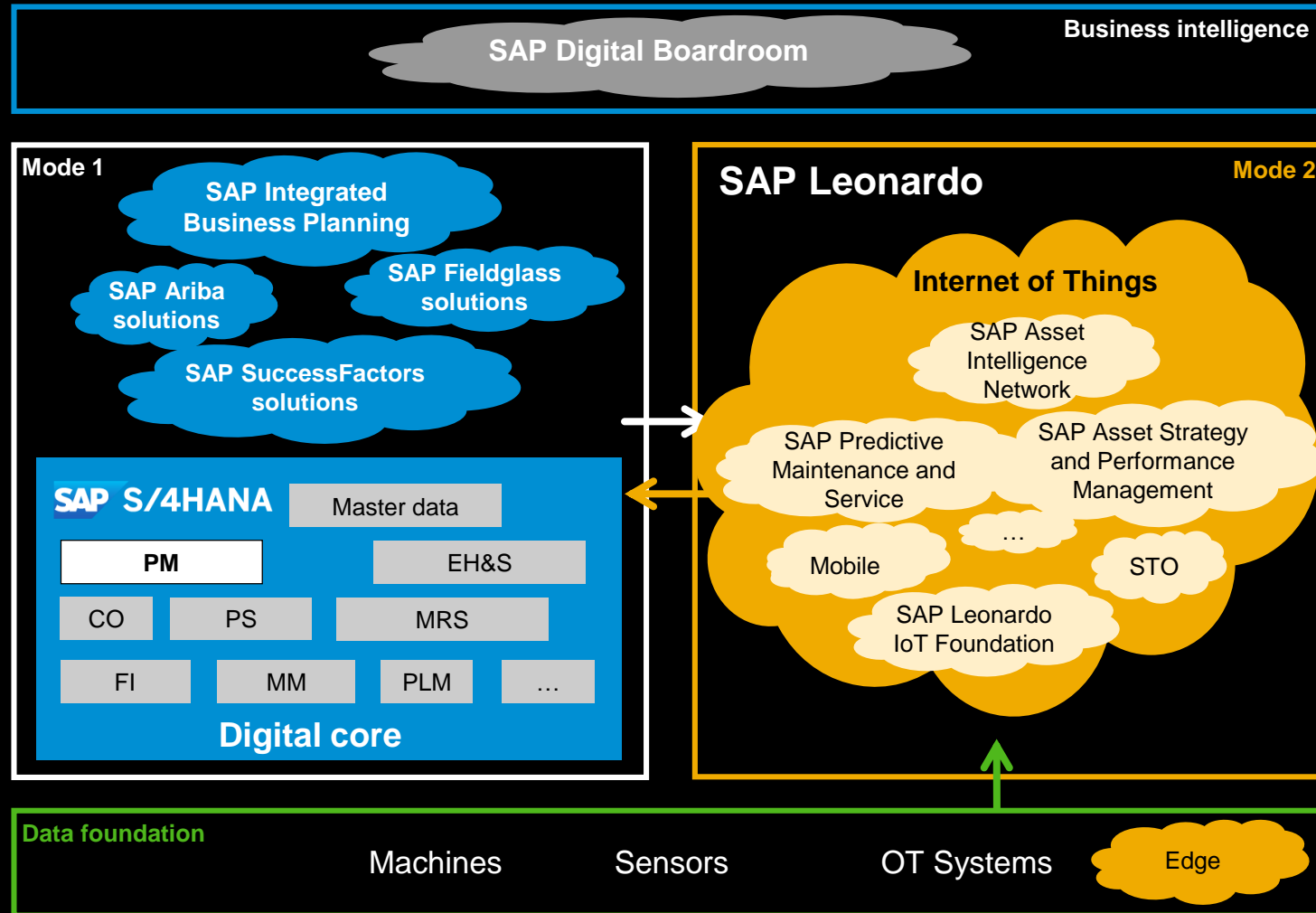
Systems of record versus systems of innovation



Source: Gartner

Envisioned logical architecture for SAP Enterprise Asset Management

Strategic direction



Run businesses

Hyperautomate business processes

Embrace data

Orchestrate data of any volume, velocity, and variety

Steer businesses

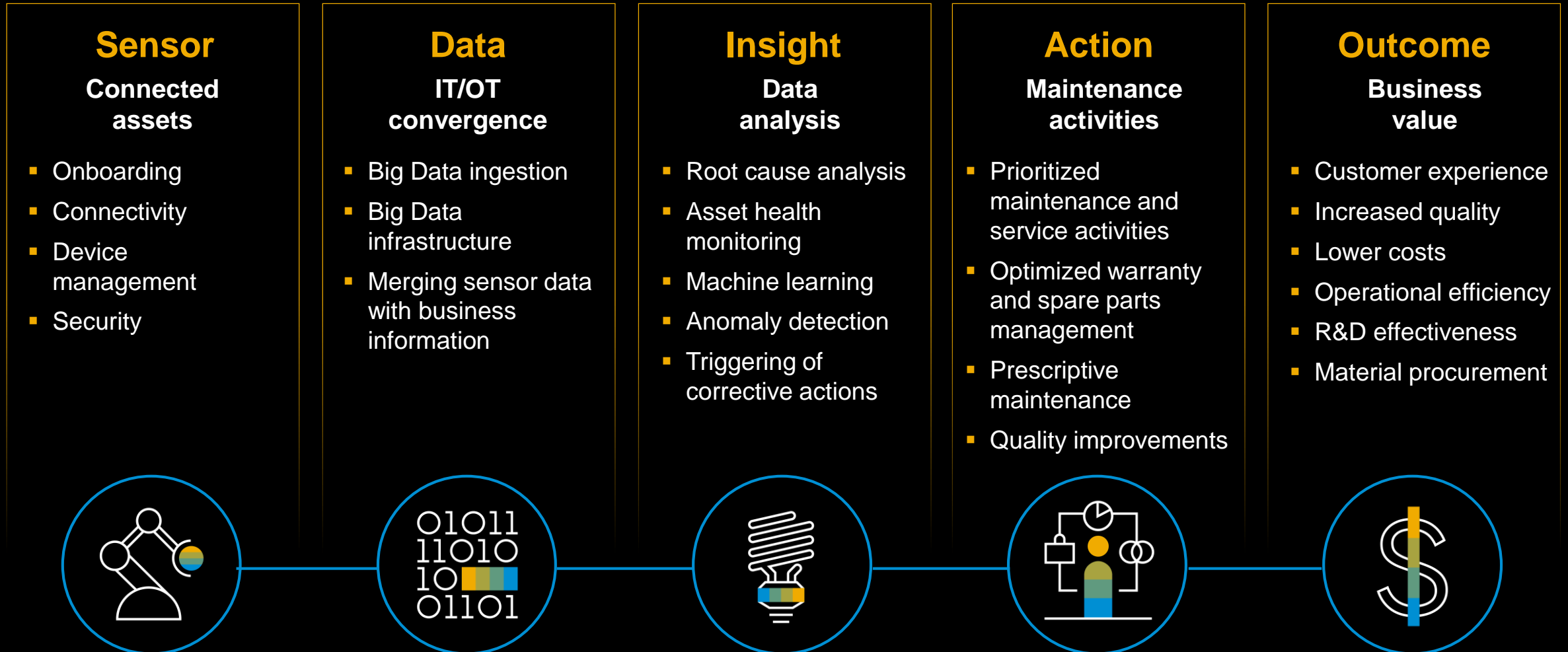
Deliver insights to drive strategic decisions

Differentiate businesses

Intelligently connect people, things, and businesses

SAP Predictive Maintenance and Service

From sensor to insight to outcome



SAP Predictive Maintenance and Service

How can information systems help?

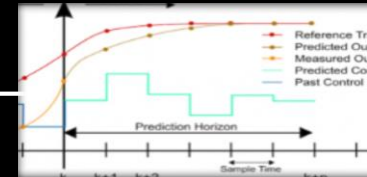
Remote monitoring



Agile planning



Alerts and actions



SAP Leonardo IoT capabilities

Engineering rules

Life indicators

Distance scoring

Anomaly detection

...

Connected assets and sensors

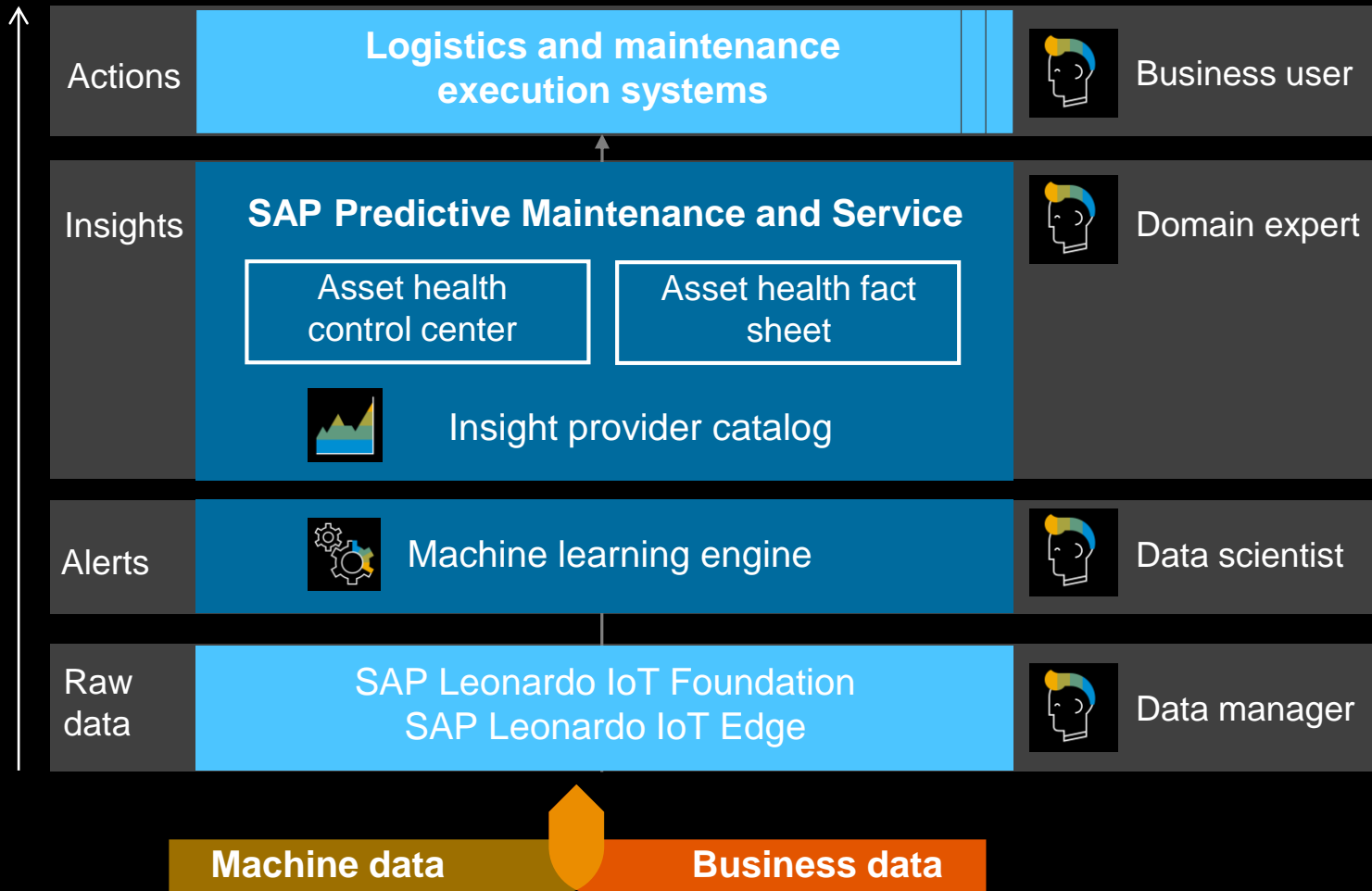
OT systems
(such as SCADA)

Other data sources
(such as weather)

Digital core
(SAP S/4HANA)

