
lotgroup
Smart Solutions
for Railway Transport

CONTENTS

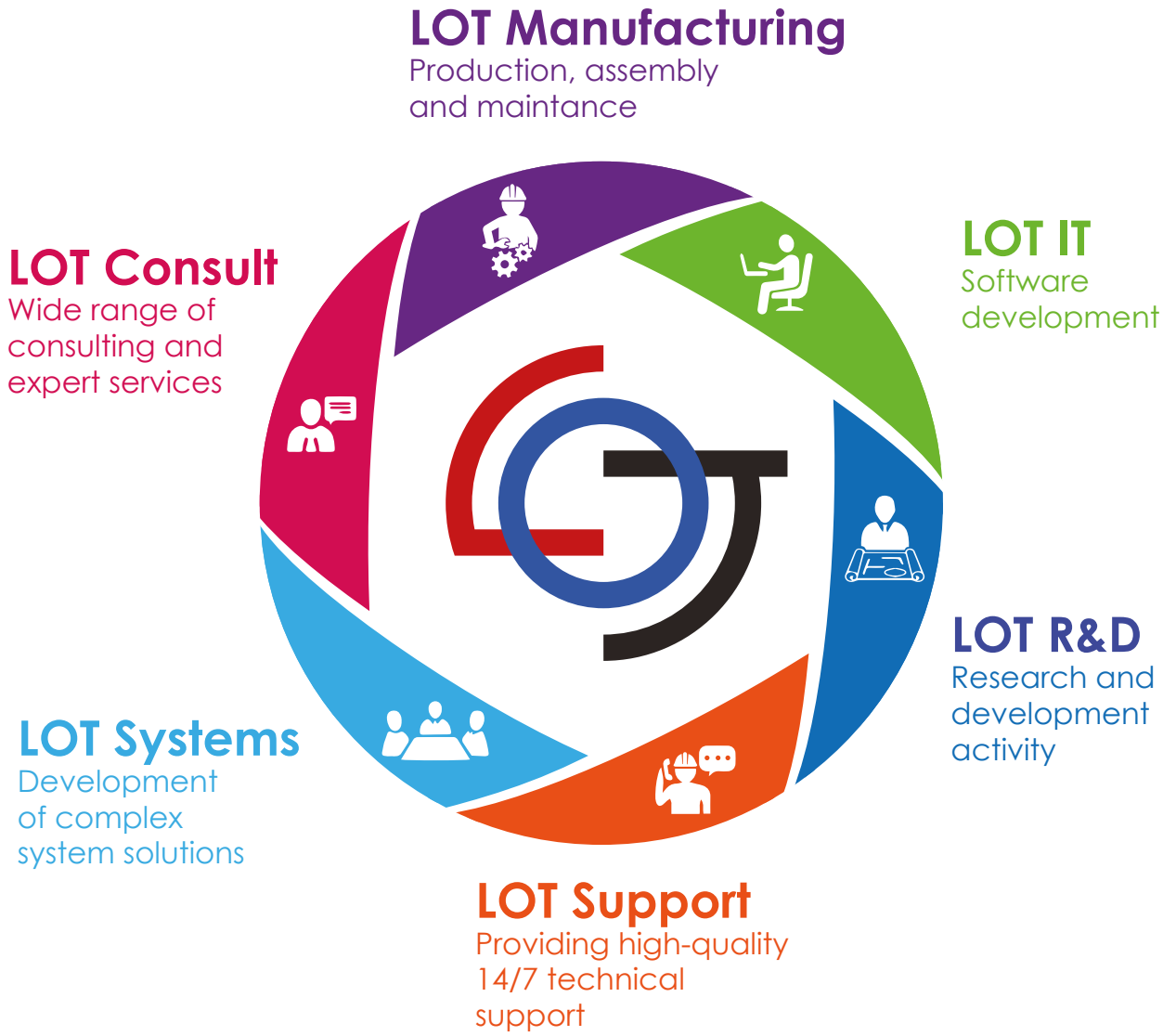
ABOUT LOT GROUP

LOT Group is an innovative engineering company specializing in development and integration of complex systems for transport. Founded in 1996, the company has been manufacturing hi-tech hardware and software systems for almost 20 years.

The company has its own R&D department, manufacturing facilities as well as software development team that allow us to offer reliable hi-tech solutions for transport companies.

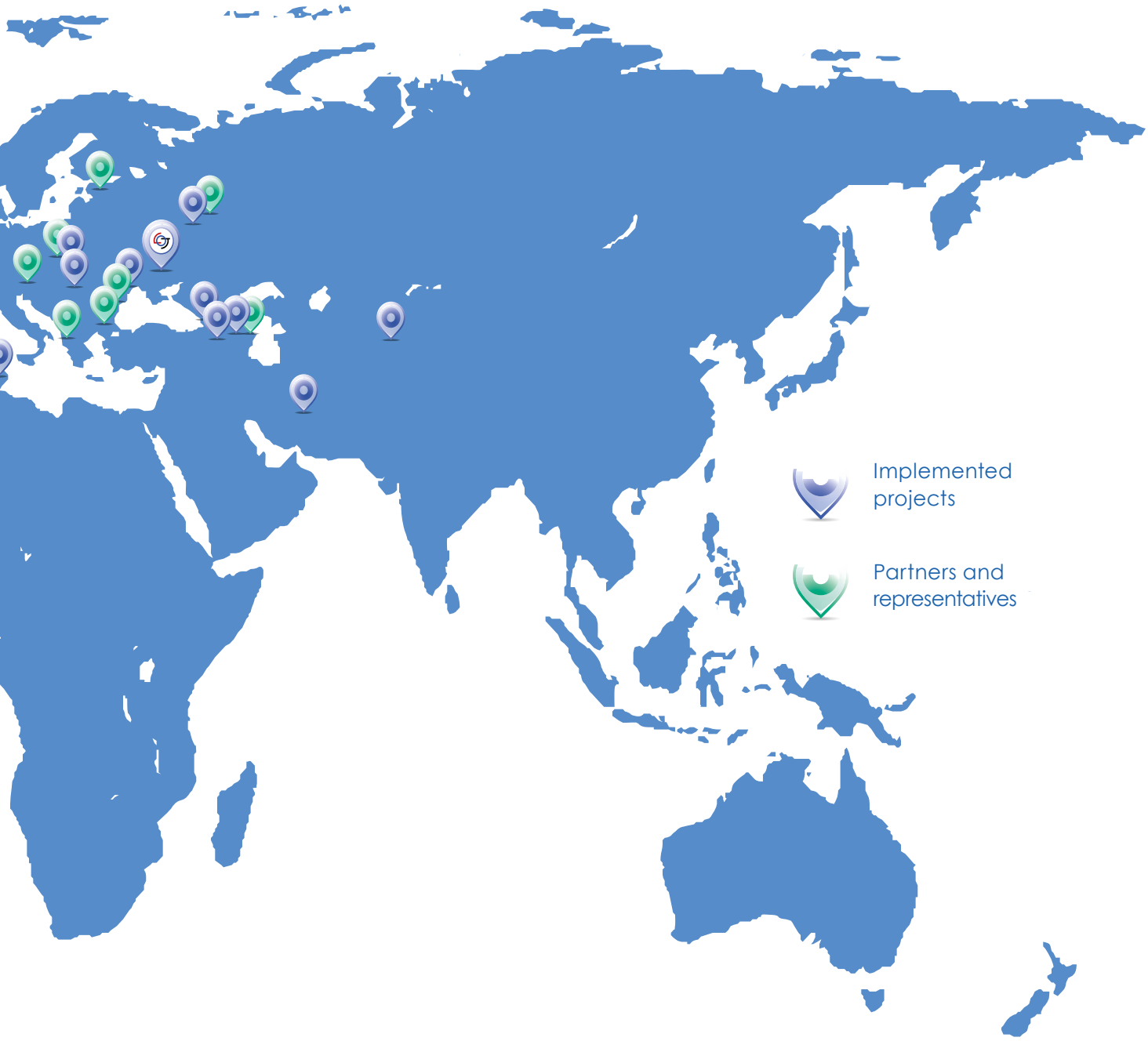
LOT Group is a team of professionals comprising leading experts in all specific fields who apply any complex project fast and effectively. Our software developers succeeded to release more than 3 000 projects, hardware engineers designed and implemented more than 500 devices, competent manufacturing department ensuring production of more than 4 000 units of hardware per year.

The key feature of our competitive advantages is multiple systems from a single manufacturer that ensures systems trouble-free integration and stable operation



Present in **11 countries**, LOT Group has adapted its organization to strengthen its international coverage and better respond to the needs of customers on local level.

All LOT Group business units are supported by the head office situated in Eastern Europe that manages overall strategy, product policy, innovation and implementation of joint processes.



REPUTATION AND CERTIFICATION

LOT Group Quality Management System has certificates confirming compliance with the international standards ISO 9001: 2008.

All new products are subject to all required testing including resources and environmental testing, electrical safety testing, testing for electromagnetic compatibility and fire safety.

Our products meet international safety requirements and European quality standards. LOT Group provides warranties for the whole range of products and performs the full range of measures in terms of guarantee service.

OUR STRATEGY

CUSTOMER-FOCUSED POLICY

Our experts will closely examine customer's specific situation and develop optimal solution approaches for the problem. Specific considerations are taken into account for each individual customer. In this way we can better understand the needs of our clients and offer them tailored solutions.

COMPLETE RANGE OF SOLUTIONS

Long-term practical experience in the core areas enables us to propose the broadest range of solutions for a variety of businesses. We draw on an array of expertise spanning all transport segments to offer our customers not just products, but comprehensive solutions.

VALUE CREATION THROUGH INNOVATION

For us innovation is a source of competitiveness and differentiation. We are fully focused on a forward looking approach to understand and anticipate the expectations of customers, who are central to the innovation strategy.

