Diagnostic and **M**onitoring **T**echnologies

The Honeycomb-Principle –
a modular approach.

Manfred Arndt

Digital Transformation – Evolution or Revolution?

Railways need to be competitive!

- Essential target: Competitiveness as a means of transport!
- Digital transformation appears as an opportunity to increase efficiency in organizational processes.
- Diagnostic and Monitoring Technology will be of decisive importance to improve safety, availability and efficiency of railway operations!
- Diagnostic and Monitoring Technology is an essential prerequisite in successful asset management.
- BUT: What are the obstacles in the future path of DMT?

Are we prisoners of our History?

- Railways have a history of almost 200 years
- Some things have not changed at all – like rail gauge
- Some things might change to slow…

Economical and Organisational Resistance to Change

- Significant historical investments in existing technology

  with long life cycles: e.g. a rail car >= 50 years

- Security reasons

  - Protection of IT networks (e.g. difficulty to offer remote maintenance)

  - Complexity of homologation for DMT

- Organization

  - Stability of historical organizational structures (grown over 200 years)

  - Political influence; Unions; official bodies, like EBA, etc.

  - „Lock-In“ situations for several organizational reasons:
    e.g. the fear to lose position or power…

Technological Resistance to Change

- Classic Diagnostic and Monitoring Technologies have their historical origin in different railway departments and therefore promoting heterogeneous developments.
- System manufacturers have developped independent system solutions which are based on different hardware- and software architectures resulting in Expensive Monolithic System Design and Proprietary Interfaces and Protocols.
- Existing data are often stored in independent and incompatible data bases.
- Only a few railway organisations are able to identify measurement data by tagging systems (RFID) in order to combine and correlate data.
- Individual communication protocols interfere with the integration of data into a common data base thus creating high level information on an superior diagnostic platform.

3. Forget about Asset Management ?

RESULT:

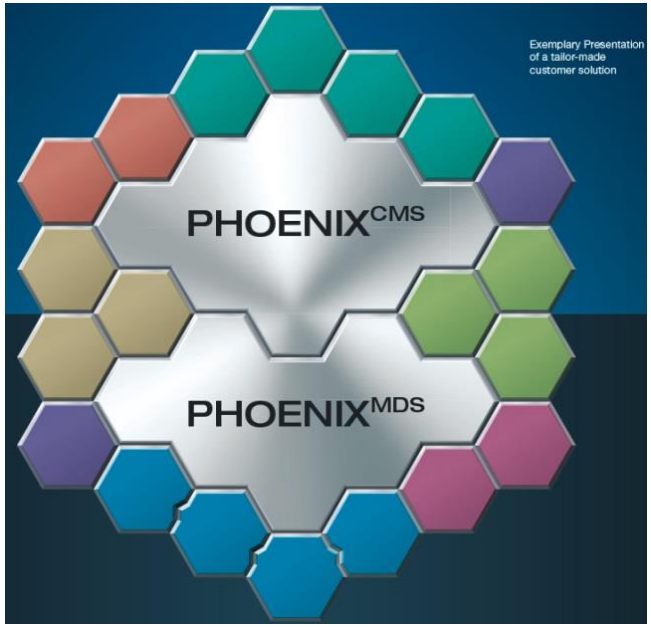
1. High Cost for Operators and Suppliers
2. Low Motivation to Change

How to create a new path in DMT?

To overcome existing obstacles
and to create a new path in DMT we need to be:

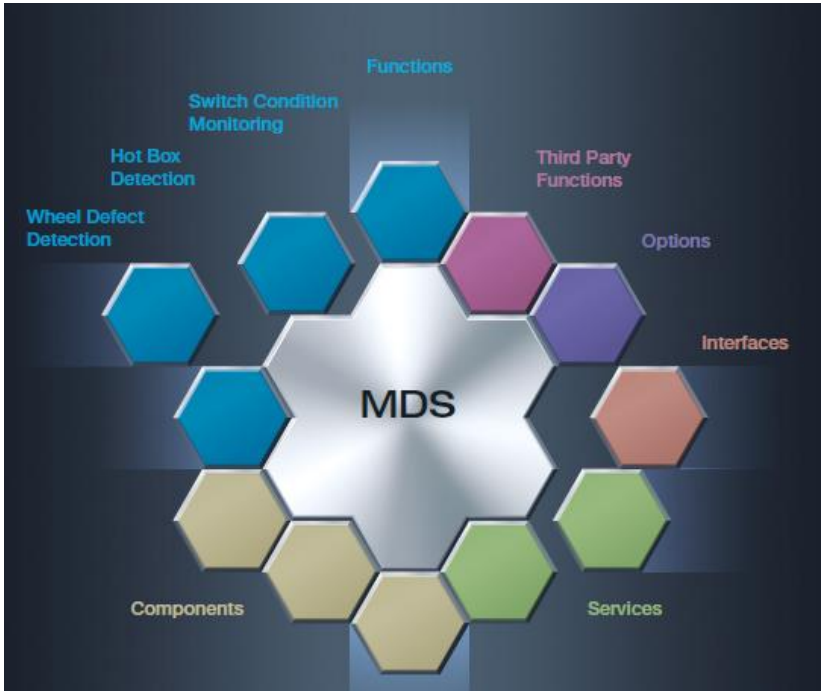
- Open
- Flexible
- Cost Effective
- Standardized

