

Integration Architecture for the Automotive Digital Thread

OSLC Fest 2022

Jens Krueger, NTT DATA

© 2022 NTT DATA Corporation

NTT Data

Trusted Global Innovator

is part of the **NTT Group**, with over **330,000** employees in more than **80+ countries** and revenues of over **108 billion dollars**.



88%
of the Fortune
100 are
customers

80+
Countries

#1
operator of
Data Centres

#4
Global internet
traffic

\$3.6 B
R&D invest with
5.000
R&D researcher

Germany
385 MEUR rev.
2000 employee
12 locations

#5
IT Consultancy
in Germany

Top Employer
Germany
2022

SAY DIGITAL THREAD AGAIN

I DARE YOU

Agenda



Product Development



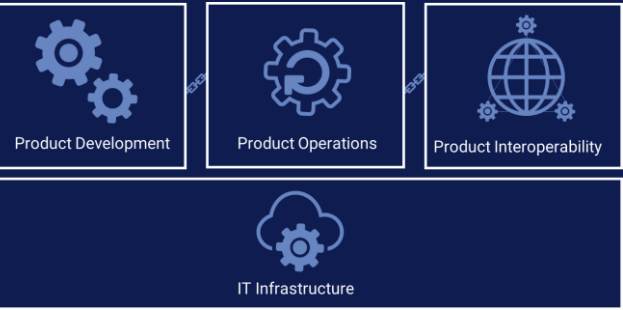
Product Operations



Product Interoperability



IT Infrastructure



Product Development

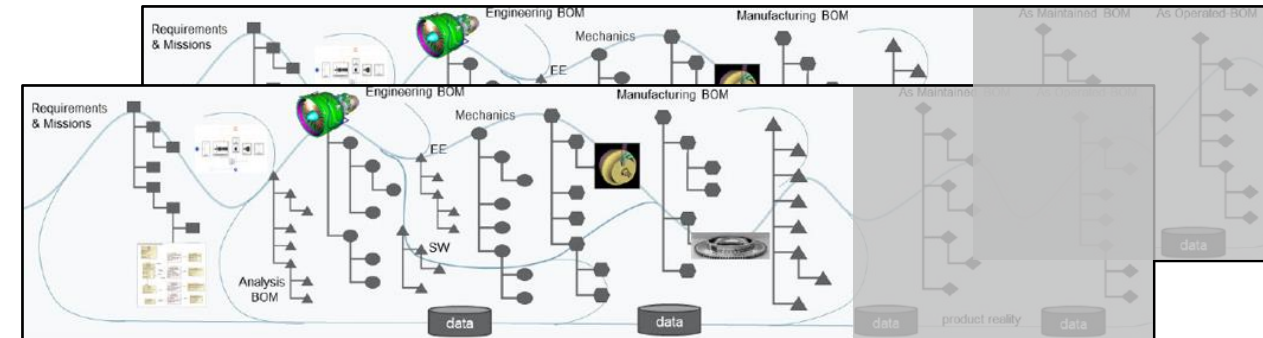
Connecting product structures

Digital thread to connect product structures throughout the lifecycle for traceability and automation



Digital thread connects the system break-down

- requirements
- architecture models
- items (mechanical, electrical, software)
- manufacturing planning
- test plans / results



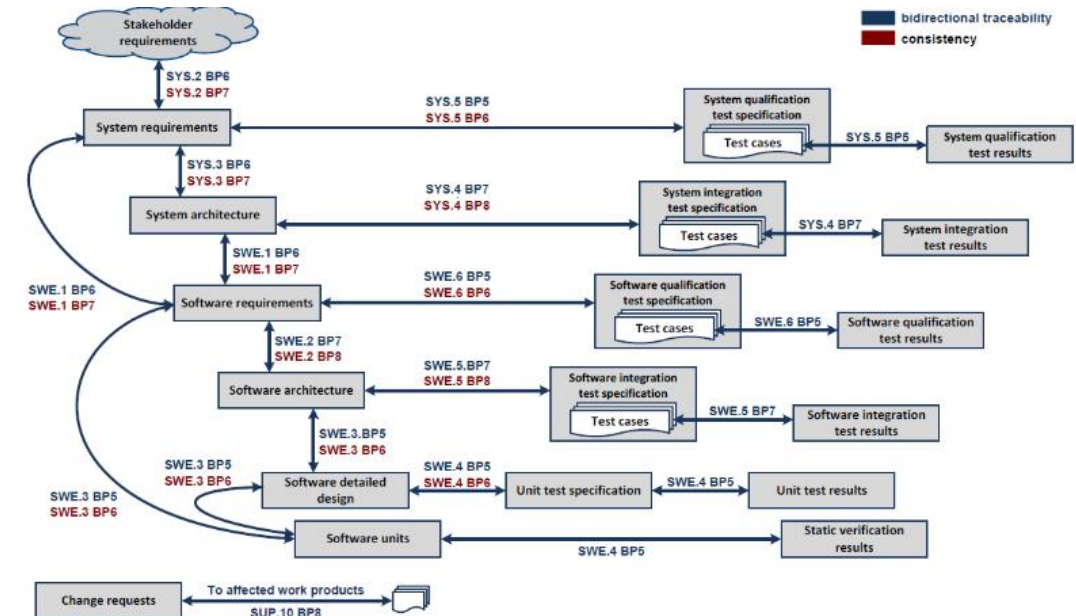
Source: Raytheon, PDT Europe 2020

Configuration & change management
with versions, revisions, alternatives, options, baselines