LONG-TERM PARTNERSHIP

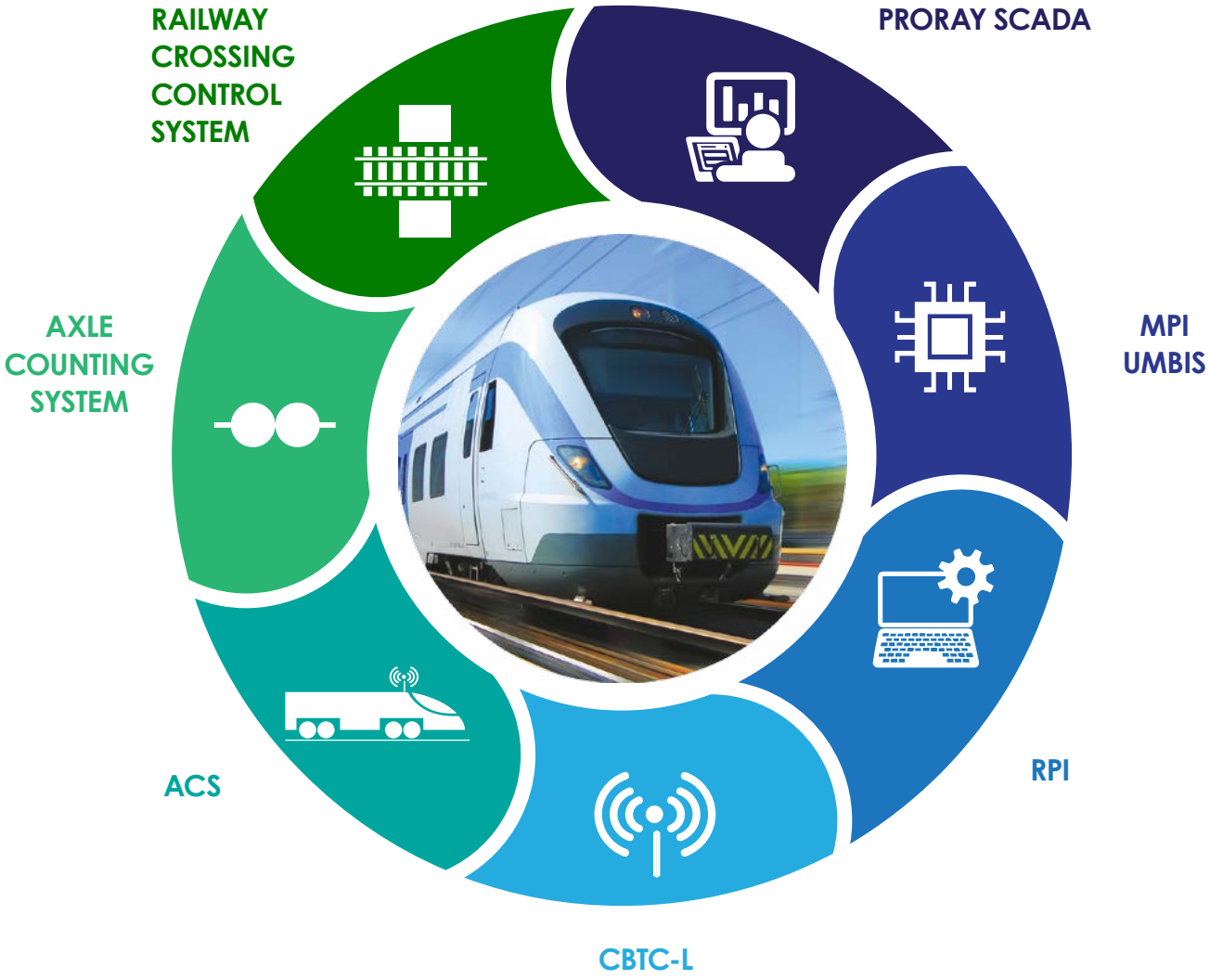
Long-term partnership based on mutually beneficial cooperation is of great importance for our company. Team of our professionals is ready to share our high-tech technologies, knowledge and experience to create innovative solutions.

SMART SOLUTIONS

Development of the transport infrastructure plays a vital role in the development of the region's economy. The operation of safe, efficient and cost-effective railway system reflects the demands and creates new opportunities for both railway operators and passengers.

Our experience in developing, engineering and installing advanced rail control and signalling systems has helped us gain recognition in this field.

Implementation of the advanced highly-technological up-to-date systems is a key to increased safety, availability, line capacity and operational line speeds to meet the requirements of every railway operator. They are paramount to the effective, efficient and profitable operation of the rail systems of the future. Improvements through enhanced safety, increased reliability and experienced comprehensive support systems and processes are the additional demands from railway and transport operators.



lotgroup.eu | info@lotgate.com | +38 057 714-22-88

PRORAY SCADA CENTRALIZED TRAFFIC CONTROL SYSTEM

PRORAY SCADA centralized traffic control system is a software package intended to collect, process, display and archive information about train traffic and its control.

Software package is operated under QNX real time operating system intended for embedded systems. QNX operating system is transferred to many platforms and can be operated on any modern processor that is used with embedded systems.

PRORAY SCADA PROVIDES:

- **collection and analyze of data** received from system trackside assets (points, traffic lights, point sensors, etc.);
- signal **state visualization**;
- **keeping history and archiving** of system states, signals and emergency situations;
- **system objects centralized control** from operator's automated work place;
- **reliable and safe data transfer** to the operations control center;
- **access right differentiation and access authorization** to the data sources and control facilities.

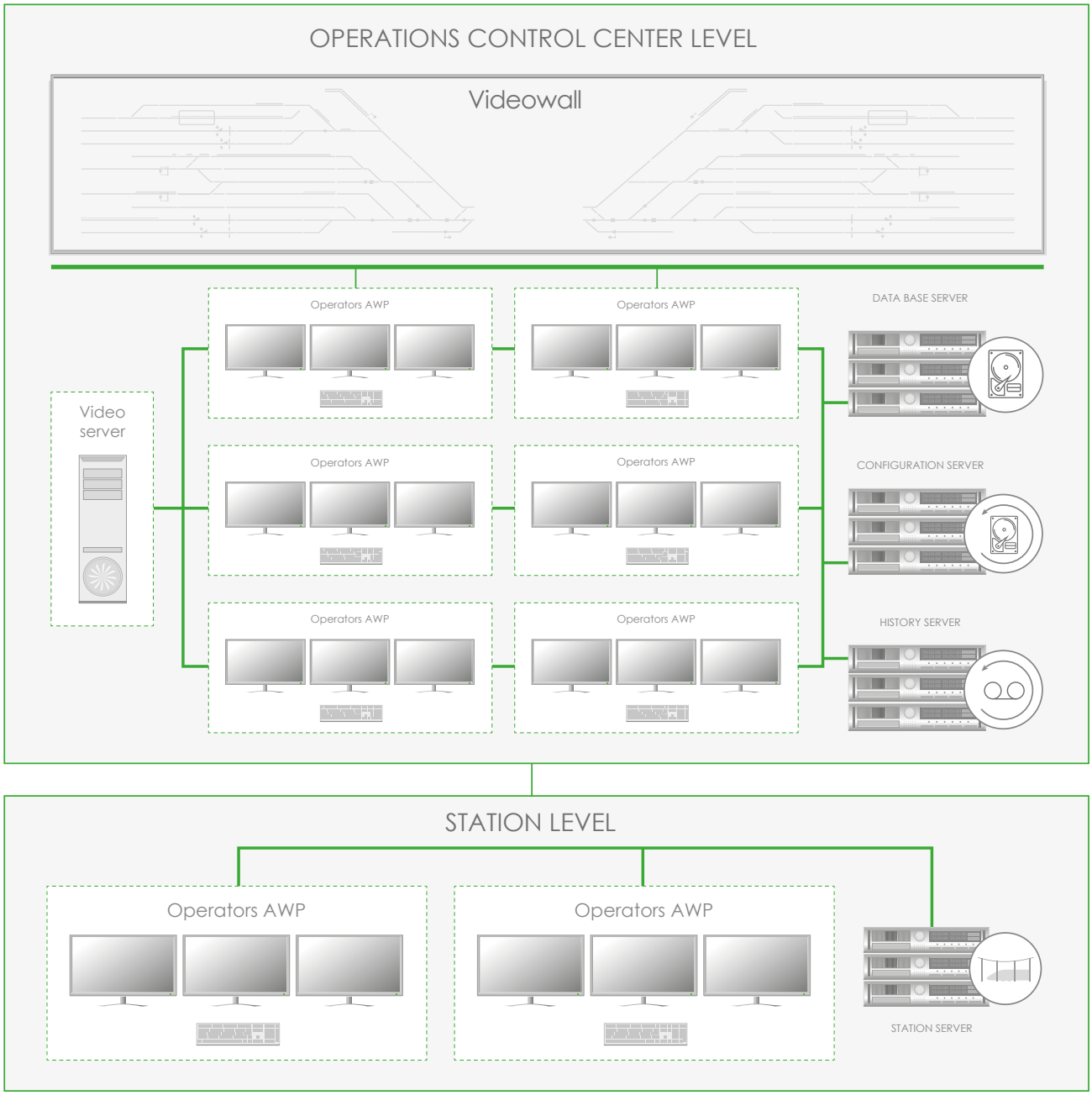
SYSTEM COMPOSITION

STATION LEVEL

Station level includes operator's automated work places (AWP) and set of station servers intended to receive, process and store the information from trackside assets. Station level includes operator's automated work places (AWP) and set of station servers intended to receive, process and store the information from trackside assets.