PHOENIX$^{CMS/MDS}$ – a Catalyst for Digital Transformation



- Modular and cost-effective architecture of monitoring systems
- Standard interfaces and protocols
- Flexible implementation of APPs and Functions

PHOENIX^{MDS} – Modular Diagnostic System



Fixed Asset Monitoring

- **SCM** Switch Condition Monitoring
- **TCM** Track Circuit Monitoring
- **SPM** Signaling Power Monitoring
- **RXM** Rail Crossing Monitoring

Rolling Stock Monitoring

Bearing and Brake Temperature

- **HBD** Hot Bearing Detection
- **HWD** Hot Wheel Detection
- **CWD** Cold Wheel Detection

Wheel Impact Load Detection

- **WDD** Wheel Defect Detection
- **WIM** Weighing In Motion

Supplementary Functions

- **ECM** Environmental Condition Monitoring
- **DED** Dragging Equipment Detection
- **AVI** Automatic Vehicle Identification

Third Party Functions

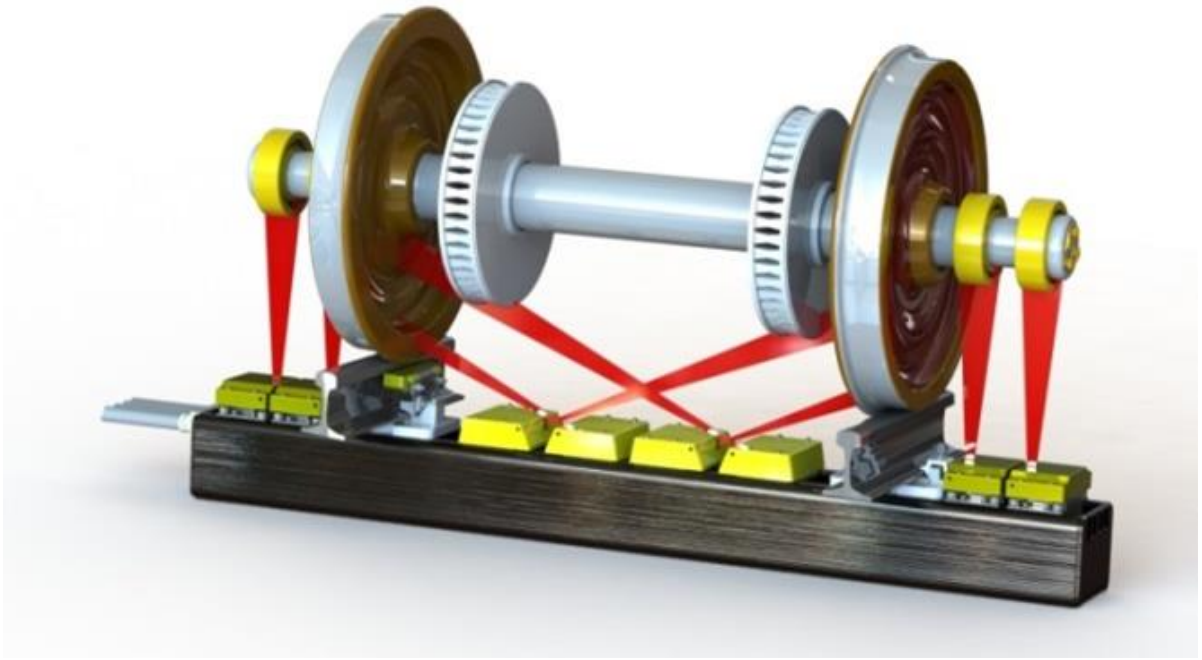
- **ABD** Acoustic Bearing Detection
- **PVS** Profile Validation System
- **WPM** Wheel Profile Monitoring
- **PIM** Pantograph Integrity Monitoring