Horizontal and vertical traceability in Automotive SPICE

Authoritative data for type approval (homologation)

PLM – ACES ALM integration



Source: Automotive SPICE PAM 3.0

ACES ALM defined



ACES

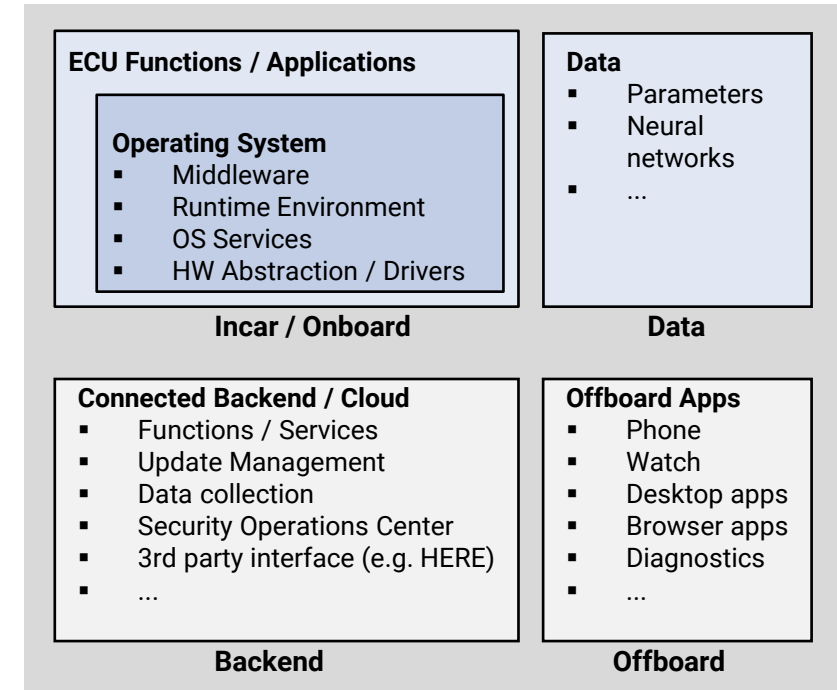
- Autonomous, Connected, Electric and Shared
- The four major strategic pillars of automotive companies

ALM

- Application Lifecycle Management
- Managing software from its initial conception, through the development & testing phase and ongoing support to its end of life
- ALM tools provide support for activities such as software planning, requirements management, team collaboration, development, test, integration & build

ACES ALM

- Application Lifecycle Management for ACES software
- For incar (embedded) and related data / offboard / backend software



Types of ACES Software



ACES ALM Software Lifecycle

Drivers of ACES ALM



ACES engineering business drivers

- Separation of hardware and software
- Domain-controller architectures
- Integrated enterprise & embedded IT
- **Data-driven engineering, e.g. ADAS functions**



Processes & Methods

- Model-based systems engineering (MBSE)
- Process & tool baselines
- Variant & configuration management and PLE
- Scaled Agile



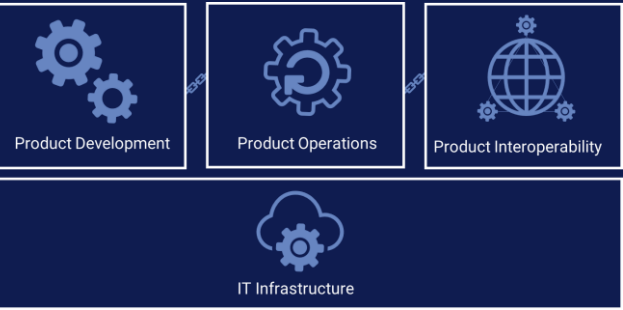
Regulatory requirements

- Automotive SPICE
- **Lifecycle management / Software Update Management**
- **Cyber Security**
- Functional Safety



IT strategy drivers

- Cloud-native architectures
- Developer experience



Product Operations

Connecting operations data

Digital thread to connect product structures with operations data for feedback and data-driven engineering