SAP Predictive Maintenance and Service

Solution components and value drivers



- Availability through the **cloud** or **on premise**
- Flexible **extension concept** to build industry- or customer-specific models and analytics
- Scalable **machine learning engine** that drives data science insights into our business processes
- **Flexible visualizations** across equipment structures
- Comprehensive process integration: **alert, discover, remedy**

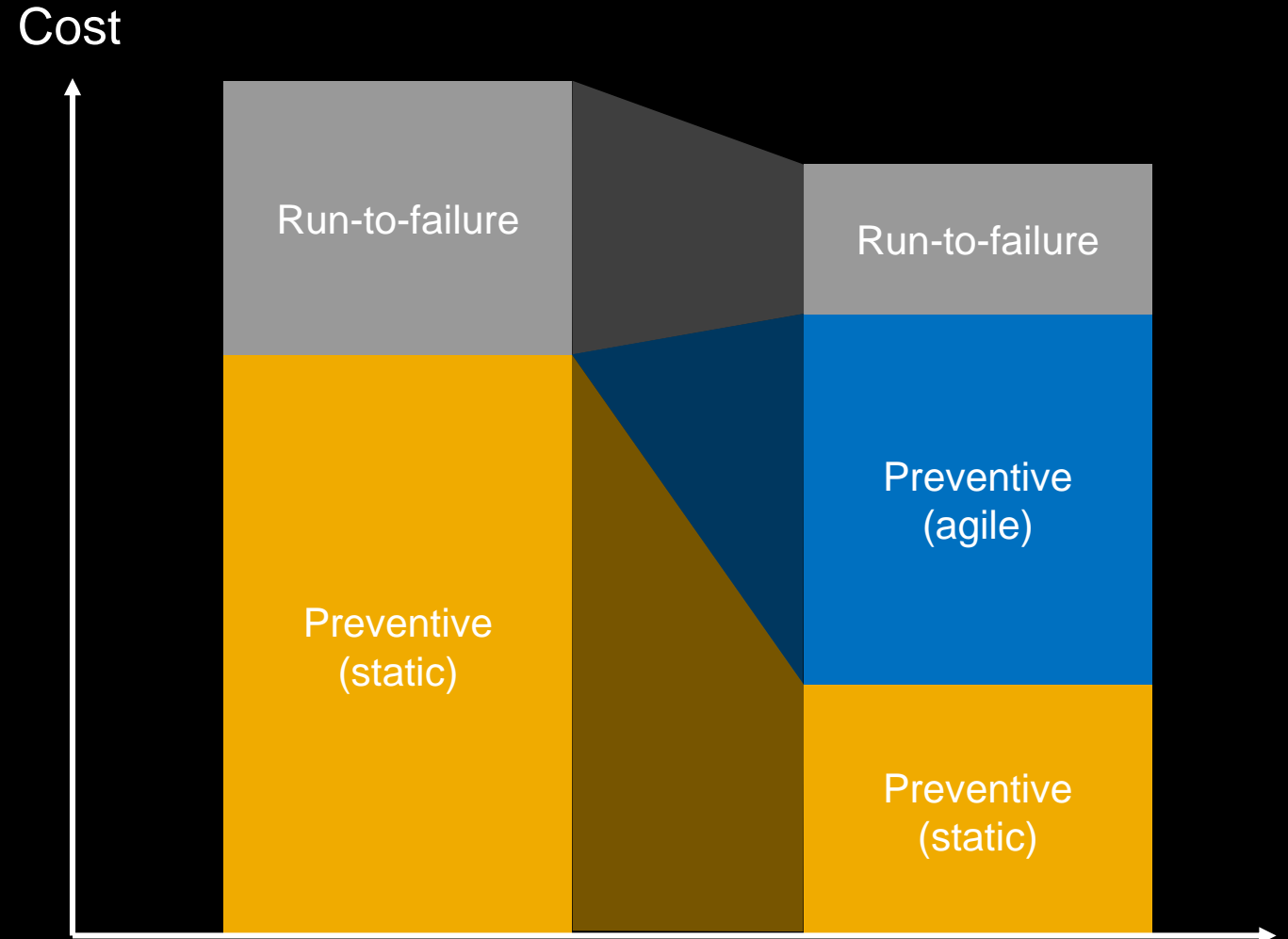
SAP Asset Strategy and Performance Management

Adding more efficiency by looking at the fleet

Condition data allows for a ranking of assets according to a health score.

For “healthier” assets, the service interval can be prolonged, while it can be shortened for others.

This results in fewer failures and lower maintenance costs.



SAP Asset Strategy and Performance Management (planned)

End-to-end process enablement

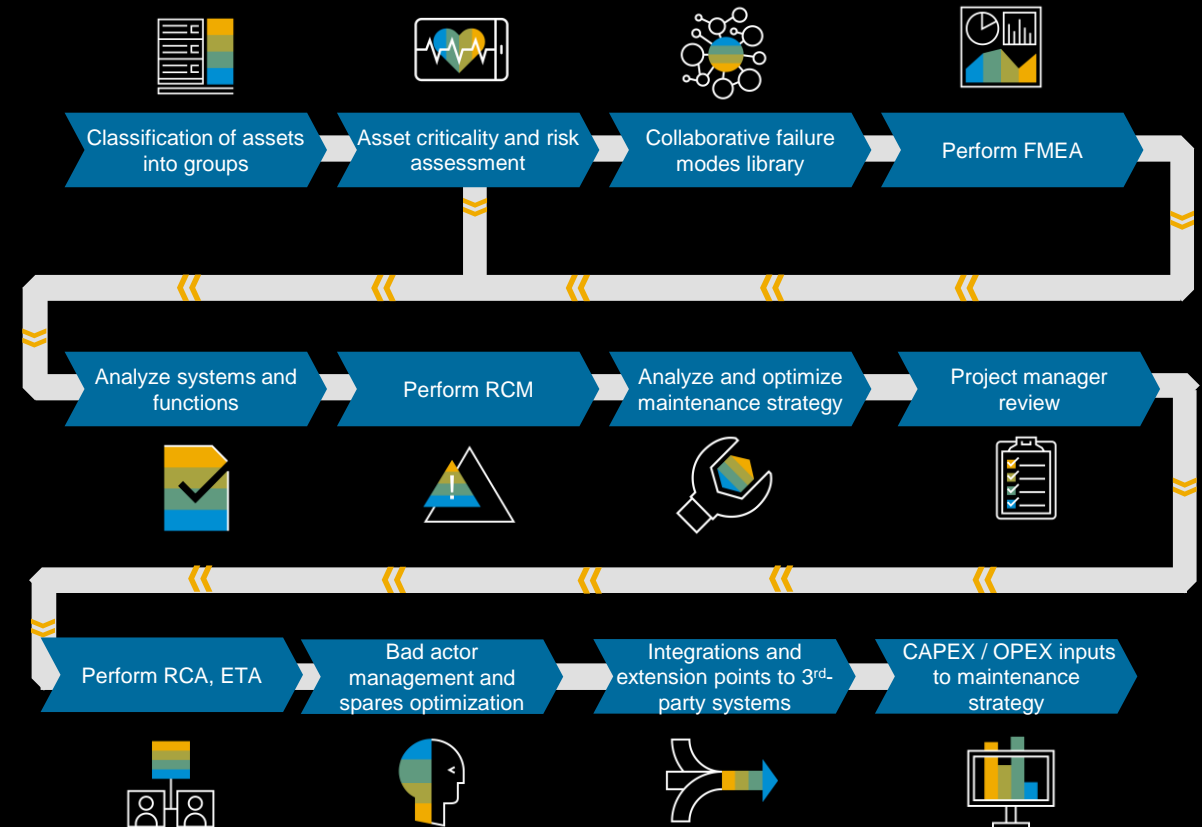
Benefits

- Increase overall asset availability
- Increase MTBF – increase equipment reliability
- Improve utilization of assets
- Control maintenance spend
- Reduce work backlog
- Identify savings opportunities through preventive and predictive maintenance
- Reduce capital tied up in spare parts inventory
- Adopt a proactive and targeted maintenance strategy
- Change the sequence of the process using point apps

Solution integration points

- SAP Asset Intelligence Network
- SAP Predictive Maintenance and Service
- SAP ERP application or SAP S/4HANA (PM, MM, FI/CO, PP functionalities)
- SAP Integrated Business Planning

Process innovation



MTBF – mean time between failures; FMEA – failure mode and effects analysis; RCM – reliability-centered maintenance; RCA – root cause analysis

Digital transformation in asset management driven by IoT, cloud, and business networks

What does digital transformation mean for enterprise asset management?

Connect to the asset

- Bring together information from operational and business systems (IT/OT convergence)
- Utilize the IoT for scaling transparency without neglecting existing information sources

Predict asset system behavior

- Avoid unplanned downtime and major operational consequences through simulation and prediction
- Discover patterns of failure and preserve operational integrity
- Blend business IT information with operational (OT) data

Share asset information and collaborate

- Activate the ecosystem of OEMs, EPCs, service providers, and operators
- Make sure there is one version of truth on asset master data
- Use a business network to enable integrated processes in the cloud

SAP solutions for the asset management line of business

Where to find more information about our road map and innovation

SAP Road Maps

SAP Road Maps communicate the solution and product direction so you can optimize business value and the return on your IT investment.

Solution and Product Road Maps

Customer Login Required (S-User) – Road map information is available to current SAP customers and partners only. Your S-User login is required to access this information. Please contact your local SAP support center for assistance.

Solution Road Maps

- Discover the planned innovations for our solutions
- Find out about our solution today and how they add value to your business
- Get a perspective on the future direction – inspired by your requirements

Product Road Maps

- Provide detailed information on the current version of the product with features grouped by value and capabilities
- Provide detailed information on the planned innovations of the product with features grouped by value and capabilities
- Summarize future direction for the product

[Browse all Road Maps](#)

Click here to see the schedule of [Upcoming Webinars](#)
See below for the complete set of published road maps

Industry | Line of Business | Platform & Technology | Cross Topics

Hello Achim Krueger from SAP
Welcome to Innovation Discovery

Find the innovations and features that you can turn into tangible value for your business

[DISCOVER INNOVATIONS](#)

HOT TOPICS

SAP S/4HANA 353 Innovations related to SAP S/4HANA	User Experience 333 Innovations related to user experience	Digital Transformation 132 Innovations related to digital transformation
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Road maps:

<http://www.sap.com/roadmaps>

Value maps:

<http://www.sap.com/solutionexplorer>

Innovation discovery:

<http://sapsupport.info/support-innovations/innovation-discovery/>

Thank you.