PHOENIX^{MDS} - Example of Functions and Options

HBD
Hot
Box
Detection

HWD
Hot
Wheel
Detection

CWD
Cold
Wheel
Detection



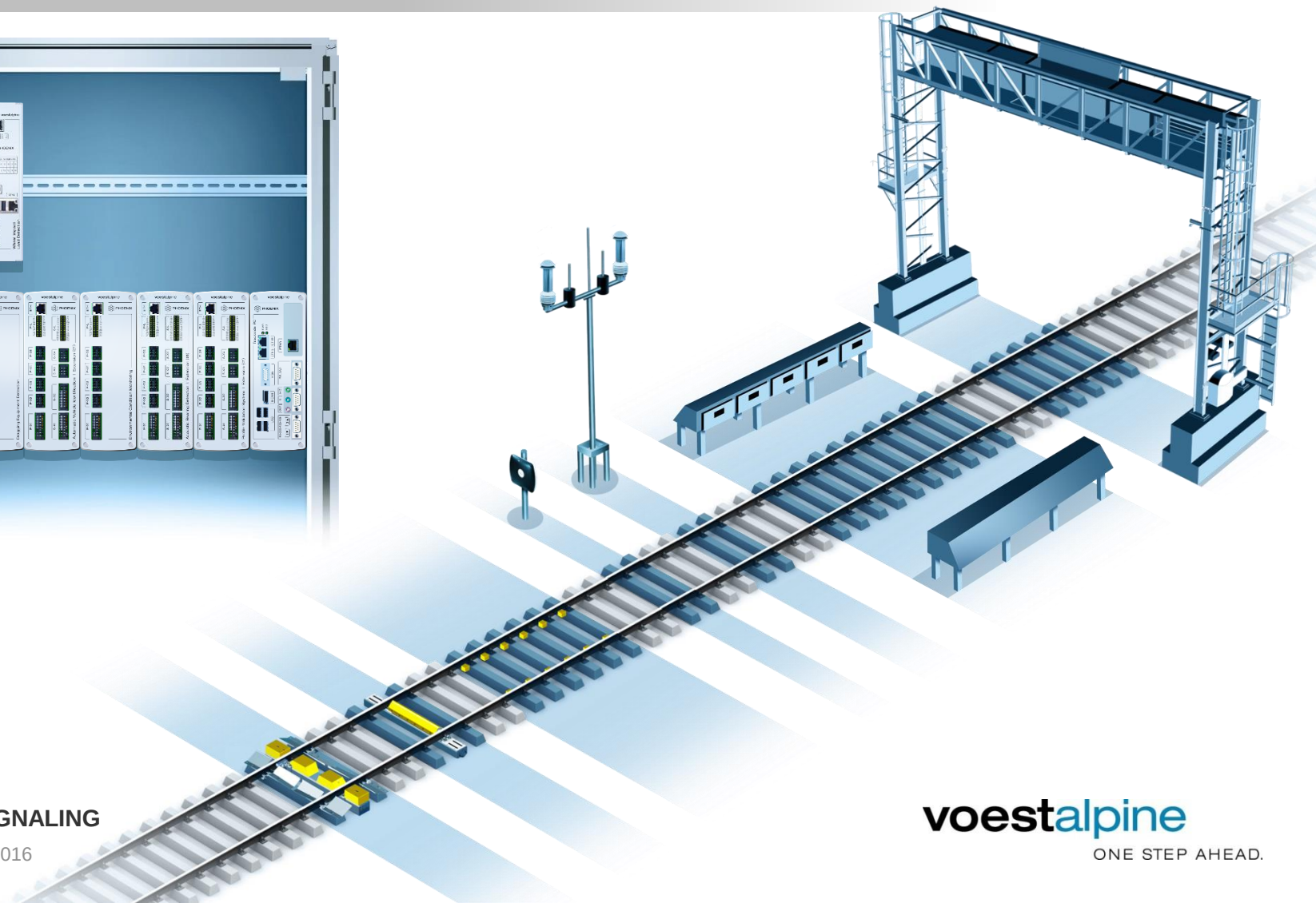
Arctic

Desert

Slab Track

Train Talker

PHOENIX^{MDS} – Modular Concept



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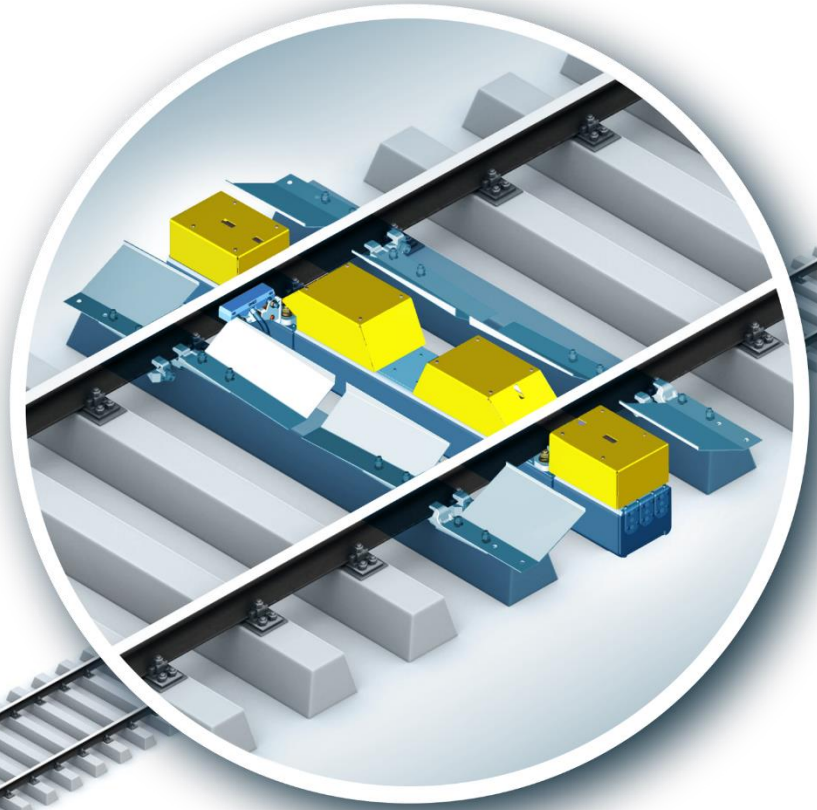
ONE STEP AHEAD.