OPERATIONS CONTROL CENTER LEVEL

Operations control center level comprises operator's AWPs as well as system configurator's AWP, communication equipment with station level, video wall and data base server intended to collect and store configuration of system elements as well as system state history



SYSTEM COMPONENTS STRUCTURE

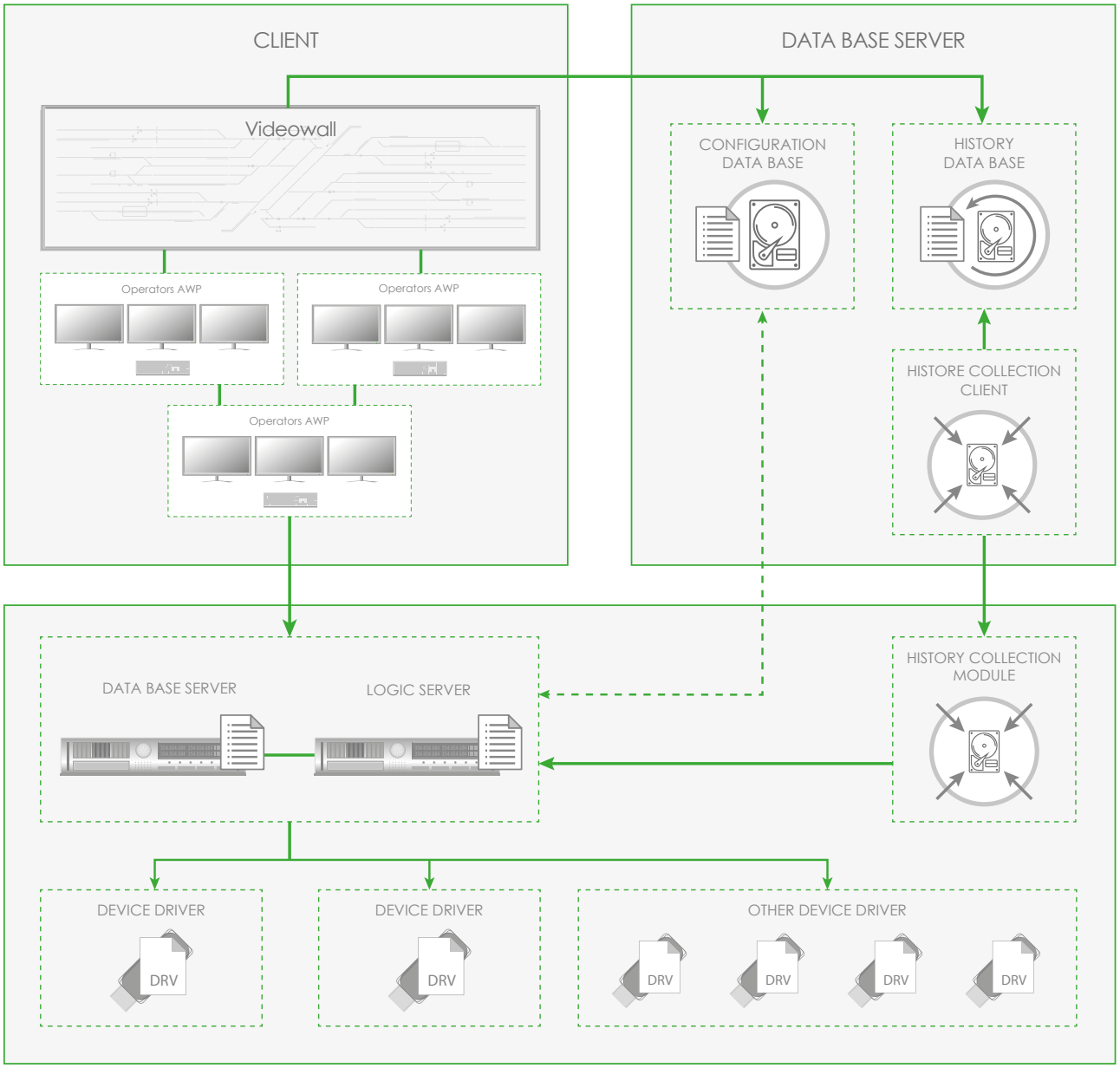
ProRay SCADA system includes such components **as client, data base server, node server and devices.**

Client is a part of the system that provides interaction with users and comprises video wall, which displays general information about the state of all system elements as well as operator's AWP, which displays information about certain system components and controls them.

Data base server is a part of the system that ensures storage and provides information about sequence of states and settings. It includes configuration data base of the system elements, data base of the system elements history as well as history collection client i.e. current state of the system elements.

Node server includes data base server and logic server, history collection module, Modbus RTU device driver, Modbus TCP device driver and Custom additional device driver.

System **devices** include Modbus RTU device, Modbus TCP device, Custom additional device.



TO REALIZE INTERACTION BETWEEN THE USERS AND THE HARDWARE THE SYSTEM INCLUDES THE FOLLOWING COMPONENTS:

- **users** who follow up complex changes in hardware device states and if necessary control them;
- **terminal** that provides user friendly interface of interaction between users and hardware devices.

TERMINALS INCLUDE THE FOLLOWING SOFTWARE COMPONENTS:

- state display module that shows the users current state of hardware and logic elements of the system;
- state history display module shows the users history of state changes of the system hardware and logic elements;
- state control module allows the users to set (change) the state of system hardware elements;
- authentication module is a system of verification and differentiation of user's access rights to different system control functions.

SERVERS ARE INTENDED TO RECEIVE, PROCESS AND ACCUMULATE THE INFORMATION FROM HARDWARE DEVICES AND TERMINALS. SERVERS PERFORM THE FOLLOWING FUNCTIONS:

- Data analyze and collection. Servers process and accumulate data from hardware and logic components of the system.
- Control of the system hardware devices. Servers collect, process and transmit the commands to the hardware components of the system.
- Configuration of the system components. Servers process and store setting changes of hardware and logic components of the system.
- Accumulation and processing of change history. Servers collect and process state history of logic and hardware components of the system.

ADVANTAGES OF PRORAY SCADA SYSTEM IMPLEMENTATION

HIGH INFORMATION CAPACITY AND RELIABILITY

System implementation allows to analyze large amounts of information about system device status suitable for archiving.

ANALYZE OF OPERATOR'S ACTIONS

Keeping the history of the system device status allows to analyze operator's actions, define mistakes and correct them.

IMPROVING THE QUALITY OF OPERATOR'S WORK

User friendly interface of the system allows to decrease the level of tiredness and increase accuracy of operator's work.

ADAPTABILITY

This system is open and extensible. It can be connected to any types of electric interlocking system. The system is easy to adapt at the design stage as well as at its modernization stage during the operation.

UMBIS MICRO-PROCESSOR BASED INTERLOCKING SYSTEM (MPI)

Micro-processor based interlocking system (MPI) is a station automated control system intended to control the trains and shunting operation at station and adjoining hauls to meet the requirements of traffic safety.

UMBIS SYSTEM PROVIDES:

- **process control** of automation objects at station (core functions of electric switch and signal interlocking);
- **automation objects' status control** at the station;
- **provision of safe train movement**;
- **diagnostics** of automation objects and **self-diagnostics** of system components;
- **correlation with systems** of the same or upper level (centralized traffic control system);
- **archiving of information** about the status of control objects, operator's actions, operation diagnostics data component elements.

SYSTEM COMPOSITION

UPPER LEVEL

Control equipment level includes main and backup station operator's AWPs as well as technician's AWPs.

Integrity and confidentiality of the system information resources is ensured by restriction of unauthorized access to the AWPs and no possibility to make unauthorized changes in UMBIS working program.

