Digitale Schiene Deutschland

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IT Platforms for future Railway Systems

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I.NDB 5

Who we are?

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Dr. Patrick Marsch
Lead Platform Development

Alexander Heine
Lead Computation Circle

Key innovations are being implemented in all main areas oft the rail system and create new opportunities

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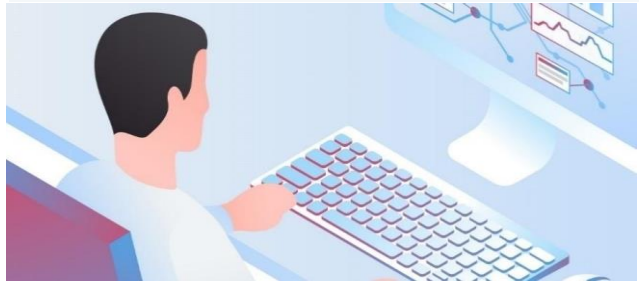
DIGITALIZED INFRASTRUCTURE

HIGHLY AUTOMATED VEHICLES



SMART CONTROL

Target picture for the entire rail system

- Trains run **automatically** and sense **their environment**
- Trains driving at **optimal headway**
- AI based **traffic management** plans and dispatches trains and routes
- **Interruptions** are **automatically detected** and managed

The target image is achieved via various product bundles - for more capacity, quality and efficiency

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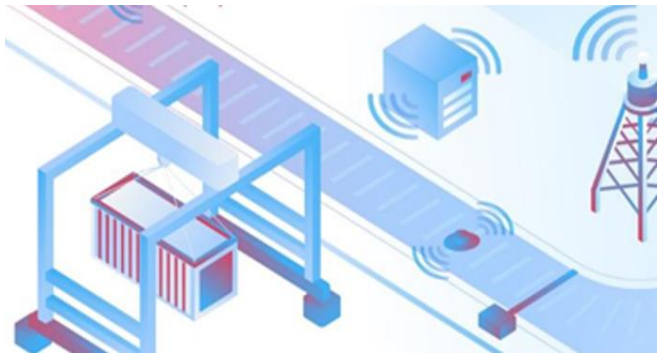
Basic Digitalisation



BASIC DIGITISATION OF THE INFRASTRUCTURE

ETCS L2 & Digital Interlockings (DSTW) and DSD vehicle equipments

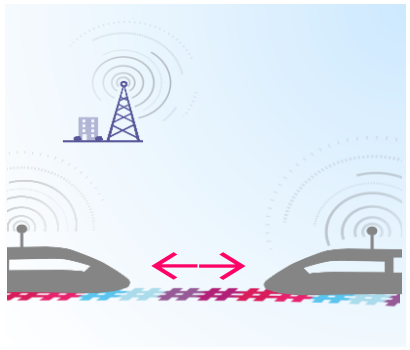
HIGHLY AUTOMATED DRIVING

- Trains run stably and predictably
- GoA2 as an important intermediate step for implementation and migration

Advanced Digitalisation

FULLY AUTOMATED DRIVING

- Trains run fully automated (GoA4) and are aware of their surroundings
- Trains react automatically to disruptions



DRIVING AT THE OPTIMUM DISTANCE

- Innovative safety logic
- Enables driving at the optimum distance (moving block)

INTELLIGENT CAPACITY PLANNING AND TRAFFIC CONTROL

- Automated capacity planning
- Automated traffic control and dispatching in real time