PHOENIX^{MDS} – Modular Concept



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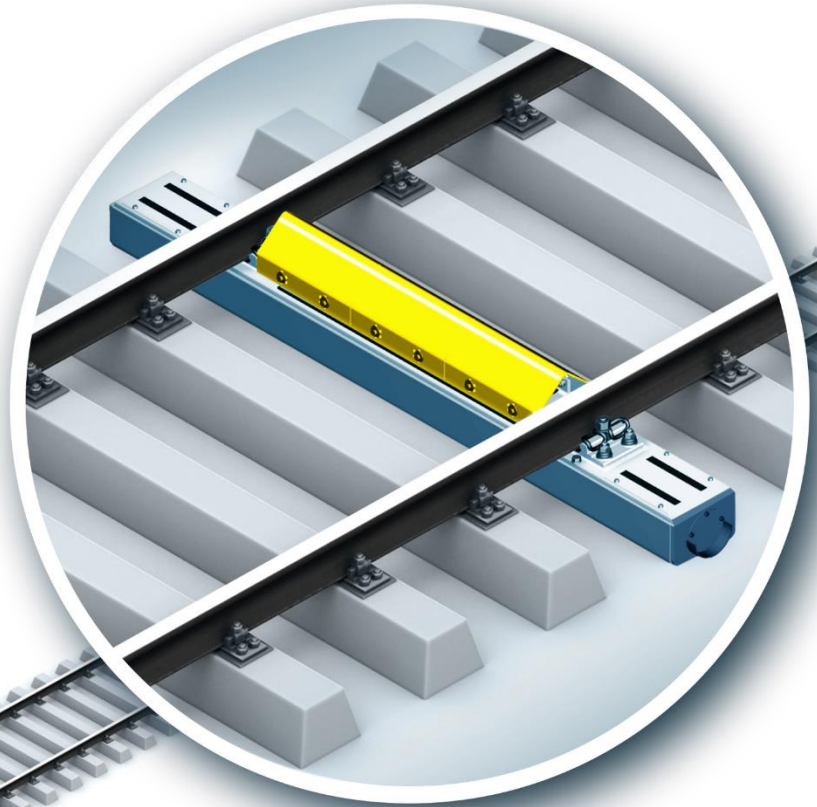

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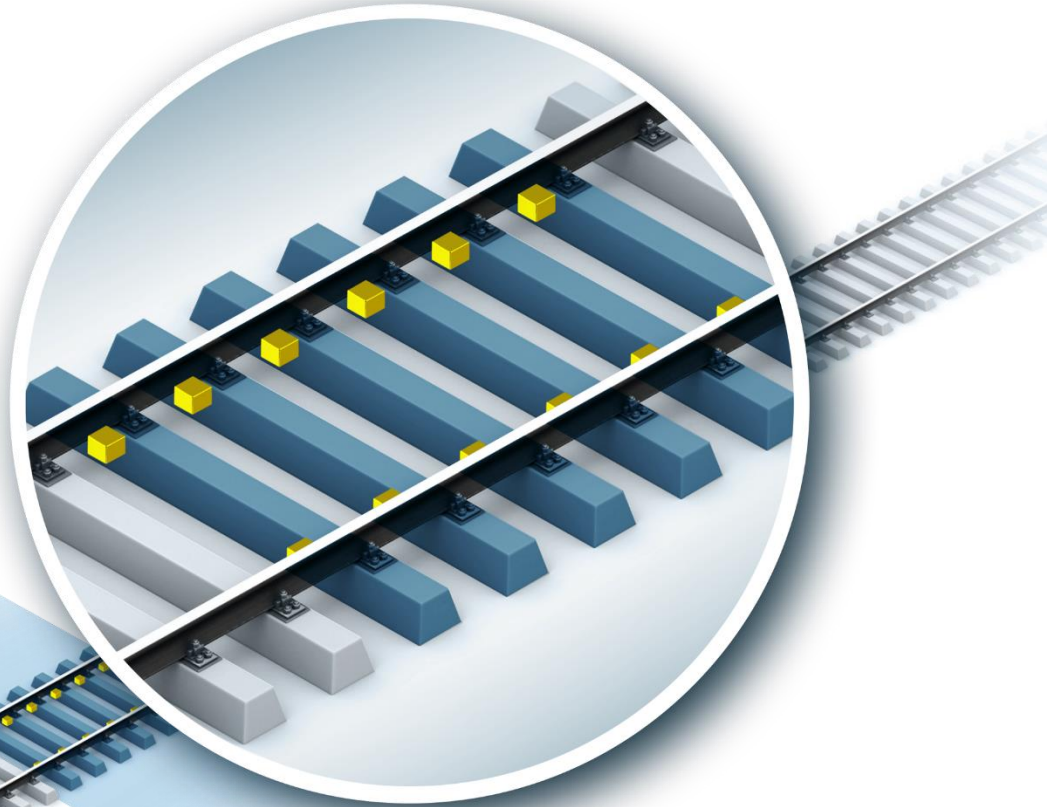