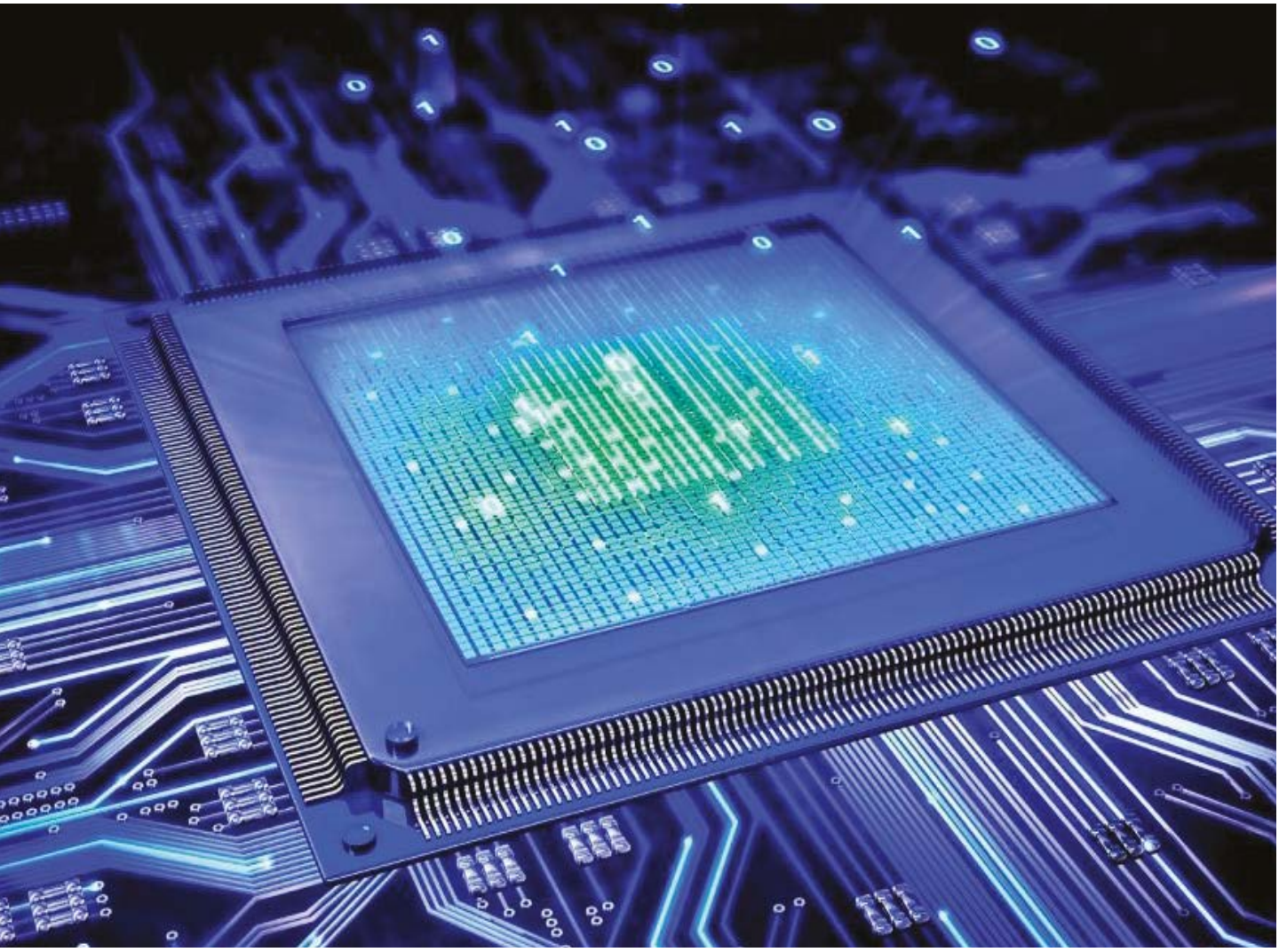
MIDDLE LEVEL

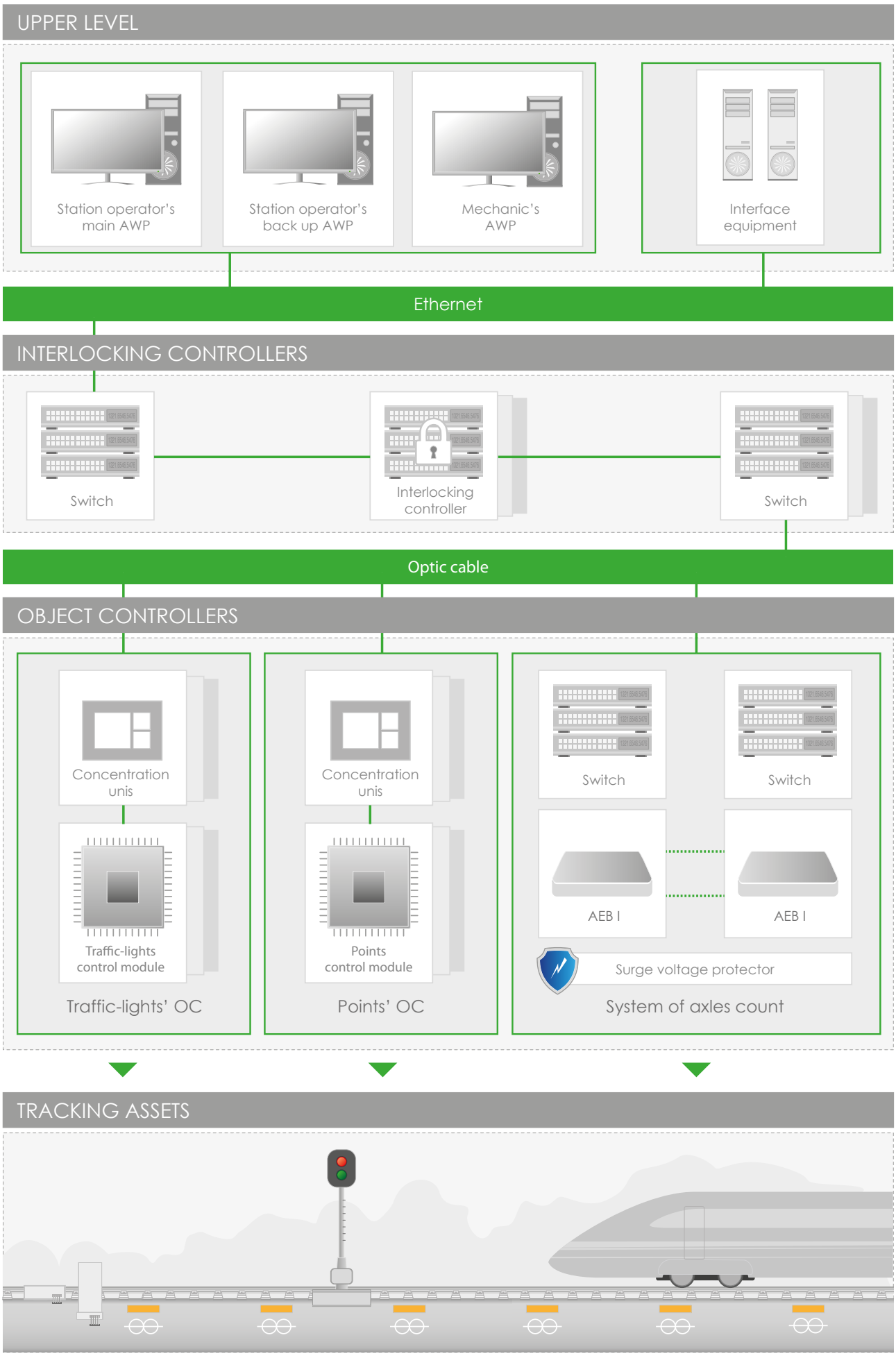
Middle level is a hardware and software that ensures control of the main dependences of interlocking logic and sending control commands as well as provides communication between subsystems.

Middle level includes interlocking controllers and object controllers.

LOWER LEVEL

Lower level of the system includes trackside assets such as point machines, LED traffic lights, axle counting sensors, power supply racks, cables.




UPPER LEVEL
Station operator's main AWP
Station operator's back up AWP
Mechanic's AWP
Interface equipment
Ethernet
INTERLOCKING CONTROLLERS
Switch
Interlocking controller
Switch
Optic cable
OBJECT CONTROLLERS
Concentration unis
Traffic-lights control module
Traffic-lights' OC
Concentration unis
Points control module
Points' OC
Switch
Switch
AEB I
AEB I
Surge voltage protector
System of axles count
TRACKING ASSETS

ADVANTAGES OF THE UMBIS SYSTEM IMPLEMENTATION

ADAPTABILITY

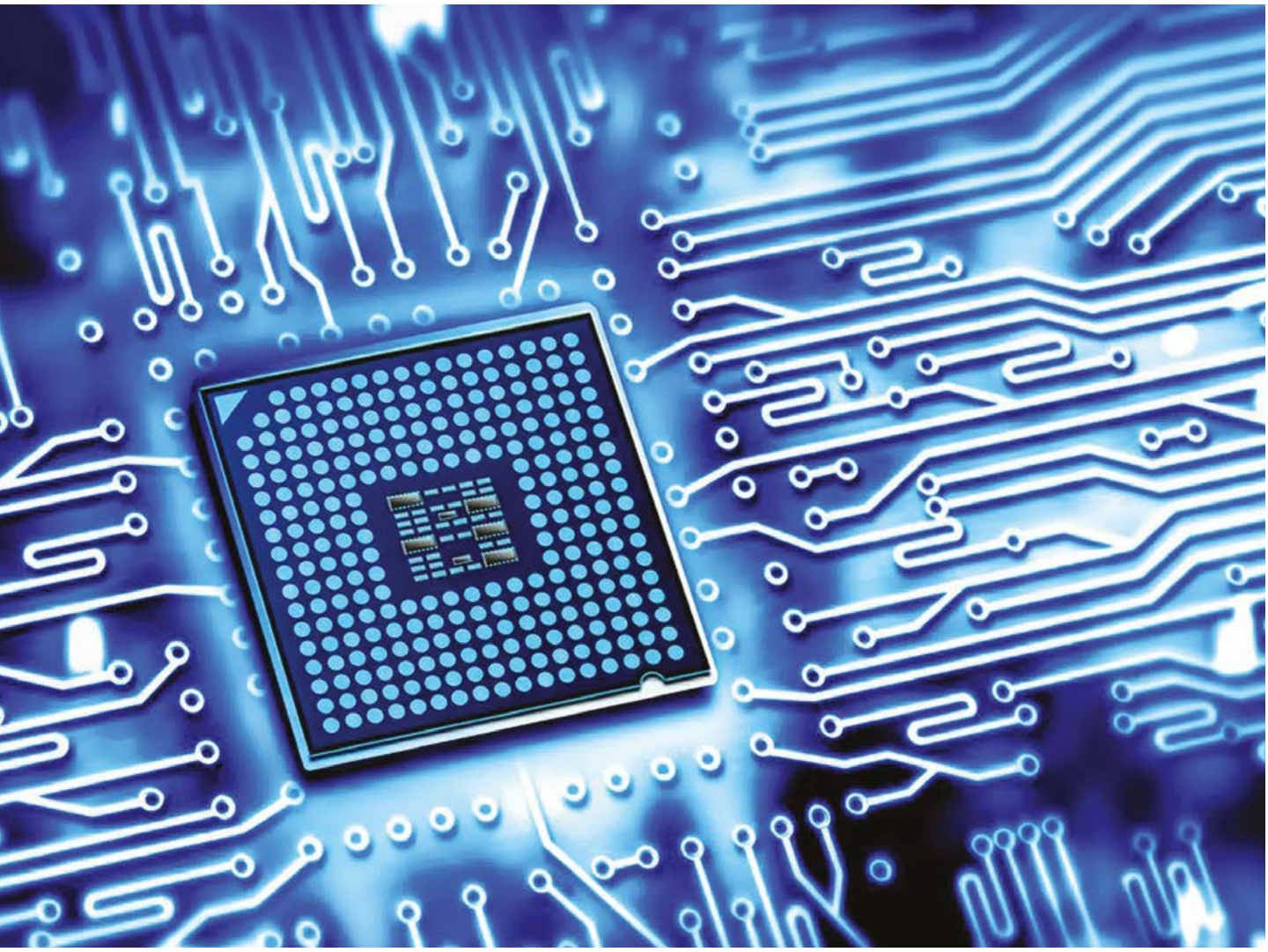
The offered solutions allow easy and quick adaption of the system for use on the main and industrial railway transport lines.

SAFETY

Safety of micro-processor based interlocking system is achieved by means of hardware redundancy (MBIS controllers, interface loops) and the use of the control policy «2 of 3».

RELIABILITY

Reliability of the UMBIS is provided by hot redundancy of all nodes of the system and structural redundancy of communication channels.
Continuous monitoring and diagnostics of microelectronic devices' state ensures timely detection and troubleshooting of pre-failure conditions.
The system features an effective surge protection, minimizing the impact of external interference on the microprocessor device.