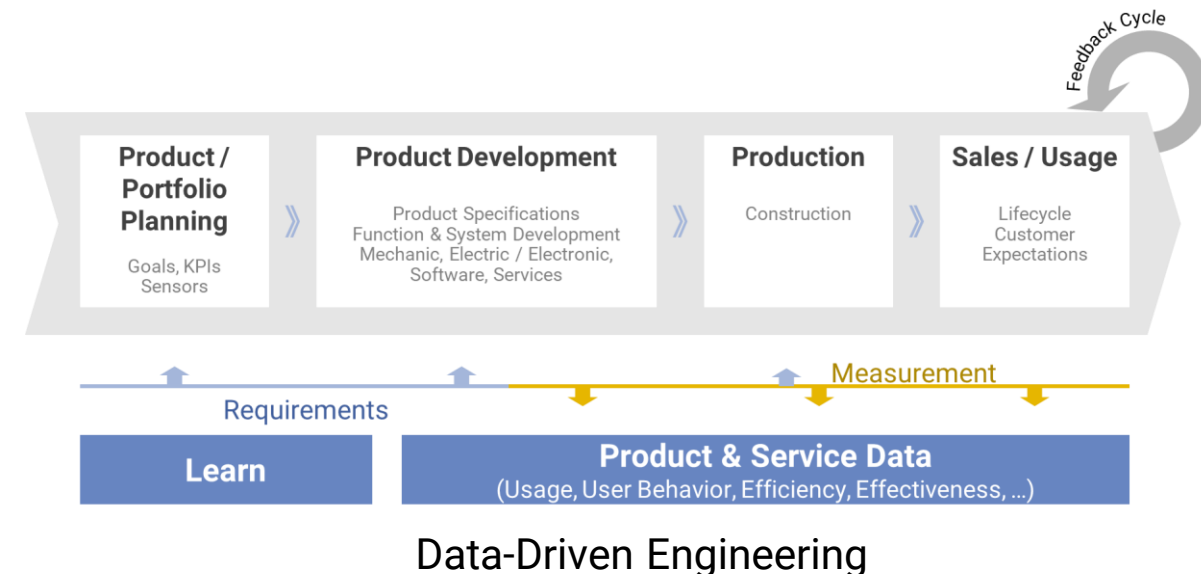
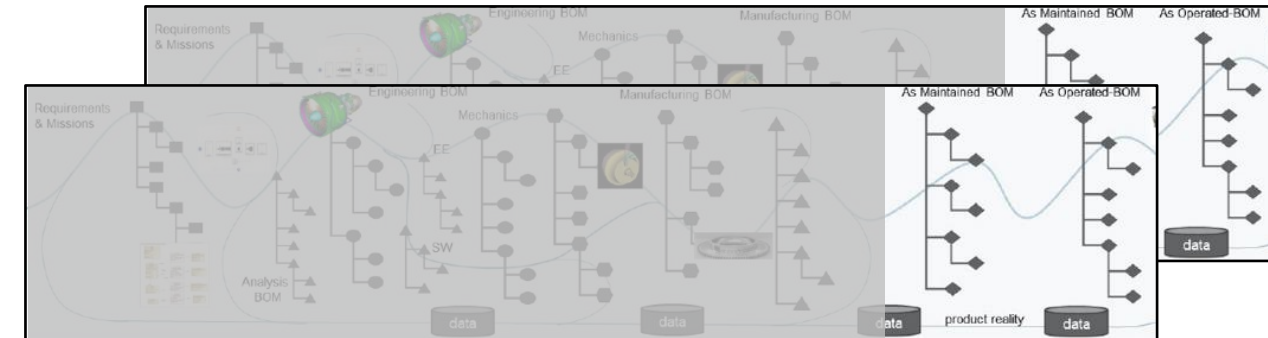
Requirements optimization by understanding customer behavior in different markets

Product portfolio and variance optimization by understanding actual function usage in the fleet

After-sales optimization by tracing back error codes to design data and requirements

Regulatory compliance

- China Real Time Monitoring for BEV
- UNECE R155 / 156 SUMS CSMS



Example: UNECE R155 / 156 SUMS CSMS



United Nations Economic Commission for Europe (UNECE)

