DIGITAL SOLUTIONS

ŠKODA



Škoda Group is one of the leading European companies in the field of transport engineering, with a history spanning more than 165 years. Škoda focuses on the development and production of vehicles for railway and urban public transport. Its products include primarily electric suburban train units, battery-powered trains, low-floor trams, metro trainsets, trolleybuses, electric buses, hydrogen buses, electric motors, components, passenger coaches, digital solutions, and complete drive systems for environmentally friendly public transport.

Thanks to its ecosystem of production plants, service centers, and engineering offices, the outstanding work of thousand of project engineers, and designers, and billions invested annually in its own research and development, Škoda Group boasts a portfolio of modern vehicles that meet the latest European standards. Škoda places great emphasis on the use of cutting-edge technologies for modern urban and rail transport vehicles. Škoda is also developing railway vehicles and buses with alternative propulsion systems.

Škoda Group's transport solutions are used in the Czech Republic, Slovakia, Germany, Finland, Poland, Lithuania, Latvia, Estonia, Italy, the Balkans, Australia, the USA, and many other countries around the world.

Škoda Group currently employs 10,000 people. In addition to its production sites and technology centers in the Czech Republic, Finland, and Turkey, Škoda Group also has branches in Germany, Italy, Austria, Belgium, Hungary, Poland, and Ukraine.

Škoda Group provides comprehensive transport solutions for urban, intercity, and mainline rail transport, and it continues to work to ensure that travel is comfortable, fast, sustainable, and safe. Thanks to a wide range of boarding height options, low-floor and barrier-free access is ensured in all areas where its vehicles operate.

Škoda Group is part of PPF Group, which invests in a wide range of sectors – from financial services and telecommunications to biotechnology, real estate, and engineering. PPF Group operates in Europe, Asia, Africa, and North America.

ŠKODA GROUP
DIGITAL SOLUTIONS









AUTONOMY

The Autonomy cluster brings together technologies for autonomous vehicles. The main goal of these technologies is to gradually replace drivers and make public transport options more efficient. The systems are designed with an emphasis on safe, environmentally friendly, efficient and economical vehicle operation.

AUTONOMY

ACS	ANTI-COLLISION SYSTEM
ATO	AUTOMATIC TRAIN OPERATION SYSTEM
SMART DEPOT	ECOSYSTEM OF AUTONOMY PRODUCTS
ISL	INTELLIGENT SPEED LIMITER

ANTI-COLLISION SYSTEM (ACS)

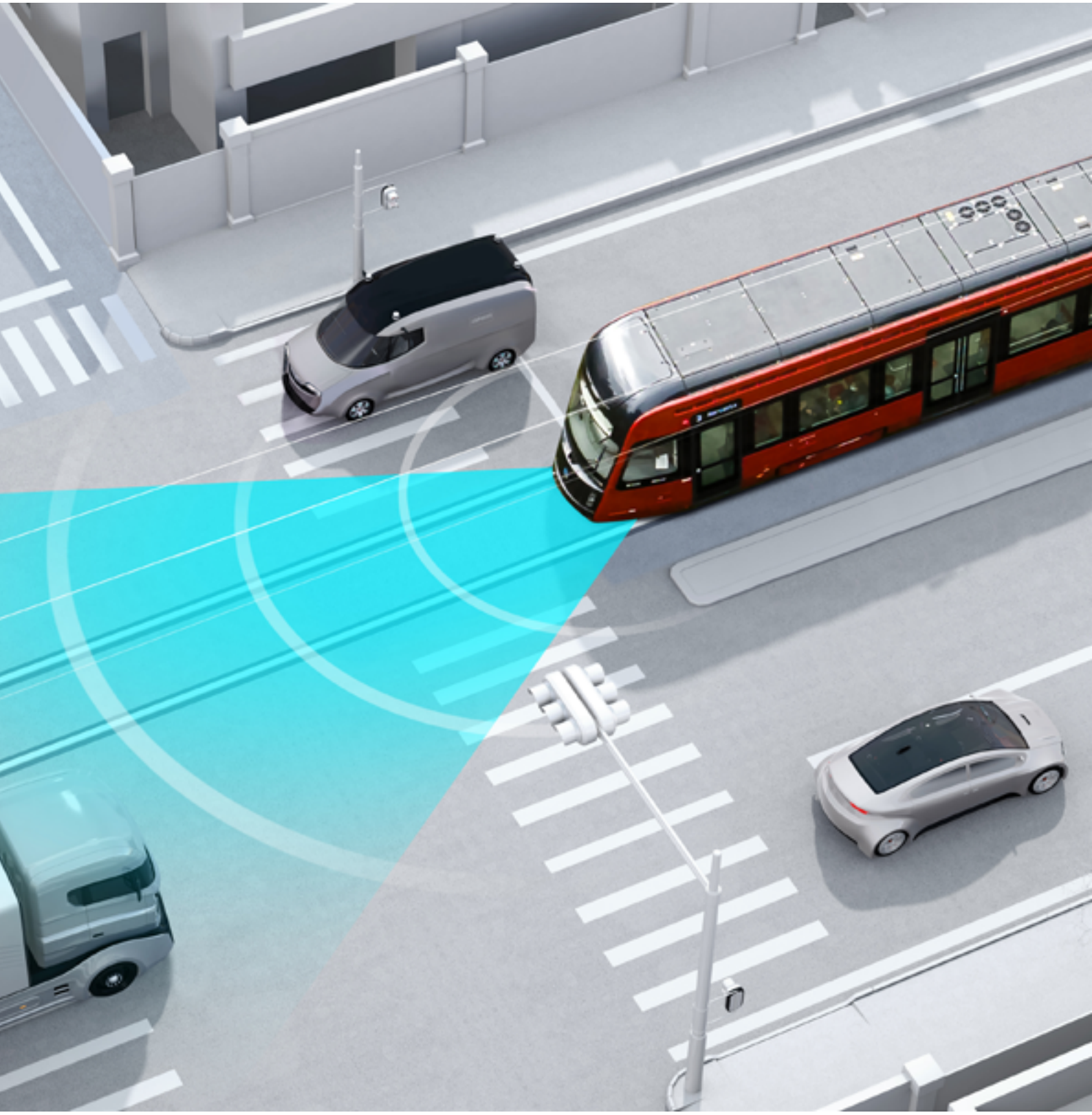
ACS reduces the impact of collisions in depots and urban traffic. It uses a combination of smart sensors and HD maps with a virtual tunnel to detect people, cars and other rolling stock. The system is currently available in CWNB (Collision Warning No-Braking) mode.

It will only be possible to implement the next development stage CWAB (Collision Warning Active Braking) by updating the software.

KEY FEATURES

- Detection and acquisition of information about objects occurring on the line.
- Short-term motion prediction of dynamic objects.
- Early warning to the driver of an imminent collision in CWNB mode.
- Switch to CWAB mode thanks to automatic software update.
- Precise visual localisation based on HD maps, GNSS and odometry.
- Storage of information on significant events, including the ability to analyse and evaluate the system response.
- Detection of adverse weather conditions impairing remote obstacle detection.
- Sharing of system status information with TCMS.
- Available in CWNB and CWAB modes (later in 2023).
- Based on the proprietary High Performance Computer platform.
- ACS is based on LiDAR, camera, GNSS and HD map data.
- The use of LiDAR and camera enables obstacle detection at longer distances (up to 100 meters).





AUTOMATIC TRAIN OPERATION SYSTEM (ATO)

The ATO in the GoA2 category automates train control, optimises the timetable and reduces energy consumption. The system works on the basis of a positioning system that receives data from GNSS and odometry. The system in the GoA2 category represents the first step towards fully autonomous vehicles.

KEY FEATURES

- Automation category GoA 2 according to UITP classification.
- ATO and Driver Assistance (DAS) modes.
- In ATO automatic mode, speed limitation is in accordance with the track speed profile.
- System response to train protection system commands.
- Position subsystem based on own odometry.
- Position information obtained from GNSS multiband satellite navigation and trackside balises.
- Automatic stop in station with an accuracy corresponding to the quality of the position information from GNSS; typically ± 2 m.
- Time and energy optimal driving according to the timetable and infrastructure operator command ability to speed up.
- Electronic track map support with the possibility of user changes.
- Provision of data for displaying assistant and operating information on the driver's display.
- Provision of position information for other train subsystems.




Cyber Security
Automatic
Driving GoA2
Energy
Optimization
Contact to Stationary
Infrastructure
metry
Timetable
Optimization

SMART DEPOT

Smart Depot is a family of products that includes automation and digitization of depot operations using automated vehicles and AI-based control technologies. The aim is to increase the productivity and efficiency of key tasks performed in depots. The project introduces a group of products that together form an automated depot ecosystem. These products can be deployed individually or used together according to customer specifications and requirements.

