Europe's Rail

TCCS Diagnostics and Configuration

Service Function Diagnostics & Data Sharing

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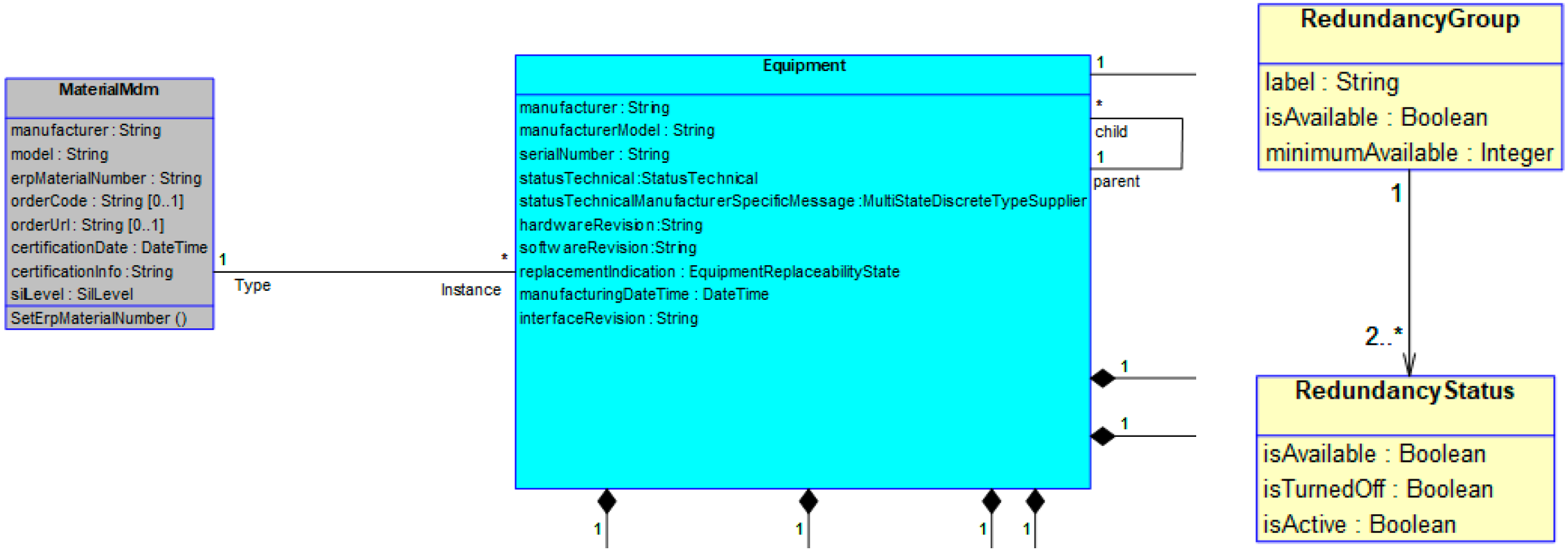
Operational User Stories

As a **maintainer**,
I want standardized, up-to-date asset and diagnostic data
so that I can efficiently detect, understand, and resolve faults across systems and manufacturers.

Key Needs:

- **Understand data**: standardized models &semantics
- **Localize faults**: Precise identification (LRUs)
- **Repair Efficiency**: Correct material on-site

Online Inventory
“physical” Equipment model



We standardize the Description, not the system architectures!

Source: SDI-GEN, ptc-model EULYNX/ NeuPro, 03/2025

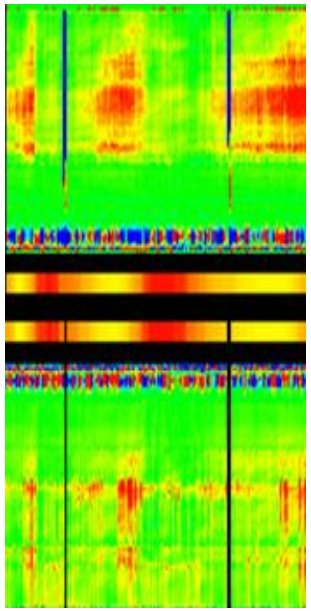
Is a switch ready to operate?

