Internet Of (Big Rolling) Things @DB Cargo's European Rolling Stock

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Agenda

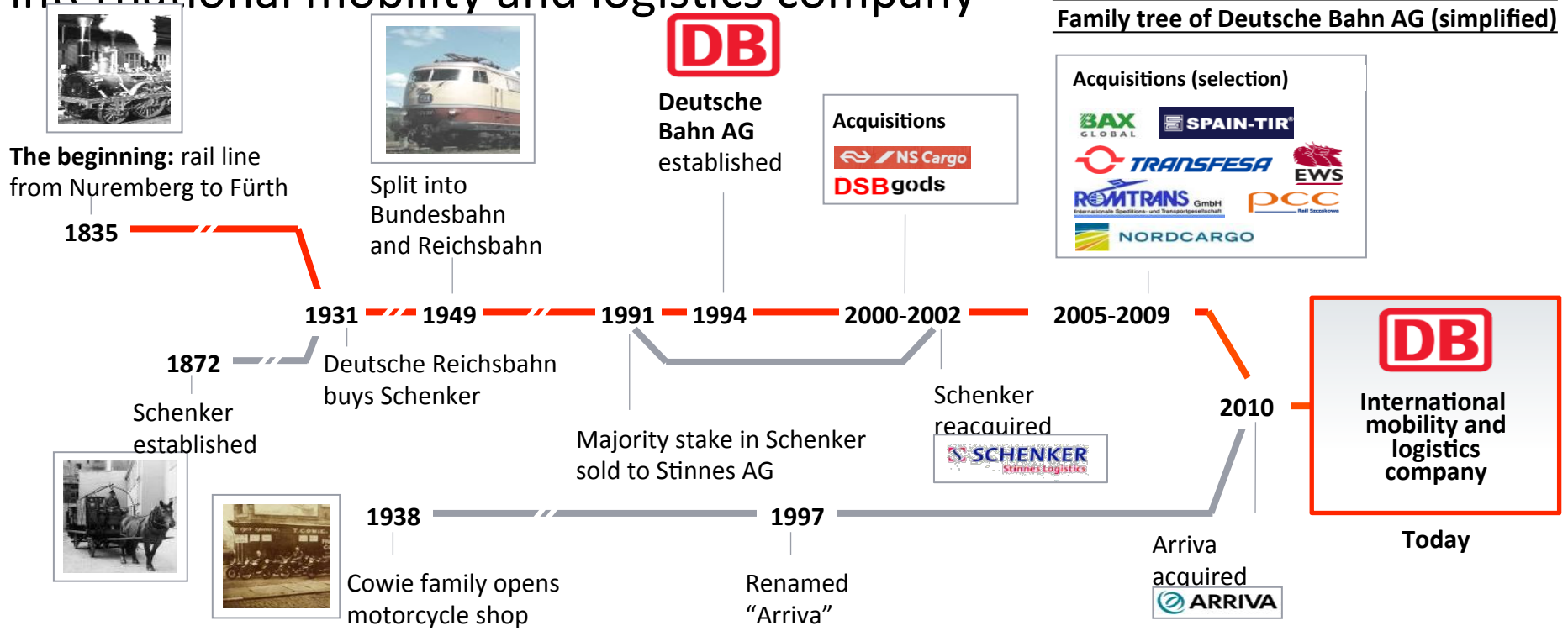Company Overview
Deutsche Bahn & DB Cargo

Project TechLOK

Business Case and Use Cases

Current Stage of Splunk Deployment

Summary and Outlook

The history of Deutsche Bahn is the history of several large, long-established companies that joined over the years to form an international mobility and logistics company

The beginning: rail line from Nuremberg to Fürth

Split into Bundesbahn and Reichsbahn

DB

Deutsche Bahn AG established

Acquisitions

NS Cargo

DSBgods

Family tree of Deutsche Bahn AG (simplified)

Acquisitions (selection)