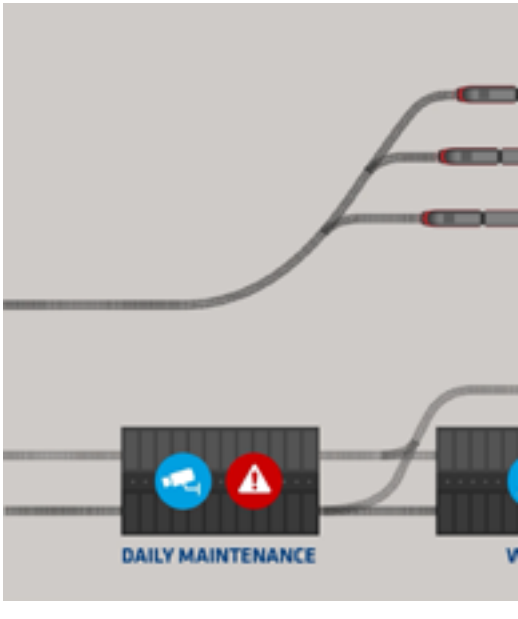


PRODUCTS OF SMART DEPOT

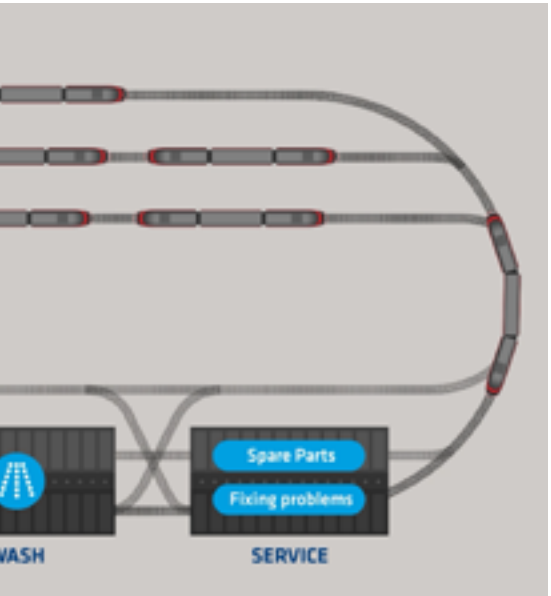
- Automatic Washing
  – Driverless operation in tram wash
- Automatic Shunting in Depot
  – Driverless operation in Depot
- Automatic Turning Loop (GoA2+)
  – Assisted driving at turning loops
- Automatic Turning Loop (GoA4)
  – Automatic driving at turning loops
- Vehicle Self-Surveillance
- Safe Departure Assistant
- Remote control
- Fleet Management
- Vehicle Visual Inspection

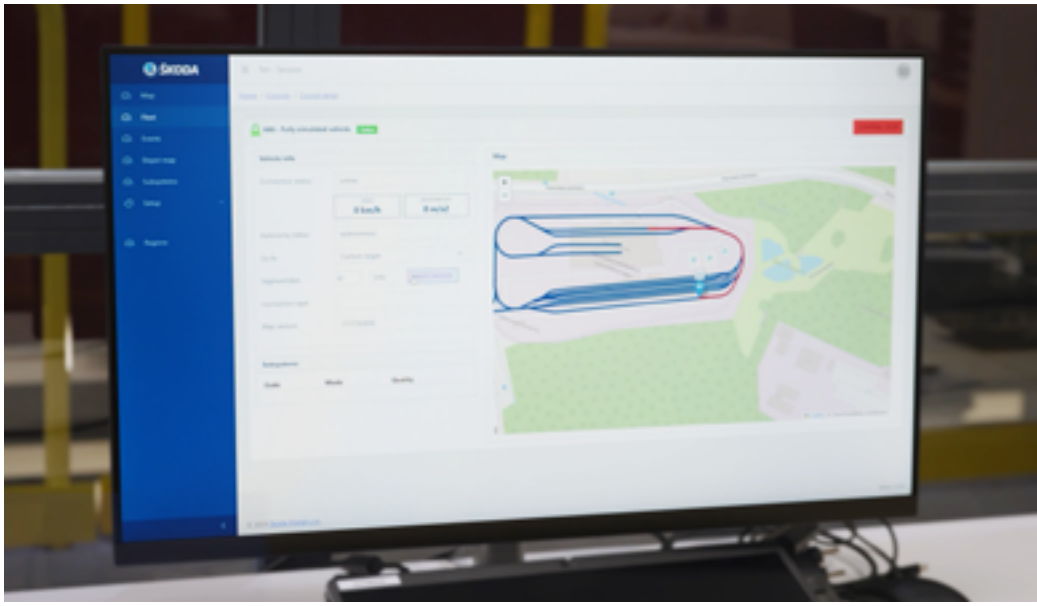
KEY FEATURES

- **Reduced Depot Staffing Costs**
  Automation helps cut expenses related to manual shunting tasks.
- **Better Use of Qualified Personnel**
  Skilled workers, such as mechanics, can focus on their core duties instead of operating vehicles.
- **Addresses Staff Shortages**
  Minimizes reliance on hard-to-find qualified staff.
- **Improved Working Conditions**
  Eliminates routine and undesirable tasks like night shifts, stop-and-go movements, and waiting at turning loops.
- **Enhanced Depot Safety**
  Clearly defined operational zones and no-go areas for personnel improve safety during autonomous tram movements.
- **Foundation for Full Autonomy**
  Builds experience and trust in automation, paving the way for broader autonomous operations.




AUTONOMOUS
01


Spare Parts
Fixing problems
SERVICE



INTELLIGENT SPEED LIMITER (ISL)

Intelligent Speed Limiter improves the safety of rolling stock by automatically limiting the speed on certain sections of track to prevent derailments. ISL uses advanced hardware platforms and sensors to accurately determine position and monitor the dynamic properties of the tram. The system is regularly updated, which includes data on speed limits and track conditions, allowing the tram to adapt its journey in real-time according to current conditions.

KEY FEATURES

- Intelligent Speed Limiter provides geolocation data with an accuracy of approximately 1 meter.
- Anti-derailment protection against overspeed.
- Requires no infrastructure modifications or additional balises.
- System ISL runs on High Performance Computer hardware platform.
- Operates either as a standalone system or in conjunction with the ACS Anti-Collision System.
- Utilizes a digital track map with predefined speed limits, including periodic (e.g., night-time) or time-limited restrictions (e.g., due to track maintenance).
- Designed to be effective even in vehicles with higher loads where vehicle dynamics may be more variable.
- Optimizes braking maneuvers based on current vehicle adhesion conditions.




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60

ŠKODA GROUP
DIGITAL SOLUTIONS









MOBILITY APPS

The Mobility Apps cluster is a key part of the digital ecosystem that connects vehicles with smart applications and backend systems. It enables efficient collection, analysis, and utilization of real-time vehicle data. This data is used for passenger information, fleet management, and predictive maintenance. Thanks to its open interface, the cluster can be easily integrated into existing urban and enterprise systems. Mobility Apps is thus a vital enabler of modern, connected mobility.

MOBILITY APPS

VEHICLE SECURITY	
COUPLER MOTION DETECTION	
SAFE DEPARTURE DETECTION	
VISUAL INSPECTION	
DIGITAL TRANSPORT COMPANY	
FLEET MANAGEMENT FOR PUBLIC TRANSPORT	
PRMS	PREDICTIVE MAINTENANCE SYSTEM
BSU-XX	BOGIE SENSOR UNIT

VEHICLE SECURITY

Vehicle Security is an advanced AI-driven solution designed to enhance tram security by utilizing existing onboard cameras for smart threat detection. The system is specifically developed to identify and respond to acts of vandalism and graffiti in real time, helping to prevent damage and maintain vehicle integrity.

Using sophisticated artificial intelligence algorithms, the system continuously monitors tram surroundings and detects suspicious activities, such as unauthorized tagging or destructive behavior. Upon detecting a potential threat, the system can trigger various deterrent responses, including alerting the control center, activating warning lights, or sounding an alarm to deter offenders.

By integrating seamlessly with existing security infrastructure, Vehicle Security provides an effective and proactive solution to urban transit security challenges, ensuring safer and well-maintained public transport vehicles.

KEY FEATURES

- **AI-Based Threat Detection**
  Identifies vandals and graffiti attempts in real time.
- **Proactive Deterrence**
  Can activate alarms, lights, or audible warnings to scare off offenders.
- **Control Center Notification**
  – Sends immediate alerts to the dispatch center for rapid intervention.
- **Seamless Camera Integration**
  Expands functionality of already installed tram cameras.
- **Automated Response System**
  Reacts dynamically to detected threats without requiring manual intervention.
- **Enhancing Urban Safety**
  Helps preserve public transport assets and improves passenger security.

FUNCTIONS & TECHNICAL SPECIFICATIONS

FEATURE	DESCRIPTION
AI THREAT DETECTION	Real-time identification of vandalism and graffiti
AUTOMATED DETERRENCE	Triggers alarms, lights, or sounds to scare off offenders
DISPATCH INTEGRATION	Notifies control center for immediate response
CAMERA COMPATIBILITY	Uses existing onboard surveillance systems
SYSTEM AUTOMATION	Operates without manual supervision
SECURITY ENHANCEMENT	Reduces vandalism-related maintenance costs


person 0.870588

COUPLER MOTION DETECTION

The Motion Detection System for Tram Couplers is designed to enhance passenger and pedestrian safety by preventing fatal accidents caused by reckless individuals attempting to jump over the tram coupler. Utilizing AI-driven camera technology, the system continuously monitors the area around the coupler and instantly detects any motion. If movement is identified, a live video feed from the camera is automatically displayed on the driver's screen, accompanied by a visual warning alert.

This proactive safety measure ensures that tram operators are immediately aware of potential hazards, allowing them to take appropriate action in real-time. By leveraging advanced image recognition algorithms, the system minimizes false positives and provides reliable detection even in challenging environmental conditions.

KEY FEATURES

- **AI-Powered Motion Detection**
  Uses advanced algorithms to accurately identify movement in the coupler area.
- **Real-Time Video Display**
  Automatically activates a live feed on the driver's screen upon detecting motion.
- **Instant Visual Alert**
  Ensures immediate awareness for the tram operator to prevent accidents.
- **Enhanced Pedestrian Safety**
  Reduces the risk of fatal incidents by discouraging dangerous behavior.
- **Seamless Integration**
  Compatible with existing tram monitoring and safety systems.