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www.sap.com/solutionexplorer

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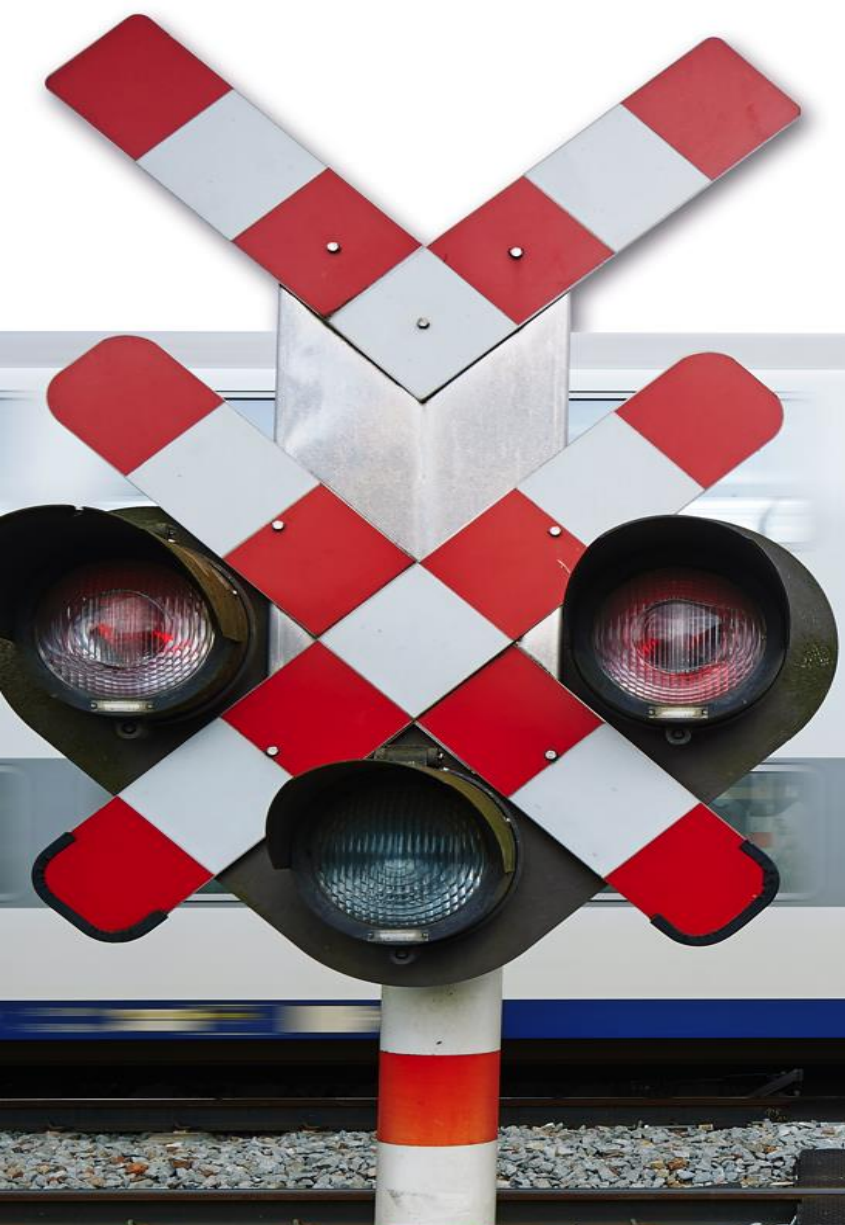
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Building the Smart Railroad

SAP Leonardo Live event

Jeroen De Roeck





Key Figures Asset Management

10.176 Main Signals

(31/12/2016)

1.751 Level Crossings

(31/12/2016)

6.511 km of Main Track

(31/12/2016)

5.905 km Overhead lines

(31/12/2016)

7000+ Employees

(31/12/2016)

11.769 Civil Engineering

Constructions (31/12/2016)

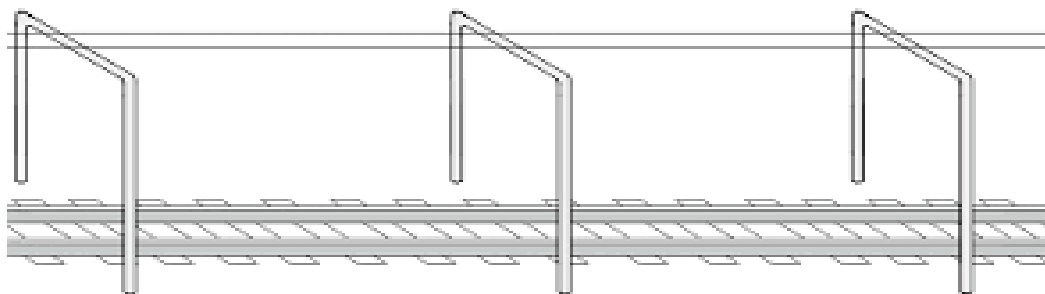
SAP objects

>500.000 Functional locations

>2.000.000 Pieces of equipment

Spare Parts 270 M€

“STUPID Assets” NOT CONNECTED



“SMART Assets” CONNECTED



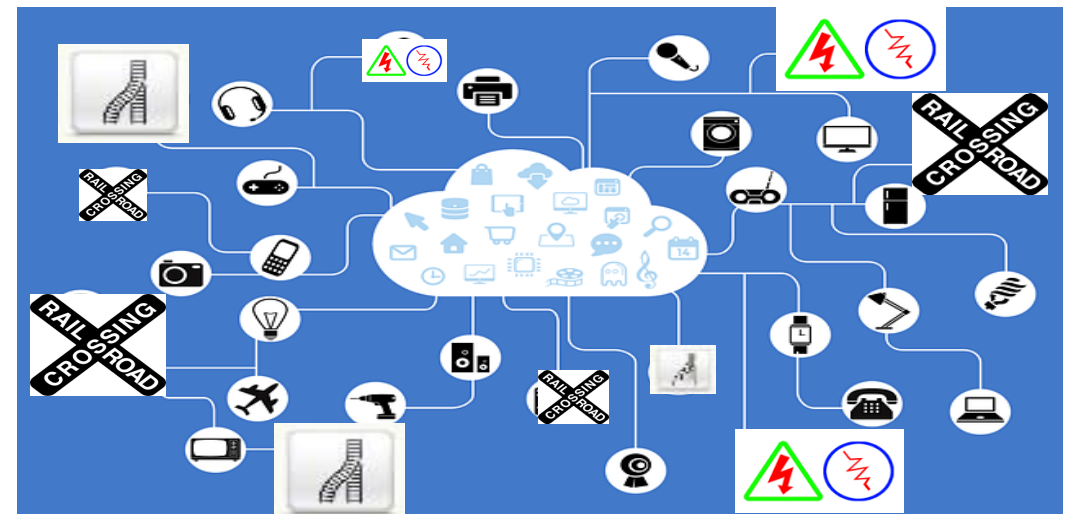
SMART
TECHNOLOGY

“STUPID Assets” NOT CONNECTED



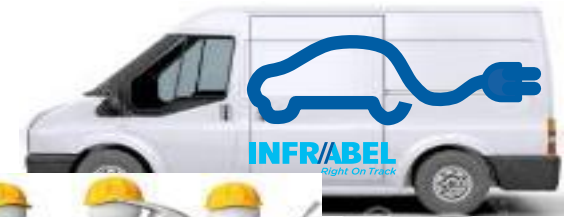
Sensors &
Measure Trains

“SMART Assets” CONNECTED



Sensors &
Intranet of Things

Digital Strategy



**Technicians
& TABLETS**



**Preventive
maintenance
plans**

Incidents

**Preventive/Condition/Predictive-based
maintenance**

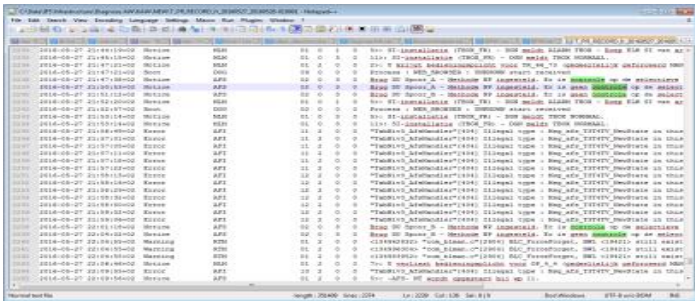
SAP



PLANNER

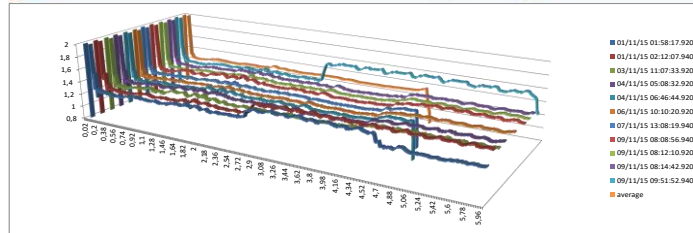
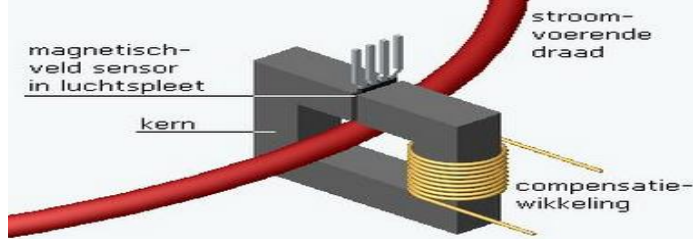


EBP



EBP logbook

PQube



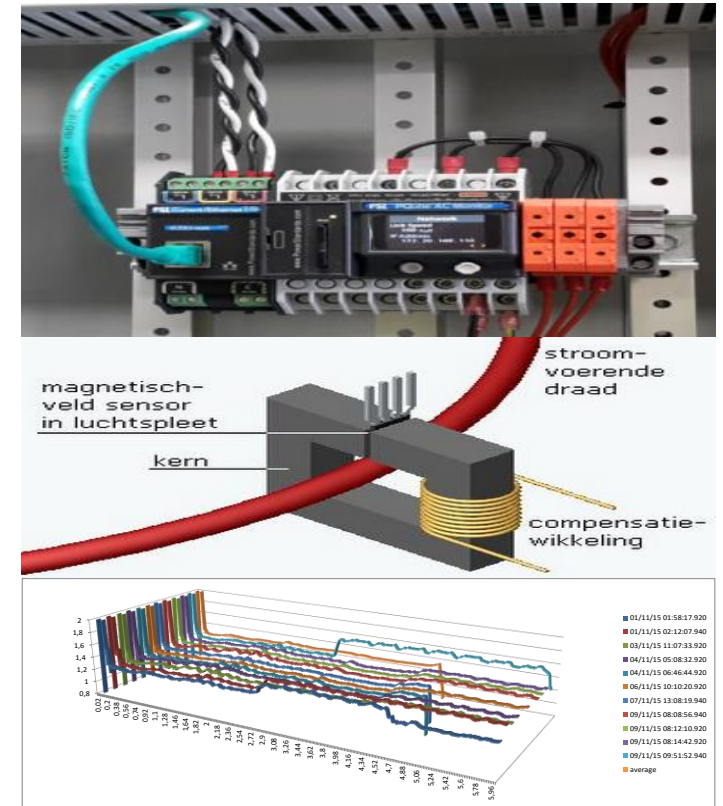
Current Curves (1.000.000)
100 Turnouts

Turnout – motor



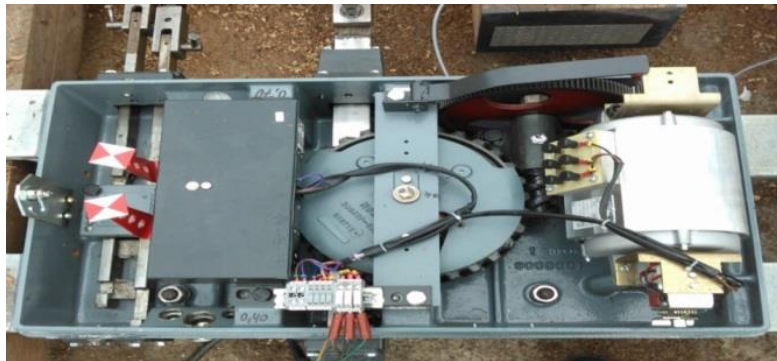
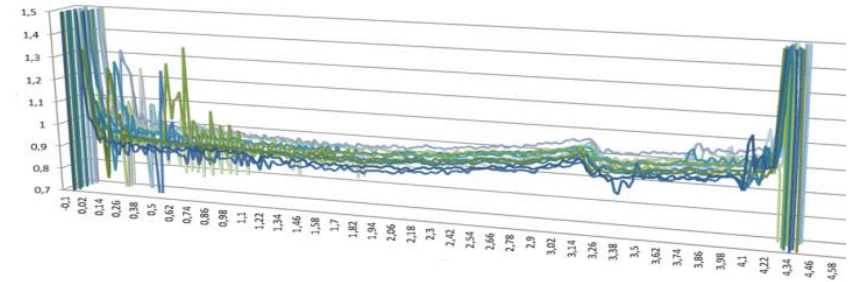
SAP Enterprise Asset
Management (SAP EAM)

- Turnouts are more or less a blackbox
Information currently available from distance
 - Left or right
 - In/out control
- Placing the Pqube sensor should increase the
 - **Visibility** on the functioning of a turnout
 - Provide **Data** to examine behaviour



Going from individual measurements to current curves

- Plot measurement values in time
- Business value:
 - ⇒ Current curves
 - ⇒ A correct image of the physical functioning of a turnout



- *Each turnout has its own curve that evolves during time*
 - *Each type of turnout has a typical curve*
 - *It defines the ‘DNA’ of the turnout*