BAX GLOBAL   SPAIN-TIR

TRANSFESA   EWS

ROMTRANS GmbH   PCC Rail Szczakowa

NORDCARGO

1835

1931 — **1949** — **1991** — **1994** — **2000-2002** — **2005-2009**

1872

Schenker established

Deutsche Reichsbahn buys Schenker

Majority stake in Schenker sold to Stinnes AG

Schenker reacquired

SCHENKER Stinnes logistics

2010

DB

International mobility and logistics company

Today

1938

1997

Cowie family opens motorcycle shop

Renamed "Arriva"

Arriva acquired

ARRIVA

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With Its Eight Business Units, DB Is Active In All Segments Of The Transport Market

Passenger Transport:
Domestic and European-wide mobility services

- **DB Long Distance**
  Long-distance rail pass. transport[2]

- **DB Regional**
  Regional/urban pass. transport (GER)

- **DB Arriva**
  Regional/urban pass. transport (EU)[3]

Transportation and Logistics:
Intelligent logistics services via land, air and the sea

- **DB Cargo**
  European rail freight transport

- **DB Schenker**
  Global logistics services

Infrastructure:
Efficient and future-oriented rail infrastructure in Germany

- **DB Netze Track**
  Rail network

- **DB Netze Stations**
  Traffic stations

- **DB Netze Energy**
  Traction current

1   The former business unit DB Services has been dissoluted and its activities assigned to different divisions;   2   Within Germany as well as cross border traffic;
3   In UK with Arriva-affiliate 'CrossCountry' also long-distance passenger transport;

DB Cargo Has A Strong European Network And Is The Number One In European Rail Freight Transport

DB Cargo in 2015

Revenues	EUR 4,767 m
EBIT	EUR -183 m
Employees (FTE)	30,303
Metric ton km	98,445 m tkm
Freight carried	300 m. t
Fleet[1]	2,869 / 87,264
Avg. dist. transported	313 km

Profile

- With some **4,200 private customer sidings in Europe**, DB Cargo offers its customers access to one of the world's largest rail networks

- DB Cargo's **international network** follows the major European rail freight corridors

- DB Cargo offers European rail transport in the form of **block train, single wagonload** and **multimodal services**

- **Tailor-made transport and logistics solutions** are also available as additional services that can link the rail mode with road (trucking) and ocean freight service

- The **key industries** served by DB Cargo are metals and coal, chemicals, automotive, building materials, industrial and consumer goods, and intermodal transport

- DB Cargo's customers are primarily **key accounts**

1 Locomotives / freight cars

- Most of DB Cargo's services are carried out using its **own fleet of** locomotives and freight cars

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The Group's Digitalization Activities Are Organized In Six 4.0 Initiatives

Mobility 4.0

This initiative works to design new products with a focus on **customer centricity,** based on different scenarios for developments on the digital mobility markets. It also works to establish a strong cult... **novation** as a foundation.

Logistics 4.0

This initiative uses **big data** and **smart assets** to develop a product portfolio for the future, **digital customer interfaces** and **web-based production p**...**ses.**

Infrastructure 4.0

This initiative focuses on digitalization in infrastructure: end-to-end **connectivity with customers**, digital **process improvements** and the creation of new **business models**.

Working Environments 4.0

This initiative centers on overarching topics involved in **working, communicating and learning**. Potential future scenarios are drawn up for **job profiles**.

Production 4.0

This initiative focuses on the **automation** and digitalization of rail operations and maintenance.

IT 4.0

This initiative works to develop a **smart, agile, effective, efficient** and **reliable IT landscape** for DB.

Project Scope TechLOK

Data Access
existing and additional sensors;
diagnosis boxes;
hardware interface

Data Collection
secure data transmission;
data translation;
combine different data sources

Data Visualization & Analytics
Development of use cases;
transform data into information
and results