FUNCTIONS & TECHNICAL SPECIFICATIONS

FEATURE	DESCRIPTION
AI-BASED DETECTION	Advanced image recognition for motion tracking
LIVE CAMERA FEED	Instant video display on driver's monitor
VISUAL ALERT	Warning message on screen upon detection
WEATHER RESISTANCE	Operates in diverse environmental conditions
INTEGRATION	Can be integrated into existing tram systems
SAFETY ENHANCEMENT	Prevents unauthorized pedestrian movement


MOTION DETECTED
HUMAN DETECTED
ROI

SAFE DEPARTURE DETECTION

Safe Departure Detection is an advanced AI-driven system designed to ensure a secure departure process for trams, preventing accidents caused by passengers being trapped in closing doors or other hazardous situations. By leveraging smart sensors and AI-based monitoring, the system continuously scans the boarding and exit areas to detect any obstructions before departure.

This proactive safety solution minimizes the risk of injuries and enhances passenger confidence by providing real-time alerts to tram operators in case of potential dangers. If an obstruction is detected, the system can prevent door closure, delay departure, or notify the driver to take immediate action.

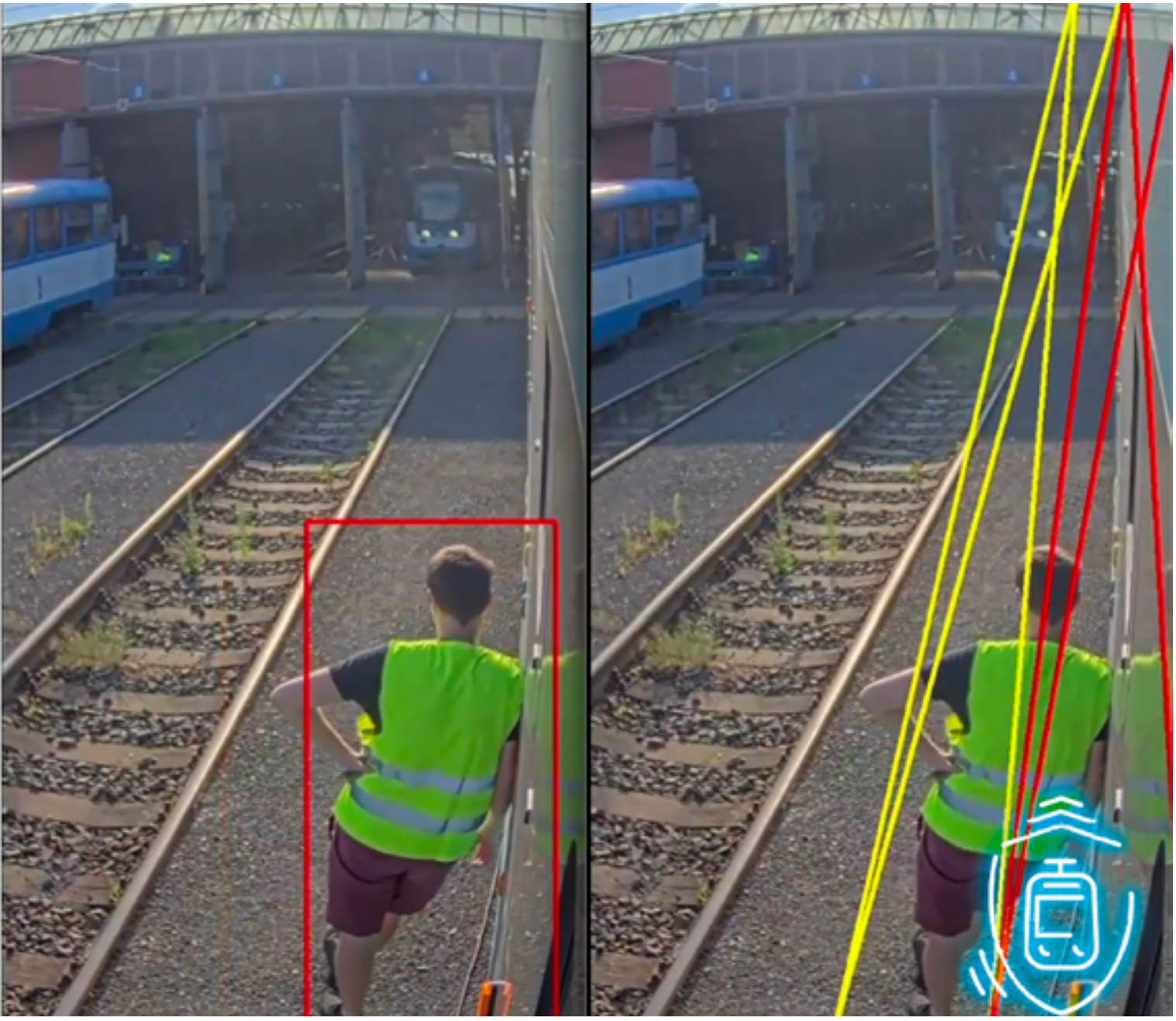
Safe Departure Detection seamlessly integrates with existing tram door and monitoring systems, contributing to a more reliable and passenger-friendly public transportation network.

KEY FEATURES

- **AI-Powered Obstruction Detection**
  Monitors tram doors and boarding areas in real time.
- **Accident Prevention**
  Identifies potential hazards, such as trapped passengers, and delays departure if needed.
- **Operator Alerts**
  Provides immediate visual and audio warnings to tram drivers.
- **Seamless System Integration**
  Works with existing tram door mechanisms and safety systems.
- **Real-Time Monitoring**
  Ensures continuous surveillance to enhance passenger safety.
- **Reduced Liability Risks**
  Helps prevent injuries, reducing potential legal and operational costs.

FUNCTIONS & TECHNICAL SPECIFICATIONS

FEATURE	DESCRIPTION
AI-BASED DETECTION	Identifies obstructions in boarding and exit areas
AUTOMATIC RESPONSE	Prevents door closure and delays departure if necessary
DRIVER ALERT SYSTEM	Provides real-time notifications for immediate action
SYSTEM COMPATIBILITY	Integrates with existing tram monitoring solutions
CONTINUOUS MONITORING	Ensures ongoing safety compliance
INJURY PREVENTION	Minimizes risks for passengers and improves overall safety



VISUAL INSPECTION

AI-Powered Automated Inspection Gate for Urban Fleet Assets

Visual Inspection is an advanced AI-powered inspection gate designed to automate the condition assessment of urban fleet vehicles, including trams, buses, and trolleybuses, with unmatched speed, precision, and reliability. Built for demanding operational environments, the system combines high-resolution imaging, state-of-the-art computer vision, and real-time analytics to deliver comprehensive asset inspections without disrupting operations.

As vehicles pass through the inspection gate, a network of synchronized high-resolution cameras captures detailed imagery from multiple viewpoints. AI algorithms automatically detect defects, anomalies, wear patterns, and maintenance-critical issues, enabling operators to improve safety, reduce downtime, and optimize maintenance planning.

KEY FEATURES

- **Fully Automated Inspection** – Continuous, non-intrusive inspections during normal fleet operations.
- **High-Resolution Imaging** – Captures fine details for accurate defect detection and condition assessment.
- **AI-Powered Analytics** – Advanced computer vision models identify defects and generate actionable insights.
- **Industrial-Grade Reliability** – Designed for 24/7 operation in harsh urban transport environments.
- **Real-Time Results** – Immediate access to inspection findings, alerts, and historical trends.
- **Scalable Architecture** – Easily integrates with existing maintenance and fleet management systems.

INSPECTION CAPABILITIES

Bogie Inspection

Comprehensive inspection of chassis, wheel assemblies, suspension components, braking systems, and underbody structures to identify wear, damage, missing parts, and safety-critical defects.

Body Inspection

Automated assessment of the vehicle exterior, including panels, doors, windows, markings, and structural elements. Detects dents, cracks, corrosion, graffiti, and other surface anomalies.

Roof Inspection

High-resolution monitoring of rooftop equipment and structures, enabling early detection of damage, contamination, loose components, and maintenance issues that are difficult to inspect manually.

Pantograph Inspection

Dedicated inspection of pantograph assemblies, including contact strips, arms, joints, and mounting structures. AI-driven analysis identifies wear, deformation, and operational defects that can impact power collection performance.

BENEFITS

- Increased operational safety
- Reduced manual inspection effort
- Faster maintenance decision-making
- Improved asset availability
- Lower lifecycle maintenance costs
- Consistent and objective inspection results


1771

DIGITAL TRANSPORT COMPANY

A complex telematics solution for the digital public transport operator of the future.

Digital Transport Company is designed for cities, public transport operators, and regional authorities seeking to transform their mobility ecosystem into a fully digital, data-driven and operationally efficient environment. It is a modular platform that connects vehicles, infrastructure and control systems across all transport modes—rail (trains, trams, metro) as well as road-based public transport (buses, trolleybuses). The concept aligns with current mobility trends such as digitalization, sustainability, and cybersecurity, and complies with applicable European railway standards, including EN 50155.

Digital Transport Company combines onboard systems, dispatcher tools, cloud analytics and diagnostic modules into a unified architecture. The solution enables predictive maintenance (CBM), real-time fleet management, depot automation, energy optimization and integrated cybersecurity. With its open API structure, the platform is ready to interconnect with ERP systems, smart city data layers and third-party technologies.

Backed by measurable KPIs and full data transparency, the public transport operator becomes a true mobility orchestrator—delivering safer, greener and more reliable urban and regional transport services. Digital Transport Company is the backbone of tomorrow's intelligent, integrated and resilient mobility.

KEY FEATURES

- **Modular Architecture**
  Covers the full life cycle of rolling stock and infrastructure – from operation and diagnostics to service and energy control.
- **Data-Driven Operations**
  Real-time dispatching, dynamic timetable adjustments and automated incident response.
- **Predictive Maintenance**
  Online diagnostics, automated vehicle checks and CBM strategies reduce downtime and boost availability.
- **Urban Safety Layer**
  Incident tracking, emergency braking data, integration with first responders and smart stops for vulnerable users.
- **Energy Efficiency**
  Real-time consumption monitoring, charging mode optimization, and ESG-compatible operation of lines and fleets.
- **Cybersecurity Layer**
  Vulnerability management, incident response, real-time SOC monitoring and NIS2/NÚKIB compliance.
- **Open Integration**
  Seamless interoperability with third-party systems, ERP software, municipal platforms and AI tools.

