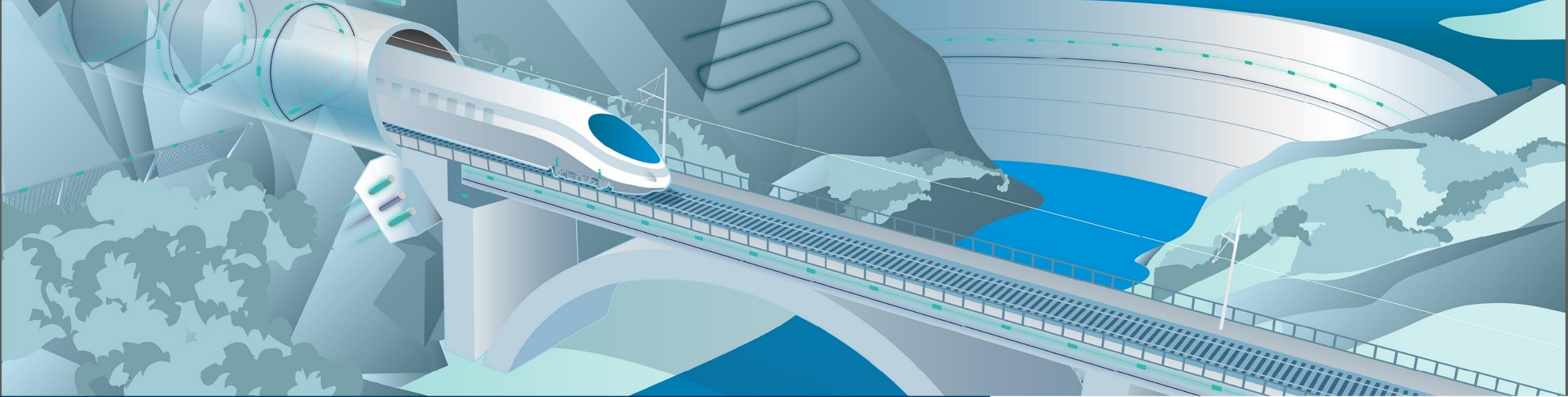




**HBK Technology Days – Virtual Seminar Series**

**Tuesday, November 15, 2022**



## **Railway Infrastructure: Reliable Measurement Data for a Holistic View to Drive Predictive Maintenance**

Presented by Dietmar Maicz,  
*Railway and Infrastructure Monitoring Expert, HBK*

# Railway Infrastructure: Reliable Measurement Data for a Holistic View to Drive Predictive Maintenance

## Abstract

With the help of HBK's TSI-Spot® (Single Point Of Truth) concept, railroad companies are enabled to obtain a holistic view of vehicles and infrastructure. New measurement methods and data processing methods allow the early detection of unnecessary wear and deviations on vehicles (wheels and pantograph) and infrastructure (superstructure and overhead line) in real time and, thanks to the high data quality, to derive reliable, fully automated forecasts for future plannable maintenance interventions.

Maintenance planning receives daily updated information about the track condition and the individual reaction of a vehicle type in real time. HBK's high-precision, compact and cost-effective measurement technology, combined with state-of-the-art software solutions, enables fully autonomous measurement of the relevant permanent way and overhead line parameters in real time.

## About the presenter, Dietmar Maicz, Railway and Infrastructure Monitoring Expert, HBK

Dietmar is a Railway and Infrastructure Monitoring Expert at Hottinger Brüel & Kjaer in Vienna. Studied industrial engineering and mechanical engineering, majoring in transport engineering and majoring in production engineering at Graz University of Technology. Since 2003 working in the field of measurement technology for Asset Health Monitoring and Predictive Maintenance.

# Railway Infrastructure:

MEASUREMENT DATA FOR A HOLISTIC VIEW TO DRIVE PREDICTIVE MAINTENANCE





# Dietmar Maicz

- Railway and Asset Health Measurement Specialist
- Master level degree in Engineering and Economics
- 20 years of experience, >15 years in test and measurement
- E-Mail: [dietmar.maicz@hbkworld.com](mailto:dietmar.maicz@hbkworld.com)