**7,000 different diagnosis
codes or status messages
per locomotive type**
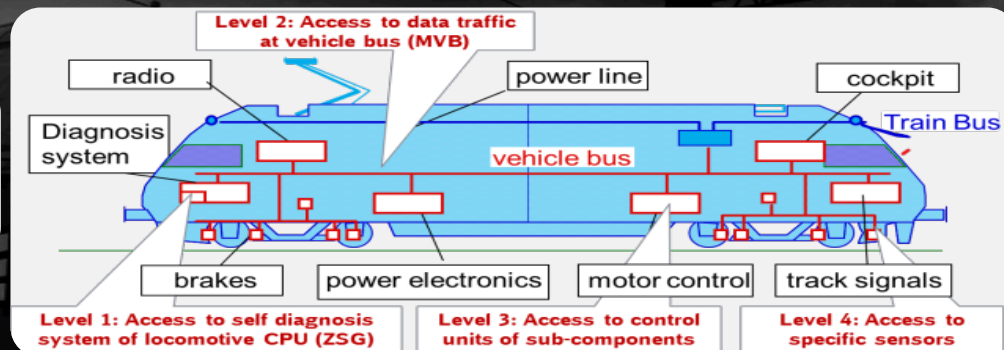
**60 different time series
values from sensor per
locomotive type**

2014
2 locomotives types and **30**
locomotives

2016
7 locomotives types and
800 locomotives

2019
16 locomotives types and
2,000 locomotives

TechLOK Architecture

Implemented And Upcoming Use Cases In 2016

USE CASES

Driver, Hotline, Technical Fleet Management

Action Recommendation (1:1)

Health Index

Maintenance Capacity

Failure Code Monitoring

Workshop, Workshop Crew, Maintenance Program

Root-Cause-Analyses

Diagnosis Tipp

Mobile Maintenance

Maintenance Program
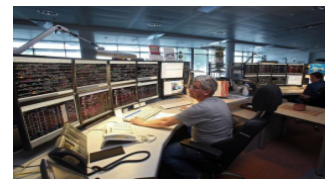
Operations, Disposition, Fleet Management

Remote Locomotive Data Access

Condition Monitoring

Action Recommendation (1:1)

Splunk Application-Fleet Summary Of Alerts

About 800 locomotives sending diagnosis codes, status messages and time series values in near-time to **TechLOK database**

Fleet wide Summary of triggered **Alarms**, Warnings and information
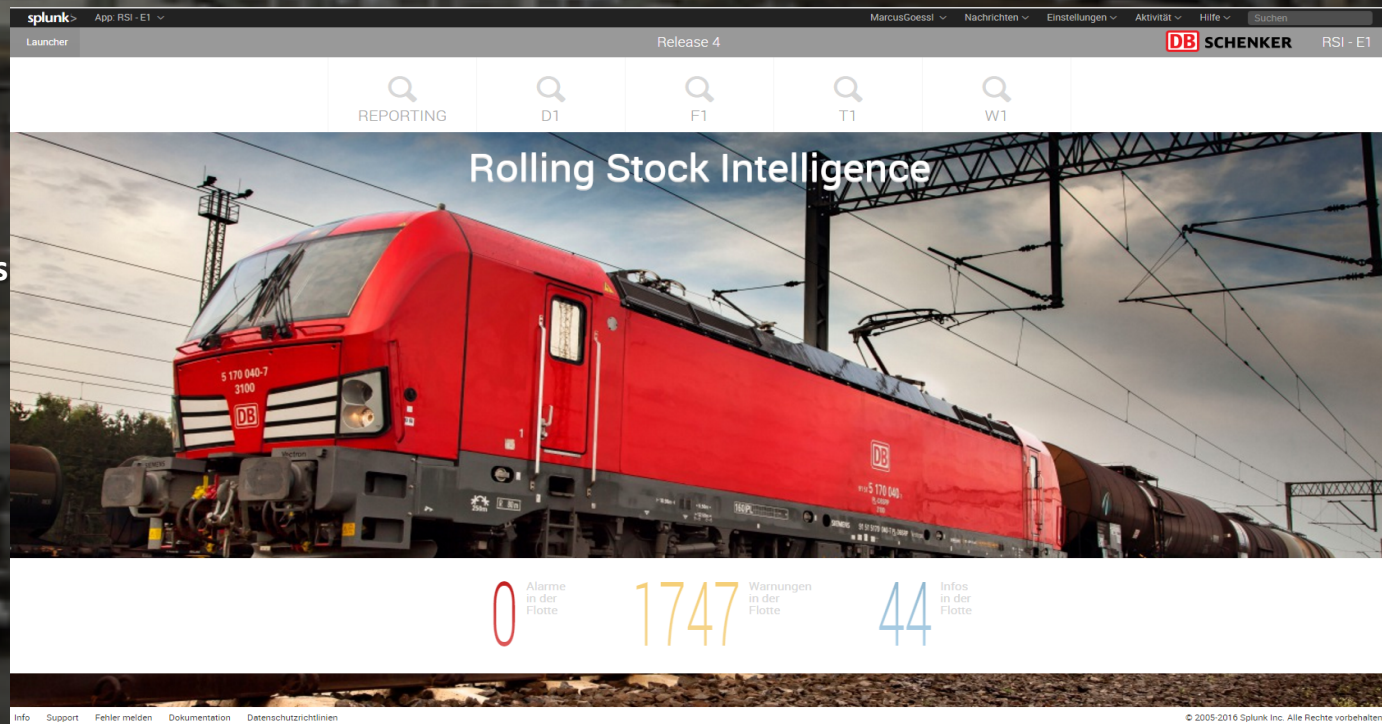
Splunk Application – User Group Fleet Management