Future Railway Mobile Communication System (FRMCS) based on 5G

Platform Development within DSD

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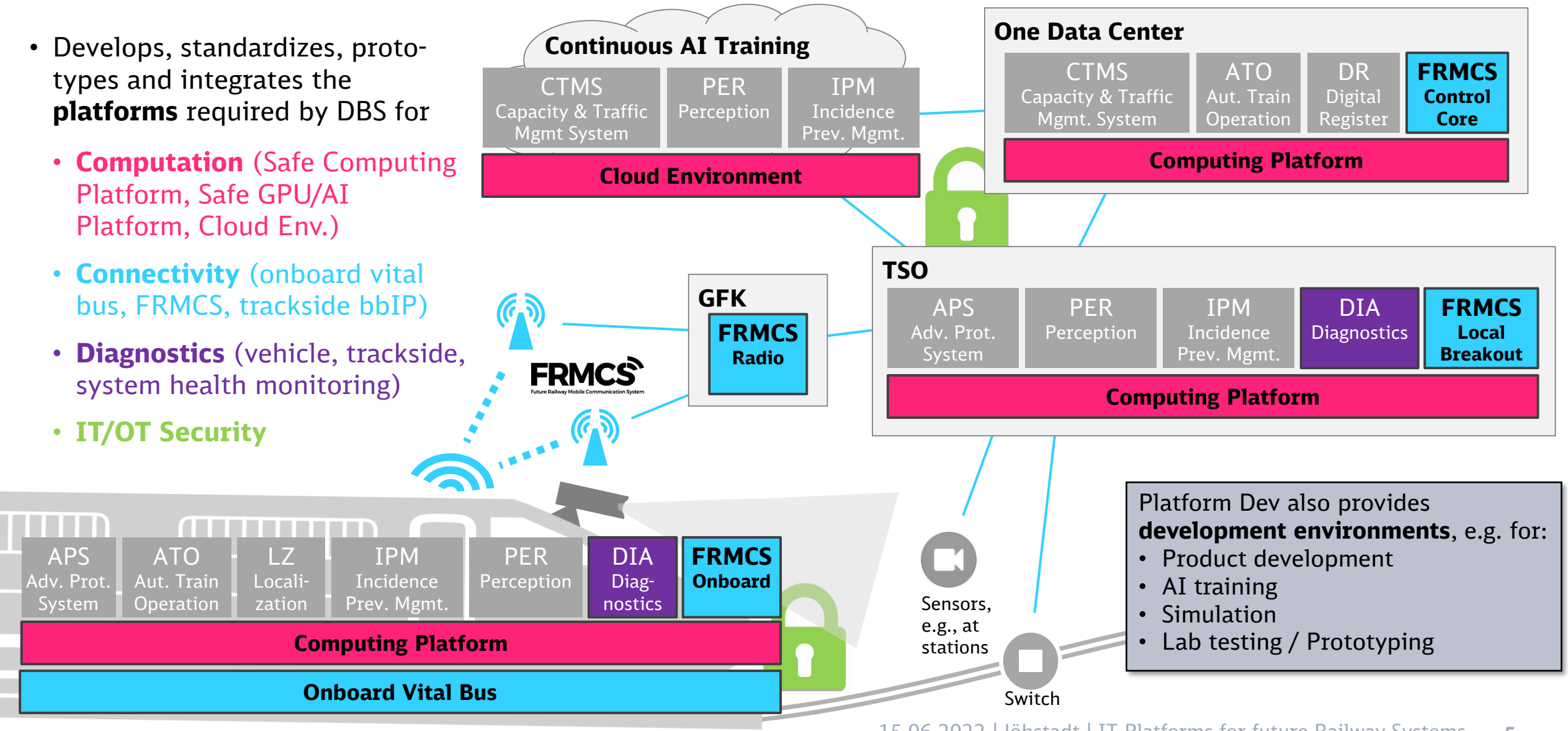
- Develops, standardizes, prototypes and integrates the **platforms** required by DBS for
  - **Computation** (Safe Computing Platform, Safe GPU/AI Platform, Cloud Env.)
  - **Connectivity** (onboard vital bus, FRMCS, trackside bbIP)
  - **Diagnostics** (vehicle, trackside, system health monitoring)
  - **IT/OT Security**



Platform Dev also provides **development environments**, e.g. for:
- Product development
- AI training
- Simulation
- Lab testing / Prototyping