FUNCTION TABLE

AREA	KEY FUNCTIONS & CAPABILITIES
OPERATIONS	Real-time traffic management, dynamic route control, incident detection and response
MAINTENANCE	CBM diagnostics, vehicle health monitoring, automated operating status reports
DEPOT	Digitized workflows, automated wash systems, resource planning (vehicles, staff, space)
DISPATCHING	Real-time control center, dynamic service rescheduling, event response, multimodal coordination
URBAN SAFETY	Risk zone identification, incident localization, emergency communication protocols
ENERGY & ECOLOGY	Consumption tracking, eco-driving support, network-level optimization
CYBERSECURITY	SOC monitoring, electronic subsystem visibility, vulnerability & incident management
KPI MANAGEMENT	Vehicle availability, timetable adherence, incident reduction, passenger safety
SYSTEM INTEGRATION	Open-source middleware for integration with ERP, SCADA, GIS, AVLS, or municipal IT
MULTIMODAL SUPPORT	Supports rail and road vehicles: trains, trams, metros, buses, trolleybuses



FLEET MANAGEMENT FOR PUBLIC TRANSPORT

A data-driven system for efficient fleet operation across rail and road vehicles.

The Fleet Management system by Škoda Group is designed for comprehensive oversight of public transport fleets – including trains, trams, metro systems, buses, and trolleybuses. It leverages real-time data to optimize operations, maintenance, and planning. Cloud-based analytics and diagnostics provide continuous insight into technical and operational conditions, supporting both control centers and depot teams.

A key advantage lies in the consolidation of data from multiple subsystems into a single intuitive interface. Operators gain instant access to harmonized information on vehicle availability, condition, and performance. Advanced analytical tools enable monitoring of key performance indicators, maintenance optimization, and cost-saving identification. The system increases fleet reliability while reducing operational expenses. It is fully scalable, supports third-party integration, and complies with EN 50155 standards for railway applications.

KEY FEATURES

- **Integration Platform**
  Open architecture enables seamless connection to external systems and suppliers.
- **Unified Interface**
  Consolidated view of all fleet data in one dashboard for simplified operation.
- **Fleet-Wide Data Analytics**
  Real-time technical and operational insights across all vehicle types.
- **Cloud-native Platform**
  High availability and secure access without local infrastructure.
- **Operational Efficiency**
  Live tracking of reliability, driver behavior, and energy consumption.
- **Decision Support**
  Data-backed outputs for dispatchers, planners, and managers.
- **On-premise Option**
  The system can be operated on-premise according to the customer's needs.

FEATURE OVERVIEW

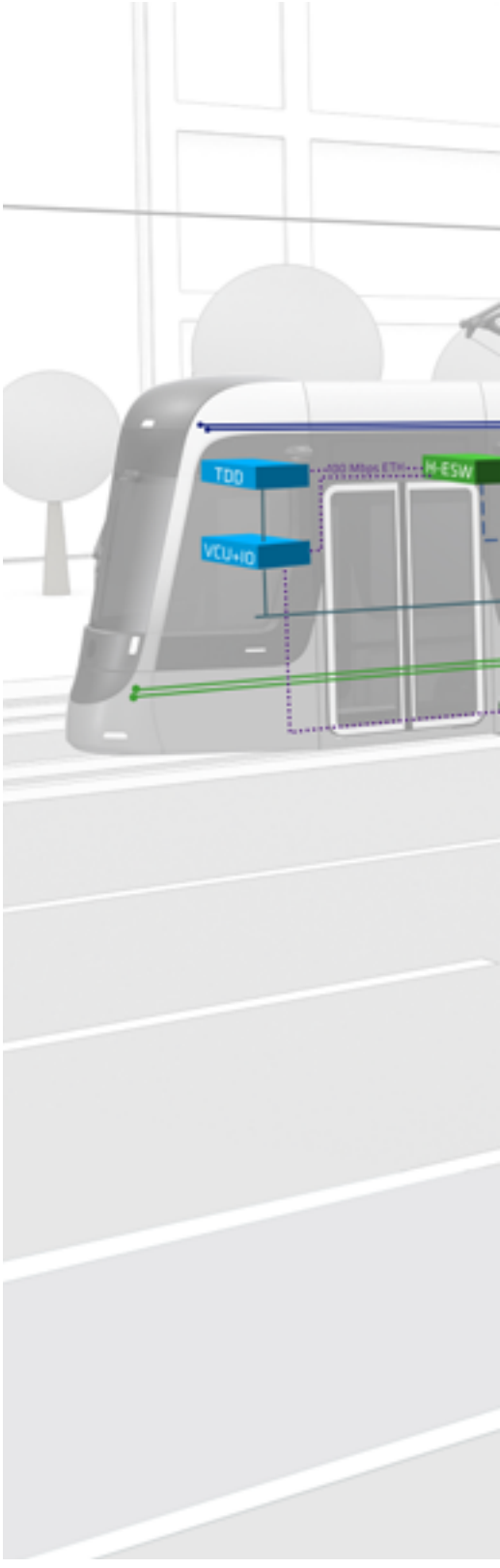
FEATURE	DESCRIPTION
VEHICLE MANAGEMENT	Detailed technical and operational profiles of each vehicle
REPORTING	Automated reports on fleet availability and performance metrics
TICKET MANAGEMENT	Fault tracking, diagnostics alerts, and maintenance records
RIDE KPIS	Performance evaluation based on schedules and planned routes
ENERGY CONSUMPTION ANALYSIS	Driver behavior tracking and suggestions for reducing operating costs
DRIVER BEHAVIOR MONITORING	Analysis of braking, acceleration, and speed for improved passenger comfort




ŠKODA
Dashboard
TRAM
General vehicle information
Commissioning
Decommissioning

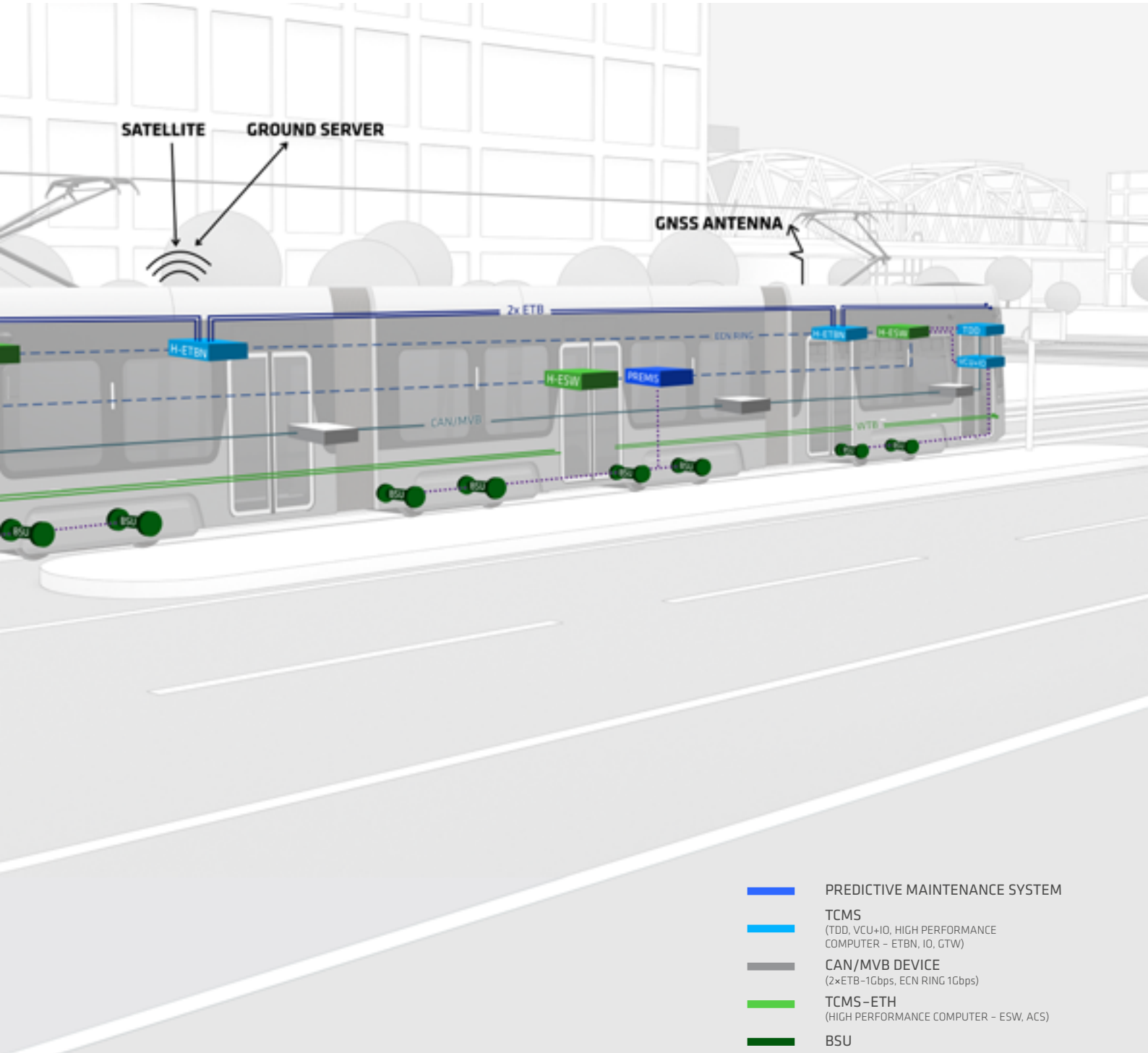
PREDICTIVE MAINTENANCE SYSTEM (PRMS)

A diagnostics system that offers Remote Maintenance, Condition-Based Maintenance and Predictive Maintenance. Predictive Maintenance System can reduce the financial and time costs of servicing. The system consists of an on-board computer, sensors and a server part that can adapt to the customer interface.
The diagnostics work by collecting smart data. A subsequent evaluation can verify RAMS parameters for individual components, allowing maintenance to be planned according to the actual condition of the components.