Fleet Overview about triggered alerts per locomotive class & single locomotive

Deep dive for failure classification based on the results of the Rule Engine

Advisory if & when a locomotive needs to get to a maintenance workshop for repair works

Splunk Application – User Group Maintenance Workshop Experts

Supporting Root Cause Analysis based on current diagnosis messages and historical failure date of the locomotive

Access to additional data concerning current locomotive condition
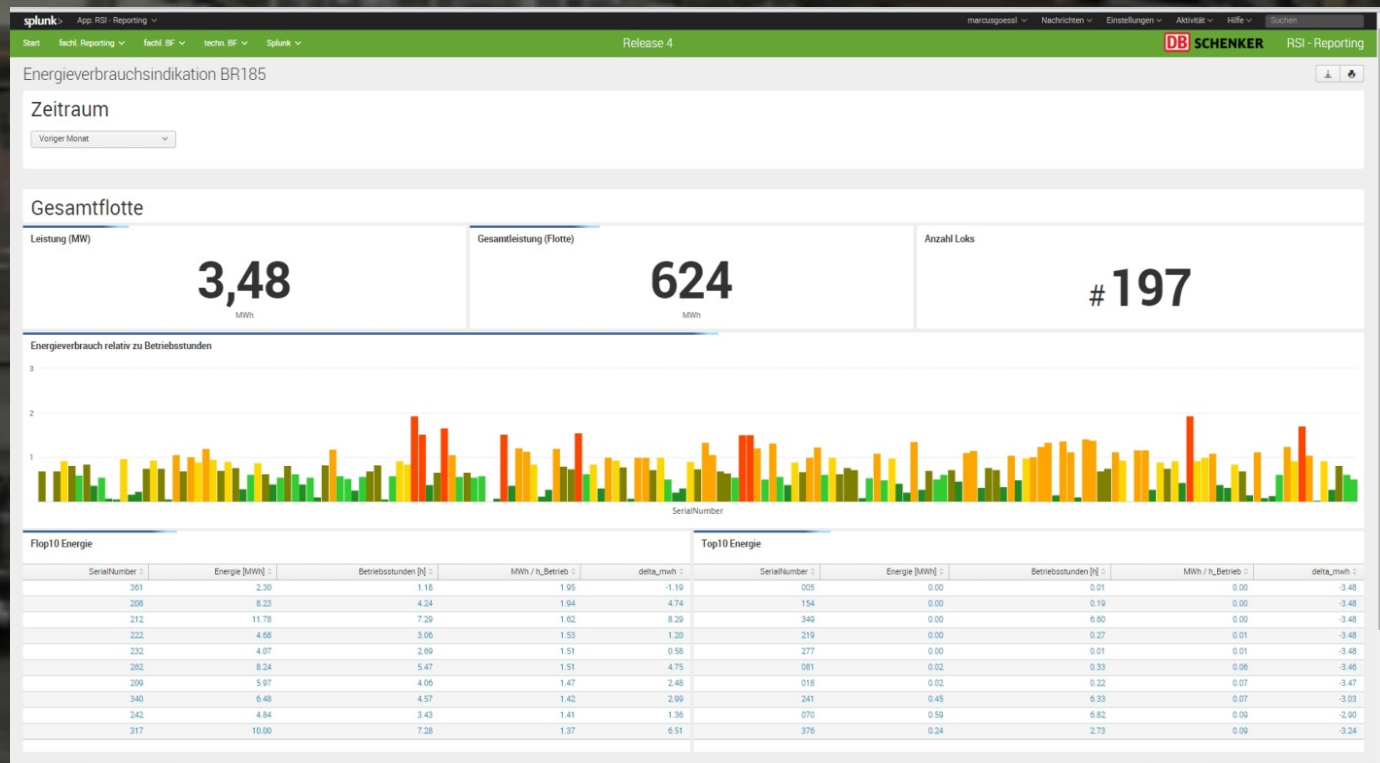
Knowledge exchange between maintenance workshop experts