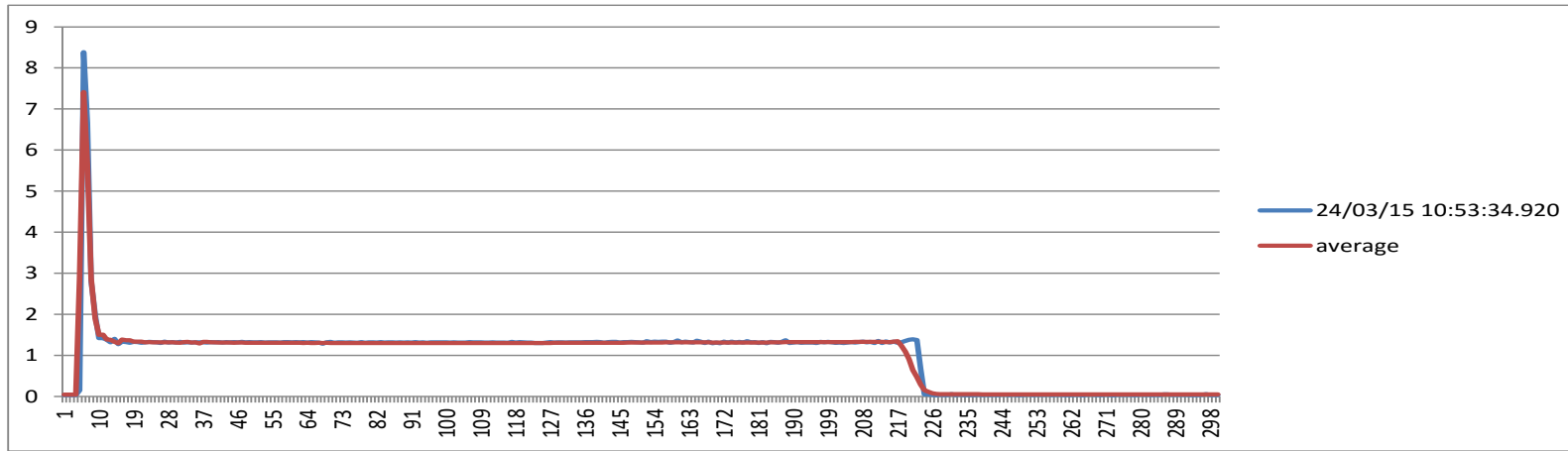


Determine algorithms to define ‘normal’ behaviour

Each unique turnout has its own characteristic evolution of the curve

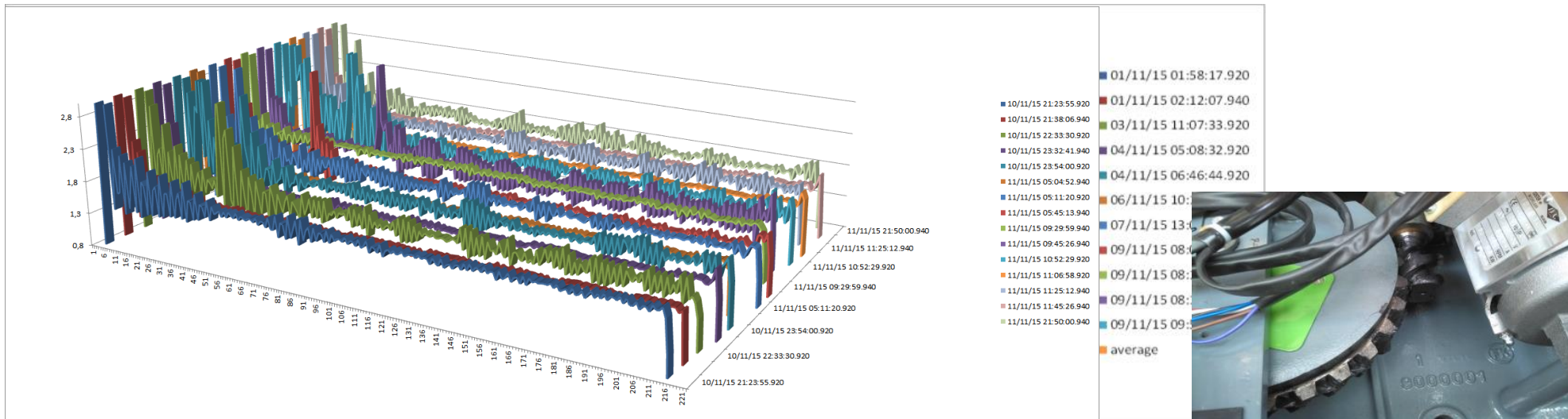
Curve:

- Difference for left or right movements
- Variation in current due to changes in mechanical properties



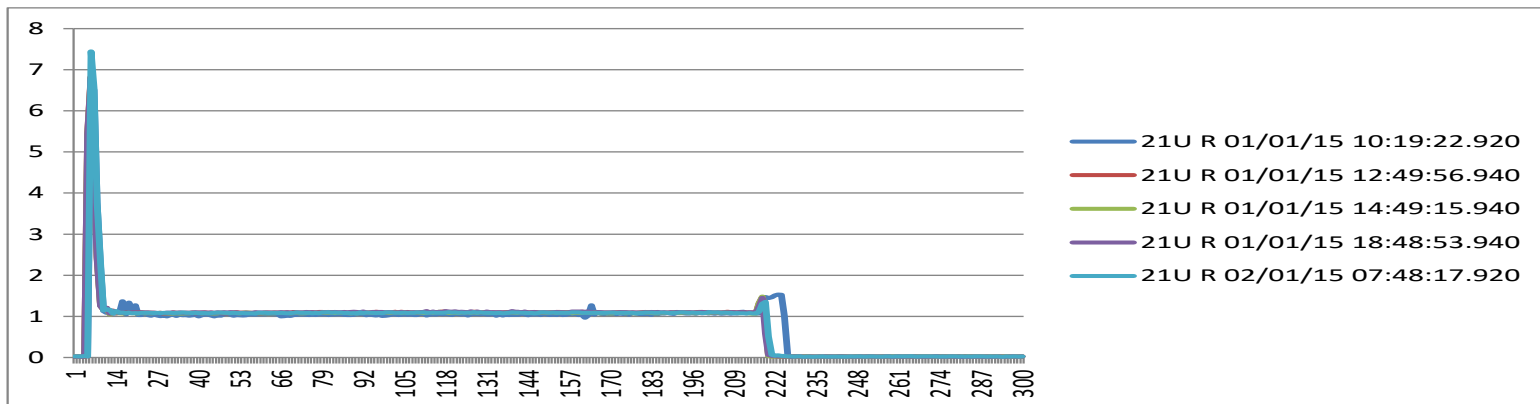
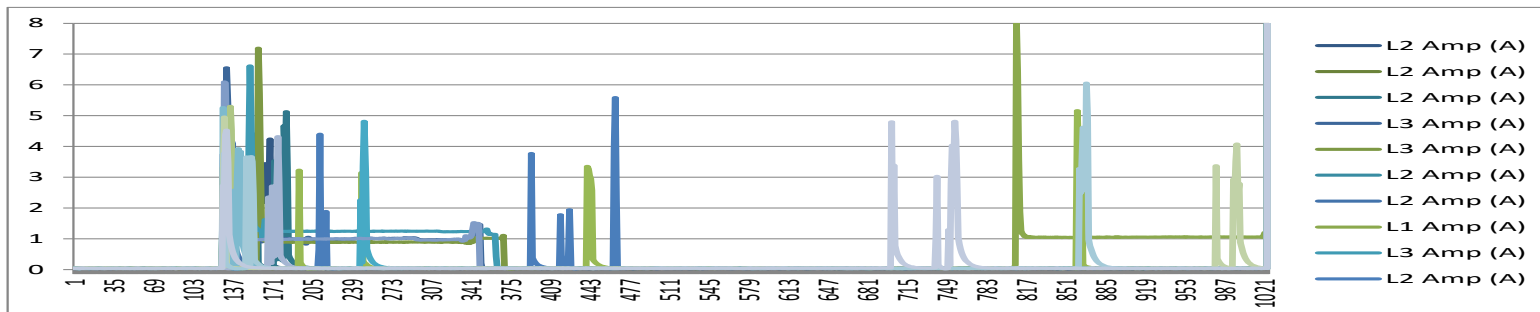
Determine algorithms to define ‘abnormal’ behaviour

- Abnormal current consumption
- Longer runtimes
- Larger deviations = malfunction
- Specific patterns ie. Bad alignment worm wheel



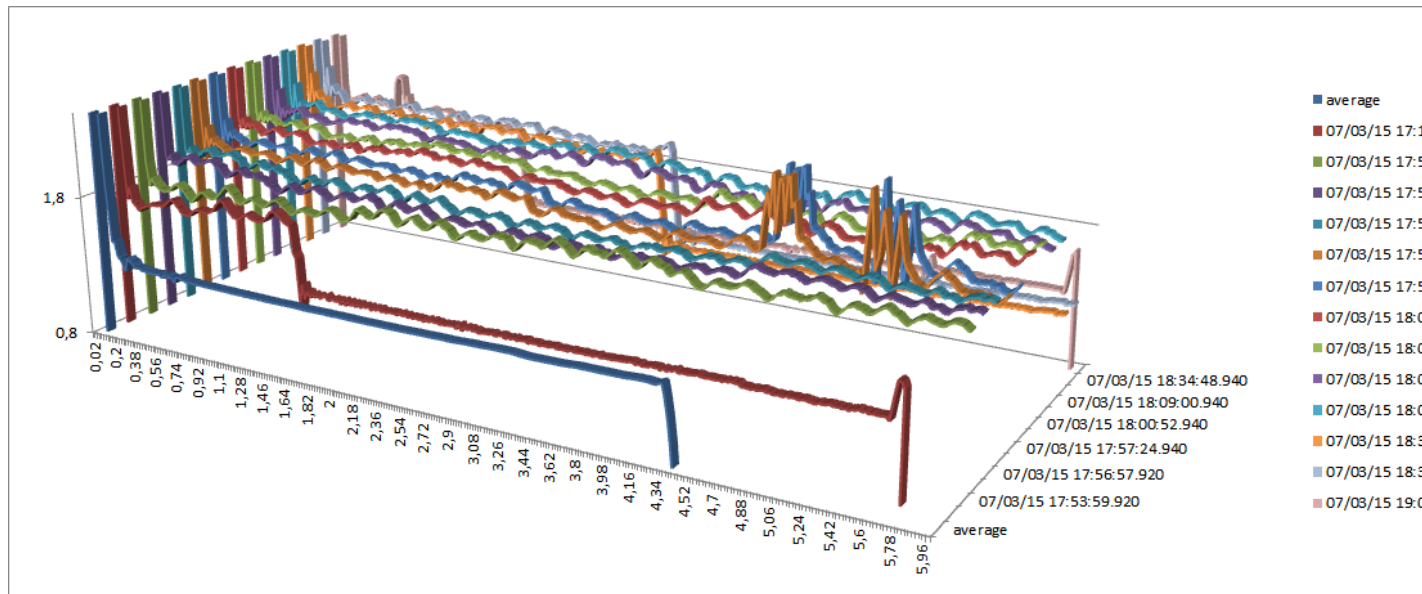
Normalisation

- Flatten out differences in timestamp between different systems
- Only keep reliable measurements