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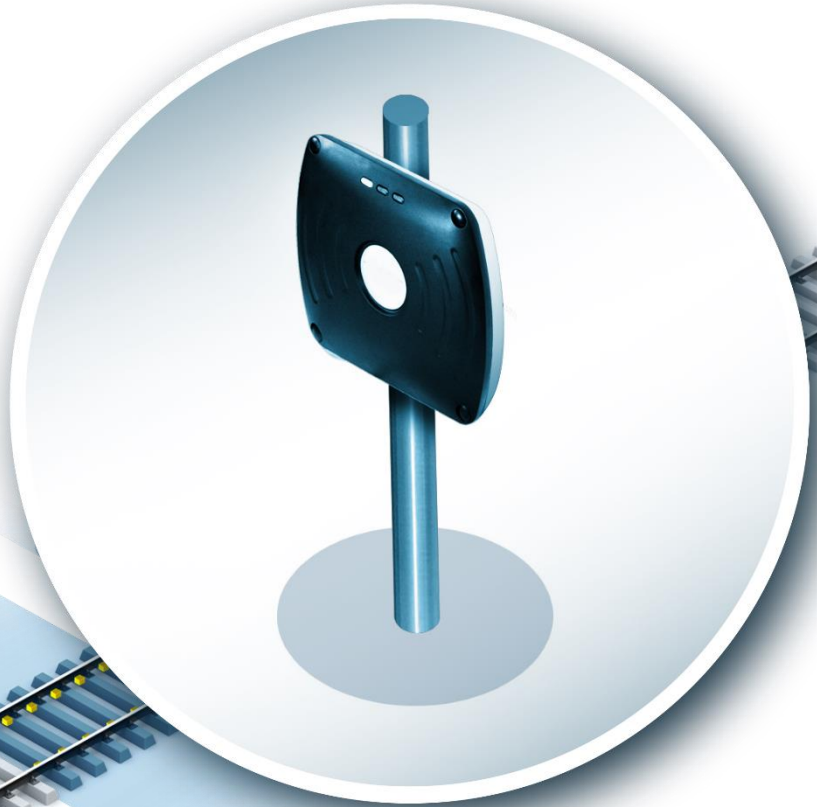

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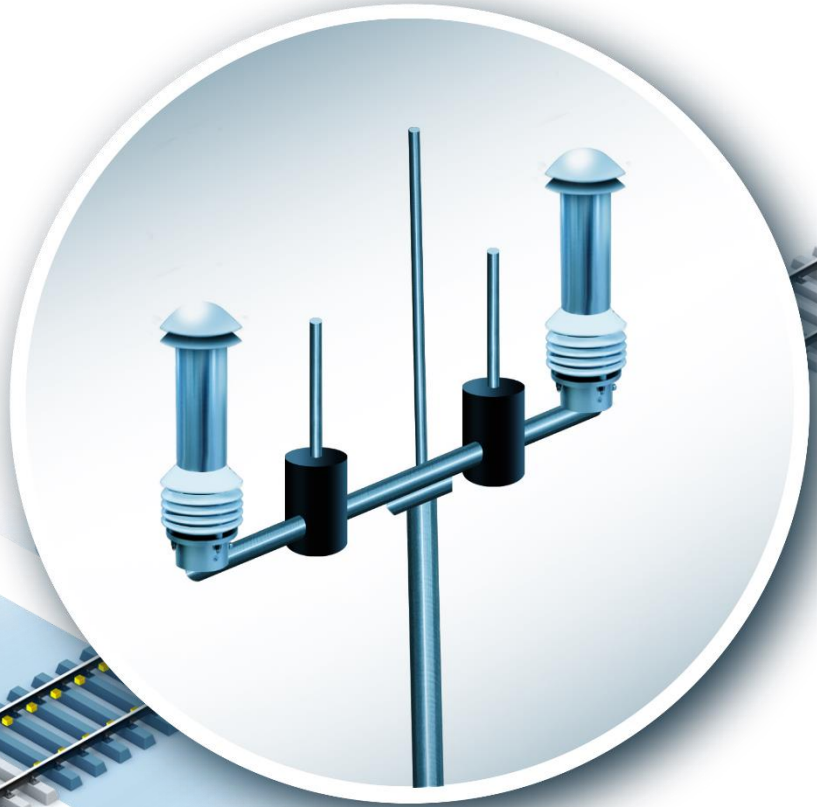

PHOENIX^{MDS} – Modular Concept

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ONE STEP AHEAD.