Splunk Application – Reporting of Energy Consumption

Reporting to identify "bad" and "good" actor locomotives as basis for in depth analysis
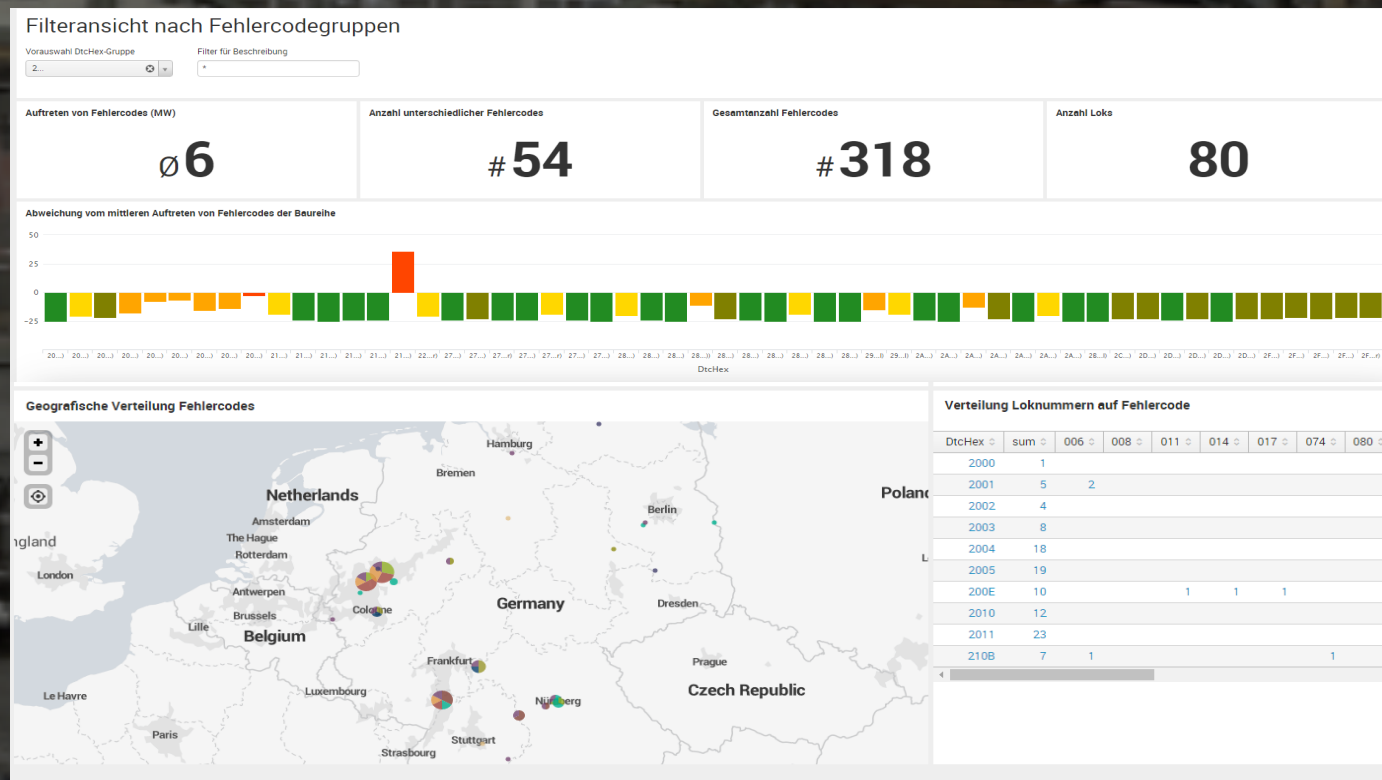
Splunk Application – Reporting of Locomotive Reliability