RELAY PROCESSING BASED INTERLOCKING SYSTEM (RPI)

Relay processing based interlocking system is a system intended for modernization of the existing relay interlocking systems and achieving the new level of train traffic control remaining the base infrastructure of track assets.

Such control centralization allows hastening route preparation, improving traffic safety, reducing number of employees at the station and increasing station capacity.

Application of microcontrollers together with modern information technologies makes the system reliable and easy to maintain.

RPI system is intended for partial modernization of existing stations with any number of points, equipped with electric interlocking (EI), **remaining the existing trackside equipment in full**.

Implementation of the relay processing based interlocking system **is a quick** and **reasonable** move to a **new technological level** of automated control. Reliable and familiar for the staff relay schemes remain unchanged and upper level is operated on a new modern platform.

Substitution of geographical panel for a **modern, ergonomic operator's industrial computer based AWP** allows to use system intellectual interface.

SYSTEM FUNCTIONS

RELAY PROCESSING BASED INTERLOCKING SYSTEM PROVIDES:

- **process control of the trackside equipment** at the station;
- **monitoring of the trackside equipment** at the station;
- **safety train operation;**
- **trackside equipment diagnostics**;
- **communication with the systems** of the same or upper level (interlocking traffic control systems);
- **archiving the information** about trackside assets state, operators actions as well as troubleshooting data about the system objects.

SYSTEM COMOSITION

UPPER LEVEL

Upper level of the system comprises control equipment. The level of control equipment provides the substitution of the geographical panel with modern ergonomic automated computer based work places:

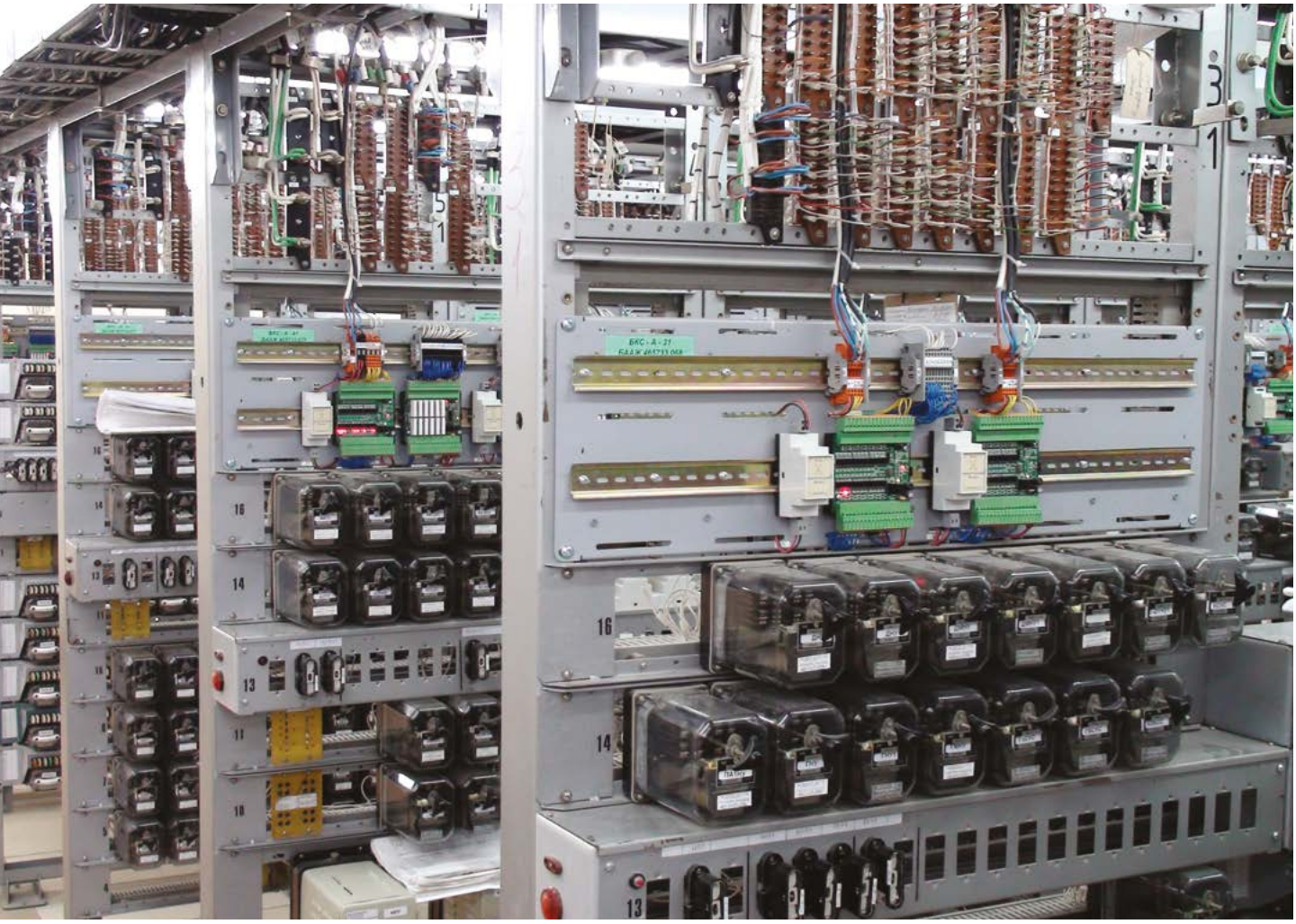
- main and back up station duty officer's AWP intended to carry on operating control of station RPI devices;
- AWP of the duty technician intended to provide control of the interlocking devices.

MIDDLE LEVEL

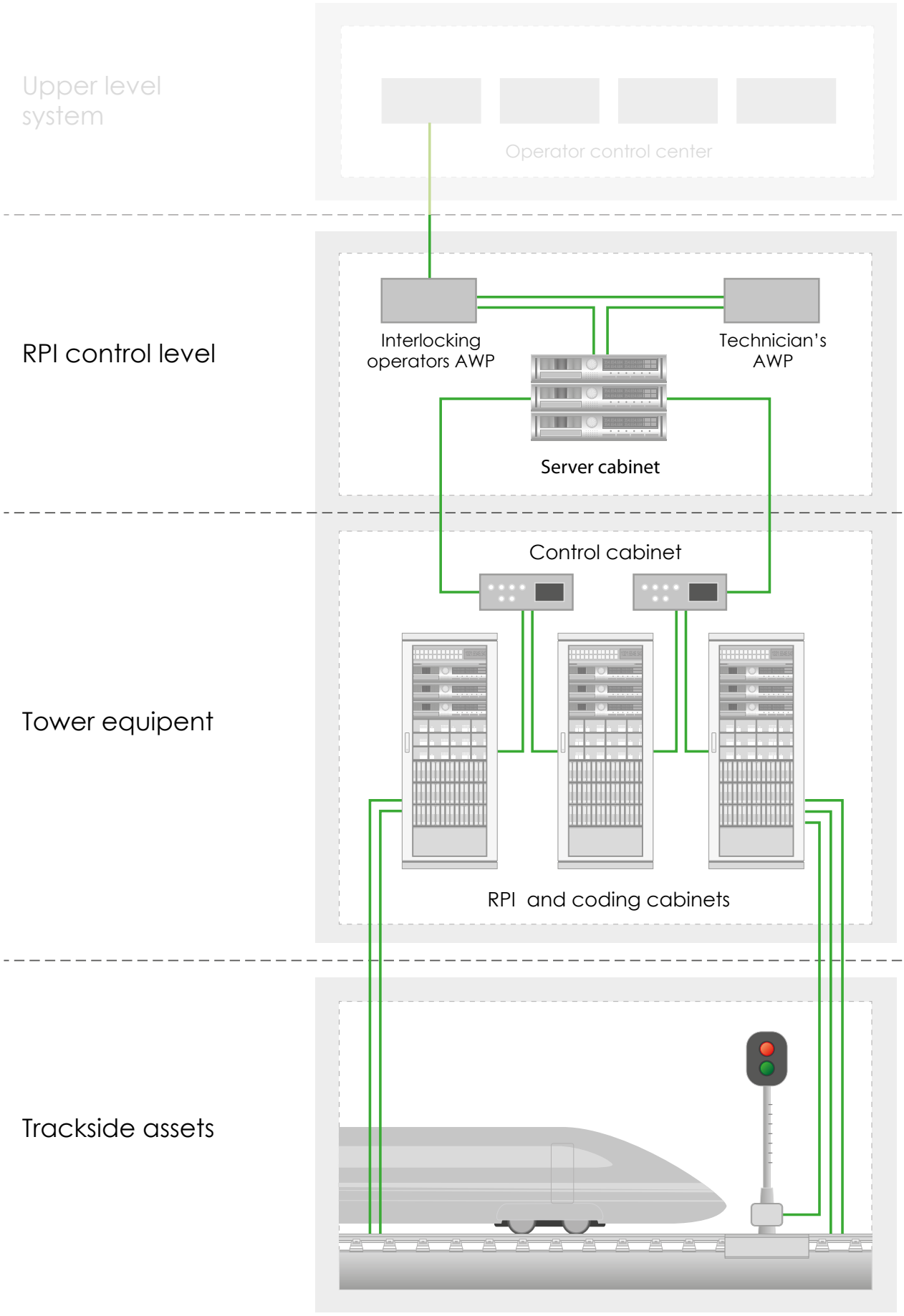
Middle level is hardware and software that ensures control of interlocking logic, sending of the control commands as well as provides connection between the systems. Microprocessor and relay processor based scheme equipment is presented on this level.

LOWER LEVEL

Lower level of the system includes control objects such as points, traffic lights, track circuits equipment (line boxes, impedance bond etc.).



RELAY BASED PROCESSOR INTERLOCKING (RPI)



ADVANTAGES OF THE RELAY PROCESSING BASED INTERLOCKING SYSTEM IMPLEMENTATION

REDUCTION OF POST SERVICE ROOM AREAS;

The implementation of relay processing-based technologies allows to reduce the sizes of service rooms;

SYSTEM MODERNIZATION

The system can be upgraded by protocoling, archiving (Black box function) and automation of route setting control.