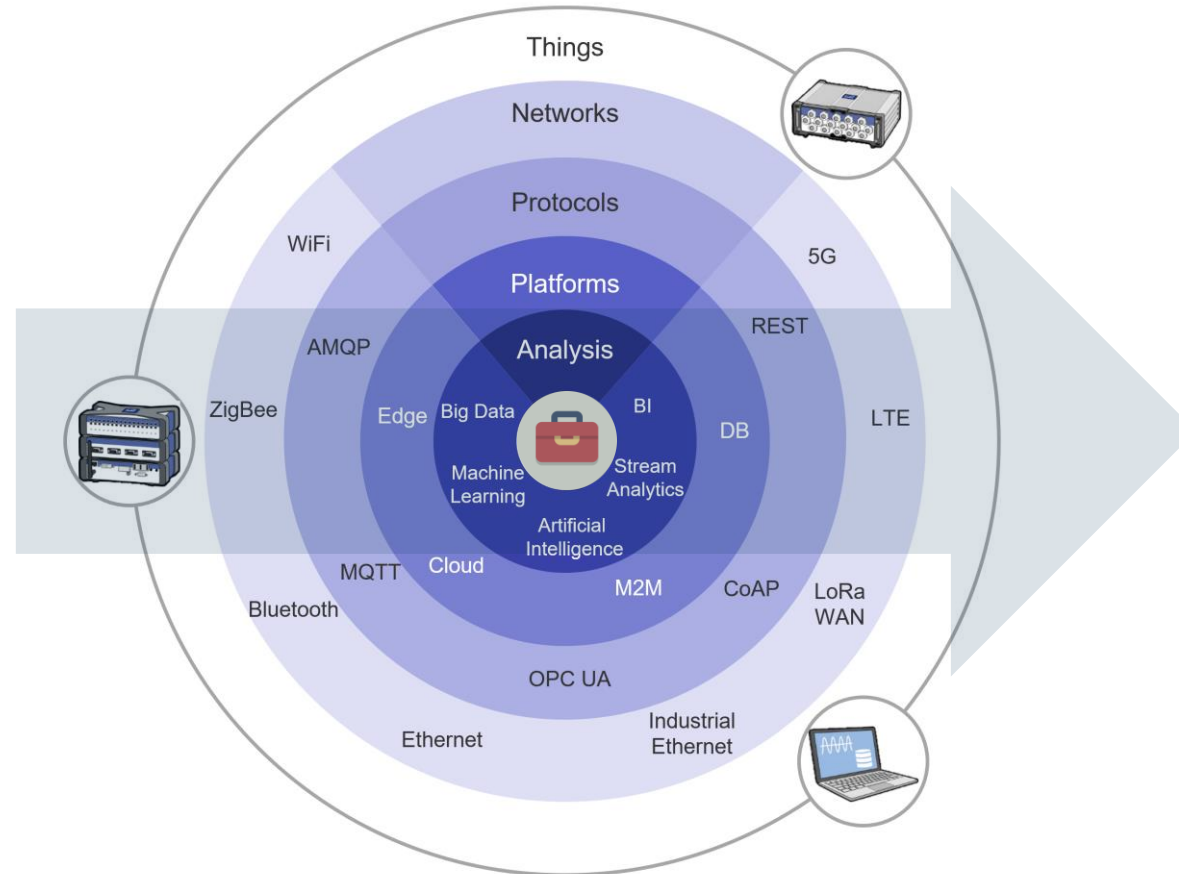
# Ongoing maintenance revolution

## Conventional strategy

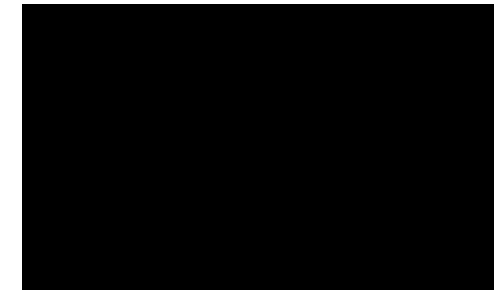


- Reactive / corrective maintenance
- Scheduled, time period-based maintenance

## Toolbox



## New strategies

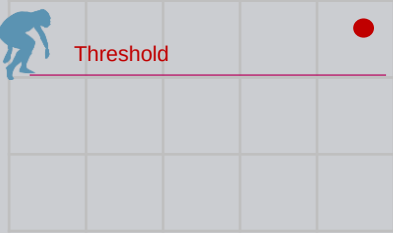
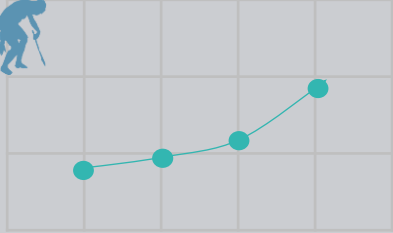
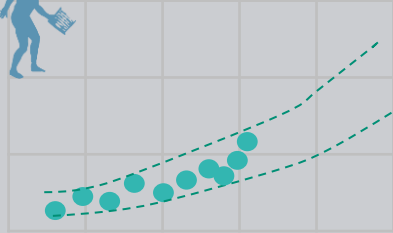
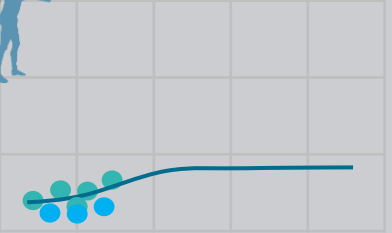


- Reactive maintenance
- Condition based maintenance
- Predictive maintenance
- Prescriptive maintenance



Depth and quality of information

# High data quality is the basis for working condition-based to prescriptive maintenance approaches

| Reactive                                                                                               | Condition based                                                                                                   | Predictive                                                                                                                        | Prescriptive                                                                                                           |
|--------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------|
|                       |                                 |                                                |                                     |
| <p>React <u>when</u> limit values are exceeded</p> <p>➔ Safety: Prevent accidents and major damage</p> | <p>React <u>before</u> limit values are reached</p> <p>➔ Reduce wear, prevent failures and unplanned downtime</p> | <p>Early response, high data quality to achieve <u>good predictions</u>. Plan maintenance early</p> <p>➔ Act instead of react</p> | <p>High data quality, linking of multiple sources and models (digital twin)</p> <p>➔ Eliminate root causes of wear</p> |