Reporting tool for analyzing the distribution of diagnosis codes across the fleet

Identification of failure **hot spots** as well as "bad" and "good" actor locomotives

Comparison of specific failures across the fleet enable the development of **technical counter measures**
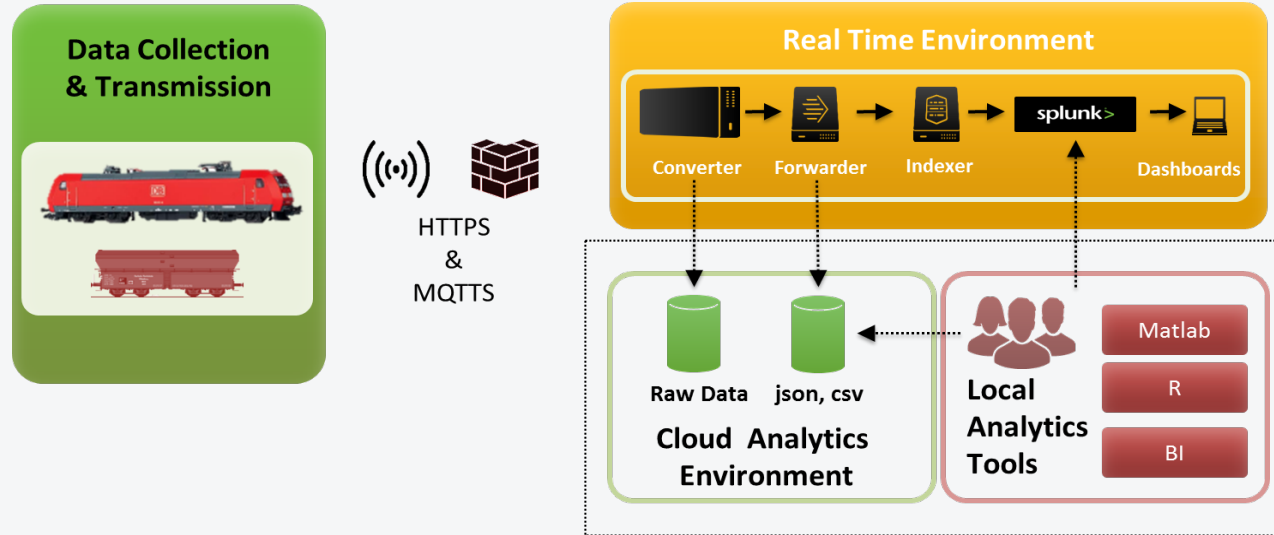
Splunk Approach And Benefits For Techlok

Live handling of technical data (continuous sensor values, diagnosis codes and location) from different locomotive types (Siemens, Bombardier, etc.) with different data sources and formats (json, csv)

Analyze and evaluate data with both simple and complex interlinks (e.g. time span and number of variables)

Easy to implement visualization for different user groups with specific roles

Data Collection & Transmission

HTTPS & MQTTS

Real Time Environment

Converter → Forwarder → Indexer → splunk> → Dashboards

Cloud Analytics Environment

Raw Data   json, csv

Local Analytics Tools

Matlab

R

BI

Summary And Outlook

TODAY

7,000 different diagnosis codes / status messages per locomotive type

60 different time series values from sensor per locomotive type

PoC **DB Regio locomotives**

7 locomotives types and **800 locomotives**

PoC **Wagon Intelligence** with **750 freight cars**

PoC **Dispo 4.0** for **empty freight car disposition**

TOMORROW

16 locomotives types and **2,000 locomotives**

Access to data via **central locomotive bus system** (MVB)

Interface to **3rd party Applications,** e.g weather or BI-Tools

200 car types and **70,000 freight cars**

Interface to all **relevant internal IT Systems**, e.g. SAP ERP

Splunk as central **Big Data Platform DB Cargo** Assets

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THANK YOU

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