Types of Compute Platforms needed for Digital Rail

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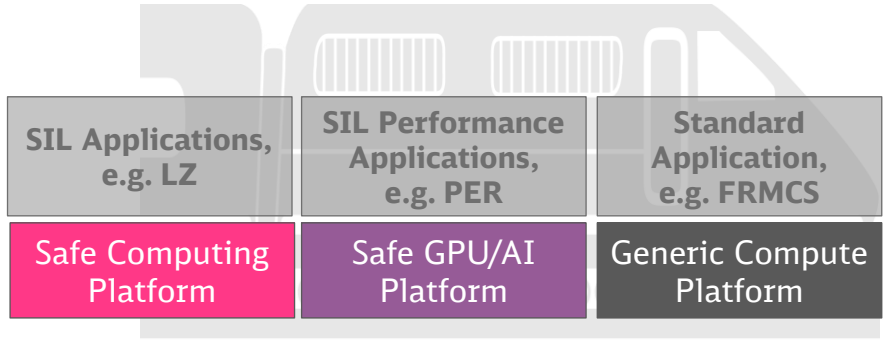
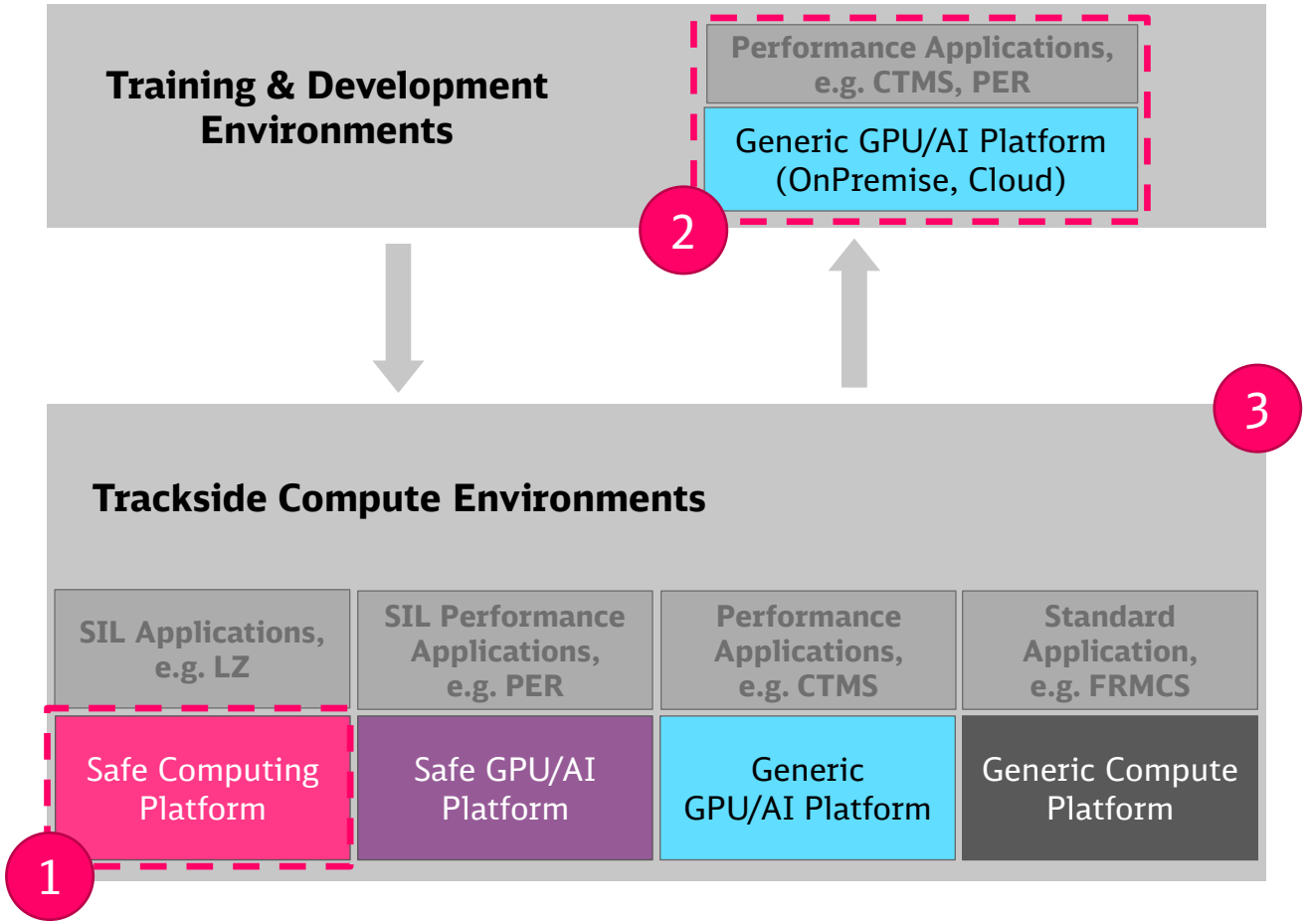
Required types of computing platforms

	Safety Integrity Level (SIL)	Non-SIL
Non-HW Accelerated	Safe Computing Platform	Generic Compute Platform
HW-Accelerated	Safe GPU/AI Platform	Generic GPU/AI Platform





GPU – Graphical Processing Unit

1 Safe Computing Platform
Basic Architecture and Key Benefits

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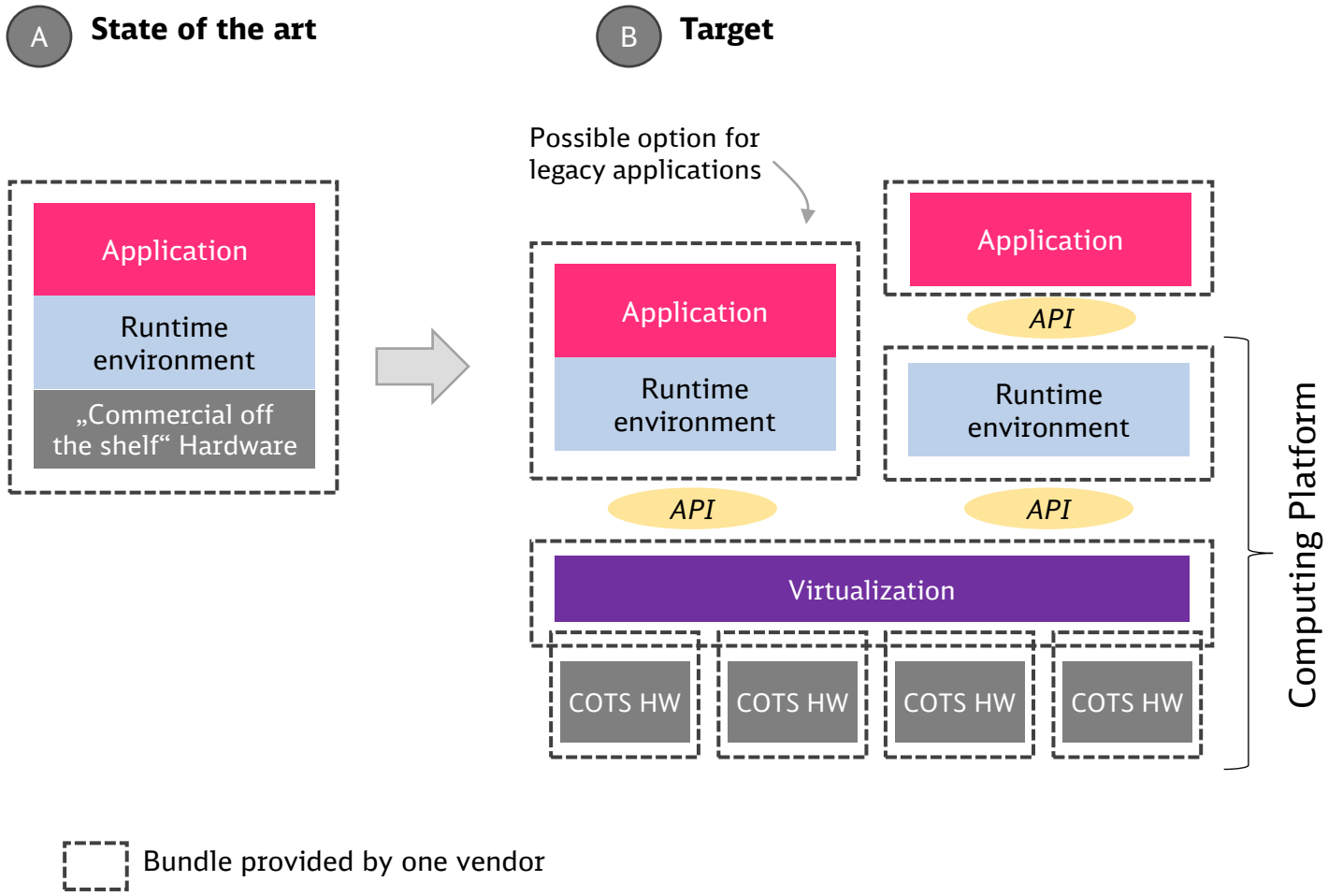