Building a predictive model

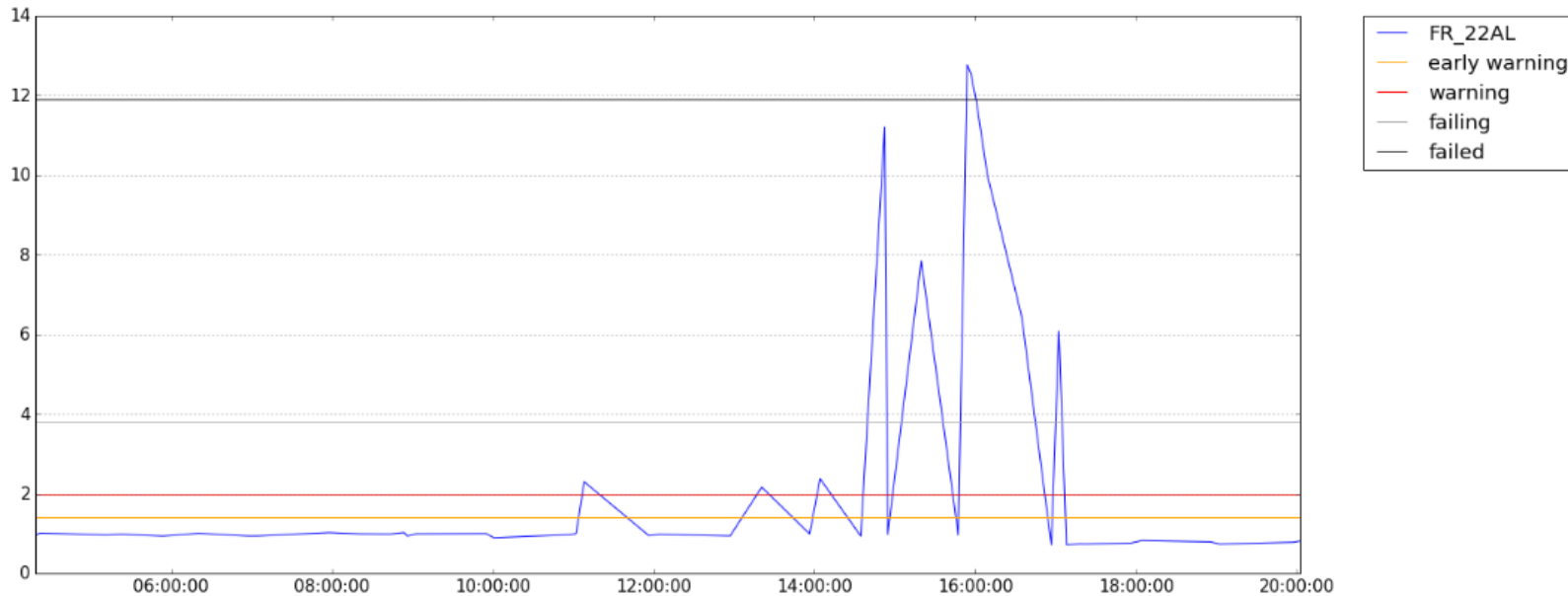
- Each movement gets a calculated number



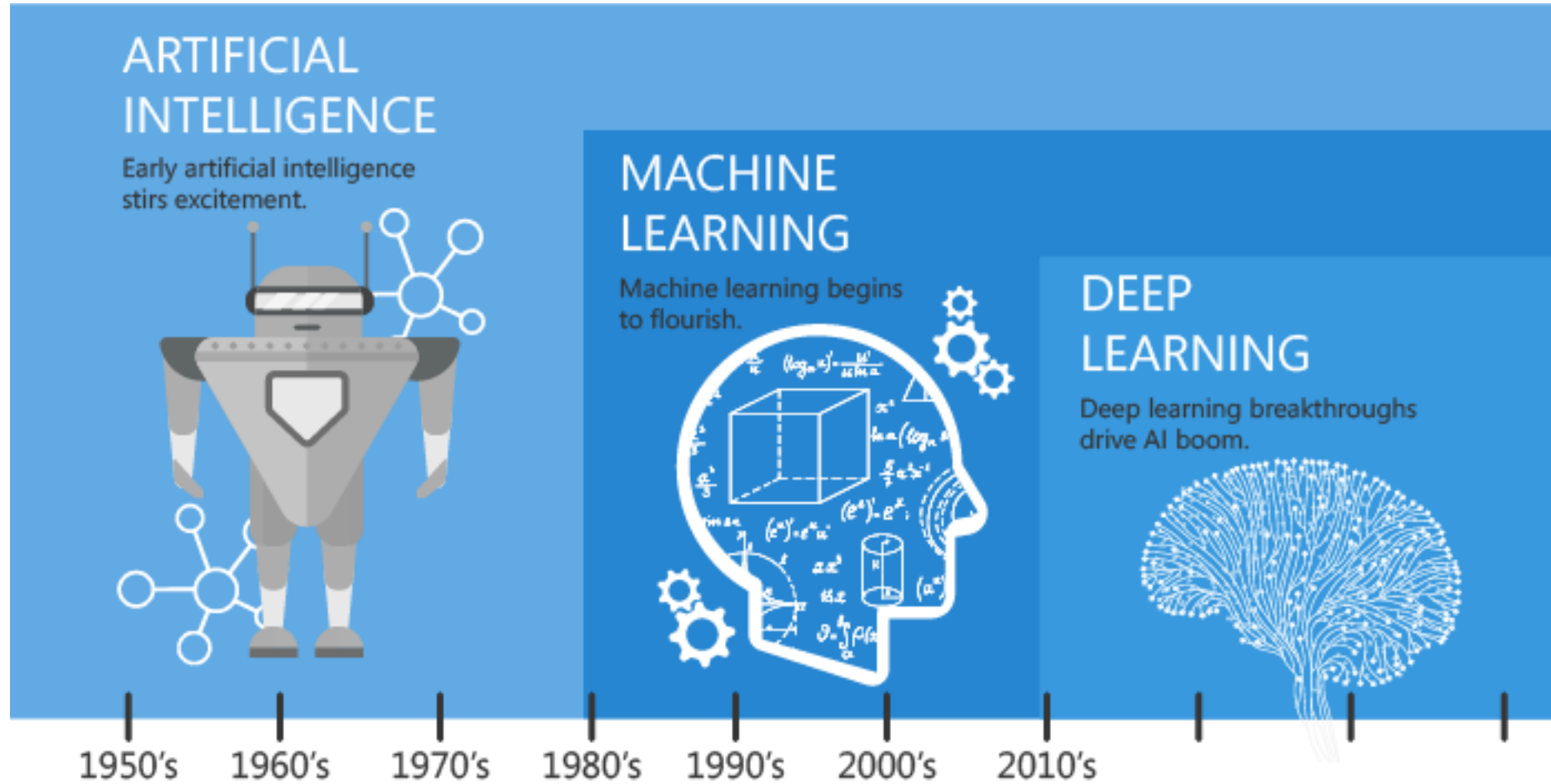
Number	Anomaly	Category
0.9762	normal	
7.84222	failing	F26
0.96101	normal	
12.7684	failed	f30
12.5305	failed	f30
12.4308	failed	f40
11.8506	failing	f30
10.0133	failing	f30
6.42567	failing	f30
0.71324	normal	
6.07957	failing	f26
0.71649	normal	
0.74115	normal	

Building a predictive model

- Each movement gets a calculated number

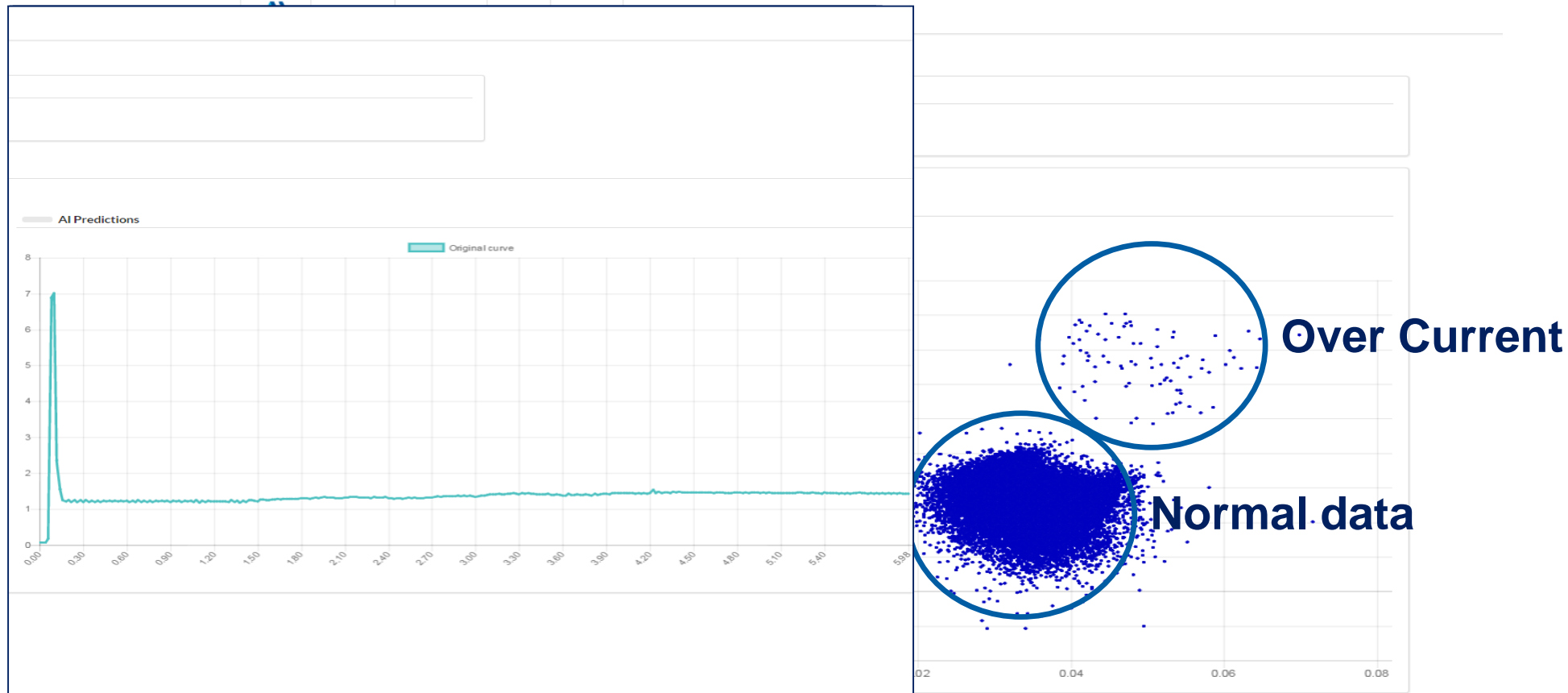


- Normal curve = 1
- Early warning $> 1,4$
 - Includes false positives
- Warning ≥ 2
 - No false positives
- Failing $\geq 3,8$
- Failed $\geq 11,9$



Unsupervised learning

Dimensionality reduction using neural networks





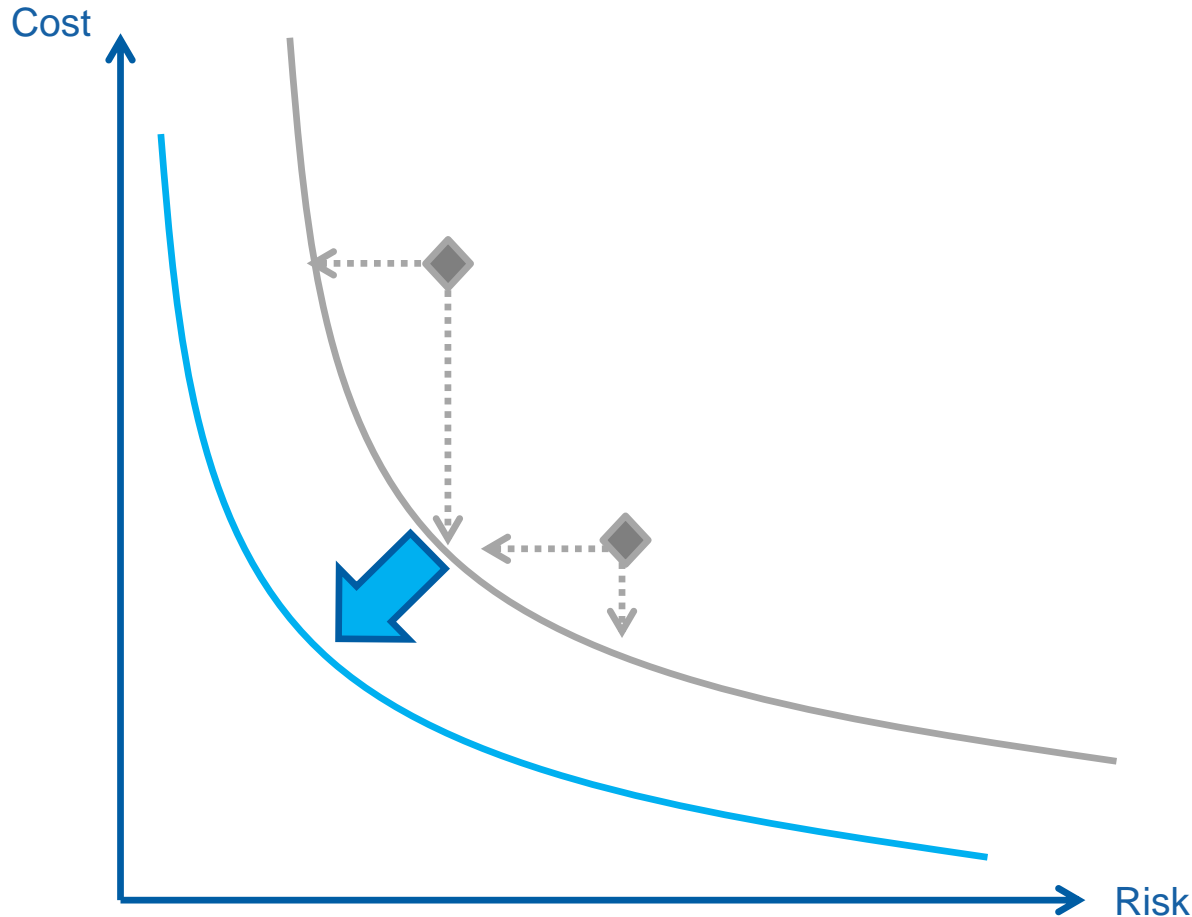
Reduce cost of operations

- **Increase installed base:** install Pqube on critical turnouts.
- **Avoid unnecessary activity** in the field
- **Better planning and preparation** based on indications from predictive model