# WTMS increased wheel lifetime: from 1 Mio. km to 1.5 Mio.

meage. When WESTbahn started, wheels had to be replaced every 1,000,000km; today, we do it after 1,500,000km. We were able to shift this goal backwards because we also had help from outside: ÖBB-Infrastruktur AG – the organisation that plans, develops, maintains and operates rail infrastructure in Austria – set up their 'Fingerprint' project about three years ago. In the course of this project – together with the companies Mermec and Hottinger and Brüel & Kjær (HBK) – ÖBB Infrastruktur established several Argos® wheel force and wheel shape measurement systems all over Austria. In real-time, this system can provide information about horizontal and vertical wheel forces, wheel cross profiles and wheel out-of-roundness.

- Global Railway Review  
Volume 27, Issue 03



# How is it best achieved?

## Measure with high precision – not only monitor

- the right parameters
- with highest accuracy and reliability

## No humans

- Data processing and prediction
- Maintenance decisions

## Organization

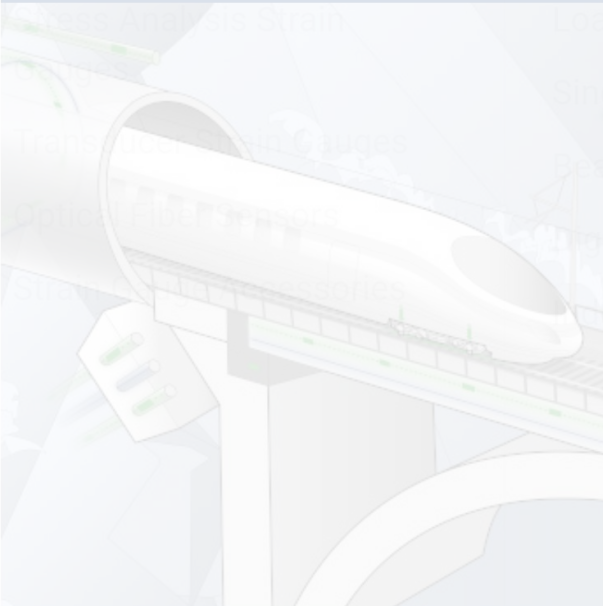
- Measurement data are part of the process





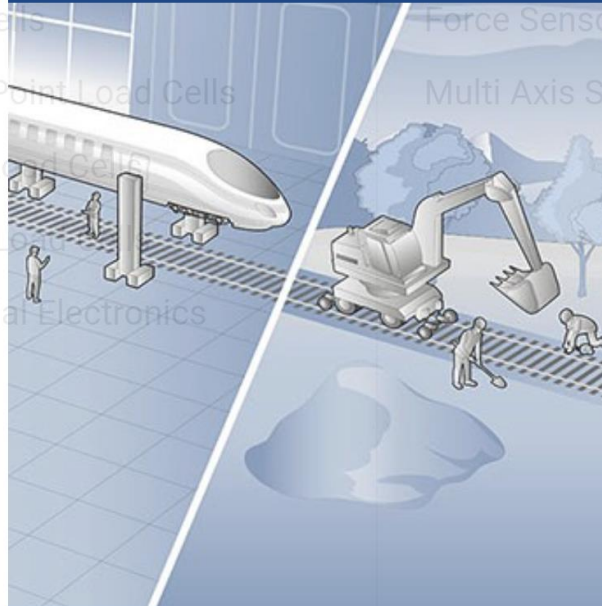
# Sensor and Software solutions for the complete railway world

**Infrastructure**



stairways, tunnels, bridges, tracks and overhead-lines in the railway industry, HBK delivers reliable and safe solutions.

**Operation and Maintenance**



Prescriptive, predictive and condition-based measurement solutions by HBK ensure safety, cost-efficiency and smooth and easy railway operations.

**Railway Testing**



HBK solutions for reliable and solid railway measurement-, test- and analysis results supporting your railway testing on the track and in the lab.