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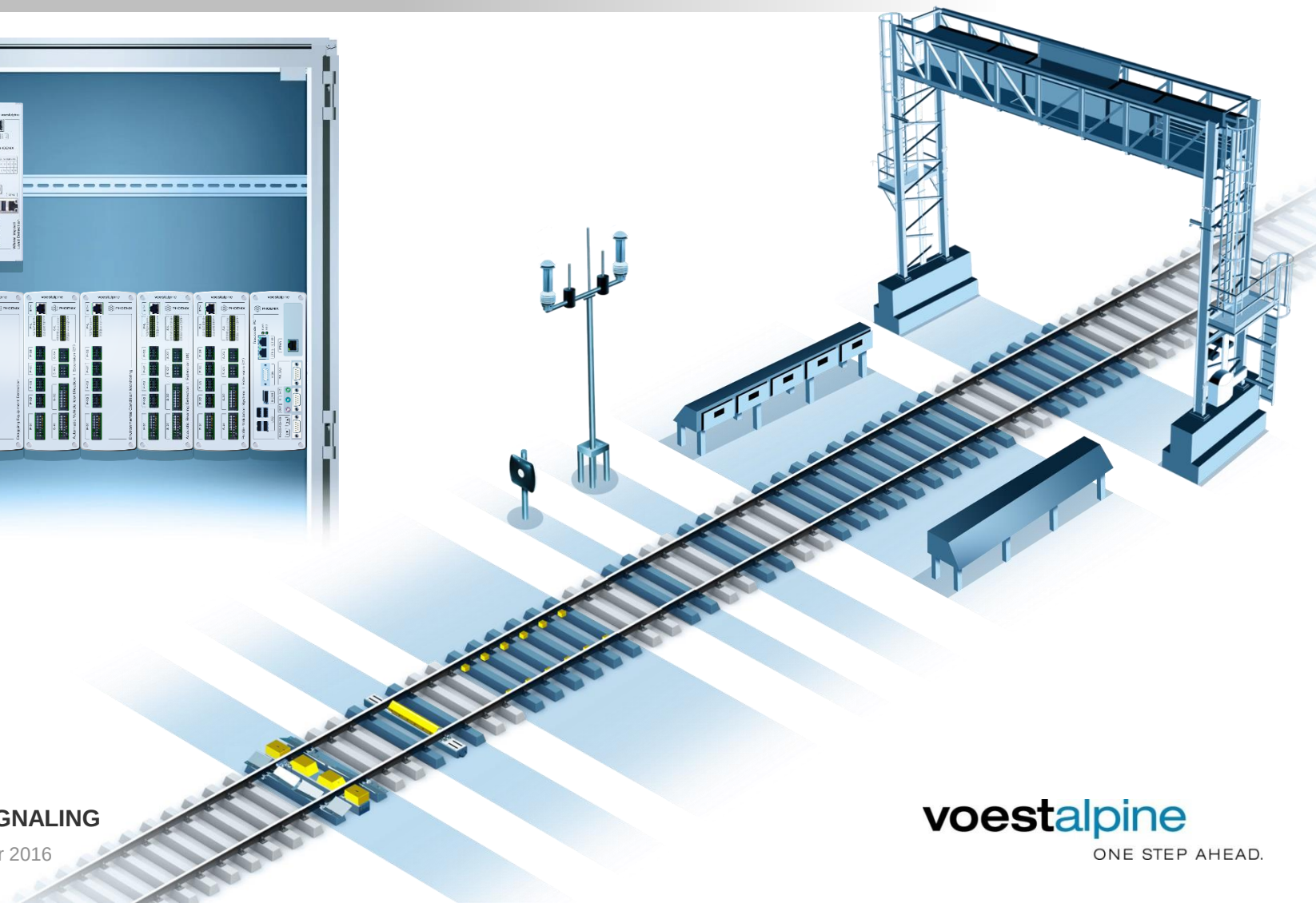

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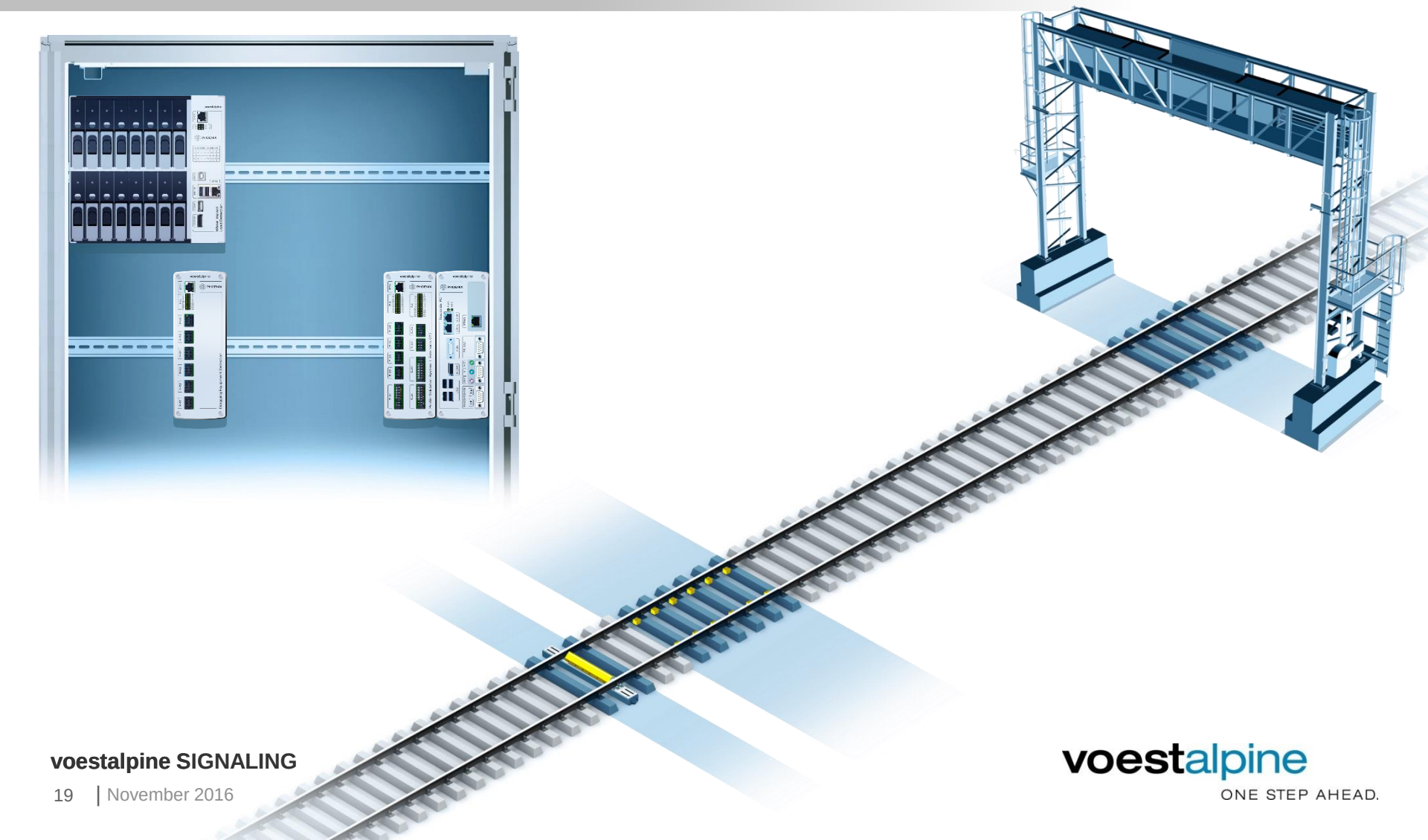
ONE STEP AHEAD.