Diagnosis

Turning Left

Temperature

Turning Right

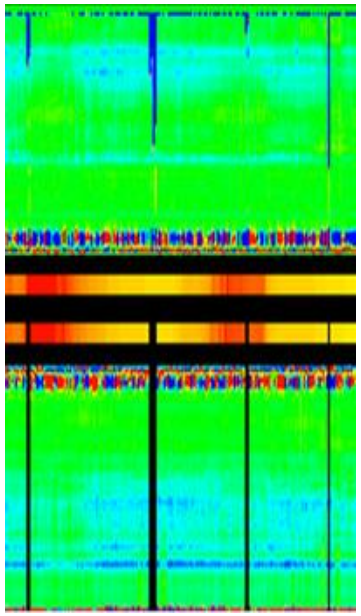


„needs more power at lower temperatures“

Corrective Measure

„switch correctly set up“

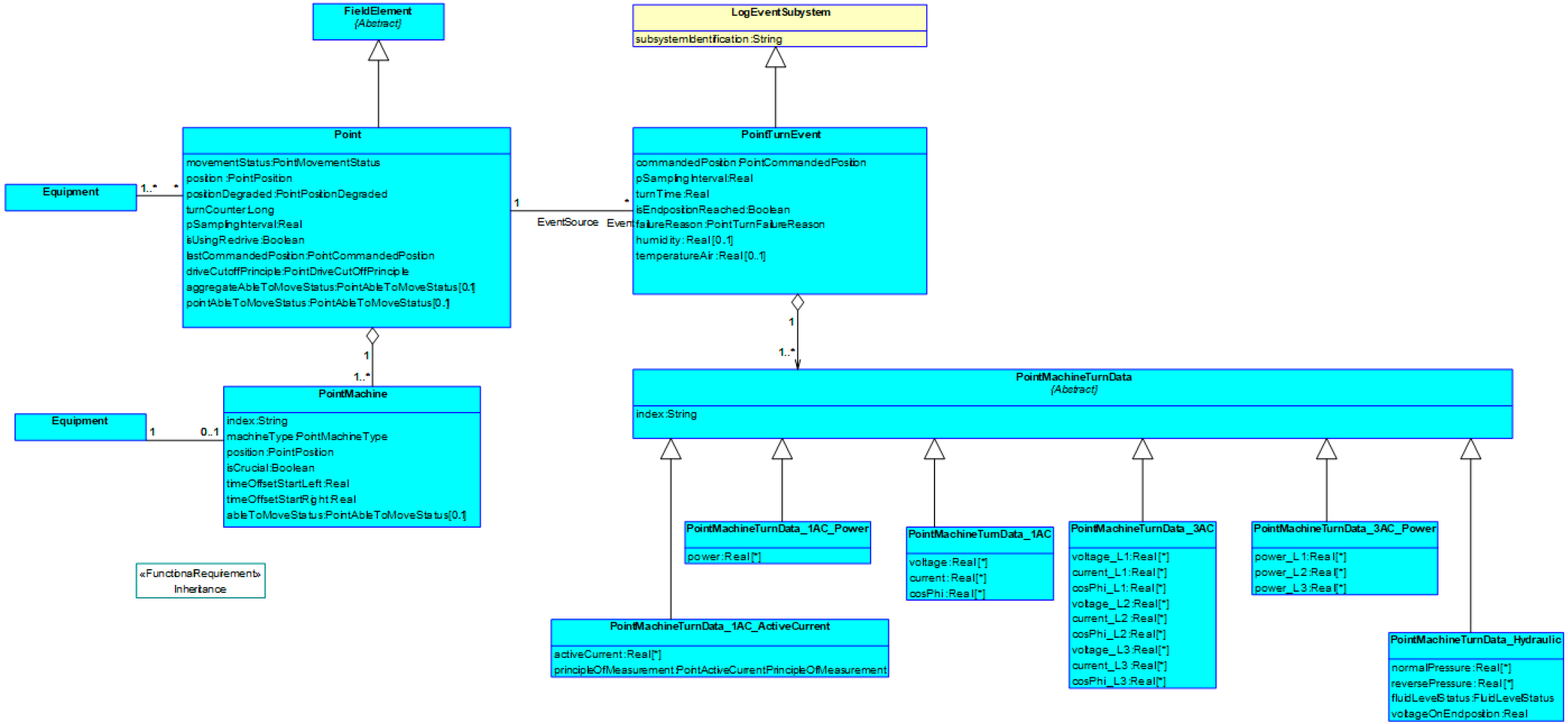
Result



„Reduced probability of failures“

Source: DB InfraGO, Grassmann, 2015

Ready for Operation?
"logical" Product Group Model



Source: SDI-P, ptc-model NeuPro/EULYNX Polarion

We need Product Group models in different “quadrants“ of the railway sector

Vehicle monitors infrastructure

Installed in/on regular service vehicles, among other things, for monitoring the track condition.