Benefits:

- **Separation of lifecycles** of application, runtime environment and hardware for their individual evolution
- **Larger vendor markets**:
  - Facilitated market entry for **new application developers** (and basis for DB application development)
  - **Larger market of platform vendors**
- **Decreased CAPEX and OPEX**, for instance due to synergies among applications
- **Improved scalability and maintainability**

Safe Computing Platform expected to provide major cost benefit to DB Netz and railway undertakings

2 Use Case: Rail Data | Platforms & Prototyping

Data Acquisition & -Engineering & Sensors Team

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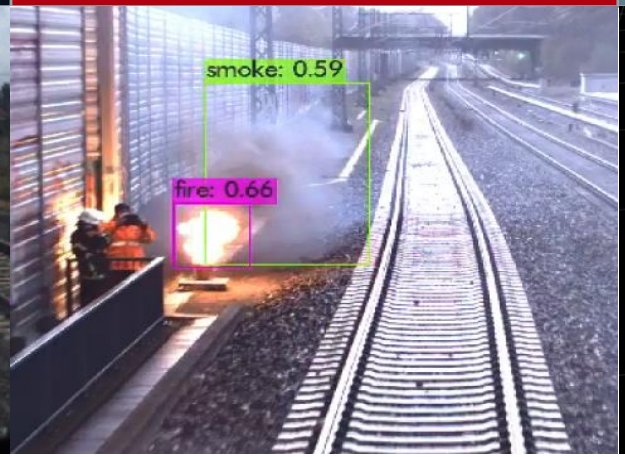
Sensor Benchmark Project

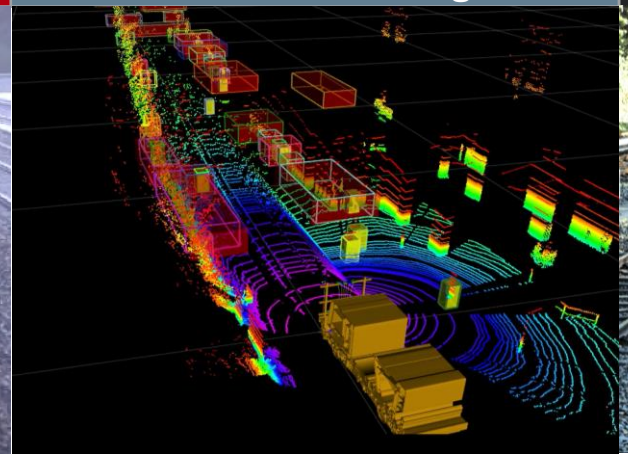
Test-Case Data of: 3x Camera, 3x Hi-res Camera, 3x IR-Camera, 2x Corner Lidar, 1x Mid-range Lidar, 3x Long-range Lidar, 2x Long-Range Radar, 1x Gas-Sensor