PHOENIX^{MDS} – Use Case ÖBB, Austria



PHOENIX^{MDS} – Use Case Trafikverket, Sweden

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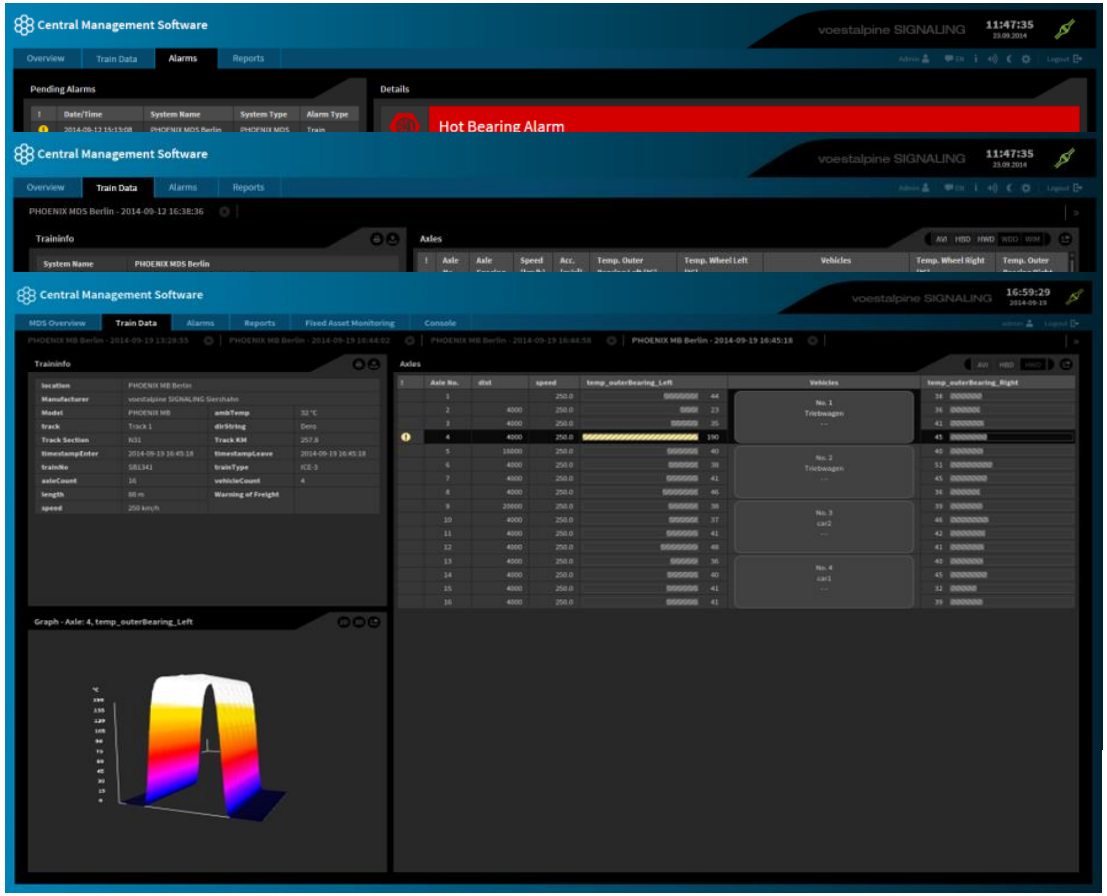
ONE STEP AHEAD.

PHOENIX^{CMS} - Central Management Software

- Integration of Wayside Monitoring Systems
- Web Based Interface
- APPs for Diagnosis and Management of Rolling Stock and Fixed Assets
- Open System Architecture allows Third Party APPs
- Open Protocols e.g. OPC-UA (IEC 62541)