→ **CTM**

Infrastructure monitors vehicles

Installed in/on infrastructure, among other things, for monitoring the condition of vehicles.

→ **Checkpoints**

Vehicle monitors itself

Installed in/on vehicles, among other things, for monitoring the condition of vehicles.

→ **Vehicle Systems**

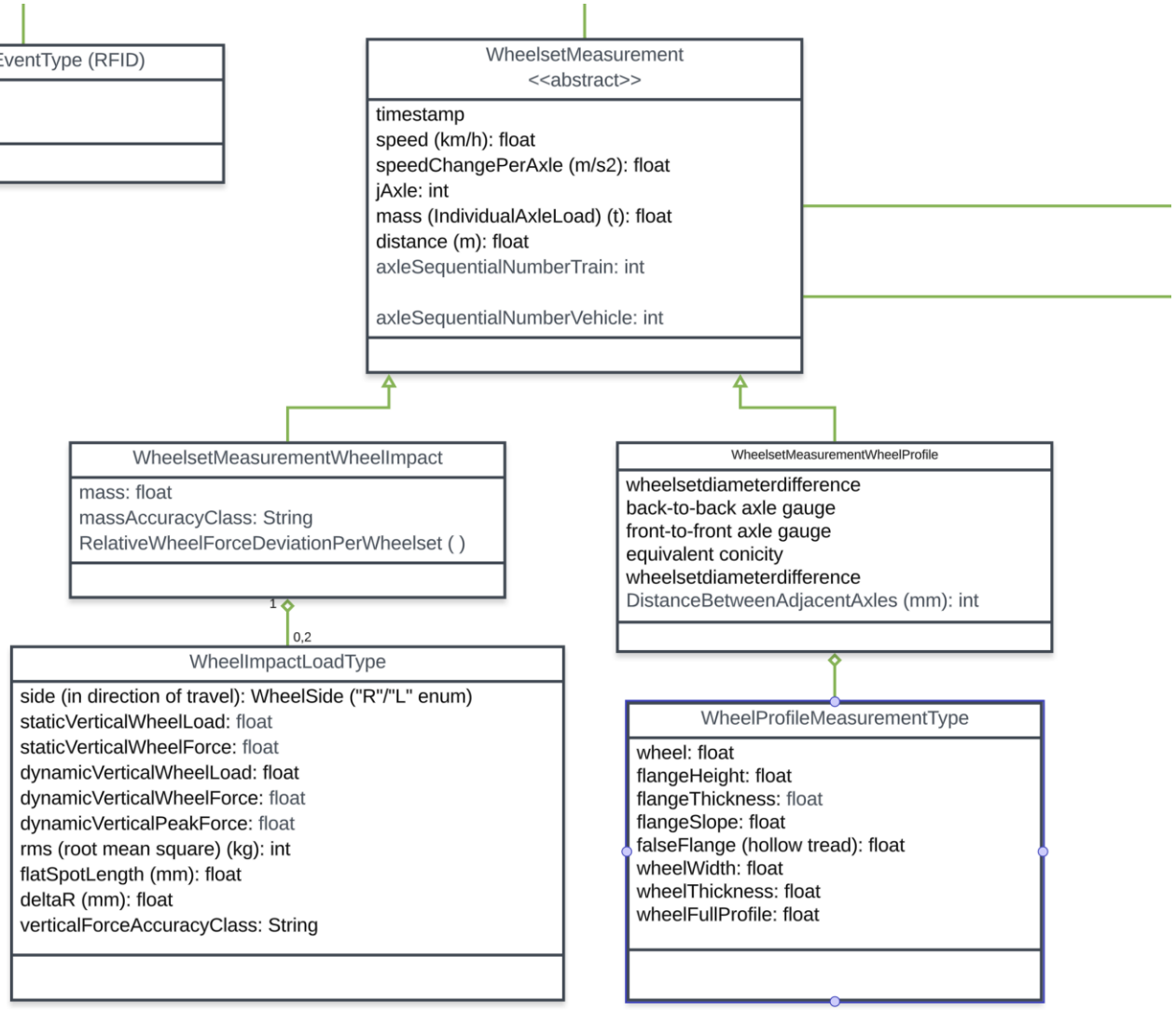
Infrastructure monitors itself

Installed in/on infrastructure, among other things, for monitoring the condition of facilities.