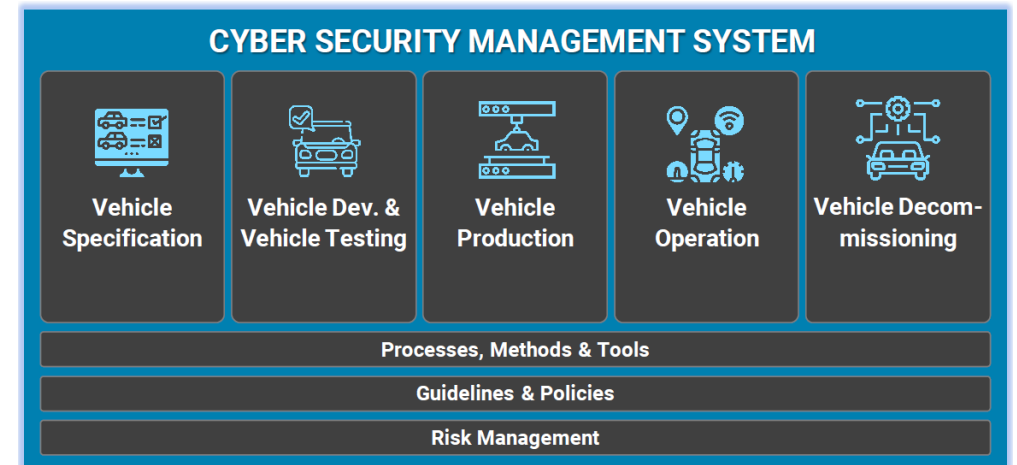
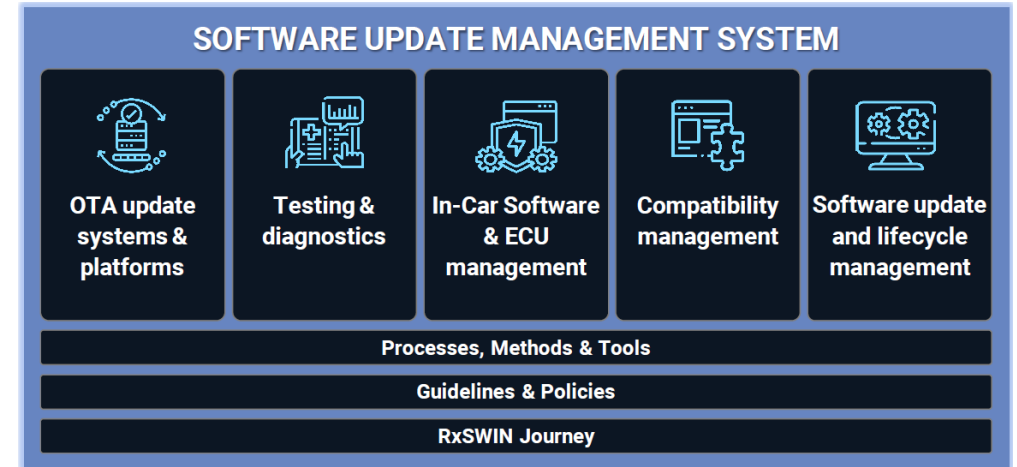
Taskforce “Cybersecurity and Over The Air Issues”.

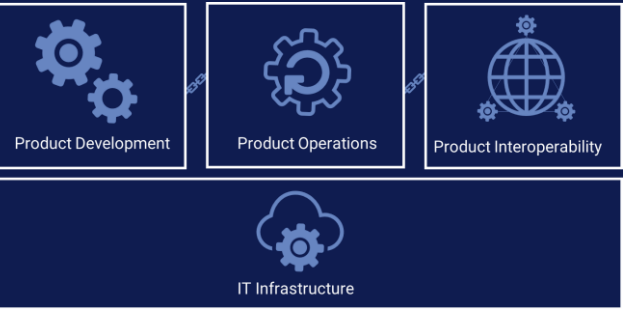
„Software Update Management System“ (SUMS R156)

- Transparency: Ensure authenticity, integrity and traceability of software and updates for vehicles
- Integrity: Verify, validate and protect software and update
- Safety: Ability to ensure recoverability and to prevent malfunction of the vehicle
- Enable adaptations throughout the lifetime of the vehicle (RXSWIN)

„Cyber Security Management System“ (CSMS R155)

- Security: Establish measures to prevent cyber attacks (Incar, backend & connections) & manipulation
- Compliance: Consider threats, mitigations and principles to certify compliance
- Ensure cyber security over the lifetime of the vehicle