Track Detection

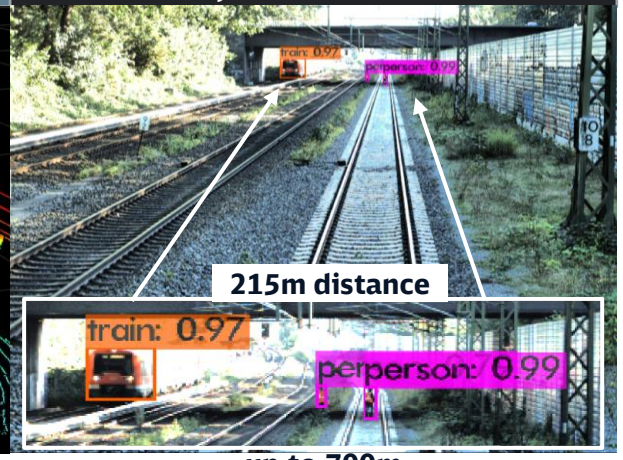
Fire Detection



Fusion & Tracking



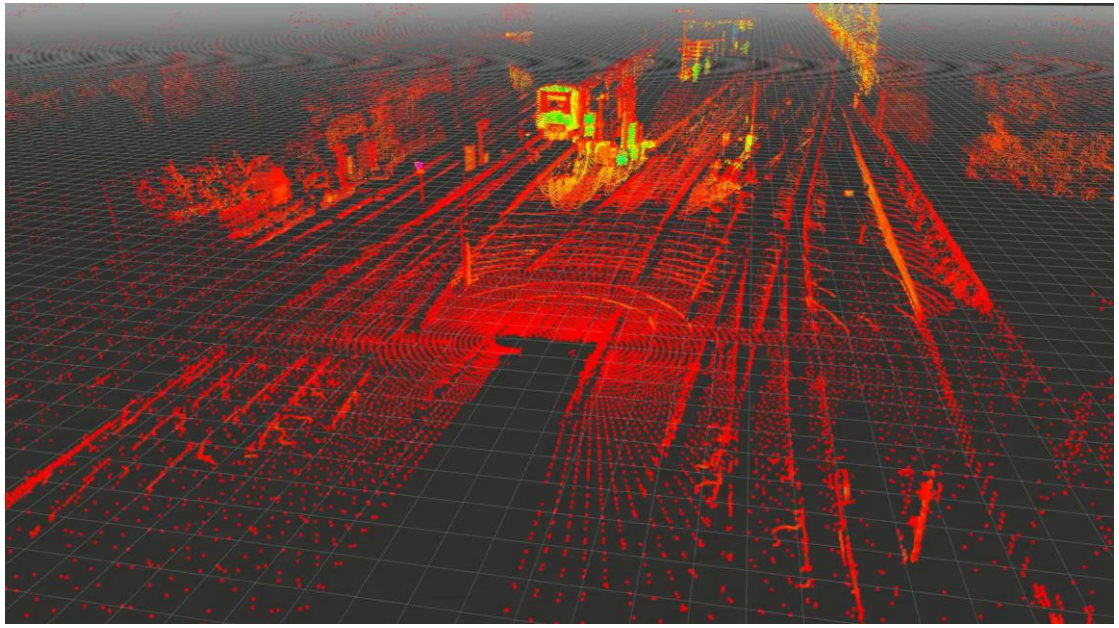
Object Detectors

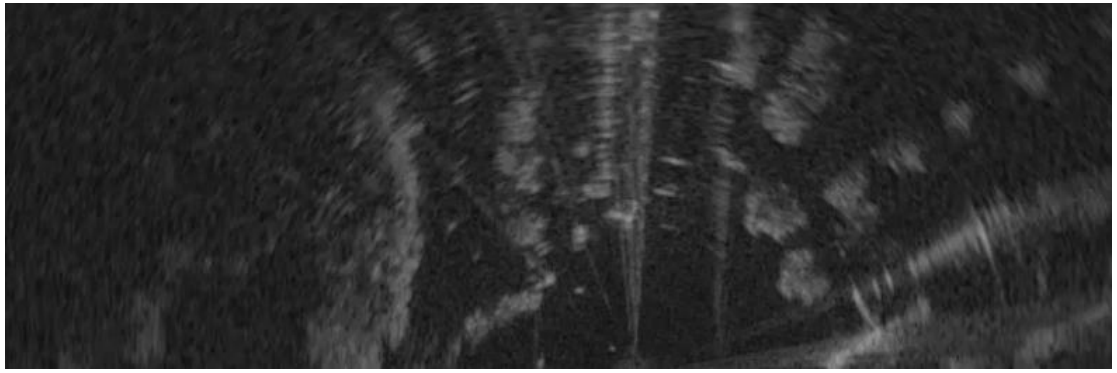


up to 700m

2 Use Case: Rail Data | Sensor-Data

RGB- | IR- | Radar-Images | 3D Point Clouds | GNSS/IMU | 1 GB/s | Meta-Data | Annotations