→ **Infrastructure systems**

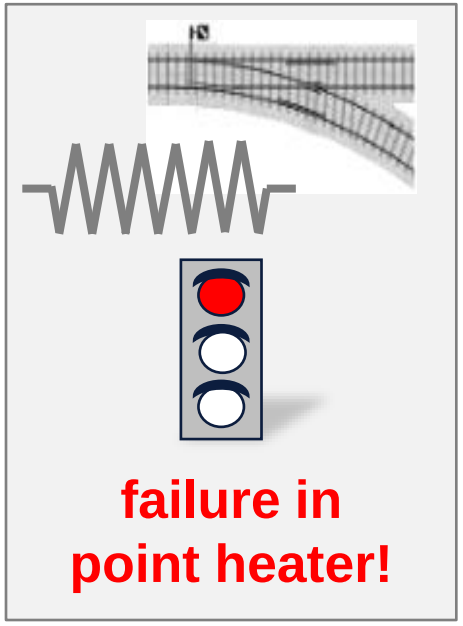
Infrastructure monitors vehicles: Checkpoint Models

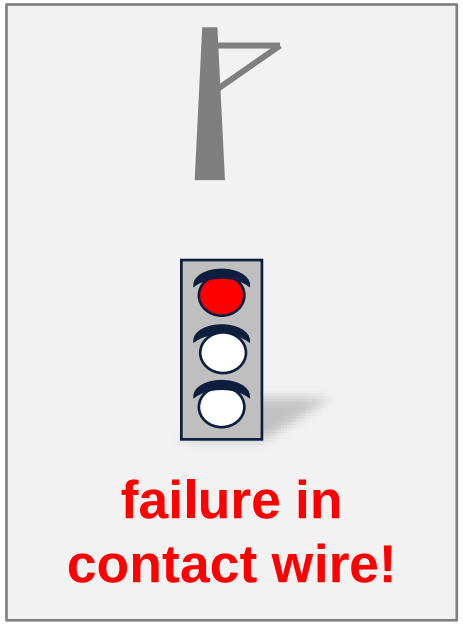
Source: http://international-engineering.com/en/divisions/monitoring-division/Wheel-Imp

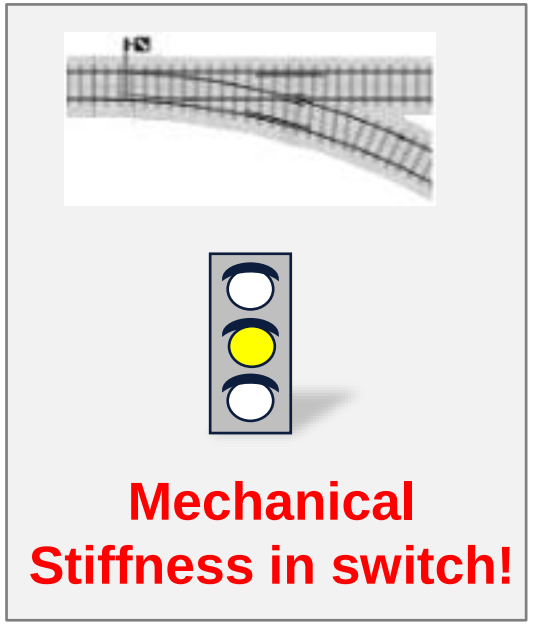


Source: System Pillar HERD Projekt, 06/2025

Failure Scenario: What is happening here? Where to go?