# Measurement - the link between vehicle and infrastructure

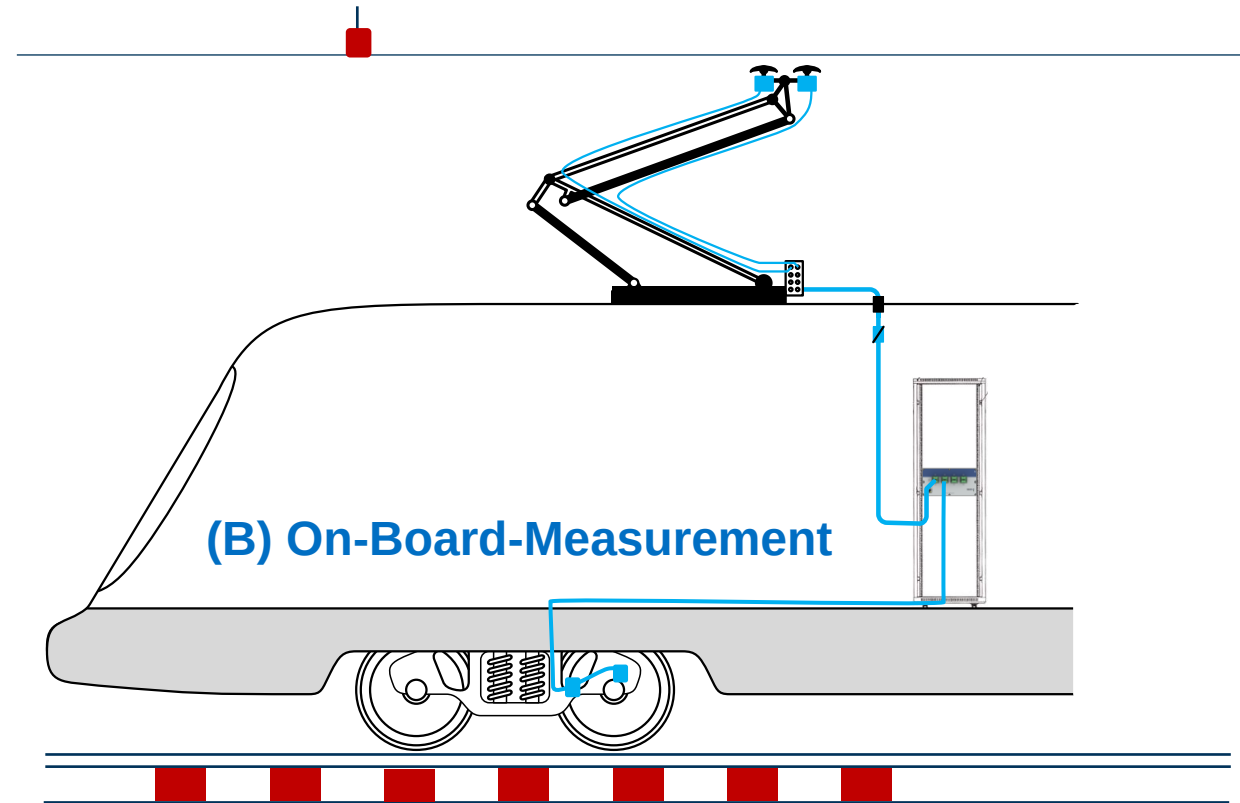
## Fundamental goal of the railway

- trouble-free and
- low-wear interaction

## Measurement technology provides the bracket for the "small details with a big impact"

- wheel-rail contact and
- Pantograph - overhead line

(A) Overhead line and Pantograph measurement



(C) Wayside Train Measurement (Argos®)

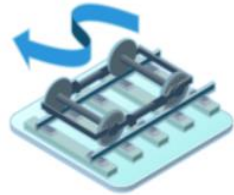
# Wayside Train Measurement with ARGOS<sup>®</sup>

## precise and reliable



### WIM

Weigh in Motion



### RBM STRAIGHT

Hunting



### RBM CURVE

Running Behaviour



### OOO STAND- ALONE

Wheel Out of  
Roundness



### DYN

Dynamic Force



### OOO

Wheel out of  
Roundness

$\Delta R$  better 0.1 mm



### LONG

Traction Forces



### PROFIL

Wheel Cross Profile

better 0.1 mm



# Typical customers targets

- Increase mobility and traffic (people and freight) → higher railway clock speed
- Increase travel comfort and punctuality
- Maximum availability with existing network / vehicle setup and resources
- Optimized maintenance and service of tracks and vehicles
- Optimize noise and vibration in urban areas