2 Data Factory for Rail – Target Picture

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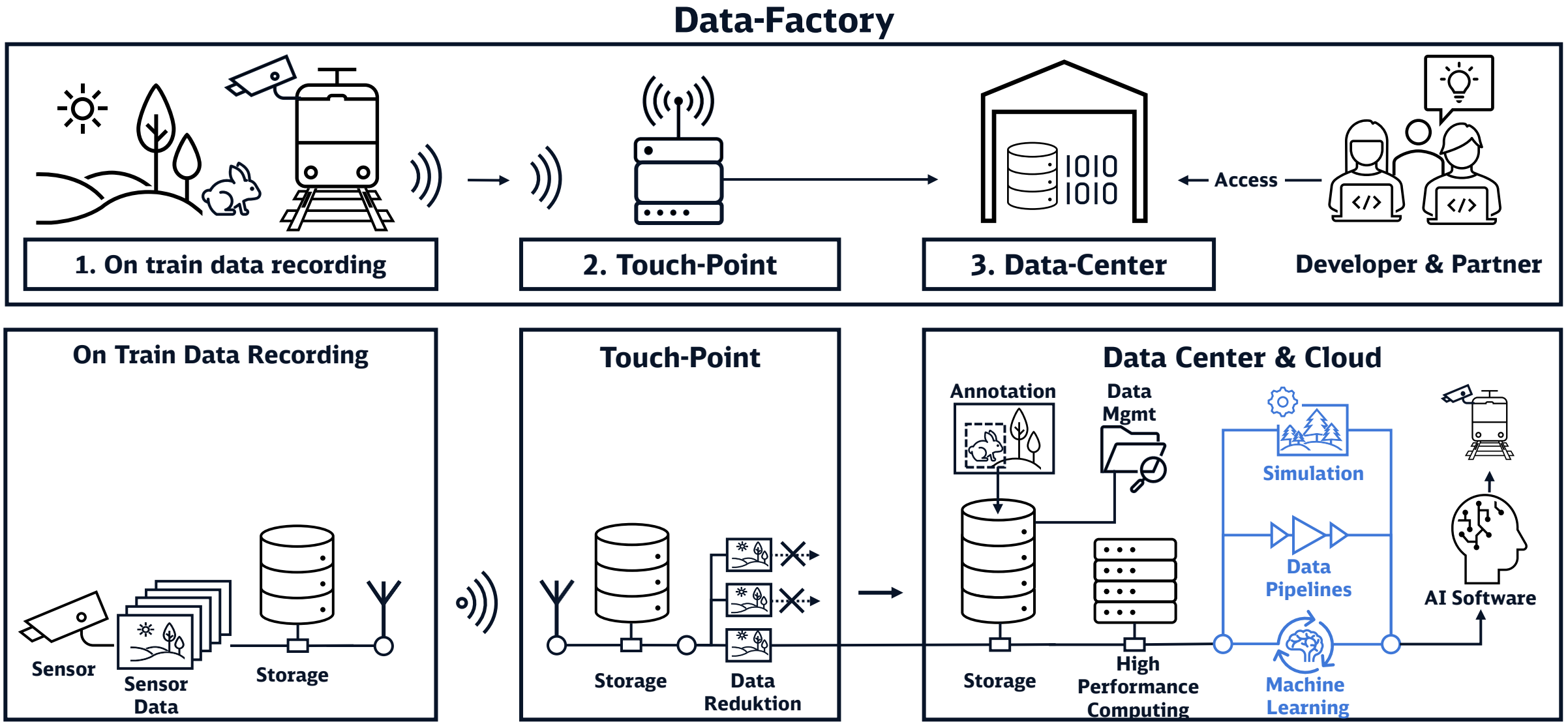

2 Data Factory for Digital Rail Germany in Detail

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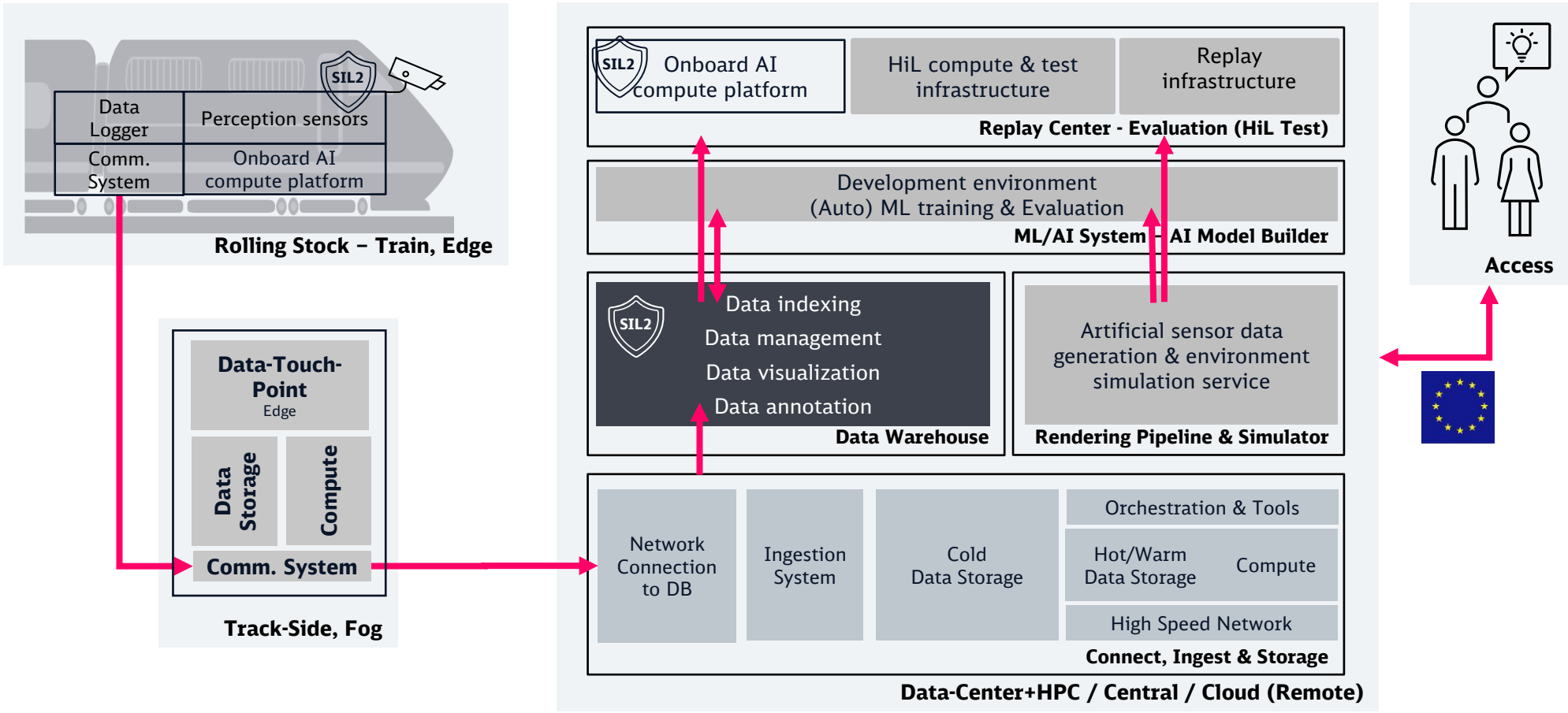
The „Data Factory“ comprises the **infrastructure to collect and store sensor data from trains and use this for AI training and simulation purposes**