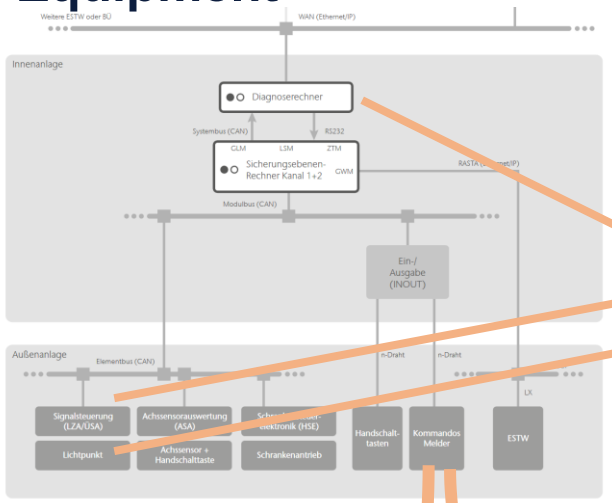


Source: DB InfraGO, Grassmann, 2015

How many systems must function correctly (logical “AND”) for a route to be set in a railway signaling system?

References: Equipment “implements” the “ProductGroup-XX”

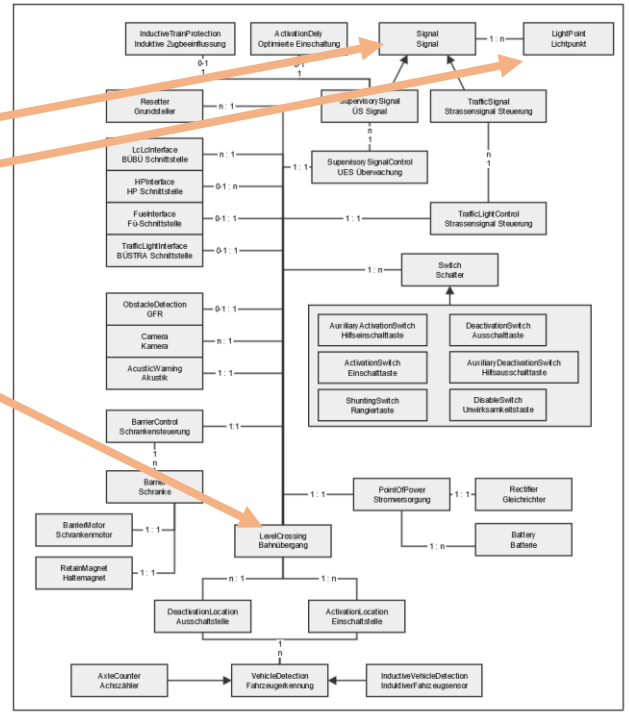
Equipment



Source https://www.scheidt-bachmann.de/de/systeme-fuer-signaltechnik/produkte-loesungen/bahnuebergangstechnik/bahnuebergangssteuerung/ am 25.02.2020

Implements

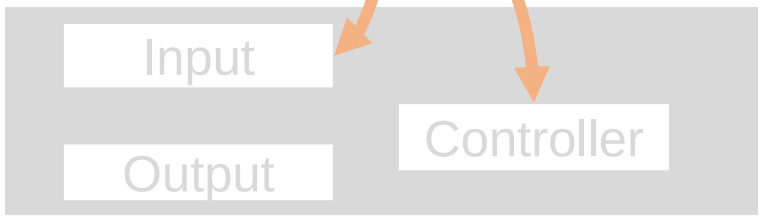
Product Group



Source: DB InfraGO, 2016

HasComponent

Child Equipments



MORE:
IsPartOfRedundancyGroup
ProvidesPowerTo, …

Tactical User Stories

As a **maintenance planner**,
I want access to standardized, condition-based and prognostic asset data
to optimize maintenance planning and dynamically prioritize actions based on environmental and functional context.

Key Needs:

- Comparable Centralized Condition data and fault prediction
- Functional dependencies for impact-based prioritization

Strategical User Stories

As a **procurement or asset planning stakeholder**,
I want standardized, vendor-independent performance and availability data across assets
to make informed decisions in procurement, migration, recall campaigns, and claims management.