MINIMIZATION OF HUMAN FACTOR

System intellectual interface minimizes the possibility of wrong or delayed duty operator's actions (voice hints or logical control of personnel actions);

INCREASED SCOPE OF THE INFORMATION

System implementation allows to increase information volume, provided on station-to-station blocks, crossings and other control objects;

HIGH RELIABILITY

System provides high reliability by means of the backing up of remote-controlled operation controllers and remote signaling controllers.

CBTC-L

CBTC-L system is a set of devices intended to position the train and transmit the information to the train, needed for optimal train control mode providing safety movement and using modern methods of data transmission.

CBTC-L PROVIDES:

- **control and indication of track section occupancy/vacancy** by using modern axle counting system technology by Frauscher (Austria);
- **data transmission to the train** using LoRa receiver-transmitters with ultralong action radius that ensures easy networking;
- **signal reception** from LoRa points in the CBTC-L area by equipping the cab with appropriate train equipment. The train is under control of current ACS system in a buffer zone, out of LoRa coverage area.

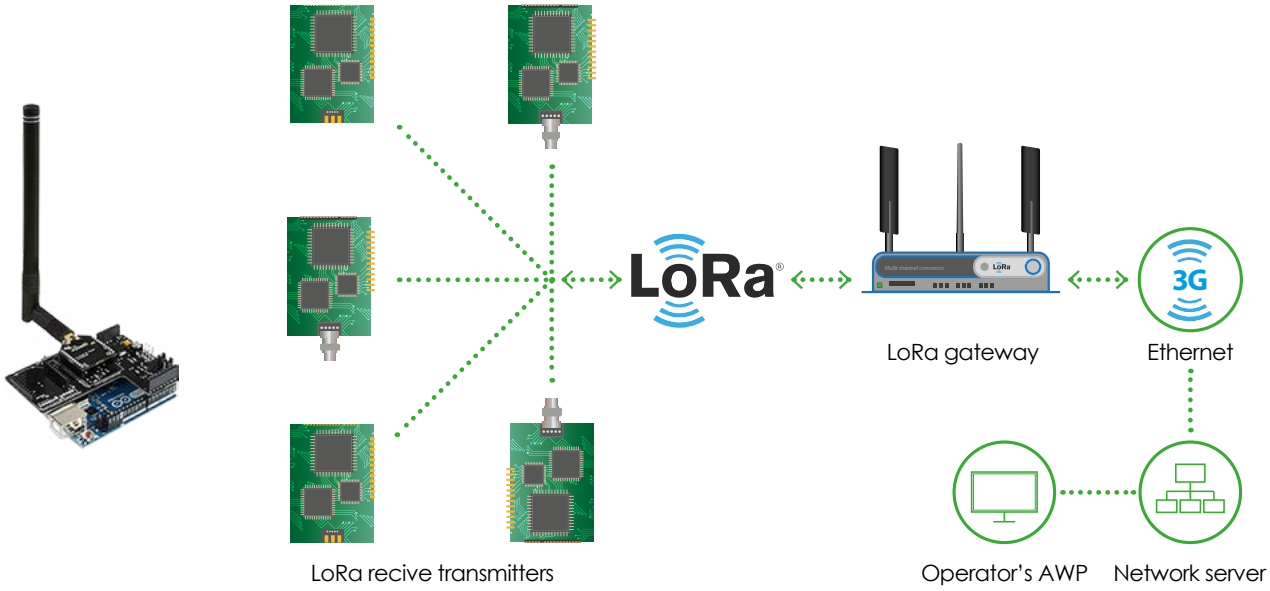
SYSTEM COMPOSITION

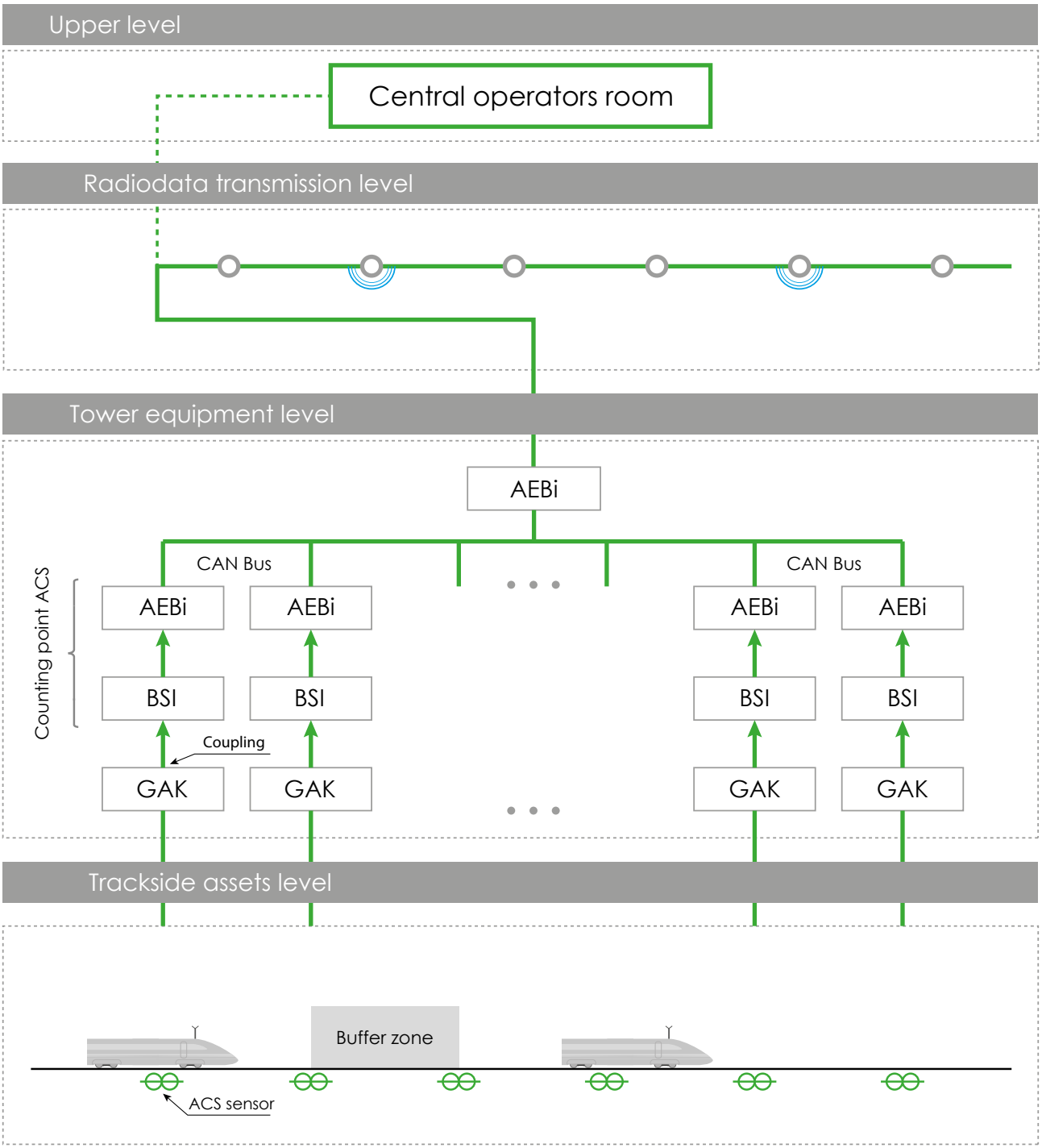
CBTC-L INCLUDES:

- **trackside assets** – axle counting system (to detect train location) и network of encoding points (receive transmitters using digital communication channel);
- **tower equipment** – counting heads of the axle counting system (located in the cabinets) and set of hardware and software that provides duplicate facilities and includes microprocessor based interlocking controllers;
- **on-board equipment** with cab antenna (that provides receiving of communication signal from the encoding points to the cab).

Encoding points (EP) interconnected into the groups by communication system based on modern LoRa communication technology.

LoRa (Long Range) is Low Power Wide Area Network developed by Semtech Corporation and IBM Research organization (USA).




Upper level
Central operators room
Radiodata transmission level
Tower equipment level
AEBi
CAN Bus
CAN Bus
Counting point ACS
AEBi
AEBi
AEBi
AEBi
BSI
BSI
BSI
BSI
Coupling
GAK
GAK
GAK
GAK
Trackside assets level
Buffer zone
ACS sensor

ADVANTAGES OF CBTC-L IMPLEMENTATION

POSSIBILITY OF THE SYSTEM IMPLEMENTATION WITHOUT SERVICE INTERRUPTION

CBTC-L development, mounting, testing and commissioning is carried out without service interruption due to the possibility of the system being integrated with the existing ACS equipment.

LOW OPERATIONAL COSTS

CBTC-L implementation allows to cut down the number of trackside assets; application of the industrial electronic equipment minimizes maintenance costs; modern diagnostic functions of the equipment allows troubleshooting beforehand to prevent possible failure; substitution of the faulty components can be performed without service interruption.

MODULAR PRINCIPLE OF THE SYSTEM

CBTC-L can be expanded to the full CBTC system with minimum investments.

OPTIMIZATION OF THE TRAIN CONTROL MODE

CBTC-L tunnel equipment provides coordinate referencing to the section and ensures train control in power efficient mode in terms of ASC system.

HIGH CARRYING CAPACITY

Implementation of the CBTC-L will allow to organize train movement with short intervals between trains and maximum permissible speed limit.

AUTOMATED CAB SIGNALING (ACS)

Automated cab signaling (ACS) is a rail transport signaling system, transmitting signal aspects to the rolling stock control station.