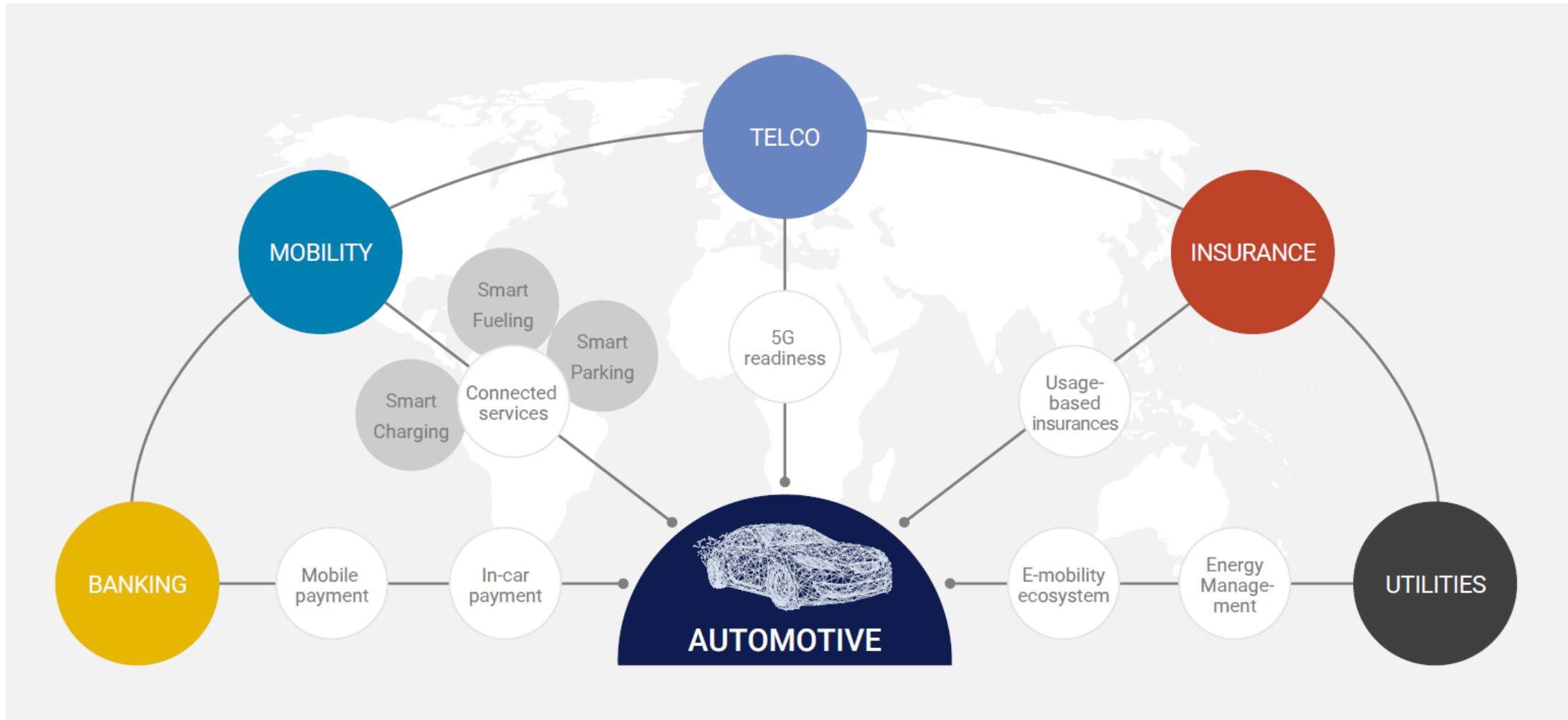


Product Interoperability

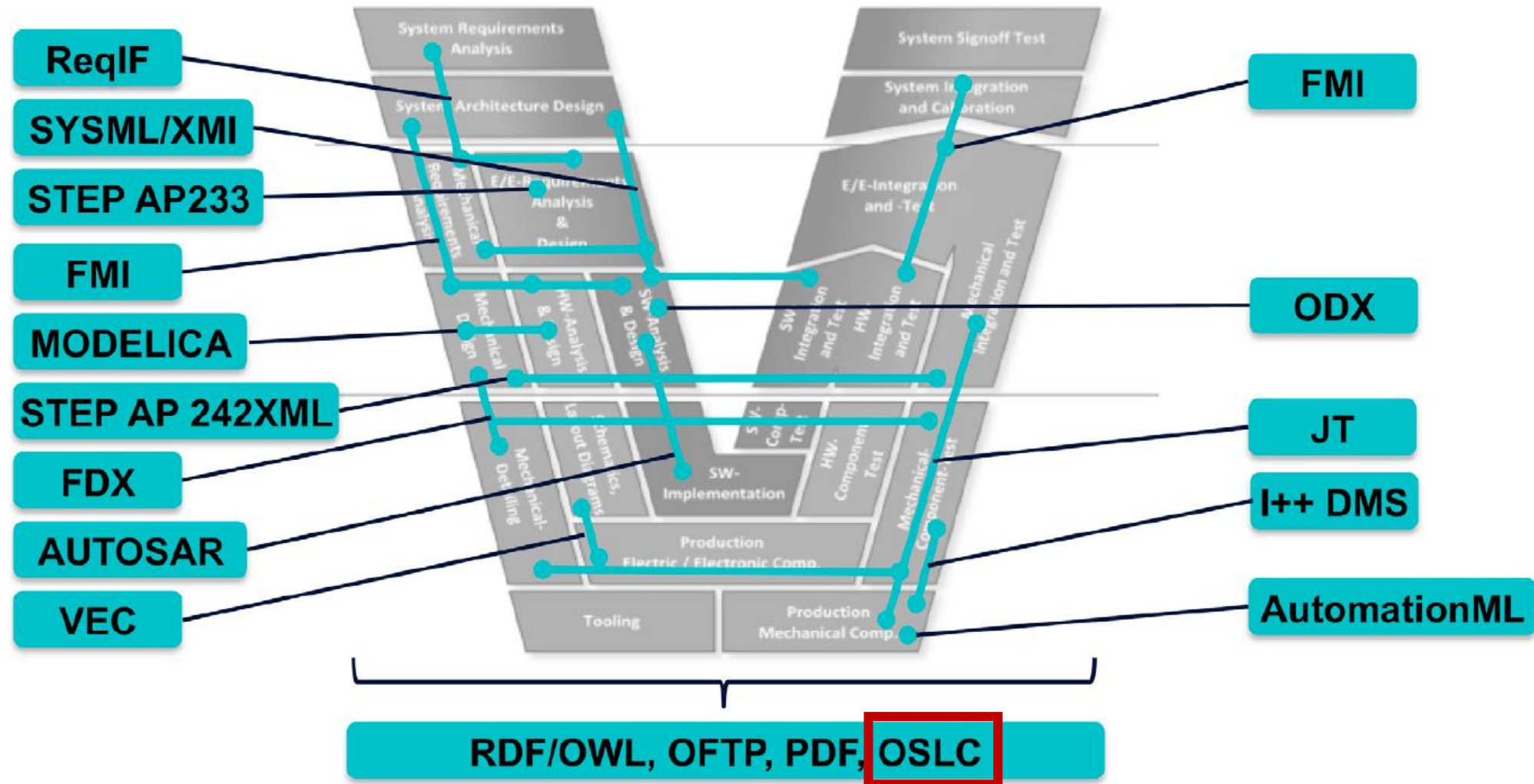


Connecting digital twins

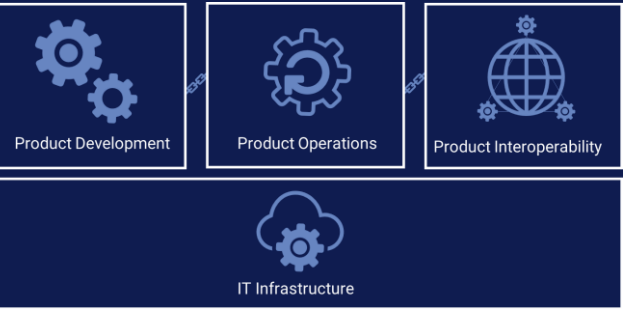