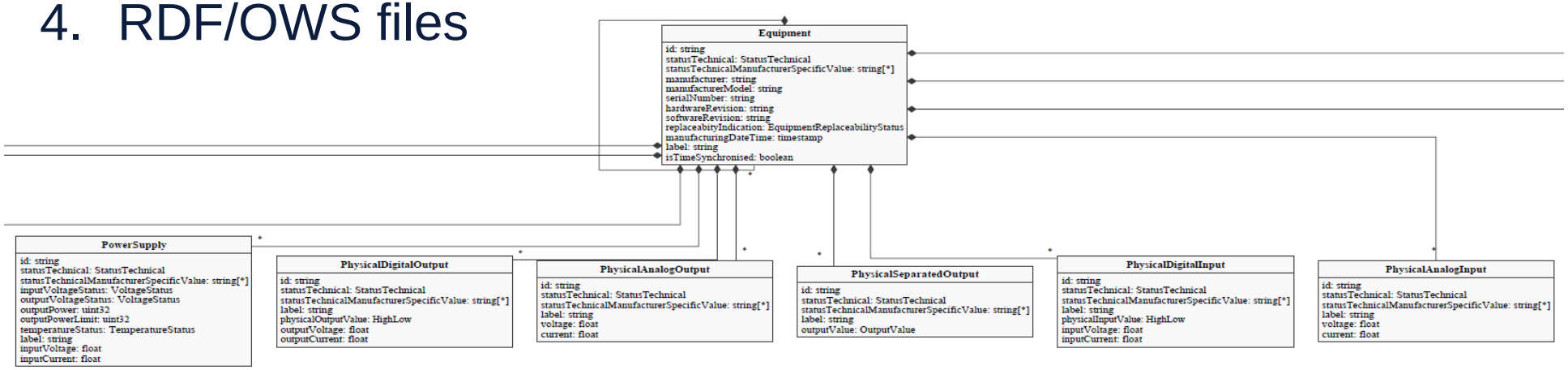
Key Needs:

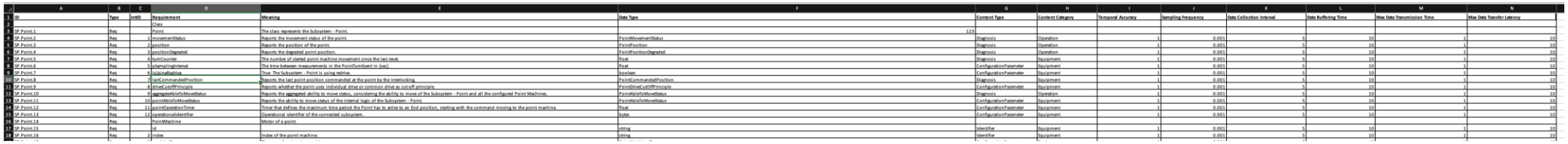
- Comparable availability and performance metrics
- Device and component model consistency
- Centralized inventory (current and historical)
- Dependency visibility and traceability

We scale:
SDI-XX Toolchain for Product Group Models

The Toolchain generates the following Artifacts:

1. UML class diagram
2. Meta Information table as an excel sheet.
3. OPC UA Information Model as a NodeSet2 XML format
4. RDF/OWS files





Areas for Cooperation

```
<?xml version="1.0"?>
<rdf:RDF xmlns="http://rail-research.europa.eu/eu-rail.sdi-generic.4.3.1-r02/equipment#"
     xml:base="http://rail-research.europa.eu/eu-rail.sdi-generic.4.3.1-r02/equipment"
     xmlns:owl="http://www.w3.org/2002/07/owl#"
```