KEY FEATURES

- A complex predictive maintenance solution consisting of a vehicle data gathering unit and data analysis, and cloud reporting applications.
- Based on Škoda's own High Performance Computer vehicle platform and renowned industry grade cloud EAM and APM applications.
- Applicable to both new vehicles and the customer's current fleet as a retrofit package.
- Easily customisable per project based on the customer's requirements.
- Provides unprecedented operational and diagnostic data availability and opportunities for analysis, including anomoly detection, condition-based maintenance and fault prediction for all standard vehicle subsystems. It includes power supply, traction, brake, door, undercarriage, fire-extinguishing, air-conditioning, lighting, multimedia, passenger information and ATO systems.



PREDICTIVE MAINTENANCE SYSTEM

TCMS
(TDD, VCU+IO, HIGH PERFORMANCE COMPUTER – ETBN, IO, GTW)

CAN/MVB DEVICE
(2×ETB–1Gbps, ECN RING 1Gbps)

TCMS–ETH
(HIGH PERFORMANCE COMPUTER – ESW, ACS)

BSU

PREDICTIVE MAINTENANCE SYSTEM

BOGIE SENSOR UNIT (BSU–XX)

The BSU-XX is a sensor that is part of the Predictive Maintenance System diagnostics, making it possible to measure, record and analyse the vibration and temperature of moving parts of the train with an impact on the optimisation of the maintenance plan. Thanks to a robust design, the BSU-XX can be placed on the chassis in any position.

KEY FEATURES

- Mechanical resistance to shocks and vibrations – meets category 3 in accordance with EN 61373.
- IP67 rating – in accordance with EN 60529.
- Temperature range: -40° C to +70° C, class OT4 IP67EN 50155.
- Supply voltage: 24 V DC or 48 V DC PoE (Power over Ethernet) with short-circuit, overvoltage and under-voltage protection.
- Compatible with a BSU-CONNECT-XX cabinet.
- Case constructed from black anodised DURAL material.
- 2× Ethernet interface constructed in accordance with IEEE 802.3 and galvanic isolation.
- 3× internal temperature sensors (1× digital, 2× analogue PT1000).
- 2× internal vibration sensors (digital).
- 2× inputs for external temperature sensor (analogue PT1000).
- 1× input for external vibration sensor (frequency range 10 Hz ÷ 15 kHz, sensitivity 10 mV / m/s^2, measuring-range ± 100 m/s^2).
- Production variants with cable gland or connector meeting the MIL-DTL-5015 standard.


SAUTER DIGITAL
POWER SUPPLY
CONSUMPTION
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ŠKODA GROUP
DIGITAL SOLUTIONS




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ŠKODA GROUP
DIGITAL SOLUTIONS

VEHICLE
CONTROL





VEHICLE CONTROL

The Vehicle Control group brings together digital technologies and systems designed for vehicle operation. These technologies include control, communication, multimedia, camera and other systems. The functionalities of these systems ensure a smooth, reliable, pleasant, clear and comfortable ride for passengers.

VEHICLE CONTROL

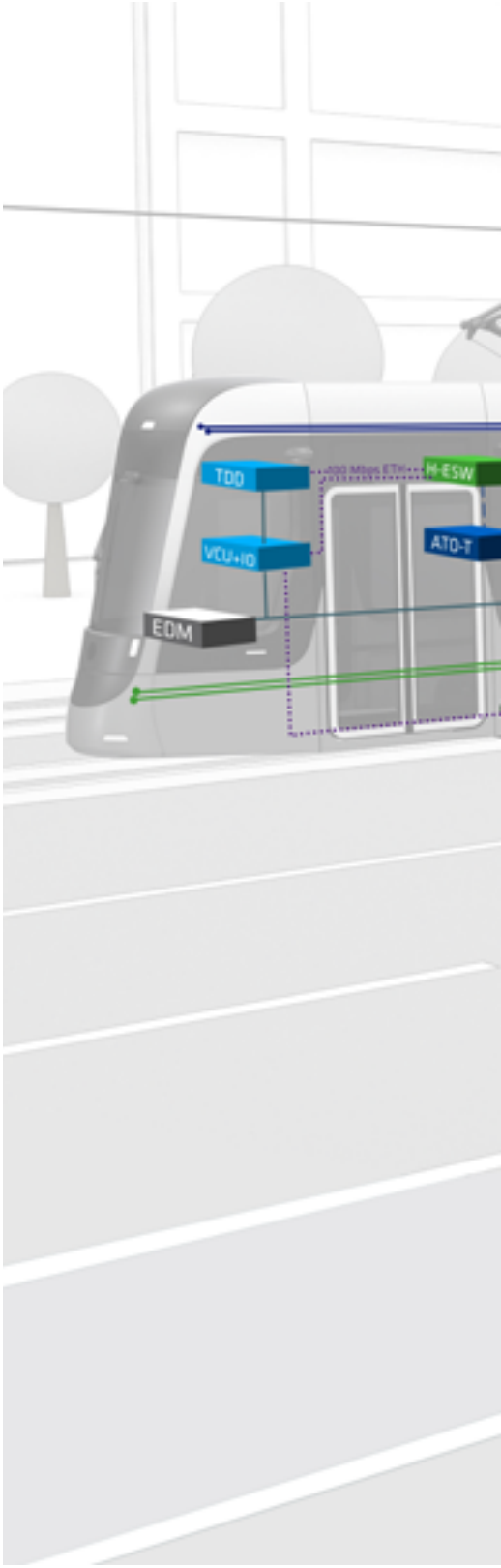
TCMS	TRAIN CONTROL MANAGEMENT SYSTEM
HIGH PERFORMANCE COMPUTER – ES	HIGH PERFORMANCE COMPUTER ETHERNET SWITCHES
HIGH PERFORMANCE COMPUTER – ETBN	HIGH PERFORMANCE COMPUTER ETHERNET TRAIN BACKBONE NODES
DPC–XX	DEVICE FOR VISUALISATION
UIC–GATEWAY	WTB COMMUNICATION NODE
OCI	ONBOARD COMUNICATION INFRASTRUCTURE
INTELO+DIN	SUBSYSTEM AND DATA COLLECTION CONTROL
MULTIMEDIA SYSTEM	
COMPACT ETHERNET SWITCH	

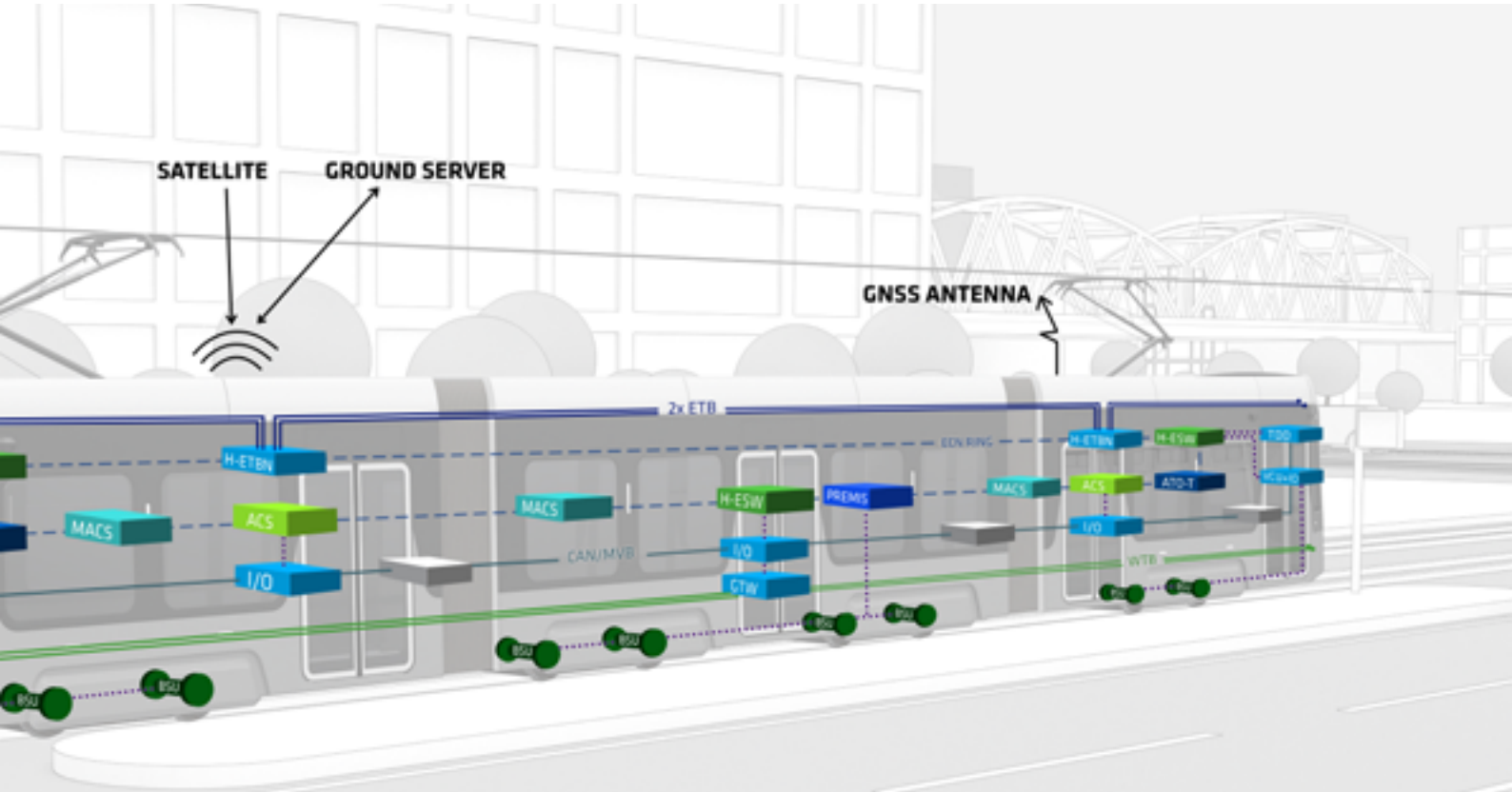
TRAIN CONTROL MANAGEMENT SYSTEM (TCMS)

TCMS is the basic system equipment of the vehicle, enabling the connection of Škoda Digital smart digital systems. The master control system is based on an Ethernet network and supports wireless data transmission in 3G/4G, GSM-R and Wi-Fi networks. TCMS software can be implemented in all types of rail vehicles DMU, EMU, Diesel locomotive, Tram, Metro, Coach, Passenger wagon).