ACS SYSTEM PROVIDES:

- **signal aspect in a control cabinet** by the train, allowing the movement if there is a vacant section with the length not less than designed stopping distance with a speed limit or prohibiting the movement and demanding stop;
- **continuous control over keeping permissible speed** and automatic braking when overspeeding;
- **automatic train (stock) brake release** after speed reduction to the permissible speed;
- **train (stock) automatic braking** to the full stop: before occupied track section, before the section, where the track circuit is damaged, when the receive command signals are disrupted, before the traffic light with a red light, when overspeeding;
- **operator's alertness control** when ACS train equipment is detached.

ACS SYSTEM INCLUDES:

- field transmitting devices;
- receiving and decrypting devices, indicators, sensors and on-board executive devices;
- devices, that coordinates ACS operation with other components of signaling.

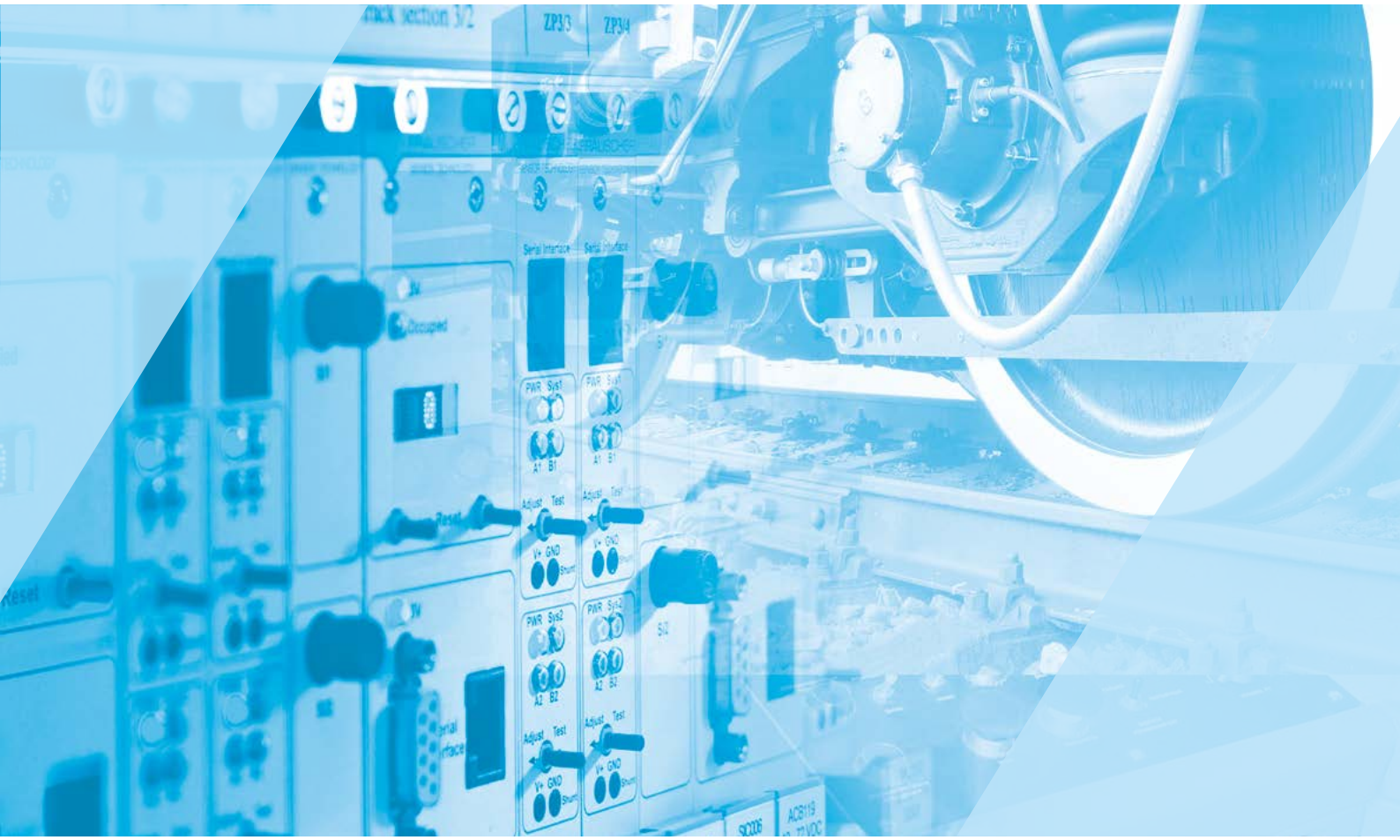
AXLE COUNTING SYSTEM

LOT Group uses Fraucher axle counting systems for all its rail transport solutions.

FRAUSCHER (FAdC) (Austria) axle counting system is a new axle counting system generation, based on the serial interface. It is used to control rolling stock passing **(control and indicate track sections vacancy/occupancy)** and to **determine movement direction**.

FAdC complies with SIL safety requirements.

System public communication interface provides optimal integration FAdC to railway automation and remote control systems.



AXLE COUNTING SYSTEM PROVIDES:

TRACK OCCUPANCY/VACANCY INDICATION

The main axle counting system function is to provide safety information about vacancy or occupancy of a certain track section. The system may control short hauls within stations as well as long sections between two stations or signal boxes.

INDIVIDUAL RESET PROCEDURES

Reset management offers numerous reset procedures to choose from.

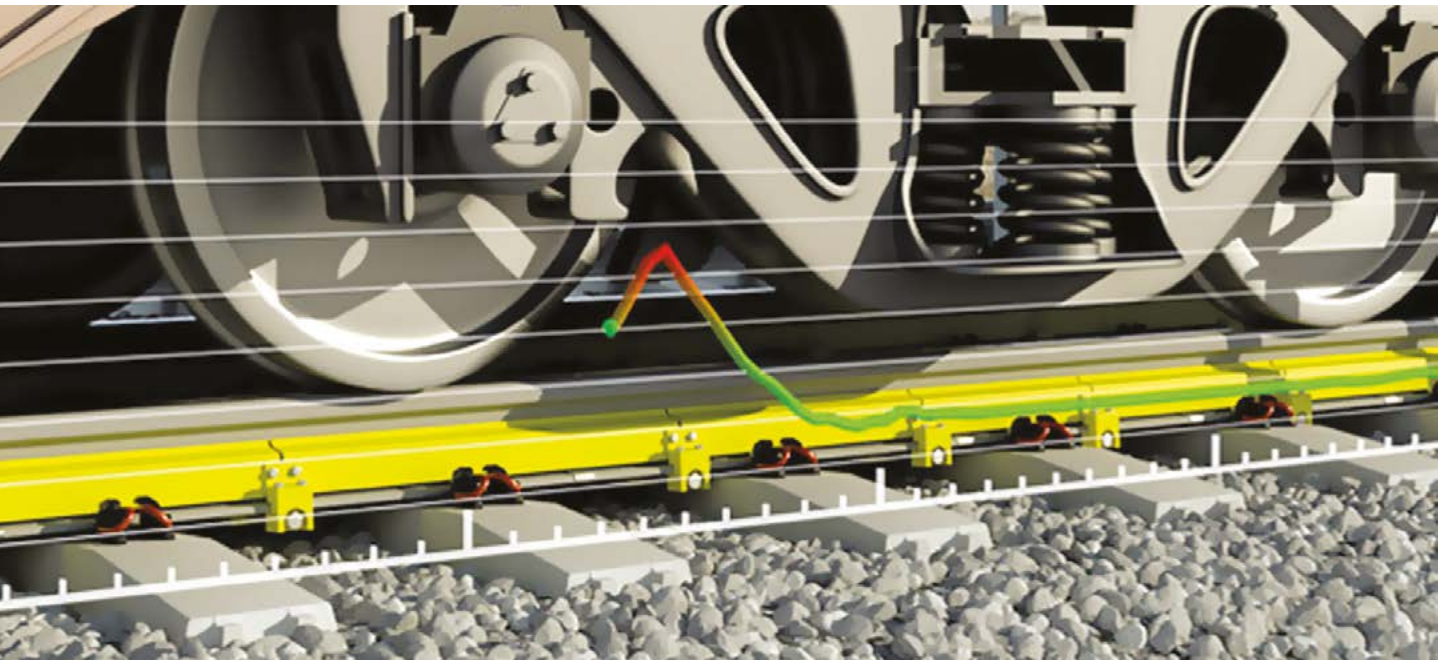
These can be selected and combined as desired directly from the interlocking, in line with current and individual requirements.

DIAGNOSTICS

Preventative maintenance, the optimization of fault rectification, unrestricted online access to data from the axle counter and the minimization of maintenance work lead to a reduction in life-cycle costs. The Frauscher diagnostics systems are designed for this. Using the software interface, it is possible to access all of the static and dynamic data from the individual boards. This means that all conceivable requirements of modern higher-ranking diagnostics systems can be met.

THE SYSTEM ALLOWS TO PROVIDE INFORMATION ABOUT:

- direction;
- detection of the wheel center;
- speed;
- counter status;
- wheel diameter, etc.



THE SYSTEM INCLUDES TRACKSIDE AND TOWER EQUIPMENT THAT CONSISTS OF:

- sensor installed on the track (using rail clamp);
- track adaptor junction box;
- cable laid between them.

Data from the sensor are transmitted to the tower equipment, where they come to the information processing module AEB.

This module performs both function of processing the information received from sensors and function of axle counting. Generated data are transmitted to the communication module providing transmitting of the received data to the system of upper level

ADVANTAGES OF THE AXLE COUNTING SYSTEM IMPLEMENTATION

possibility to determine movement direction, axle number and train speed;

digital communication interface, built-in internal self-diagnostics service;

low maintenance expenses, installation and exploitation costs;

fast system reset.

RAILWAY CROSSING CONTROL SYSTEM

Railway crossing control system is intended to control crossing signaling equipment set, allowing to transmit diagnostics parameters to dispatch level control systems.

RAILWAY CROSSING CONTROL SYSTEM PROVIDES:

- **control** of automatic crossing signaling equipment status;
- **connection to rolling stock passage control system** via wire or radio frequency data transmission channel;
- **connection to operating crossing signaling system** via status poll and relay equipment control;
- **connection to modern microprocessor based control systems** of higher level (possibilities of traffic control).
- **display** of system control parameters and haul equipment **on indicators**.