Digital thread to connect multiple digital twins for mobility systems and smart city



Standards as enabler for interoperability



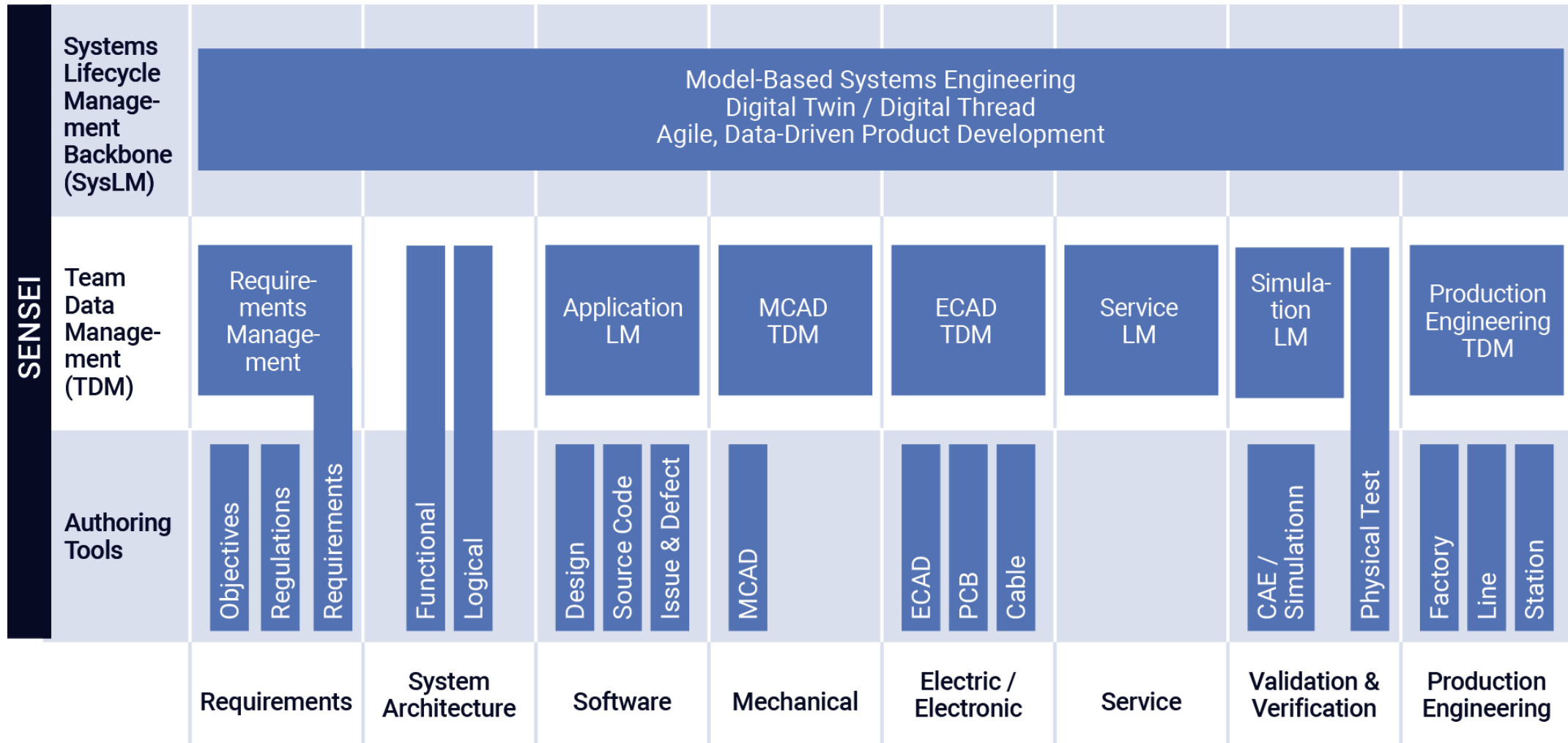
Source: prostep ivip SSB (Standardization Strategy Board)