KEY FEATURES

- Ethernet train backbone and consist networks compliant with IEC 61375.
- Large variability of connection with other train systems.
- Wireless data transmission in 3G/4G, railway GSM-R and Wi-Fi networks.
- Based on High Performance Computer technology (required redesign can be achieved effectively and fast).
- Possible integration of third party devices.
- TCMS up to SIL2.
- Processing and display units programmable in PLC and C/C++ languages.
- Remote and local I/Os for analogue and logical signals.
- Redundancy of critical components.
- Predictive diagnostic functionality – Predictive Maintenance System.
- ATO – Automatic Train Operation mode.
- Custom designed solution.
- Own HW & SW design, development, production & maintenance.
- Cost-effective solution.
  - Components can be utilised for several systems simultaneously.
  - Decrease of production costs in serial production.
- Assurance of availability of spare parts in reasonable condition.





PREDICTIVE MAINTENANCE SYSTEM

MMS – MULTIMEDIA SYSTEM
(PIS, PAS, CCTV, APC)

ATO-T

TCMS
(TDD, VCU+IO, HIGH PERFORMANCE COMPUTER – ETBN, IO, GTW)

EDM

CAN/MVB DEVICE
(2×ETB-1Gbps, ECN RING 1Gbps)

TCMS-ETH
(HIGH PERFORMANCE COMPUTER – ESW, ACS)

BSU

ACS

TCMS

ETHERNET SWITCHES (HIGH PERFORMANCE COMPUTER – ES)

The manageable Ethernet switch supports a high-speed communication line up to 10 Gbps according to project needs, with an emphasis on cyber security. A multitasking system enables multiple functionalities to be shared in a single physical switch – e.g., the Ethernet switch and multimedia management. Based on the High Performance Computer modular platform.

KEY FEATURES

- A powerful managed Ethernet routing switch.
- A modular design with a variable number of ports and optional PoE support.
- All models are based on a High Performance Computer modular platform and share the same HW and SW components.
- Support for fault-tolerant ring topology with fast recovery time.
- Up to 4 ports with bypass relays allow operation of the network even during multiple failures.
- A powerful CPU for IP routing.
- Support for configuration profiles controlled by HW configuration pins in the power connector.
- A custom Linux-based system with a complete set of networking features to help implement cybersecurity requirements.
- An integrated DHCP server with port-based address allocation to simplify end device configuration.
- Integrated diagnostic features for detailed runtime network analysis.
- Easily replaceable modules to help optimise life cycle costs.
- Both rack and panel mounting options.


HYPEX
v1
PTS.A
v1
CPU.A
v1
ETH.B
v1
ETH.B
v1
EXF.B

ETHERNET TRAIN BACKBONE NODES (HIGH PERFORMANCE COMPUTER – ETBN)

Ethernet backbone network designed for gigabit ETB and ECN networks. Robust HW developed with an emphasis on Cyber Security. High Performance Computer – ETBN – supports a circular topology with redundancy and a fast recovery time. High Performance Computer – ETBN is available with an integrated manageable Ethernet switch for ECN networks. Based on the High Performance Computer modular platform.

KEY FEATURES

- An ETBN – Ethernet Train Backbone Node designed for Gigabit ETB and ECN networks.
- Full compliance to IEC 61375-2-5 and IEC 61375-2-3 standards.
- A powerful communication CPU to ensure high routing performance with R-NAT and firewall.
- TTDP protocol handles ETB inauguration and addressing.
- Builds and maintains Train Topology Database with information regarding train, consists and vehicles.
- An ETB interface realized by 4 gigabit Ethernet ports with bypass relays.
- Integrated with a managed Ethernet switch for ECN ports.
- On ECN supports fault-tolerant ring topology with fast recovery time.
- Support for redundant configuration with two ETBNs in one network operating in active / standby mode.
- A modular design with variable number of ports and optional PoE support.
- All models are based on a High Performance Computer modular platform and share the same HW and SW components.
- Integrated diagnostic features for detailed runtime network analysis.
- Easily replaceable modules to help optimise life cycle costs.
- Both rack and panel mounting options.


HYPEX
PWR-PoE
v1
PTS.A
v1
CPU.A
v1
ETH.A
v1
ETH.A
v1
EXT.A
v1
POE.A

DEVICE FOR VISUALISATION (DPC–XX)

The UIC-Gateway is an important part of the equipment of railway vehicles according to IEC 61375. UIC-GATEWAY handles the inauguration of the corresponding train, message routing, data copy processing, aggregation functions and server mapping services.

KEY FEATURES

- Human Machine Interface technologies device type for rail vehicle visualisation.
- The device is ready in versions with and without a touchscreen and with or without keys.
- Display in sizes of 15.6“, 10.4“ or 8.4“.
- Display and keys are equipped with LED backlight.
- The device is designed for operation in harsh climatic conditions also ranging from -40 °C to 70 °C.
- Made from branded components only MITSUBISHI, TRACO, HARTING, INTEL ATOM.
- Shape and control are designed according to UIC 612.
- Robust and precise workshop processing.


ESC
OK
F1
F2





UIC–GATEWAY

The UIC-GATEWAY communication node represents an important component of equipment of railway vehicles operating according to international standard IEC 61375 and leaflet UIC 556. The motivation to comply with this standard is the benefit to connect various series of railway cars and high functional reliability.

UIC-GATEWAY addresses the UIC inauguration of the relevant train, message routing, processing data copying, aggregation functions and server mapping services. Message routing is done between the WTB train bus and the MVB-CAN railway car bus.

The combination MVB-CAN offers features of the MVB link layer and CAN bus physical layer. The solution normally contains the redundancy of key components, including a physical WTB interface with the full redundancy of hardware components.

KEY FEATURES

- Communication node between WTB train bus and and MVB-CAN railway car bus.
- Compatible with international standard IEC 61375 and UIC 556 leaflet.
- Key component redundancy or optional full redundancy.
- Option allowing to connect/couple various series of railway vehicles.
- Configuration database PDM (process data marshalling).
- Optional communication interfaces, analogue and digital outputs / inputs.
- Service and configuration application INTELO+ Viza.
- Standardised cabinet RACK 3U.
- Establishment of MTBF / MKBF and SIL/ RAMS safety levels.
- Standards EN 50155, EN 50121-3-2, EN 61373, EN 50126, EN 50128, IEC 61375.


TCN-NODE
XC5
XC1
XC2
XC3
XC4
CAN-RED
CAN1
CAN2
TCN-NODE
XC5
XC1
XC2
XC3
XC4

ONBOARD COMUNICATION INFRACSTRUCTURE (OCI)

Complete on-board communication infrastructure based on Ethernet with support for CAN, MVB and serial communications. It ensures stable and fast data transfers between vehicle systems. The main advantage of OCI is that one physical network is used for multiple on-board systems. This approach makes it possible to reduce the number of network elements and cabling, thus helping to optimise the initial costs and LCC costs. The benefits of using Ethernet are mainly the openness and simplicity of this platform compared to more expensive communication lines such as WTB.

KEY FEATURES

- A complete onboard communication infrastructure interconnecting all subsystems.
- One physical Ethernet network shared by TCMS and multimedia systems.
- A VLAN, QoS, and firewall used to separate individual systems and implement cybersecurity requirements.
- A fully redundant network topology with no single point of failure.
- A Gigabit ring network on the consist / vehicle level. Bypass relays in Ethernet switches for further network resistance to failure.
- A Gigabit train backbone (ETB) with two lines and redundant ETBN providing connection between train and vehicle network.
- Full compliance with IEC 61375 series of standards.
- All network components have a modular design based on the High Performance Computer platform.
- WTB may be used for backward compatibility with older vehicles.

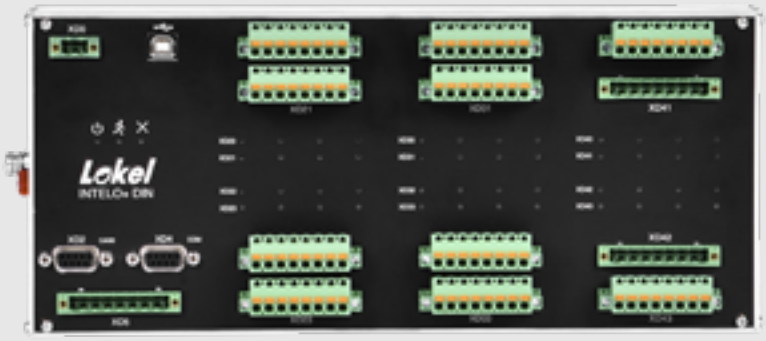
INTELO+ DIN

INTELO+DIN is a unit designed for the local control of subsystems such as door opening, heating and air conditioning, and anti-slip and wheel skid protection. The unit can also be used to collect data required for the higher-level control system.