Major data flows

2 Data Factory for Rail – European Target Picture

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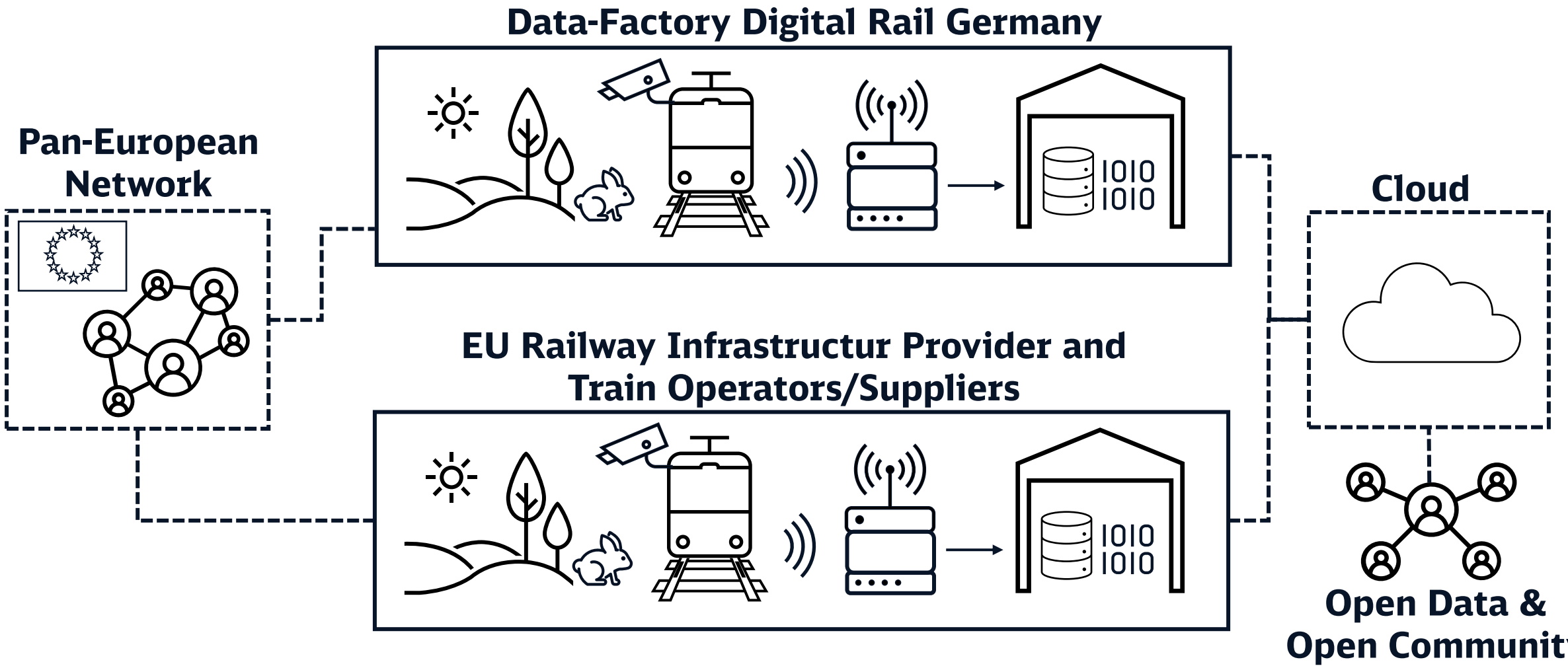


3 DB Cybersecurity Strategy - Zero Trust

Five Principles:

Networks are not trustworthy per se.