**Key parameter: Load level reduction**

# Measure where it works best

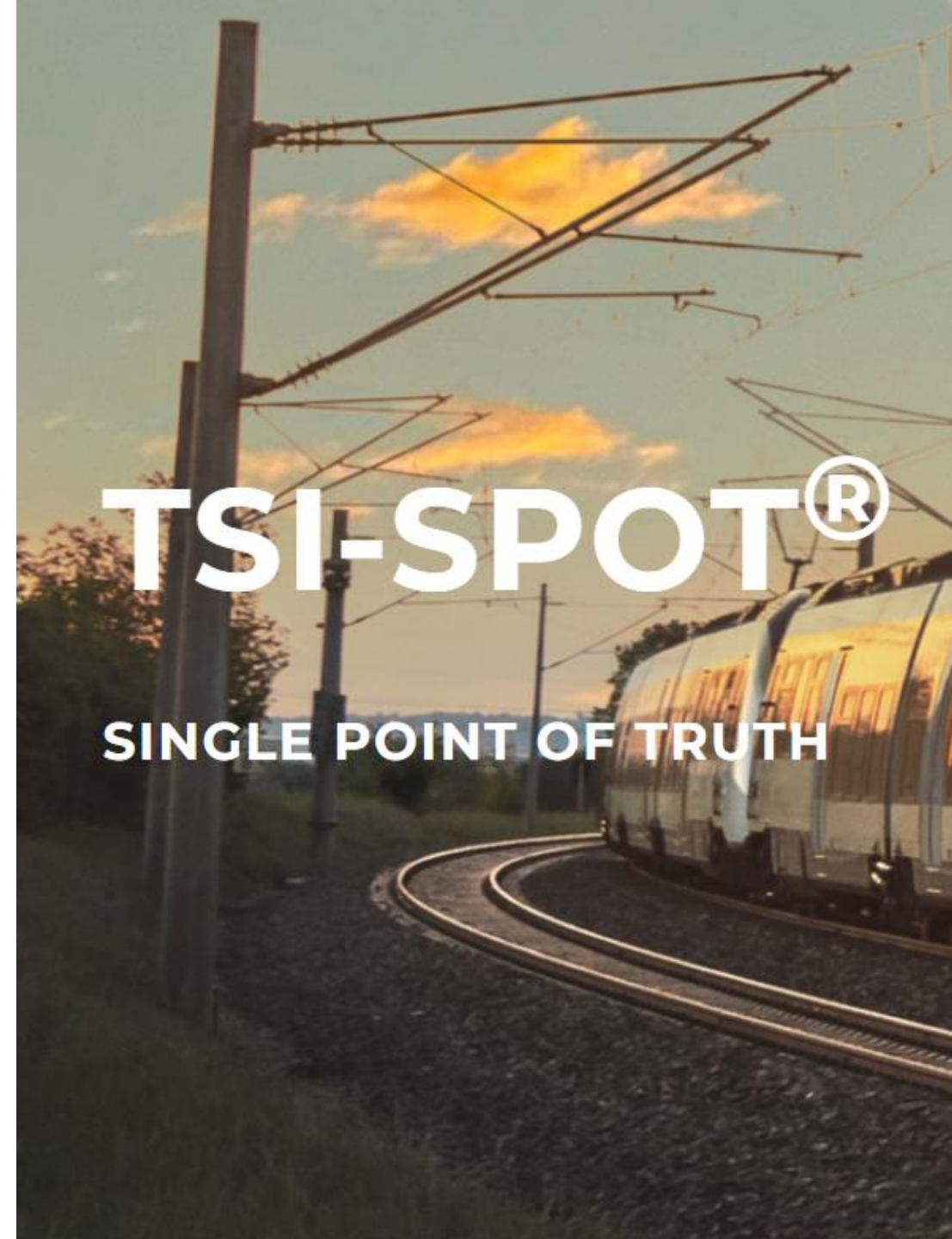
## Vehicle

- Not with countless sensors in the vehicle  
→ small number of high accurate  
wayside measurement systems

## Track and Overhead line

- 24/7 measurement with standard trains  
→ small number of standard trains  
with sensors necessary

→ The HBK invention: TSI-SPOT® concept



# The HBK TSI-SPOT® concept for digital transformation

## Ecosystem (building-blocks)

- Sensors, data acquisition system for wayside and onboard measurement
- Software for data evaluation and simulation (HBK nCode®)
- Link with commercial data (HBK ReliaSoft®)

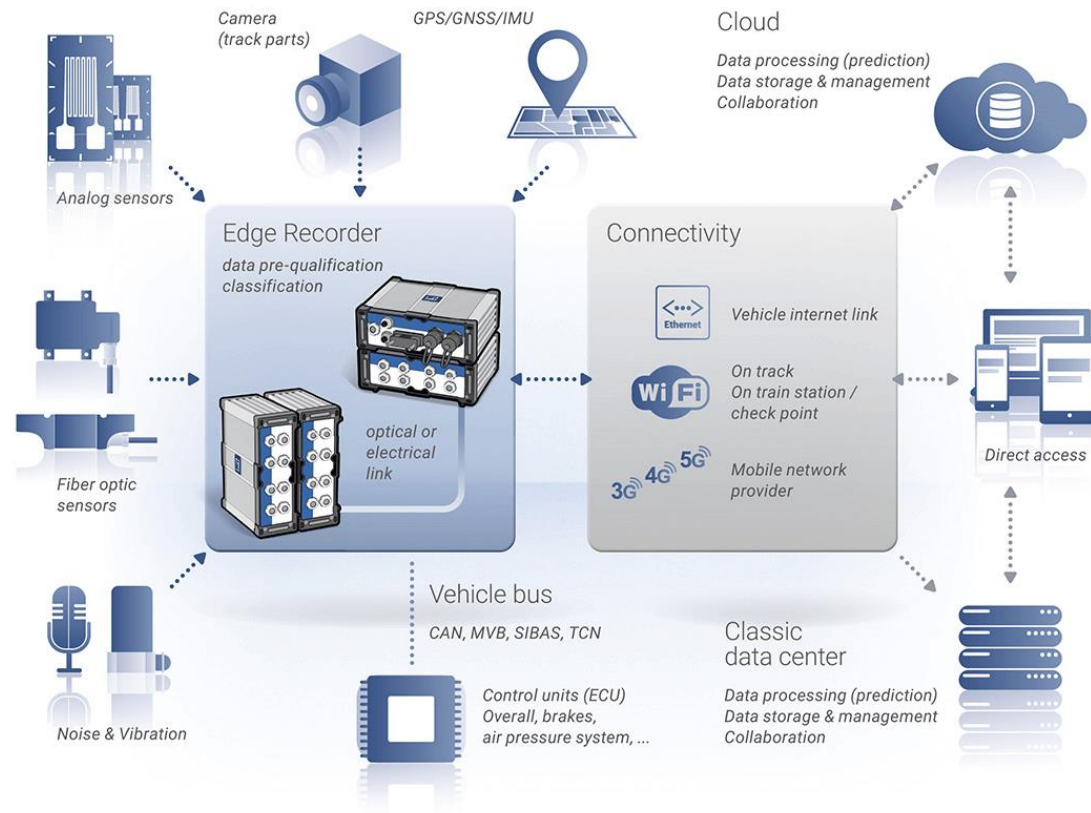
## Open interfaces, high flexibility (modular)