Reduce unplanned downtime

- **Reduction of unplanned downtime** by early warning
 - Number of false positives to be managed
- **Prevent extended maintenance downtime** due to unforeseen activities



Starting from traditional Preventive Maintenance Strategy

- Low Risk
- High Cost

- Adapt preventive Maintenance strategy
 - Cost of visits ↓
 - Risk ↑

- Use Predictive model to lower the Risk

- Total cost of Predictive Model + Lower Maintenance strategy < Traditional Preventive Maintenance
 - New balance between cost and risk

Next steps in making assets 'smart'

Increasing the business value

2017 **2018**

Singular Assets



Turnout
Measurement system



Turnout
Video Inspection system



DB 500 Gb/year
Video 100 Tb/year

Linear assets



TVS
Track
Video System



SGS
Switch
Geometry System



100 Tb/year



Pqube case enabled us to:

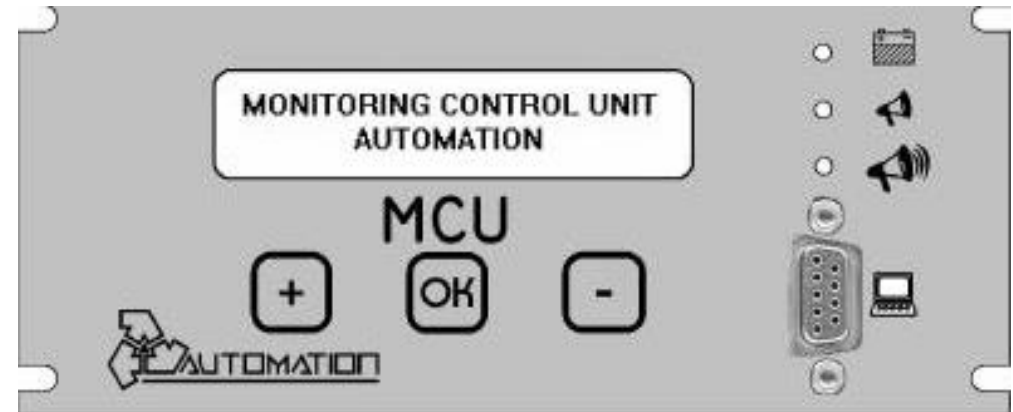
- Learn and understand possibilities of IoT @ Infrabel
 - In the beginning: a lot of manual work involved
- Unsupervised learning had the same result much faster
- Looking for additional IoT opportunities:
 - Monitoring Control Unit
 - Enhance 'old' equipment with nonintrusive new technology

Next steps in IoT – Monitoring Control Unit

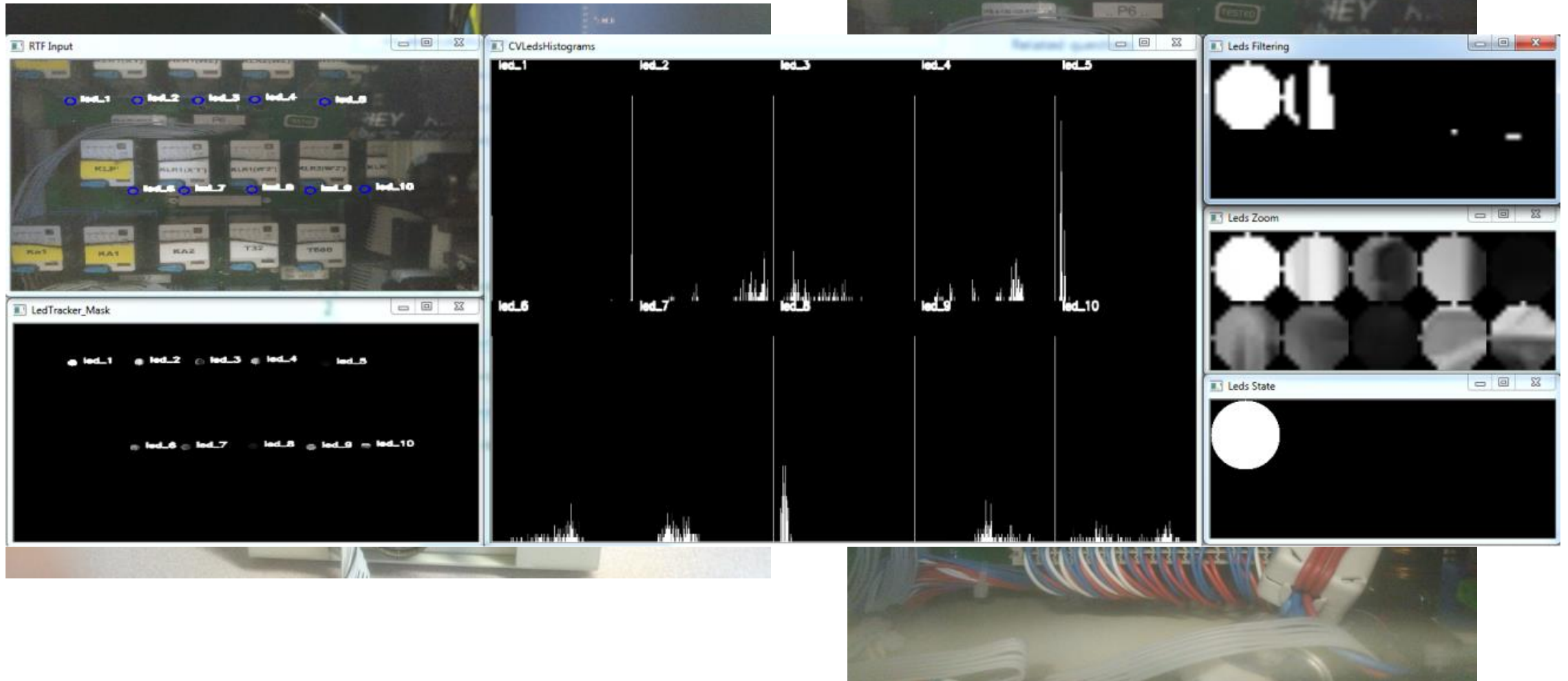


MCU:

- Remote measurement/monitoring of:
 - Batteries
 - Current rectifier
 - Active alerts
- Configuration parameters managed remotely
- **Business Value:**
 - Fewer physical visits necessary.
 - Visit takes 3,5 hours incl travel * 750 installations = 2625 hours saved
 - Active control of parameters, limit human errors
 - Early warning on battery issues

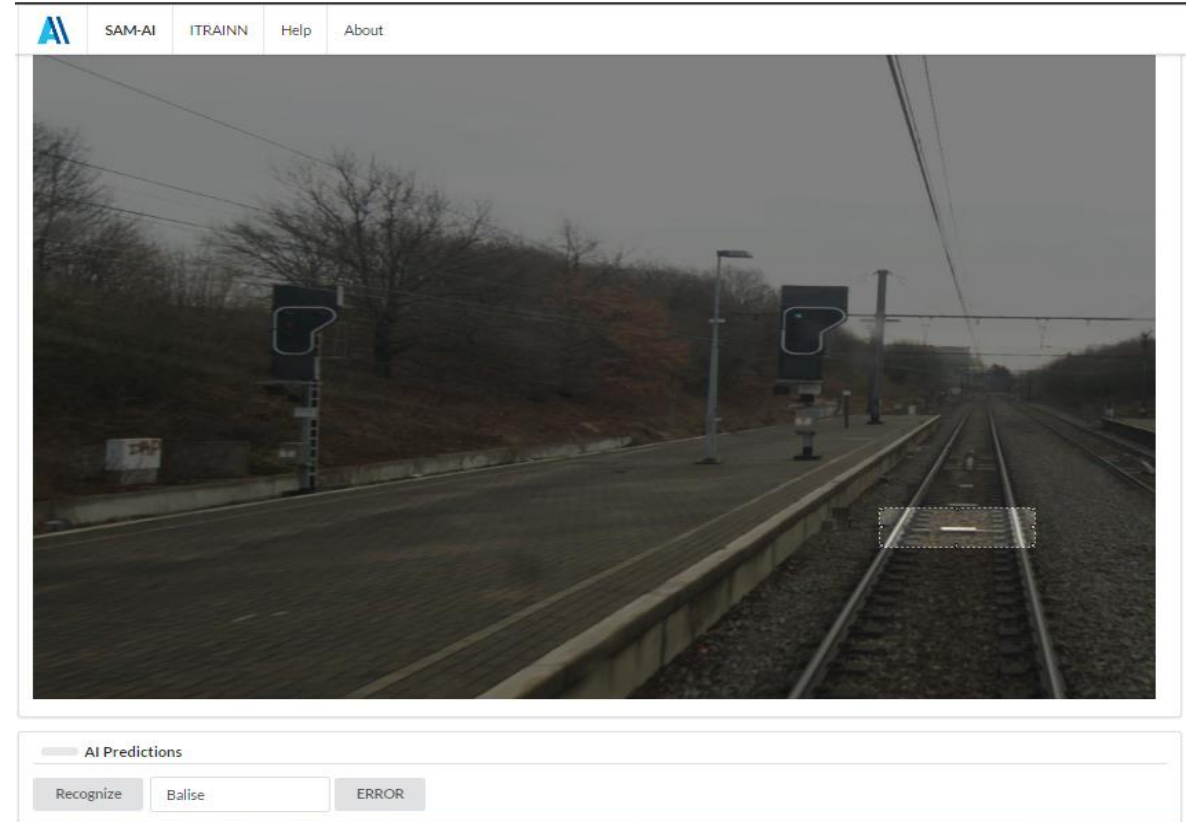
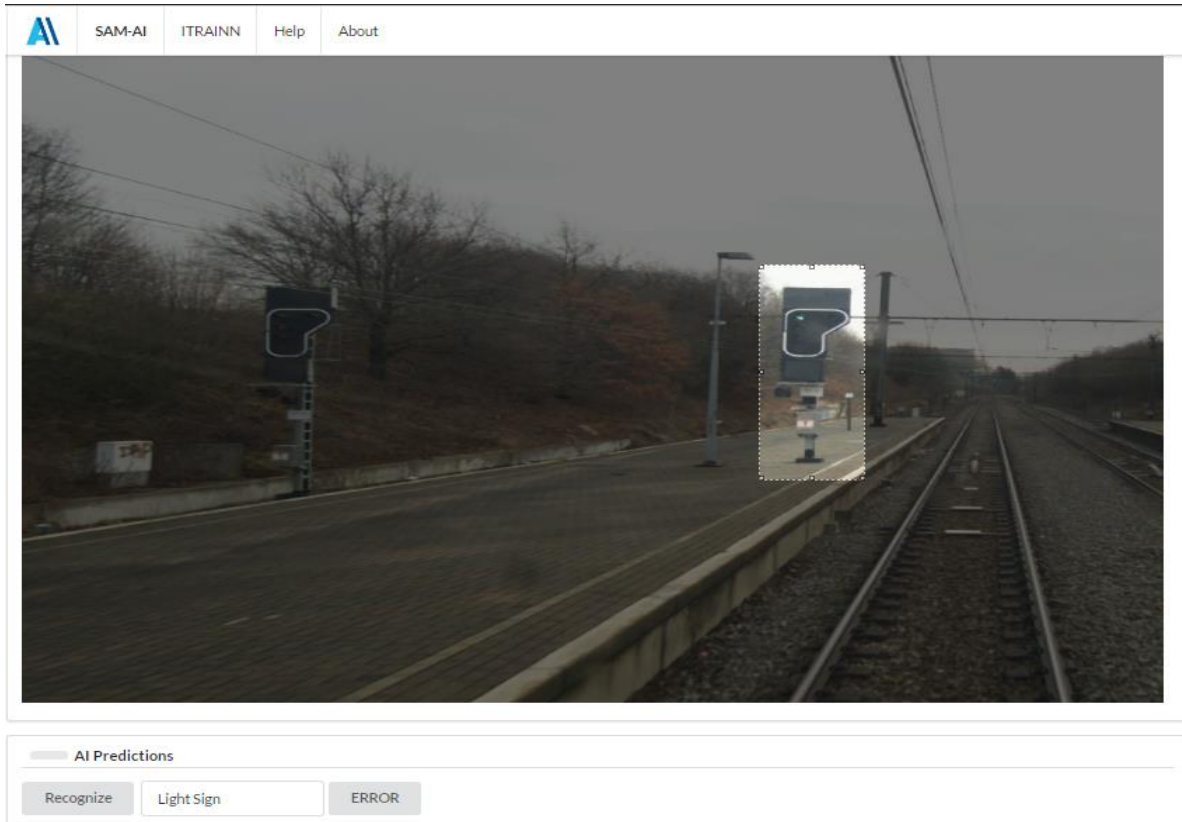


