Remote Diagnostics and Advisory System
Mobility service market –
10 key trends will shape the mobility service market

- Urbanization and demographic change
- Efficient operation and maintenance
- Guaranteed availability
- Increasing demand for data security
- From Big Data to Smart Data
- Cloud based services and virtualization
- Automation of integrated transport
- Improved asset utilization and asset value – whole of life)
- Limited budget and increasing demand
- Increasing system complexity & interoperability
- Increasing demand
- Guaranteed availability
- Efficient operation and maintenance
- Urbanization and demographic change
Rail vehicles generate large volumes of data – but what do we do with it to generate value?

The basis

**Volume**:
- Modern trains send GBs of **messages** per year
- TBs of **sensory** data (over 200 sensors / train)
- Operators need thousands of **spare parts**

**Variety**:
- Diagnostic messages (status)
- Sensor **values** (tolerance checks)
- Maintenance Data (TMPs, best practice etc..)

**Velocity**:
- Medium size fleet up to **150 Mbs** data transfer rate

**Veracity**
- up to 16% of diagnostic messages contain wrong values (e.g. GPS coordinates)
- 2% of messages are incomplete (e.g. missing time stamp)
- Intuition based decisions (e.g. When to go to maintenance)

The challenge

Turn all this **data** into **information**
And derive **actions**
## Typical benefits resulting from Big Data derived Digital Services

<table>
<thead>
<tr>
<th>Lever</th>
<th>Example</th>
<th>Key Performance Indicator (KPI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asset investment</td>
<td>Better asset utilization leads to reduced investment in trains for overall fleet</td>
<td>Investment savings of 5 – 10%</td>
</tr>
<tr>
<td>Asset utilization</td>
<td>Asset utilization can lead to increased revenue (freight locomotive but also high speed)</td>
<td>Revenue increase of up to 5 – 10%</td>
</tr>
<tr>
<td>Maintenance cost</td>
<td>Based on digital services maintenance can be optimized (integrated services, condition based and predictive maintenance)</td>
<td>Maintenance cost decrease 5 – 10%</td>
</tr>
<tr>
<td>Inventory cost</td>
<td>Optimizing inventory cost by reducing inventory, reducing obsolete inventory and its carrying cost</td>
<td>Inventory cost decrease 5 – 10%</td>
</tr>
<tr>
<td>Material cost</td>
<td>Less material through condition based maintenance (scheduled)</td>
<td>Material cost decrease of up to 5%</td>
</tr>
<tr>
<td>Labor cost</td>
<td>Less manual effort to collect and analyze diagnostic data</td>
<td>Labor cost decrease of up to 5%</td>
</tr>
</tbody>
</table>
Railigent™
The platform to manage assets smarter

Data transmission | Data processing | Data evaluation | Data visualization
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Railigent Connect
Secure data transmission from sensor to central data storage

Railigent powered by Sinalytics
Turning data into value and enabling Digital Services solutions (Smart Monitoring, Smart Data Analysis and Smart Prediction)

Advanced algorithms
Expertise domain
Know-how
Best practises

Management
Dispatcher
Maintenance engineer

Modular
Customized solution packages: Define reports as you need them

Scalable
From basic to advanced solutions: Upgrade your system as needed

Open
Fits into your environment: Standard interfaces ensure interoperability

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How to generate insights from rolling stock data

1: Data collection
- Secure data transfer

2: Advanced data analytics
- Detection and prediction of failures
  - Critical value
  - Alarm

3: Validated action proposal
- Hotline
- Analysis by experts
- Cross-project experience
- Customer reports

4: Action implementation
- Action performed by field-service experts
- Optimization of Spare-Parts usage

SIEMENS RDA & Sinalytics
SIEMENS Data Services
SIEMENS Rail Support Center
SIEMENS Customer
Some examples from the Monitoring and Data Analysis environment

Fleet overview
Overview vehicle locations and vehicle status

Component monitoring
Monitoring of sensor readings to identify deteriorating operation

Abnormal pattern identification
Abnormal patterns identification of heating, ventilation and air conditioning

Failure prediction modeling
Identification of patterns to predict failures
The Dispatcher receives all relevant information via a dashboard to initiate corrective maintenance at an early stage where required.
Monitoring – Data Evaluation
The rule engine allows users to implement their experience in the system

Smart Monitoring – Data Evaluation with function of data plots and rule engine

Data Plots
display the status of sensors or events over time in combination with the event on the map.

Reducing False Positives
Rules to filter-out irrelevant alarms. This leads to less effort for screening all the system events.

Complex rules (daisy chain events)
E.g: A power supply failure causes a HVAC failure therefore the two related systems should be combined.

Rule browser
Global view of all rules and trending analysis to show false-positive ratios to fine tune rules.
Data Analysis and Smart Prediction
Monitoring of abnormal patterns and trending for door cycles closing and opening

Wear and tear on doors

Method

• Monitoring of closing and opening door cycles
• Identification of abnormal patterns for closing and opening door cycles
• Adjustment of algorithms to avoid false alarms due to real-life scenarios (e.g. door blocked by passenger)

Result

• Simple traffic light logic ( ● ● ● ) supports the maintenance team with easy to understand recommendations on which doors to focus
• Analyzing the data over a longer period of time will even provide trending information which will help to further optimize maintenance schedules.
How to generate insights from infrastructure data

- High-Level Health check
- Alarm Priorities
- Define rules for trigger
- Predict Failures or use Condition Based Alarms (e.g. battery on charge; current too high)
- Integration of Manuals and Drawings
- Work Instruction for Equipment about to fail
- Access via tablets
Conclusion – Remote Diagnostic and Advisory System

**Monitoring** – automatic data visualization offering full transparency and fast troubleshooting

**Data Analysis** – for efficient root cause investigations

**Prediction** – algorithms for preventive fault analysis
Mike Akdeniz
Head of Products & Services

Mobile: +61 429 937 806
E-mail: michael.akdeniz@siemens.com

siemens.com/mobility-services