Alarming and Intervention

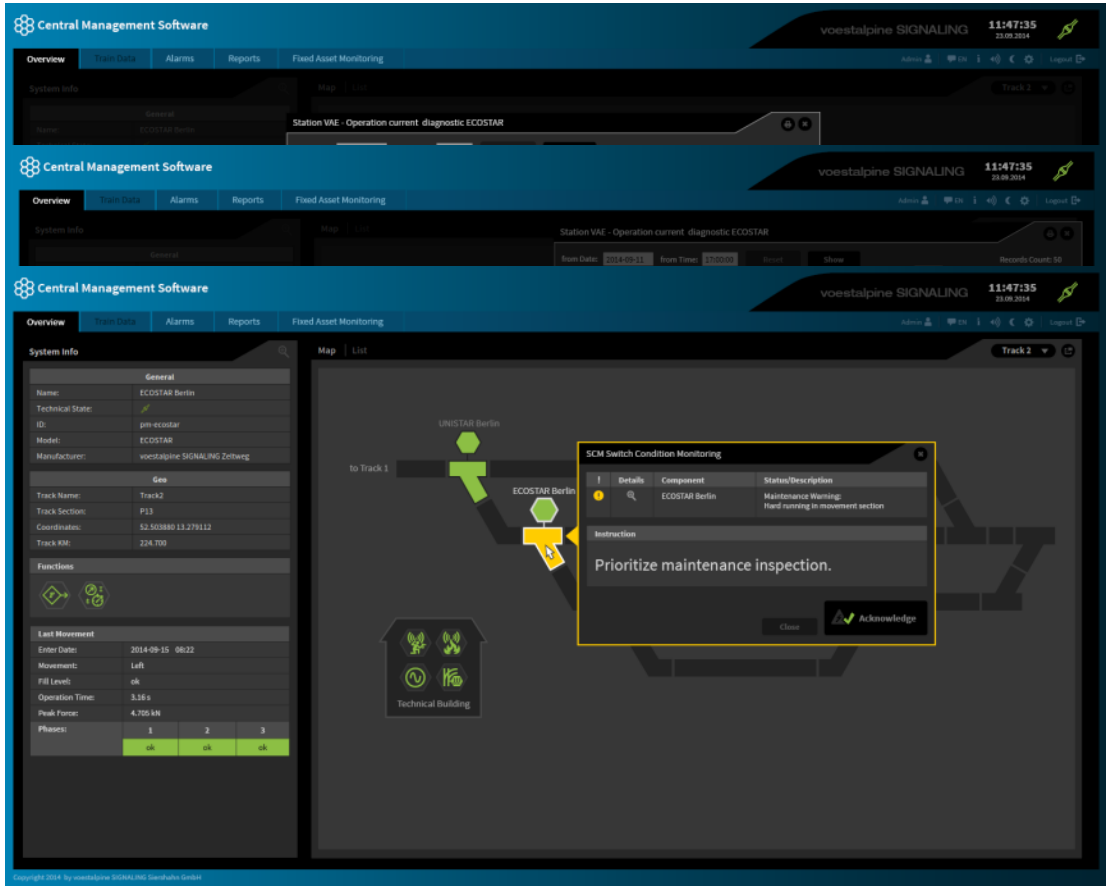


- Trending alarm
- Customized alarm levels
- Recommended alarm intervention
- Identified user acknowledgement
- Alarm filtering based on user roles

Asset Management

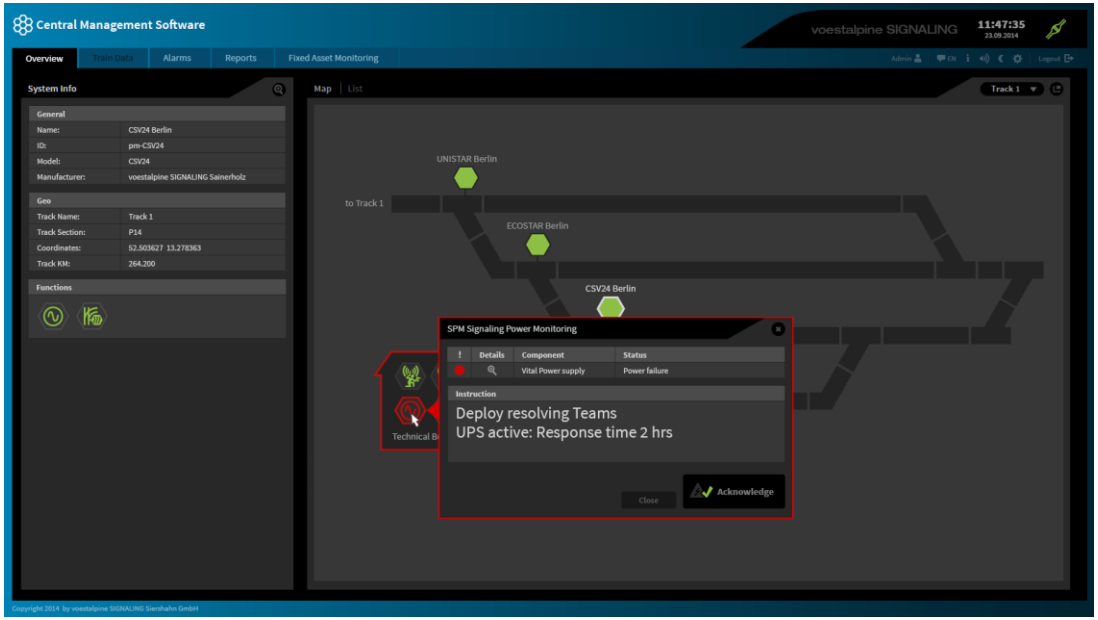
- Customized dashboards on key performance indicators
- Automatic report generation
- Interfacing for supply chain
- Asset performance trending

Condition Based Maintenance



- Predictive asset diagnosis
- Direct insight into asset status
- Work order and part list generation
- Preventive and corrective maintenance scheduling

System Supervision



- Health and status monitoring
- Insight into system performance
- Troubleshooting support
- Mobile device GUI

Thank you!