Next steps in IoT – LED's tele-monitoring in RTF boxes using Computer Vision

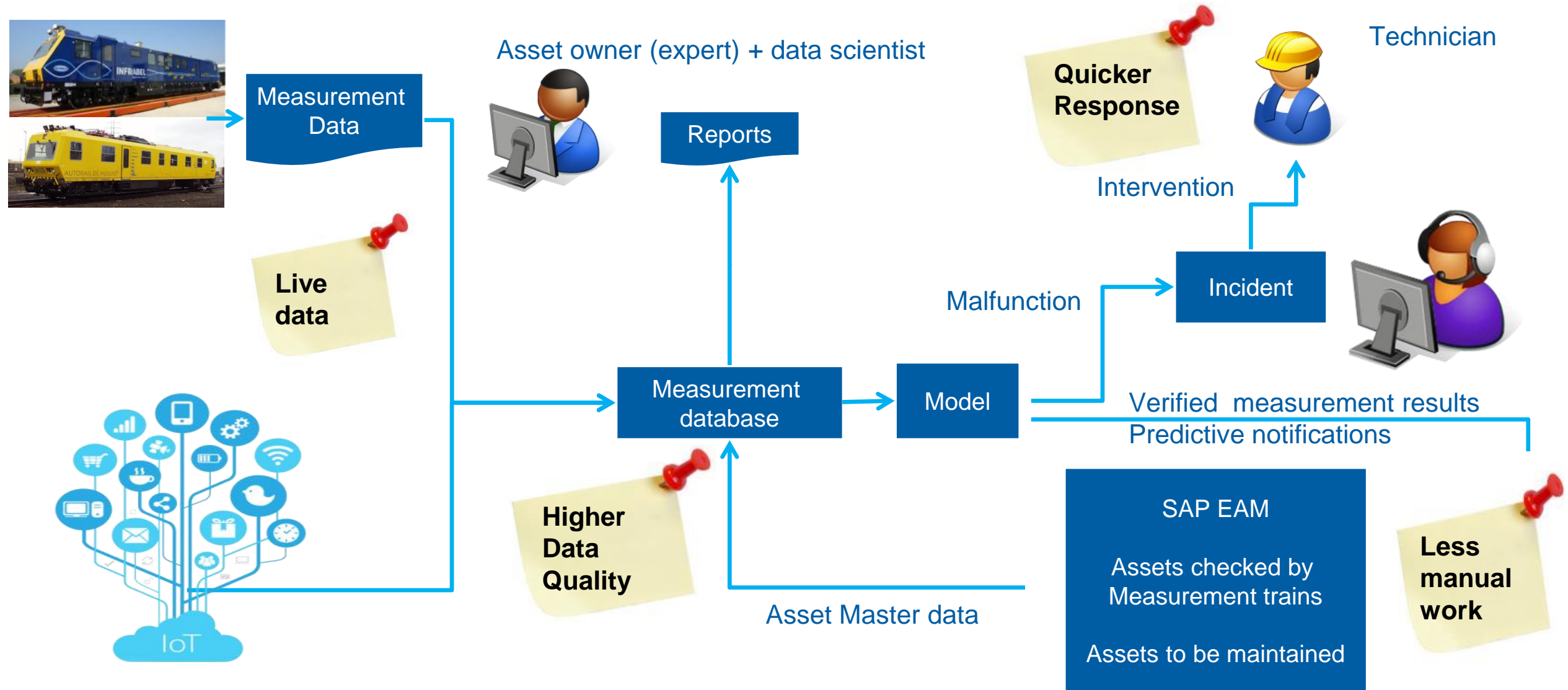


Next steps in IoT – Asset classification with Computer Vision

State-of-the-art research and development at Infrabel



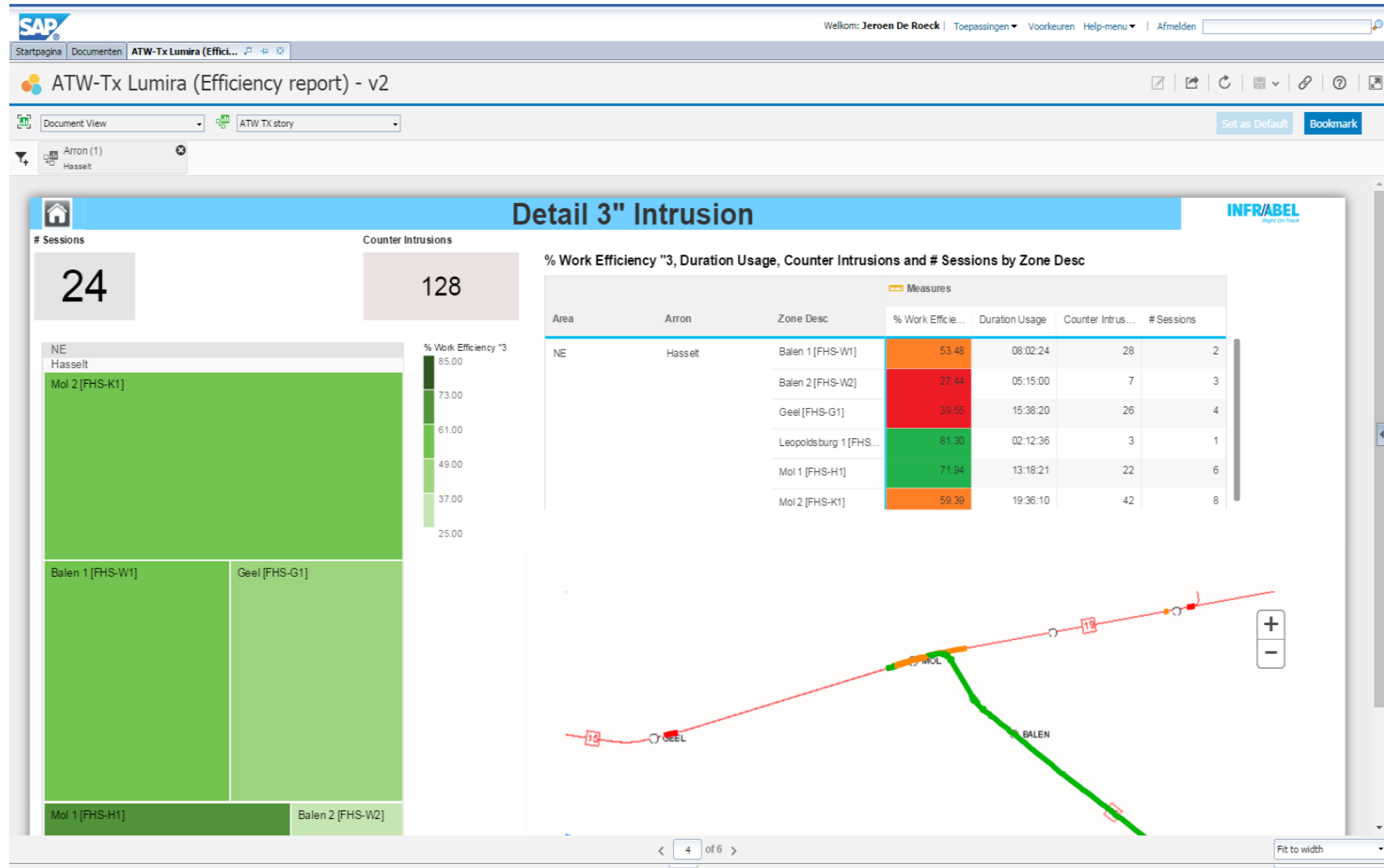
Asset Management information flow



How to digest all the data

Use of flexible reporting in SAP Lumira software

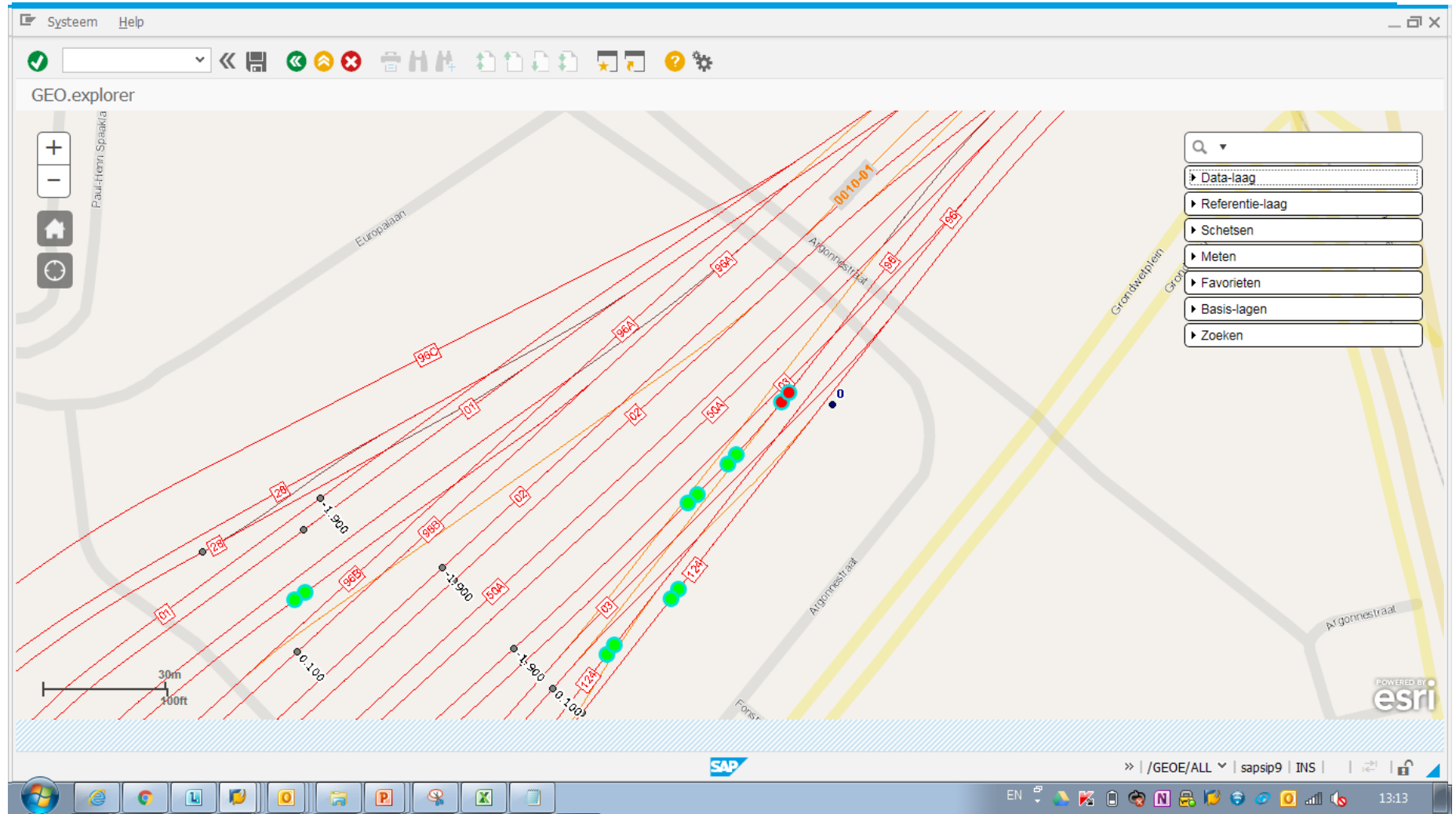
- Meaningful insight on combined data
- KPI models based on previous data analysis experience
- Tree maps and geographical visualisation to focus on the important stuff