- Customer-specific (sub) systems
- Complete solutions

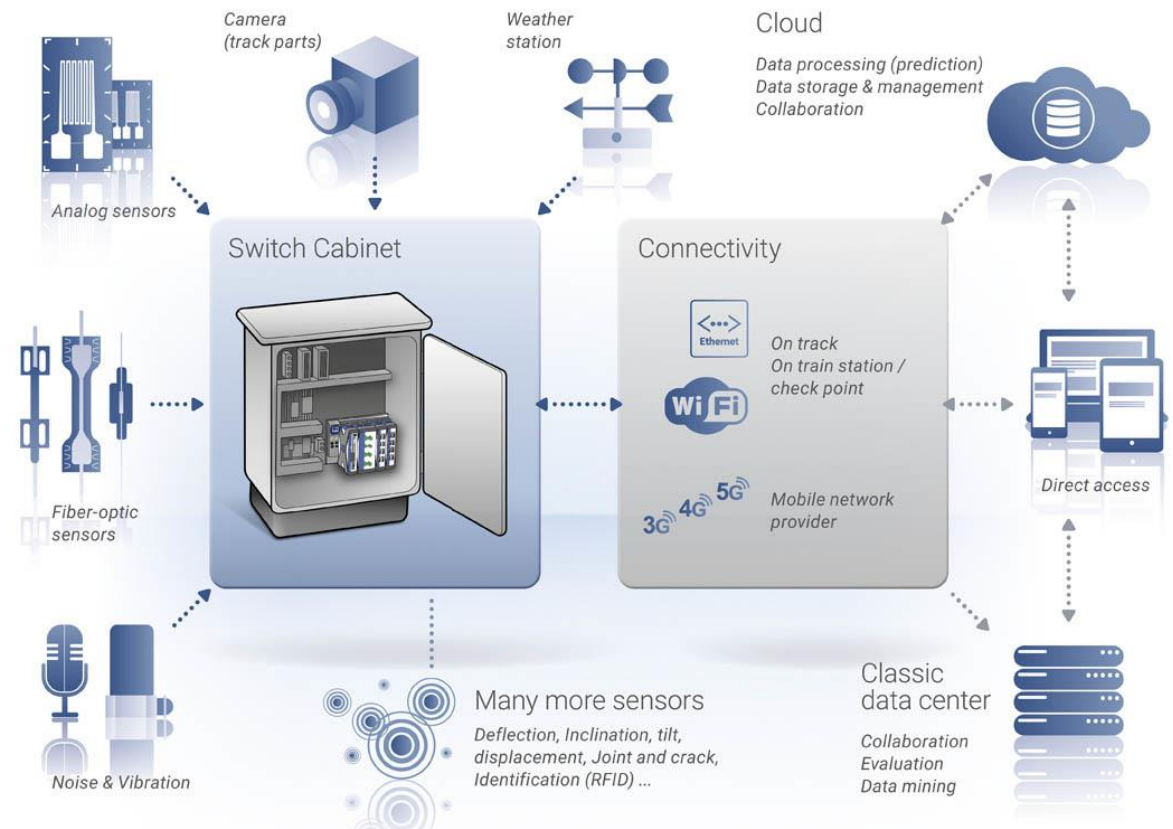


# Modular solution set - Sensors, data acquisition system for wayside and onboard measurement

## Mobile setup



## Stationary





Generate and Acquire Data



Collect and Manage Data



Analyze



Make Decisions and Act



Visualize



Sensors / Instruments



Data cleansing, validation, storage and archiving

Connectors

Maintenance Data  
 XFRACAS

Usage data (time series)  
PES VePRO Framework



Extract value from the data  
[Engineering & ML]