KEY FEATURES

- Distributed system unit for local control functions and data collection.
- Connection to a railway vehicle bus through a CAN open railway vehicle bus in CiA 301 or through an RS485 interface.
- Designed for the following control functions:
  - Pneumatic distribution cabinets, doors, stairs, heating and air-conditioning systems.
  - Regulation of combustion engine and gearbox.
  - Wheel slip and skid protection system.
- Service and configuration of INTELO+ Viza application.
- You may select the number and type of I/O signals based on control requirements.
- Standard case design allowing installation to DIN ledge/rack.
- Establishment of MTBF/MKBF reliabilities and SIL/RAMS safety levels.
- Standards EN 50155, EN 50121-3-2, EN 61373, EN 50126, EN 50128, EN 45545, IEC 60571.


Lokel


Lokel
INTELO+ DIN

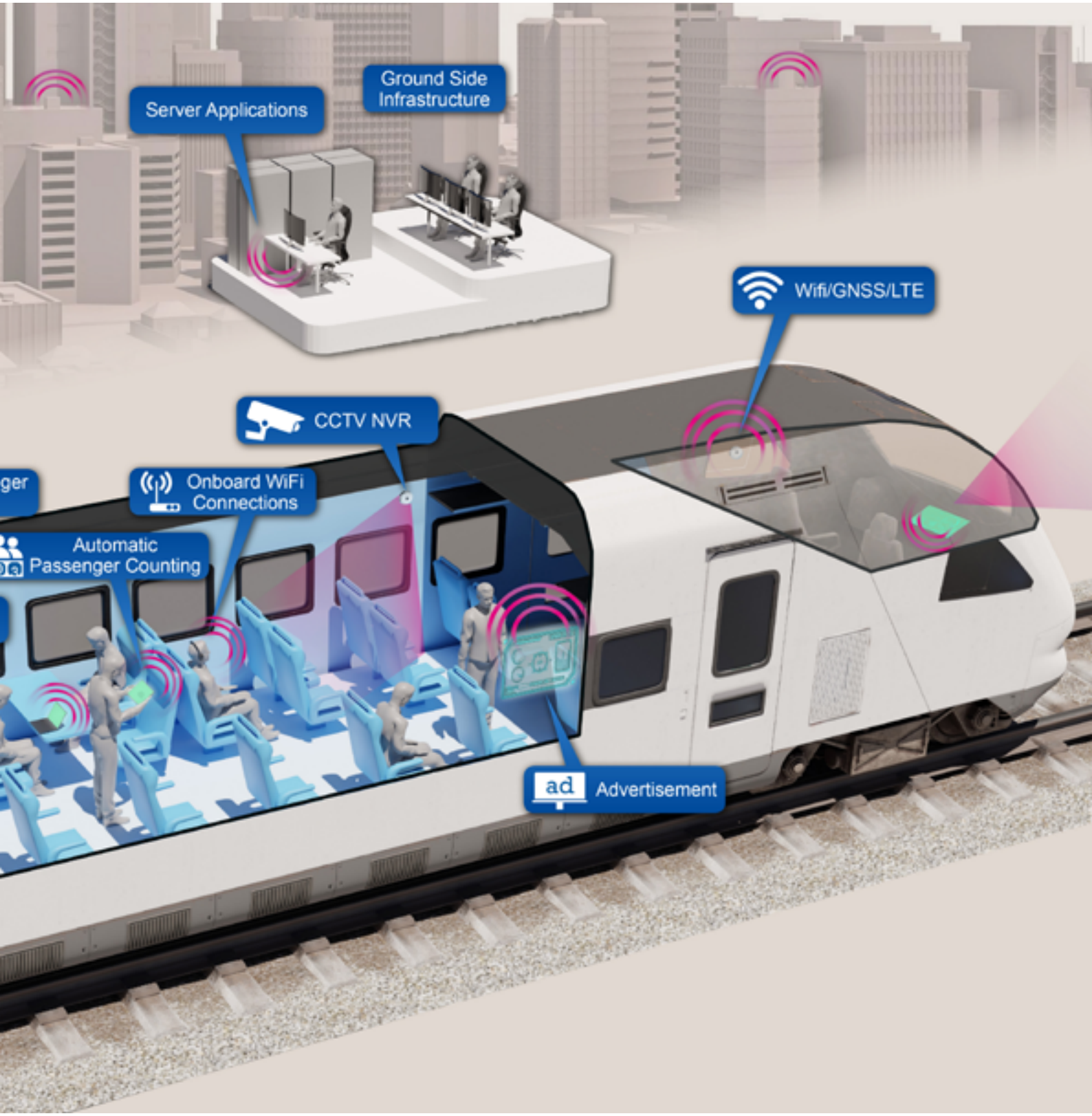
MULTIMEDIA SYSTEM

Multimedia system suitable for all types of rolling stock. The system consists of an on-board part and a server part, and it can be connected to the customer's infrastructure, thus guaranteeing the possibility of deployment on the customer's entire fleet. MMS – Multimedia system can cooperate with other vehicle systems. Due to the work with sensitive data (camera recordings), great emphasis is placed on the security of the entire solution – Cyber Security. As we move towards an autonomous future, MMS – Multimedia system will be applied, for example, in CCTV evaluation (weapon, injury, dangerous luggage, vehicle monitoring.)

KEY FEATURES

- An onboard multimedia solution with an emphasis on remote management and control.
- Targeting railway vehicles such as train units, coaches, trams and metros.
- Easy extensibility of information presented without the need to change onboard software.
- Stationary applications for:
  - Data creation, modification and automatic distribution.
  - Fleet management and monitoring (vehicle position, application and system status).
  - Data acquisition, collecting and reporting (CCTV video records, passenger counting statistics).
- Adaptable to existing stationary solution (modification of communication protocols and the provision of data import/export modules).
- Ethernet interface between all components.
- Communication protocols based on modern open standards (HTTP/MQTT/JSON) with support for public transport and railway specifics (VDV 301, ITxPT, TRDP).
- Onboard components benefit from a modular ŠDIG High Performance Computer platform.
- Simple integration with other subsystems such as ticket validators and passenger infotainment.



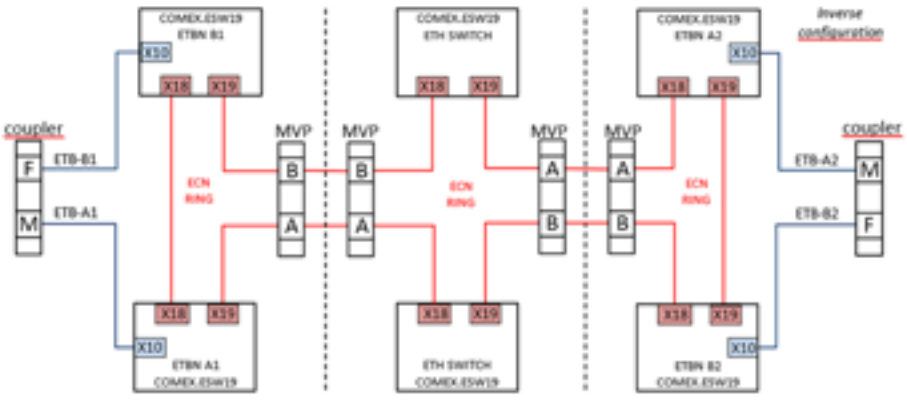

Server Applications
Ground Side Infrastructure
Wifi/GNSS/LTE
CCTV NVR
Onboard WiFi Connections
Automatic Passenger Counting
ad
Advertisement

COMPACT ETHERNET SWITCH

The Compact Ethernet Switch is the ideal solution for rail vehicles with limited space for hardware. Compact Ethernet Switch devices provide high reliability and speed by supporting a permissive ring network topology with fast recovery and a combination of 2.5 Gbps, 1 Gbps and 100 Mbps transfer rates. With flexibility and scalability, Compact Ethernet Switch devices can be configured as ETBN routers with redundant ETB links and nodes, minimizing the risk of outages.

KEY FEATURES

- A powerful managed Ethernet routing switch and ETBN – Ethernet Train Backbone Node.
- Combination of 2.5 Gbps, 1 Gbps and 100 Mbps ports.
- PoE support to power connected devices.
- Next generation dual plane ETB topology without bypass relays.
- Supports redundant ETB configuration without single point of failure.
- Tunneling ETB traffic via ECN to optimize ETB cabling.
- A powerful communication CPU to ensure high routing performance with R-NAT and firewall.
- Support for fault-tolerant ring topology with fast recovery time.
- Support for configuration profiles controlled by HW configuration pins in the power connector.
- An integrated DHCP server with port-based address allocation to simplify end device configuration.
- Integrated diagnostic features for detailed runtime network analysis.
- Both panel and DIN rail mounting options.




COMEX
X1
X3
X5
X7
X9
X11
X13
X15
X17
X2
X4
X6
X8
X10
X12
X14
X16
X18
X19

ŠKODA GROUP
DIGITAL SOLUTIONS









MAINTENANCE & OTHER

The Maintenance & Other Services cluster offers a range of tools and services that support the long-term performance and safety of vehicles. It includes solutions such as CyberSecurity, software upgrades, and diagnostic hardware. These services help operators ensure system integrity, minimize downtime, and extend the lifecycle of their fleets. The cluster is designed to support both on-site and remote maintenance processes.