IT Infrastructure

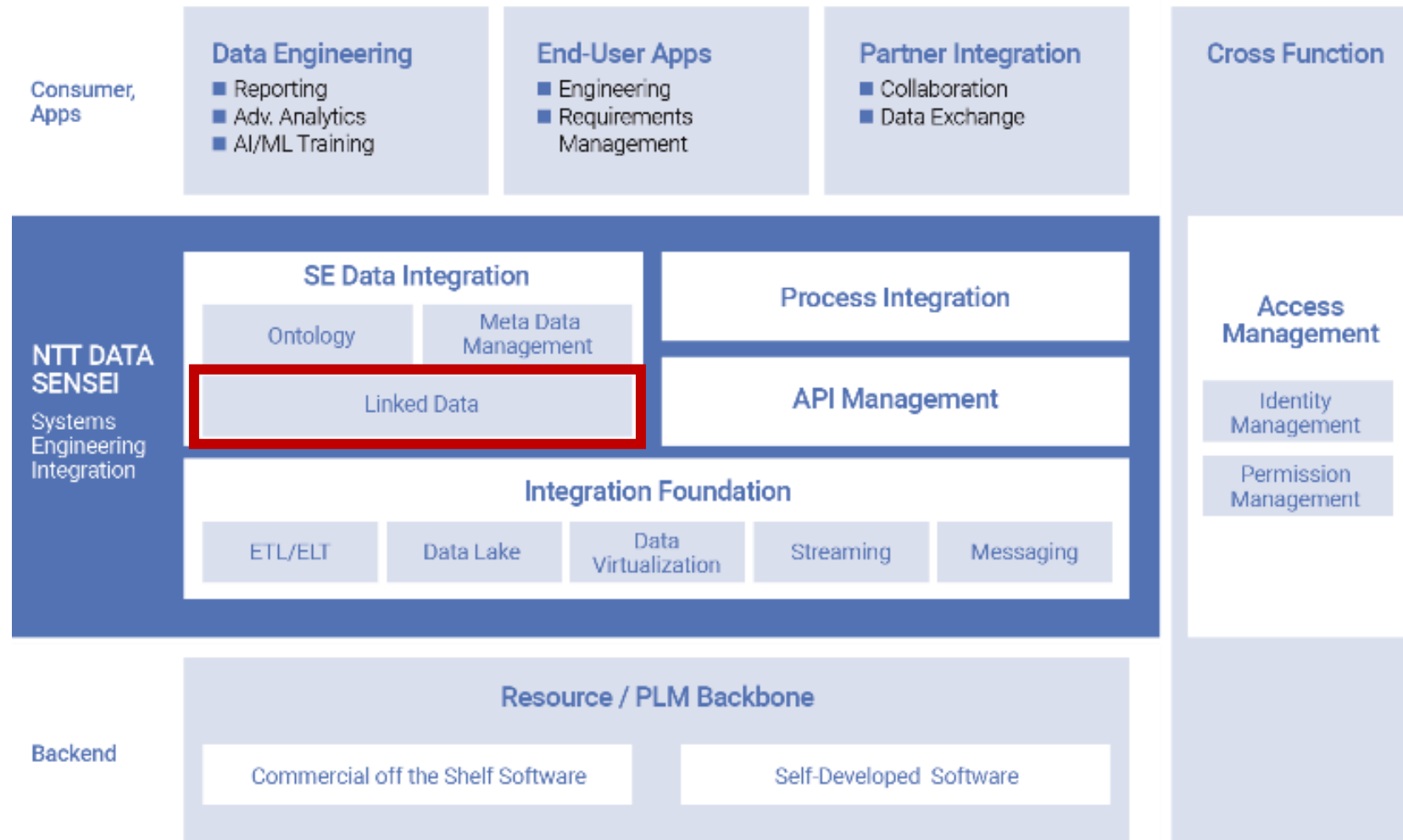
Connecting data silos

Digital thread integrates data across a heterogenous application landscape for automation and scalability