SYSTEM COMPOSITION

UPPER LEVEL

Upper level is intended for crossing control system connection to traffic control systems. The following sets can be added to the upper level optionally, depending on system configuration:

- crossing duty operator's AWP;
- upper level system AWP.

MIDDLE LEVEL

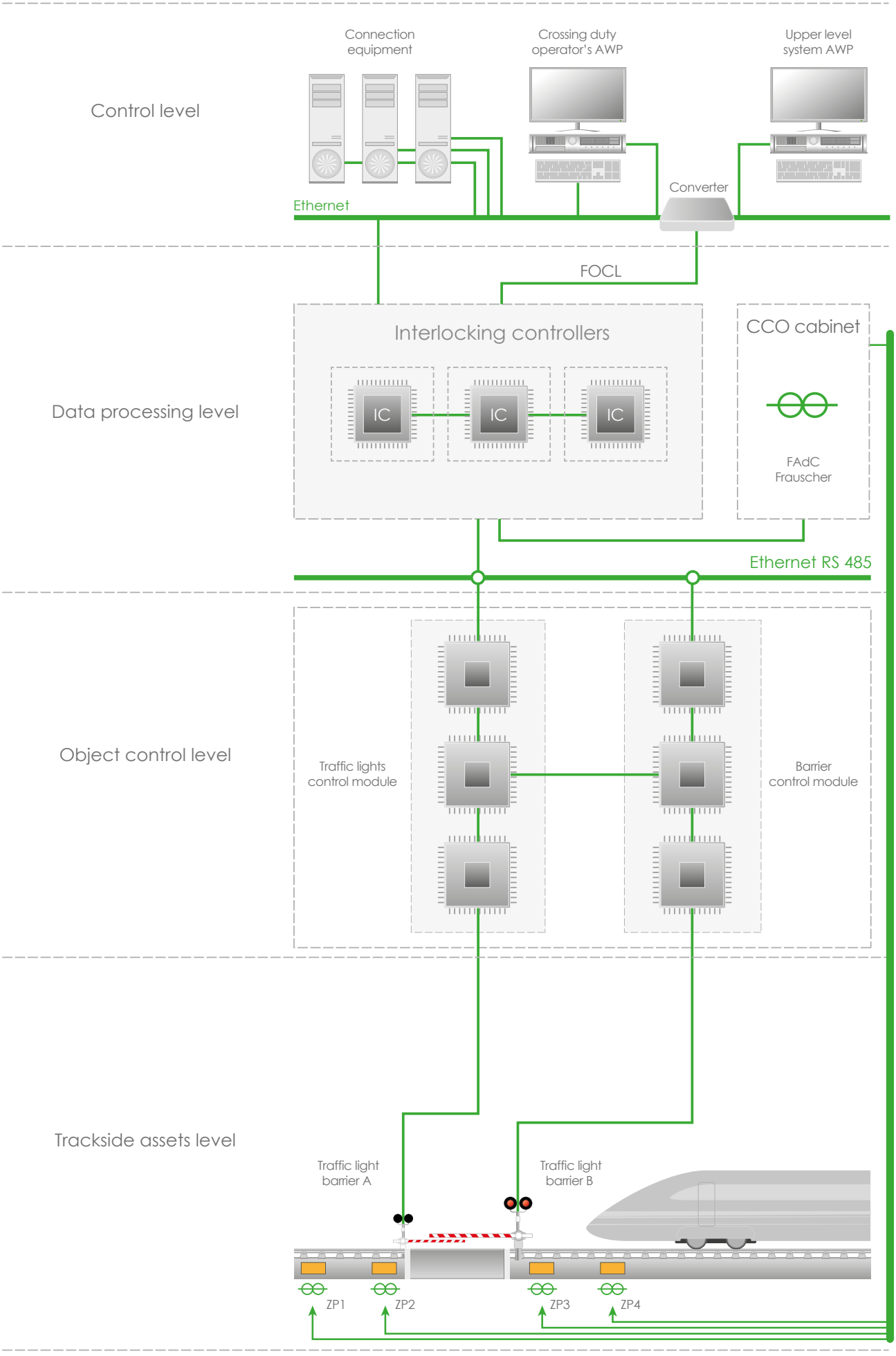
Middle level includes object controllers of crossing signaling and equipment set, providing data processing.

At this level logic data processing is carried out by crossing control controller and Frauscher system data processing modules.

LOWER LEVEL

Lower level includes trackside assets comprising:

- Frauscher ACS sensors;
- crossing signaling traffic lights;
- crossing signaling alarms (horns);
- automatic barriers (optionally);
- protecting signals (optionally).


Control level
Connection equipment
Crossing duty operator's AWP
Upper level system AWP
Converter
Ethernet
FOCL
Data processing level
Interlocking controllers
IC
IC
IC
CCO cabinet
FAdC Frauscher
Ethernet RS 485
Object control level
Traffic lights control module
Barrier control module
Trackside assets level
Traffic light barrier A
Traffic light barrier B
ZP1
ZP2
ZP3
ZP4

ADVANTAGES OF RAILWAY CROSSING CONTROL SYSTEM IMPLEMENTATION:

Railway crossing control system is autonomous and doesn't need to be connected to current automatic blocking systems.

The system allows to equip any crossing (guarded or unguarded) regardless the standard equipment installed on it.

ADVANTAGES OF SYSTEM IMPLEMENTATION:

system tolerance to equipment failures and elimination of critical failures on its outputs;

working efficiency control and failure warning of any system functional block (optical, sound) and the very system at all;

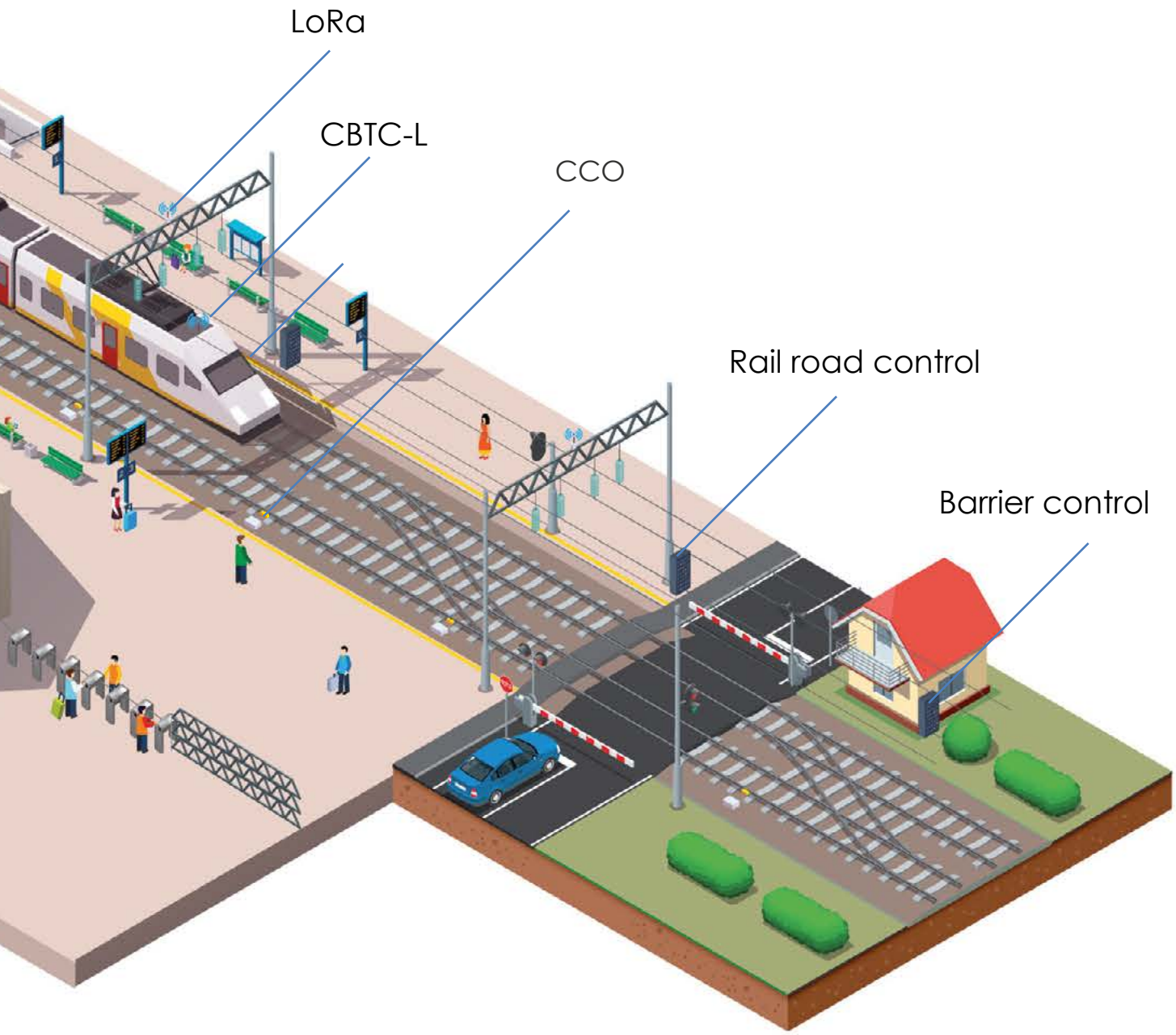
possibility of hot swapping of any system functional block in case of failure and repair;

switch to protection (close) crossing state in case of system equipment failure.

the equipment does not need manual setting during the operation lifetime.


BNSF


Passenger information system
TRAIN STATION
Operations Control Center
Technician's AWP
MPI cabinet
Unified precision time system
CCO cabinet
Operator's AWP


LoRa
CBTC-L
CCO
Rail road control
Barrier control

17, Drinova Lane, 61017
Kharkov, Ukraine
Phone: +38 (057) 714-22-88
+38 (057) 719-58-52
+38 (057) 719-58-53
Fax: +38 (057) 714-22-99
E-mail: info@lotgate.com
www.lotgroup.eu