MAINTENANCE & OTHER

WTB TESTER	WIRE TRAIN BUS TESTER
SW UPGRADES	
INCIDENT MANAGEMENT AND VEHICLE MONITORING	
INTRUSION DETECTION SYSTEM	

WTB TRAINTESTER

The WTB Tester is a state-of-the-art diagnostic tool designed to streamline WTB communication assessments across any railway vehicle, regardless of the manufacturer. By simply connecting a standard PC (laptop) through the Gateway to the WTB bus—utilizing common connections like the UIC socket on locomotives—WTB Tester offers unparalleled flexibility in testing devices compliant with the WTB standard.

KEY FEATURES

- Reading and displaying static properties of connected car.
- Customization according to customer needs.
- Possible test automation using a scripting language.
- Reading and displaying the data sent by the cars into WTB via R1, R2 and R3 telegrams.
- Simulation of any car (which is in the portfolio), manage telegrams and automate feedback for dynamic testing.
- Reading, decoding and displaying data received as MD.
- Statistics on the frequency of MD communication.
- Transmission of MD messages with specified content.




ETH
A1
B1
A2
B2
ŠKODA
24V 8A
230Vac
24Vdc
48Vdc

SW UPGRADE

The SW Upgrade is designed to ensure higher efficiency, sustainability, and operational reliability of rail vehicles. Through targeted software modifications, it is possible to expand the functionality of existing systems, extend the lifespan of key components, and adapt vehicles to the latest technological and environmental standards.

Key benefits include the implementation of ECO standby mode, which optimizes energy consumption during inactivity and contributes to the operator's ESG goals. The SW Upgrade enables the modernization of the Intelo control system to the latest Intelo+ generation, providing higher computing power and enhanced diagnostics. For SA132 vehicles, a TCMS upgrade is available to improve subsystem management and integration with modern technologies. Another significant feature is the automatic wheel flange lubrication, which improves adhesion, reduces wheel wear, and enhances passenger comfort.

By implementing the SW Upgrade, full compatibility with modern standards can be ensured, and vehicle lifespan can be extended, optimizing operational and maintenance costs.



KEY FEATURES

- ECO standby mode – Intelligent energy management during inactivity to minimize consumption and improve environmental impact.
- Intelo to Intelo+ modernization – More powerful control system with advanced diagnostics and higher safety standards.
- TCMS upgrade for SA132 – Improved subsystem management and enhanced operational efficiency.
- Automatic wheel flange lubrication – Reduced friction, lower bogie wear, and quieter operation.
- Support for ESG strategy – Optimized energy consumption and lower emissions contribute to sustainable development.
- Brake test – Comprehensive diagnostics and testing of the train's braking and pneumatic system.
- Extension of vehicle lifespan – Software modernization eliminates the need for physical modifications and reduces fleet renewal costs.
- Cruise control implementation – Delivery of hardware and software for integration into existing TCMS systems.
- Additional software modifications can be implemented based on your specific requirements.

FUNCTIONS & TECHNICAL SPECIFICATIONS

FUNCTION	**INTELO**	**INTELO+**	**HIGH PERFORMANCE COMPUTER**	**3RD PARTY SYSTEMS** (UIC 556)
ECO STANDBY MODE	✓	✓	✓	✓
INTELO+ UPGRADE	✓	✓	✓	✓
TCMS UPGRADE	✓	✓	✓	✓
AUTOMATIC WHEEL FLANGE LUBRICATION	✓	✓	✓	✓



INCIDENT MANAGEMENT AND VEHICLE MONITORING

Effectively identify and respond to cybersecurity incidents. Our Incident Management solution helps IT operations teams manage unexpected events or service disruptions quickly, restoring normal operations with minimal delay. Service outages can be costly, so a fast and efficient response is critical. This solution provides teams with a clear and reliable approach to detect, prioritize, and resolve incidents, ensuring better service delivery and satisfaction for users.

Škoda Group stands as a trusted partner in cybersecurity. As a leader in transportation, we bring extensive expertise, serving a wide array of clients across diverse markets. With our end-to-end cybersecurity solutions, we cover the complete product lifecycle—from procurement and production through operation and decommissioning.

We support our clients in detecting, mitigating, responding to, and recovering from cybersecurity incidents. Our goal is to minimize impact, maintain continuous operations, and reduce future risks. Škoda Group combines expert knowledge, efficient workflows, and hands-on experience in the cybersecurity of rolling stock, ensuring the highest standards of protection for your operations.

KEY FEATURES

- This solution is a fundamental part of NIS2 compliance, as it helps our customers to detect and manage cyber security incidents.
- Continuous monitoring (24/7).
- The service is tailored made for each customer to meet their individual needs.
- Detection of security events.
- Event management and identification of incidents.
- Incident response and service restoration.
- Forensic analysis.
- Internal and external (regulators) reporting.
- VPN – secure data transfer from vehicle and wayside.




3
13

INTRUSION DETECTION SYSTEM

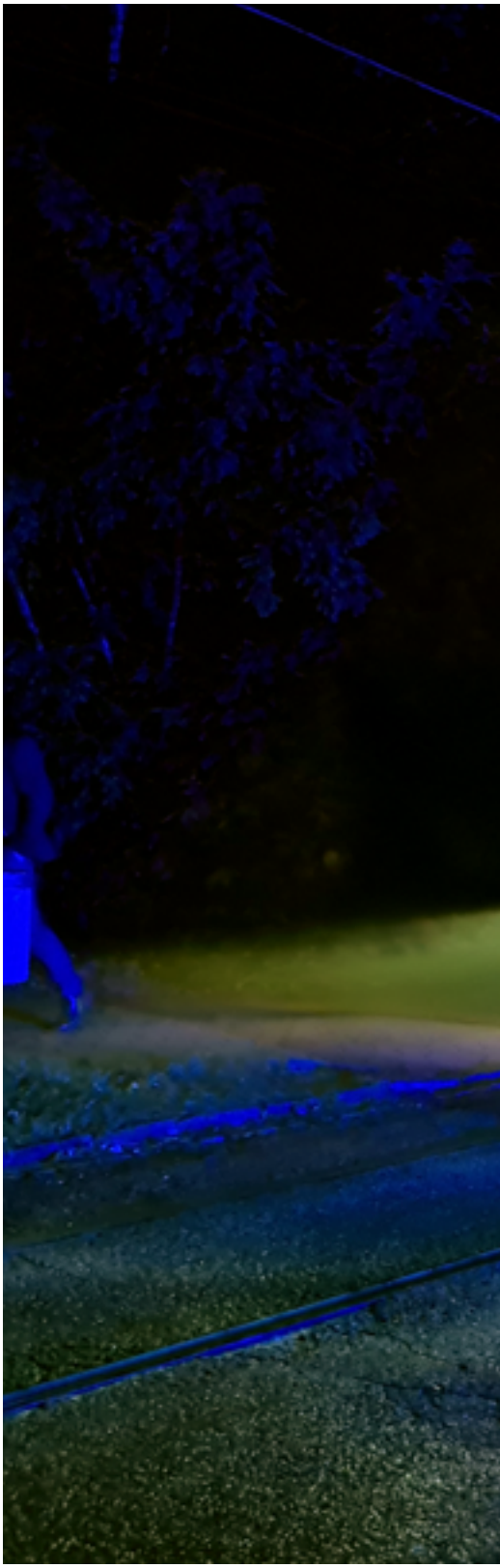
For customers with high security requirements, we offer RazorSecure's proven Intrusion Detection System (IDS), a robust cybersecurity solution. This IDS can be installed on Škoda Group's hardware platform within the vehicle, providing a proactive approach to cybersecurity. RazorSecure empowers operators to detect cyberattacks in real-time and respond swiftly. It enables comprehensive network topology monitoring and identifies unusual or unexpected traffic patterns that could signal potential risks, helping operators stay ahead of cybersecurity threats.

Škoda Group stands as a trusted partner in cybersecurity. As a leader in transportation, we bring extensive expertise, serving a wide array of clients across diverse markets. With our end-to-end cybersecurity solutions, we cover the complete product lifecycle – from procurement and production through operation and decommissioning.

We support our clients in detecting, mitigating, responding to, and recovering from cybersecurity incidents. Our goal is to minimize impact, maintain continuous operations, and reduce future risks. Škoda Group combines expert knowledge, efficient workflows, and hands-on experience in the cybersecurity of rolling stock, ensuring the highest standards of protection for your operations.

KEY FEATURES

- Proven cybersecurity solution from RazorSecure for high-security requirements.
- Installable on Škoda Group hardware platform within vehicles.
- Proactive approach to cybersecurity with real-time cyberattacks detection.
- Enables operators to respond swiftly to potential threats.
- Provides full network topology monitoring.
- Detects unusual or unexpected traffic patterns, identifying potential risks.
- This solution is a fundamental part of NIS2 compliance, as it helps our customers to detect and manage cyber security incidents.





CYBERSECURITY

Skoda adheres to cybersecurity best practices and standards and supports operators with the necessary skills and security. Skoda provides solution proposals to help implement a secure cyber framework for transport systems, maintenance and surveillance. These solutions address the specific needs of the rail environment and include features for detection and recovery in the event of cyber threats.

SAFETY INTEGRITY LEVEL 1–4

The applications and products in the Safety Integrity Level enable Škoda products and systems to deliver a higher standard of safety and reliability from design through to operation and maintenance.

SERVER APPS

Server App allows you to easily connect your rolling stock to a computer for efficient overviews and fleet management. Get detailed monitoring and diagnostics in real time, optimizing your operations and maintenance.

HOMOLOGATION

Our homologation service provides comprehensive support to customers during the approval process of digital systems for rolling stock, ensuring that all technological innovations meet the necessary regulations and standards. With our expert team and extensive experience, we are capable of efficiently guiding your projects through the homologation process to successful approval.

SIMULATOR

Our simulator, primarily designed for application development, provides a realistic environment for testing and optimizing new technologies. Additionally, we offer its use for training new drivers and train operators, ensuring their preparation for real-life situations and enhancing their safety and efficiency.

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