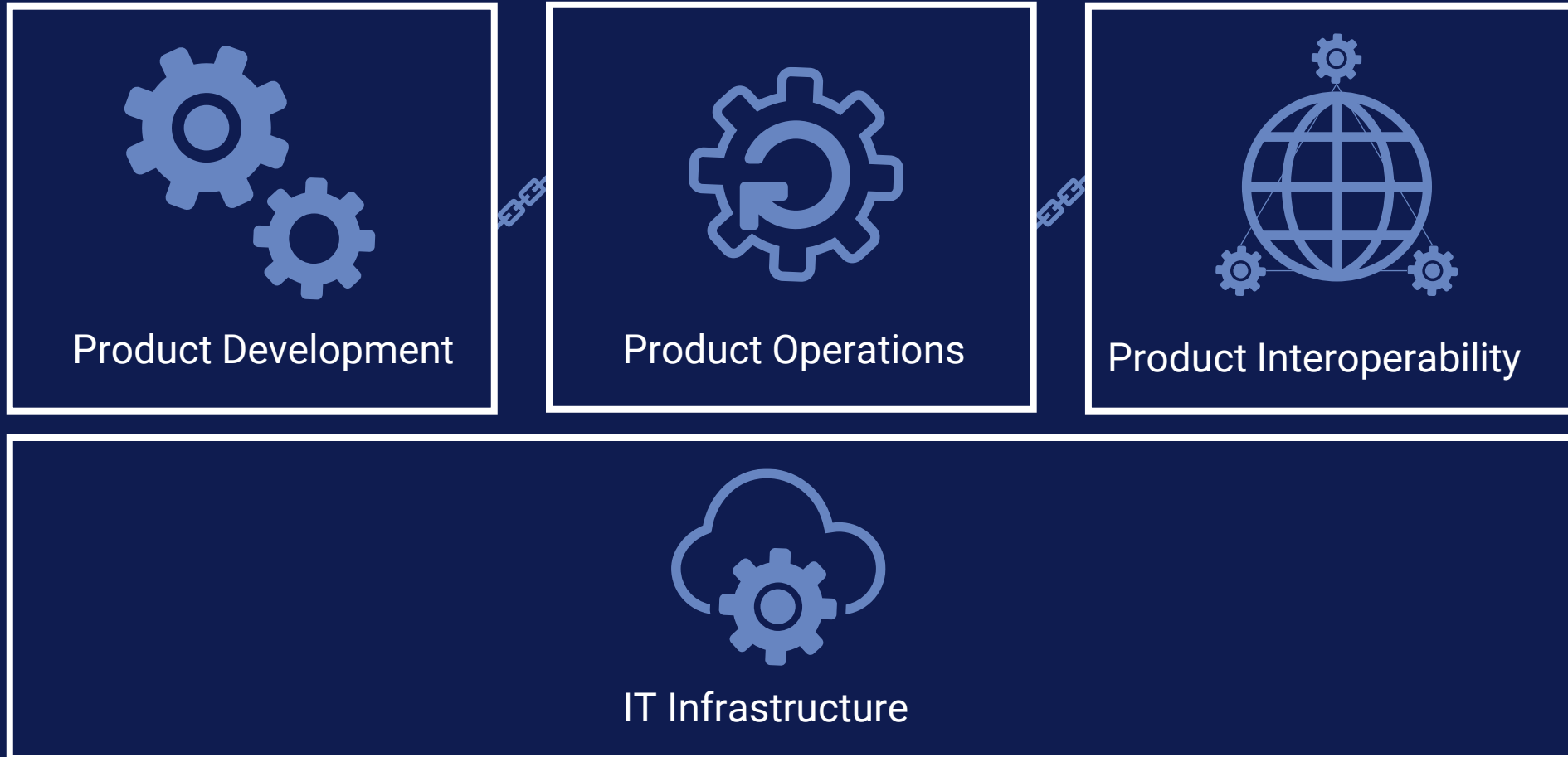


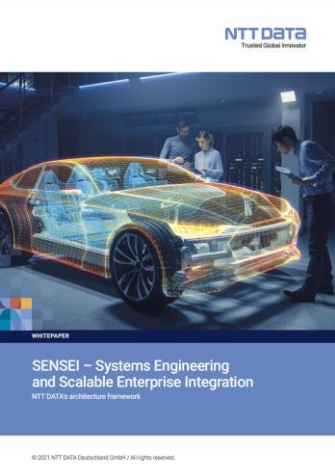
SENSEI - Systems Engineering aNd Scalable Enterprise Integration

NTT DATA Systems Engineering Integration Architecture Blueprint



Automotive Digital Thread





NTT DATA

Trusted Global Innovator



Jens Krueger

Competence Unit Manager & Head of Global Engineering CoE

Automotive & Manufacturing - Engineering

NTT DATA Deutschland

Hans-Doellgast-Strasse 26 - 80807 Munich, Germany

Tel: +49 89 9936-1133 | Fax: +49 89 9936-1844

Jens.Krueger@nttdata.com

[XING](#)

[LinkedIn](#)