nCode  
Engineering & Data Science

ReliaSoft  
Reliability Strategy and Analysis

Configurable PES tools



Facilitate decisions and take the right actions

Generate Work Orders

Create Notifications

PES Workflow Engine

Bring data into the hands of the right people

Dashboards

KPIs and trends

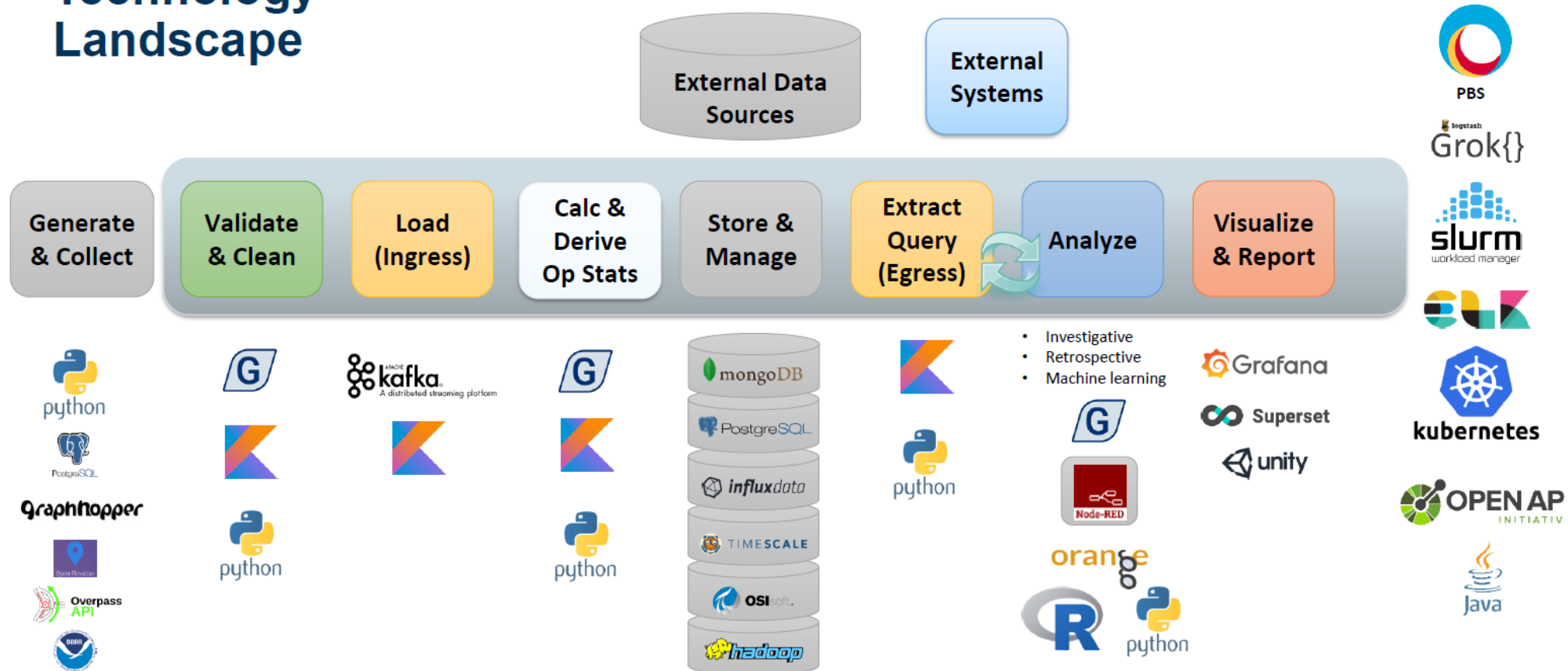
Automated Reports

3rd Party Systems



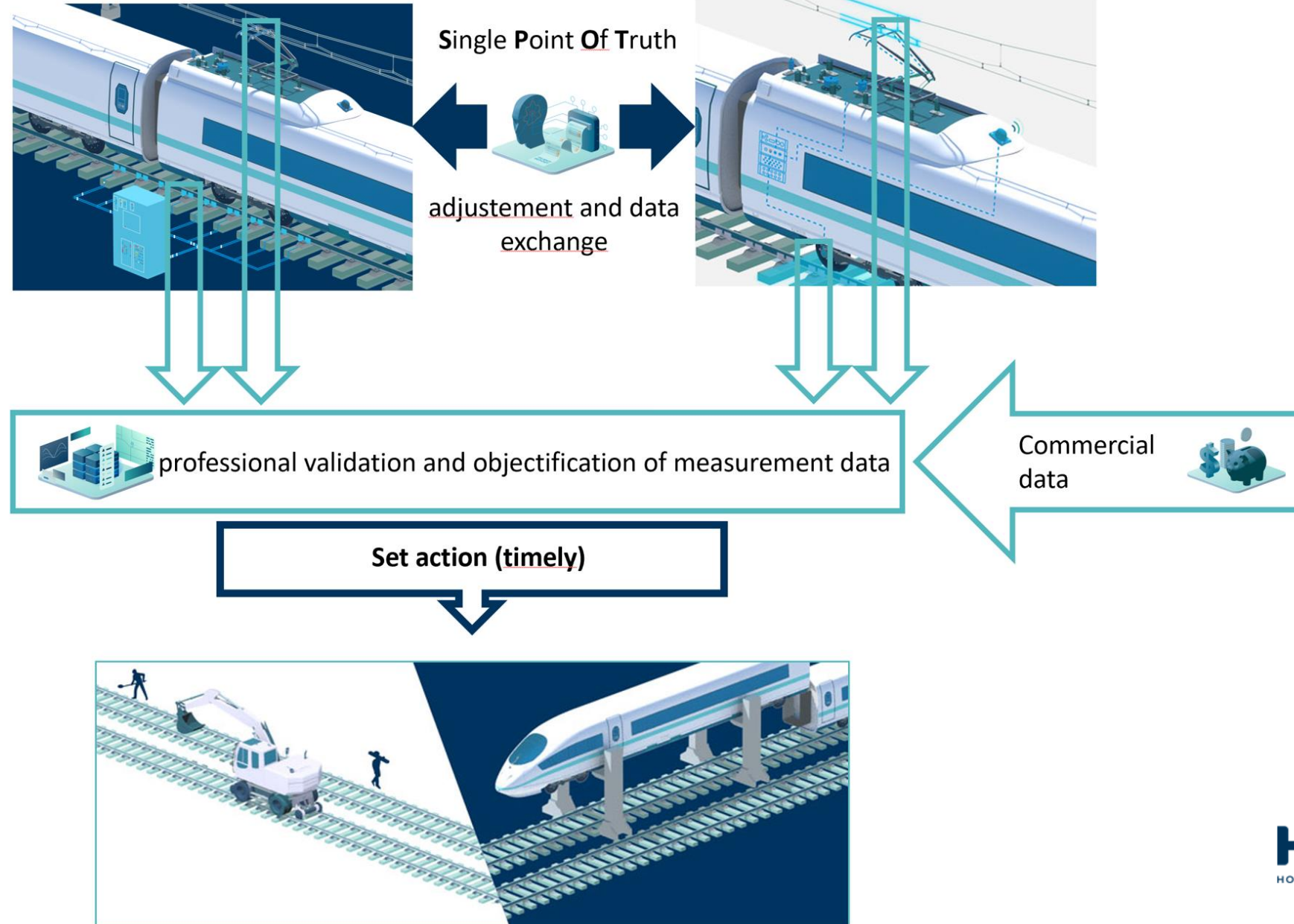
# Strategy: Add best in class open source software to (HBK) commercial products where appropriate