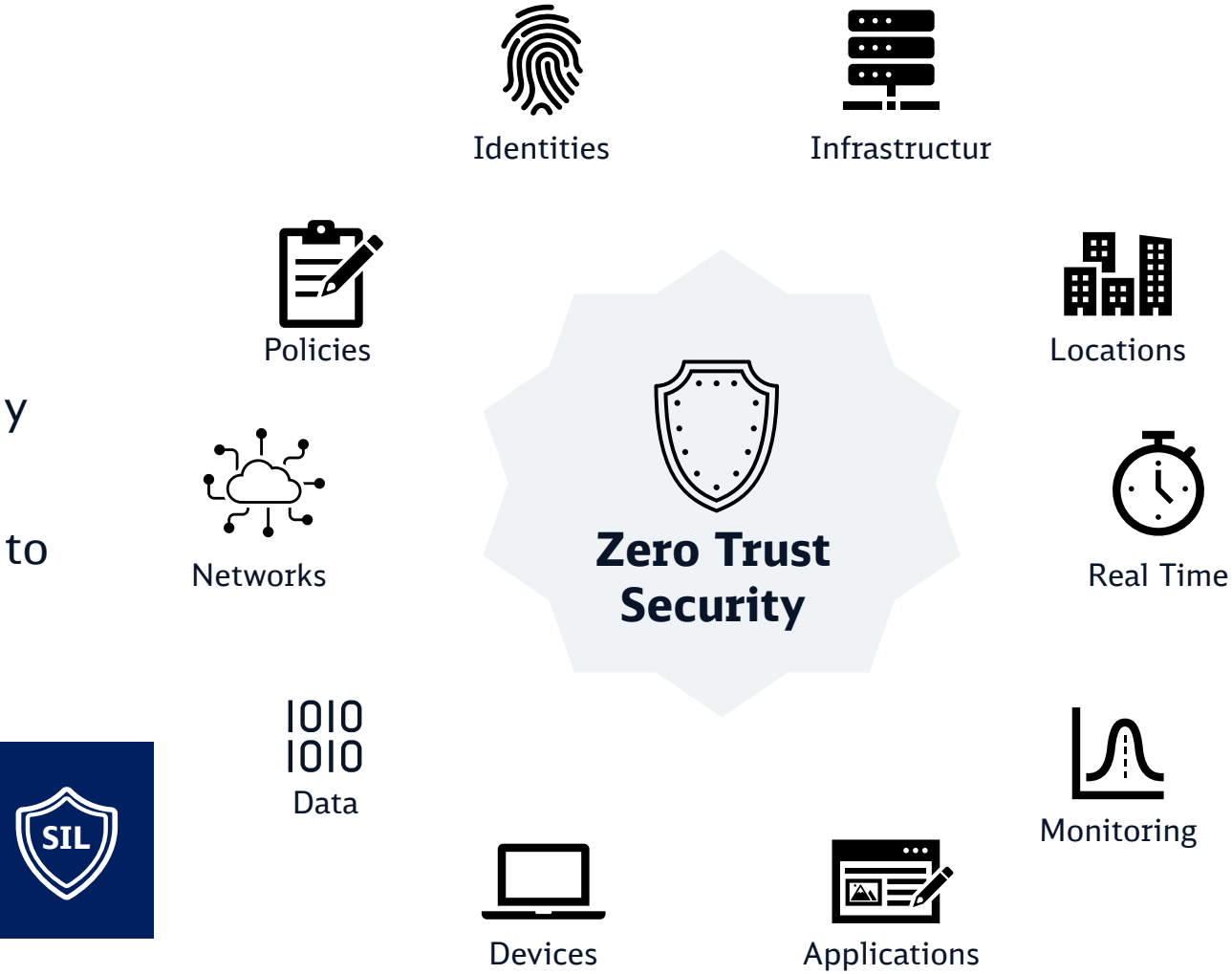
Access is only possible with authentication.

Access is only possible via a secure channel.

Anomalies and security events are continuously detected.

Authentication and authorization are adapted to the current risk in real time.

Important for future systems:
Integration of
Cyber-Security and Functional Safety



https://db-planet.deutschebahn.com/pages/db-cyber-security/apps/blog/security-meldungen/view/17353879-b24d-44cb-91d9-0b636ac679d0

Publications

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- RCA/OCORA, “An Approach for a Generic Safe Computing Platform for Railway Applications”, White Paper, Version 1.1, June 2021, see LINK
- RCA/OCORA, “Generic Safe Computing Platform – Draft Initial Specification of the PI API between Application and Platform”, Version 1.0, Dec. 2021, see LINK
- „SIL4 Data Center – a new platform architecture for safety-relevant railway applications “, Signal+Draht, Oct. 2021, see LINK
- “Research Report – SIL4 Data Center” , Oct. 2021, see LINK

More under https://digitale-schiene-deutschland.de/

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