How to digest all the data

SAP EAM with GEOe support

- Visual way of working
- Quickly identifying assets that need maintenance
- Real time follow-up



How to digest all the data

SAP EAM and Expert systems

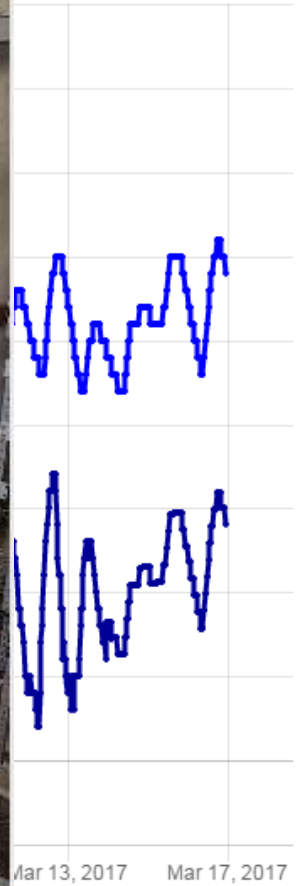
- Visualising linked assets
- Connecting measurement information
- Display information on previous measurements
- All information available from the back-end system



Straight



Left



How to digest all the data

Mobile SAPUI5 apps

- Consult measurement history
- Perform checklists
- Access location-based observations by maintenance crews

Notification list

130 - NAMUR - CHARLEROI S. A 078.525 - 094.750

Status	Description	Asset Type	Track	Distance	Start Marker	Actions	Last update	Details
	Waste - Depots (green) waste,		A		078.900	<input checked="" type="checkbox"/> Resolved <input type="radio"/> Stable <input type="checkbox"/> Worsening <input type="checkbox"/> No fix	Jan 23, 2017	>
	Rail - Corroded	AW	A		081.577		Feb 1, 2017	>
	Joint - Degraded/damaged longitudinal connection		A		090.000	097.217	Jan 23, 2017	>
	Drainage / ditch / gutters - Gutter / clogged ditch		A		090.000	097.217	Feb 1, 2017	>

Complete +

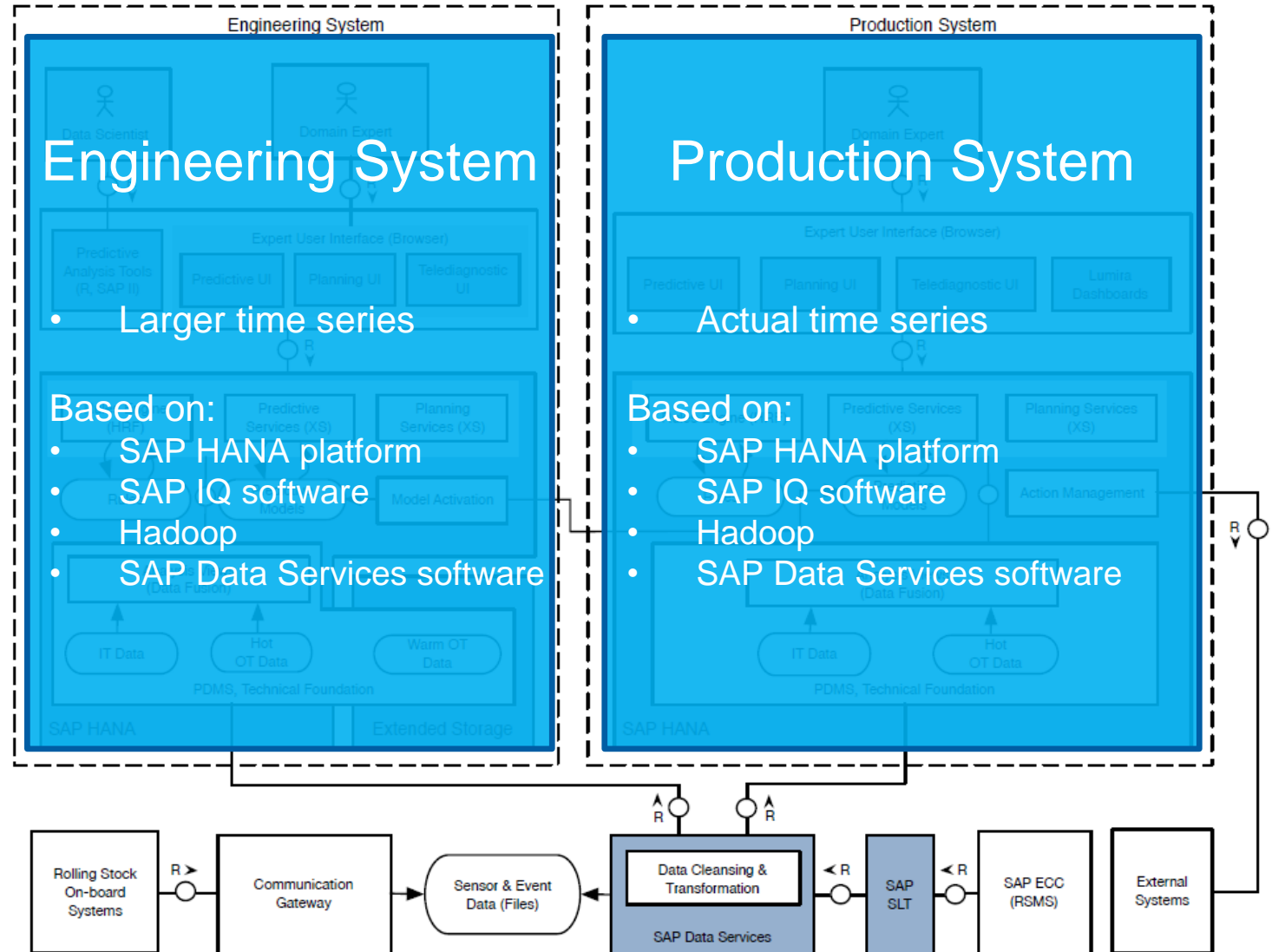
Separate engineering and production system

- Production used to plan and predict
- Engineering to develop predictive models and rules

Proven models to be displayed in production system

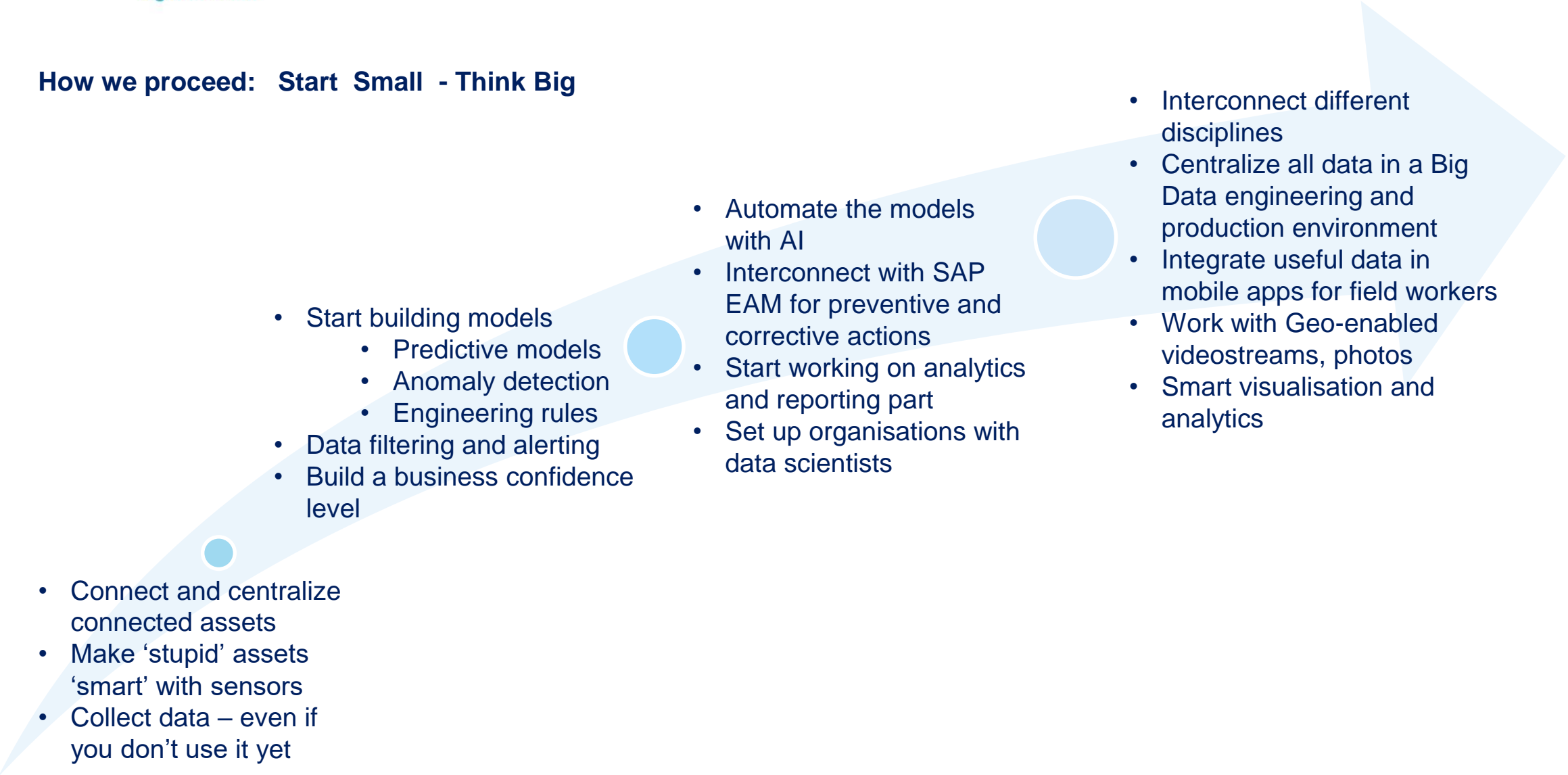
Only hot data in Production

Warm data in Engineering based on extended Storage.



Increase step by step the maturity in IOT scenarios

How we proceed: Start Small - Think Big

- 
- Connect and centralize connected assets
 - Make 'stupid' assets 'smart' with sensors
 - Collect data – even if you don't use it yet
 - Start building models
 - Predictive models
 - Anomaly detection
 - Engineering rules
 - Data filtering and alerting
 - Build a business confidence level
 - Automate the models with AI
 - Interconnect with SAP EAM for preventive and corrective actions
 - Start working on analytics and reporting part
 - Set up organisations with data scientists
 - Interconnect different disciplines
 - Centralize all data in a Big Data engineering and production environment
 - Integrate useful data in mobile apps for field workers
 - Work with Geo-enabled videostreams, photos
 - Smart visualisation and analytics



- Bring in Predictive skills (AI knowledge) to get started
- Check the economic model for placing sensors
- Quality of sensor is crucial: avoid sensor failures
- Huge change on way of working: build confidence level first
- Easy and simple solutions can work.
- Maturity can increase step by step.





Thank you