Long lasting namespace names, Downloadable

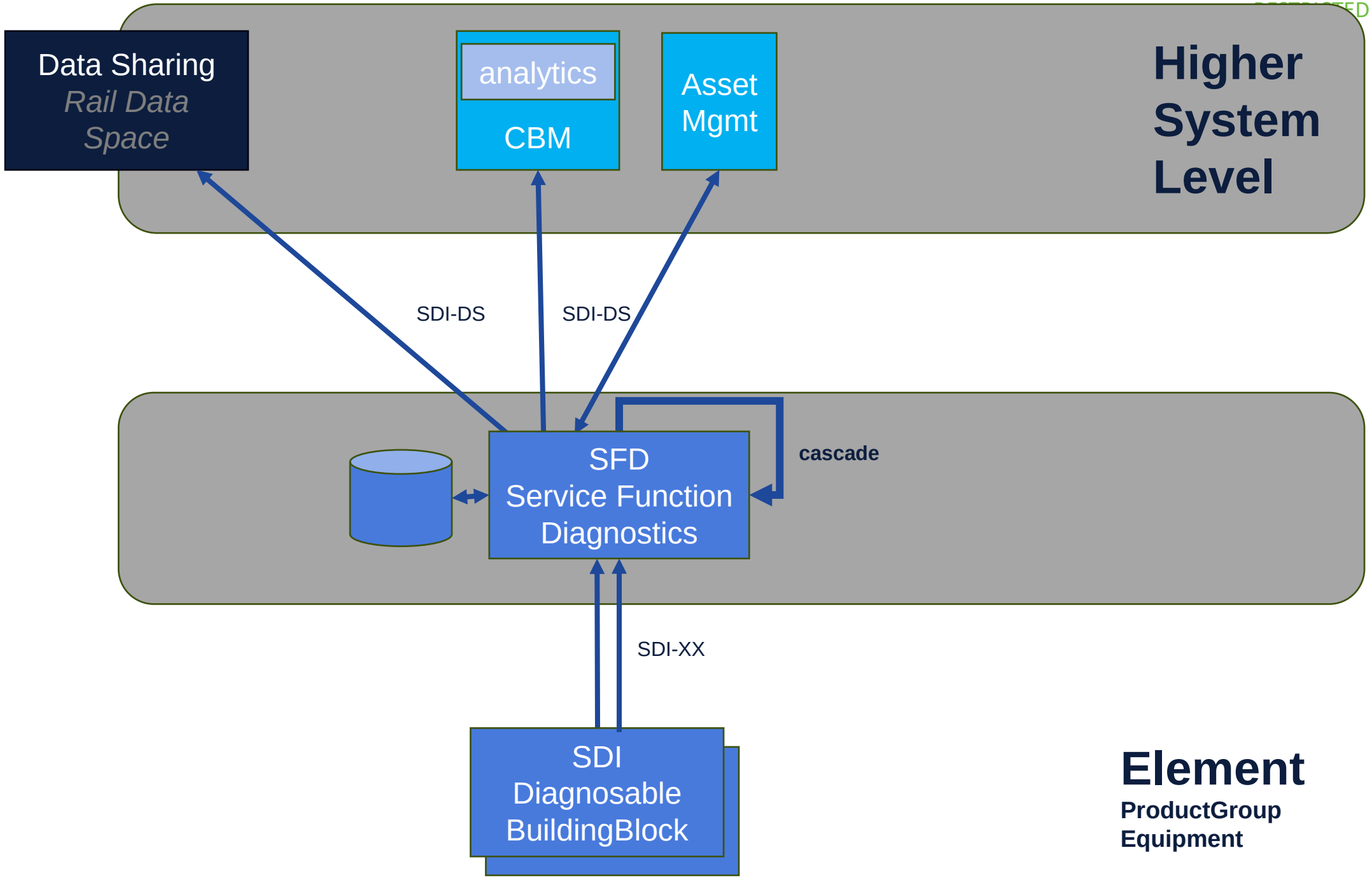
```
<!-- Core Classes -->
<owl:Class rdf:about="#Equipment"/>
<owl:Class rdf:about="#PowerSupply"/>
```

Class Names in ProductGroup Models

```
<owl:Class rdf:about="#Subsystem"/>
<owl:Class rdf:about="#Switch">
  <rdfs:subClassOf rdf:resource="#Subsystem"/>
</owl:Class>

<!-- Functional reference relationship -->
<owl:ObjectProperty rdf:about="#implements">
  <rdfs:domain rdf:resource="#Equipment"/>
  <rdfs:range rdf:resource="#Subsystem"/>
  <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
  <rdfs:comment>
    Indicates that a physical Equipment implements a logical Subsystem such as a Switch.
  </rdfs:comment>
</owl:ObjectProperty>
```