## Technology Landscape



## Wayside Measurement Wheel and Pantograph

## On-Board Measurement Superstructure and Overhead line



# The HBK TSI-SPOT® concept for digital transformation

## Ecosystem (building-blocks)

- Sensors, data acquisition system for wayside and onboard measurement
- Software for data evaluation and simulation (HBK Prencia®)
- Link with commercial data (HBK Reliasoft®)

## Open interfaces, high flexibility (modular)

- Customer-specific (sub) systems
- Complete solutions

## Single Point of Truth

- Describes data that claims to be correct (high data accuracy and integrity) and that can be relied on (technical interpretation). Some redundancies are wanted.
- Business/technical requirements significantly greater than IT requirements

→ **Reliable overall view for safe and quick technical / economic decision**





# TSI-SPOT® concept key facts

- Holistic, reliable view of the vehicle and infrastructure in real time
- Unnecessary wear and tear can be reduced where it has the least effect on performance and costs
- High data quality, fully automated forecasts to affect maintenance interventions directly



**smart**



**future-proof**



**cost-effective**



**holistic**

# LINK to Video

<https://youtu.be/8ibyDzz1aR8>



# Questions?

- Please type any questions you have into the WebEx Q&A dialog
- You can open the Q&A window by selecting the “Q&A” icon in the WebEx toolbar at the top of your screen:



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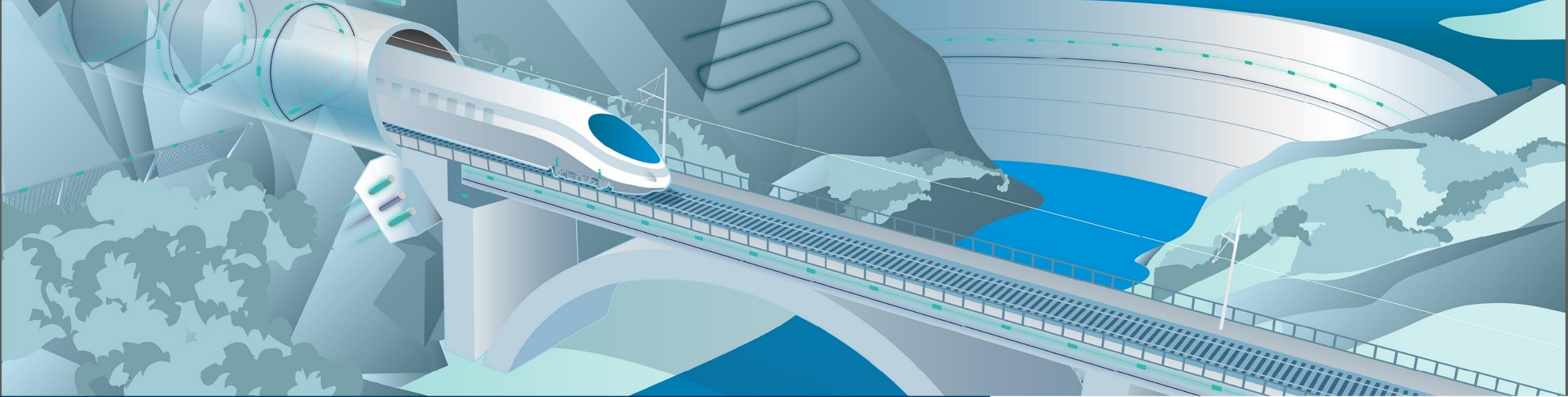


# Thank You

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[www.hbkworld.com/rail](http://www.hbkworld.com/rail)  
[www.argos-systems.eu](http://www.argos-systems.eu)





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