Functional References Naming



Element

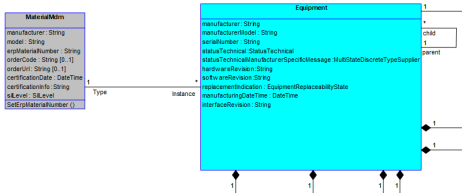
ProductGroup
Equipment

The railway operator (User) has right to access, use and share the data

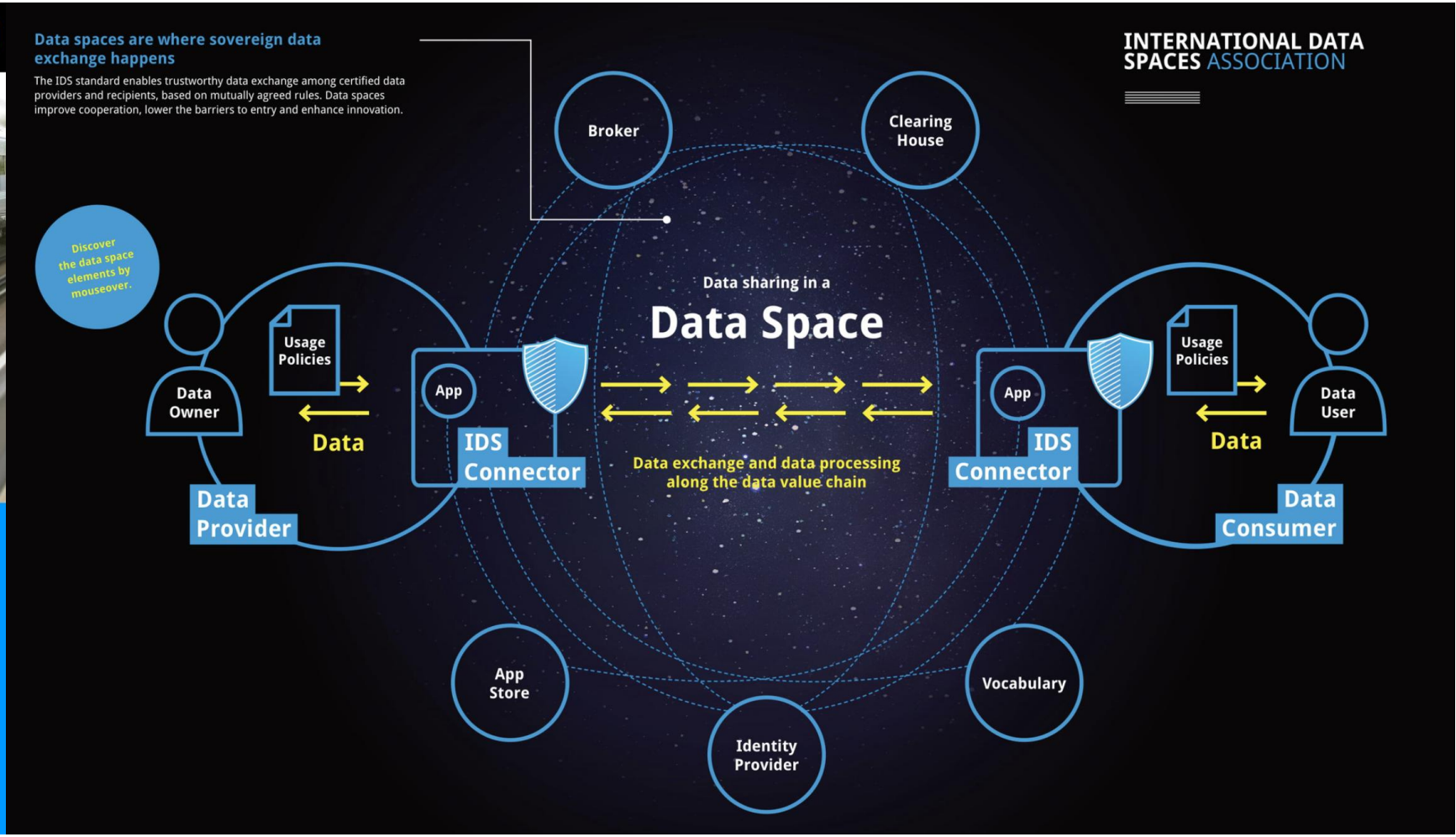
What data?

- **Condition data** of physical and logical components
- **Usage and performance metrics**
- **Fault and repair records**

With whom? Suppliers, integrators, maintenance providers
Why? improve products, innovation



We need secure, sovereign and standardized data sharing across trusted partners



Source: International Data Spaces Association – “European Rail Data Space”, "Data sharing in a data space"

Service Function Diagnostics

& Data Sharing

Thank you for Listening!

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