Keep Your Connectivity **on the Right Track**

1 OCC & ISCS Comm.

OCC

Network Management
MXview

Industrial Server
HCP-710
(on request)

L3 Core Switch
MRX-Q4064

Wireless Access
Controller
WAC-2004A

Interlocking:
Local Control Computer
V2403C

ISCS: Computer
DA-682C

Subsystems
Subsystems

— Ethernet
— Fiber
— Serial
— I/O
— PoE

2 Network Backbone

Station A

L3/L2 Switch
RKS-G4000

Backbone

Station B

L3/L2 Switch
RKS-G4000

Backbone

GbE Turbo Chain

GbE Turbo Chain

Ethernet Switch
EDS-G4000

Ethernet Switch
EDS-G4000

4 T2G Comm.

Station C

L3 Modular Switch
MDS-G4000

Subnet C

GbE Turbo Chain

200-400 m

Station D

L3 Modular Switch
MDS-G4000

Subnet D

200-400 m

Trackside
11n AP
TAP-323

**Turbo
Roaming**

Trackside
11n AP
TAP-323

Onboard 11n
T2G Client
AWK-3131A-RTG

Secure Router
(Firewall)
TN-4900

Multi-WWAN
Computer
V3200

OCC

3 Interlocking System

Controller
ioPAC 8600

• Track Circuit Monitoring
• Dragging Equipment Detection
• Cold Rail Detection

Media Converter
IMC-21GA

Terminal Server
NPort 6650

Turnout

Level Crossing

5 Traction Substation

OCC **1 OCC & ISCS Comm.**

4 T2G Comm.

2 Network Backbone

3 Interlocking System

5 Traction Substation

IRIS Certification

EN 50155
EN 50121-3-2
EN 50121-4
EN 61375
IEC 62443-4-2

Moxa Rail **Global Credentials**
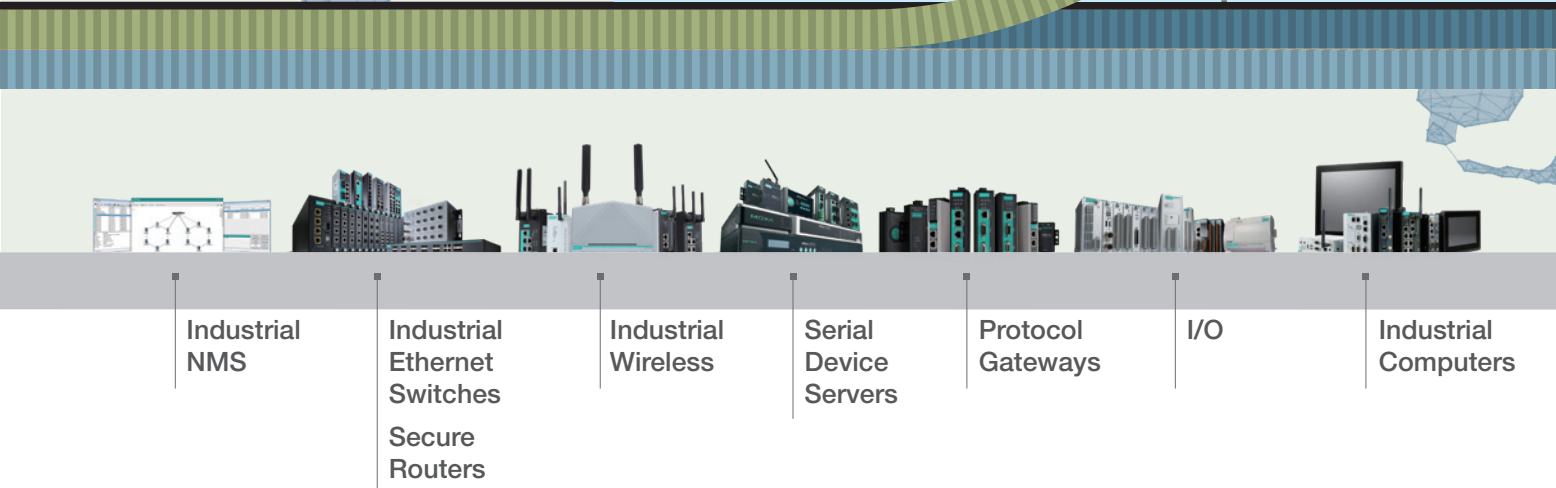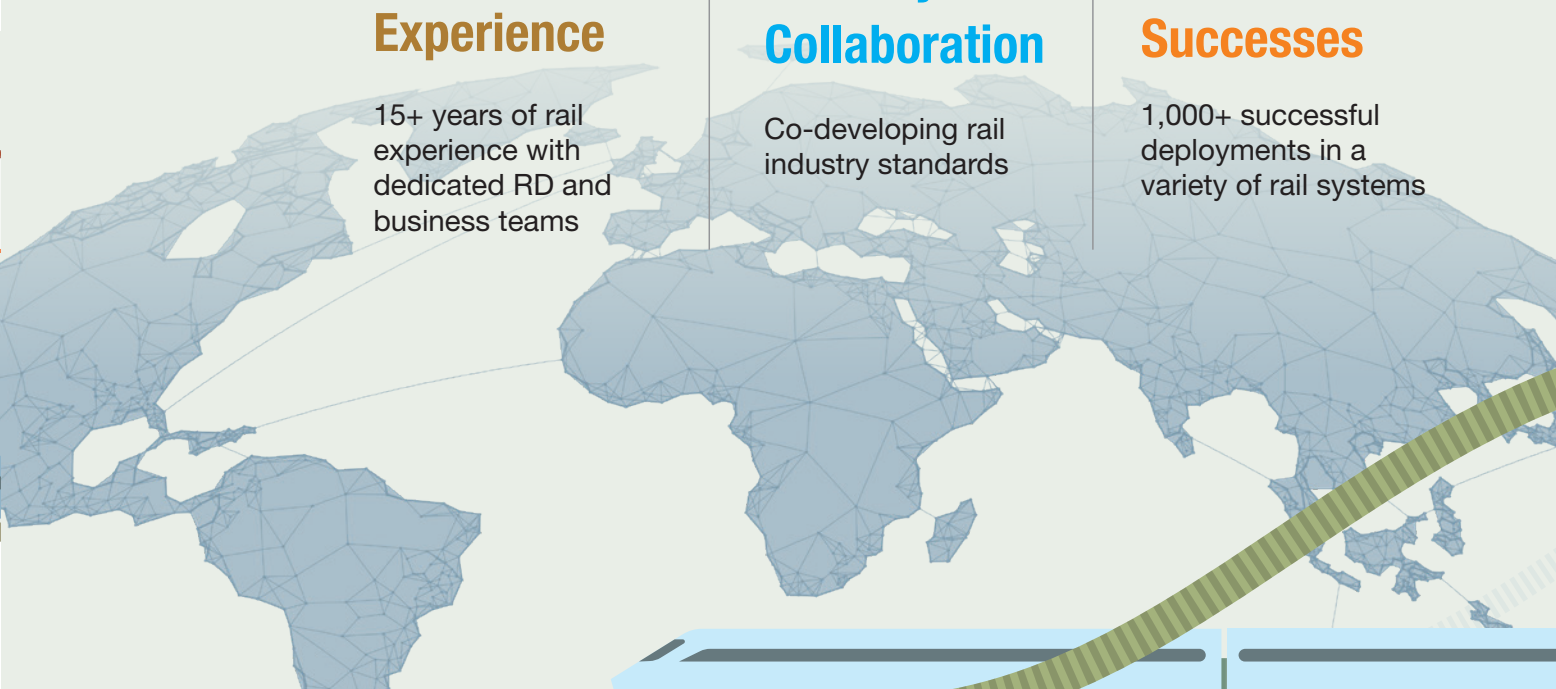
Extensive Experience

15+ years of rail experience with dedicated RD and business teams

Industry Collaboration

Co-developing rail industry standards

Worldwide Successes

1,000+ successful deployments in a variety of rail systems

Industrial NMS

Industrial Ethernet Switches

Secure Routers

Industrial Wireless

Serial Device Servers

Protocol Gateways

I/O

Industrial Computers

Keep Your Connectivity on the **Right Track**

FORGING MOBILITY AHEAD

En route to smarter, safer transportation

Seamless Train-to-ground Network Coverage

Train-to-ground (T2G) communication is an important part of onboard CCTV and PIS applications. Operators leverage the CCTV systems to check video footage when the train is on the move or at the station. When the train is docked at a depot, large amounts of video data is uploaded to the control center. For PIS systems, train-to-ground communication is crucial to keep information on the train up to date.

LTE and Wi-Fi are two leading technologies when designing T2G communication infrastructure. In some cases, customers may consider adopting LTE and Wi-Fi hybrid solutions for handling T2G communication in different situations such as when streaming to the OCC or when stationed at a depot.

Moxa provides options to cover both Wi-Fi and LTE needs.

Seamless T2G Communications
- Train-to-ground via Wi-Fi, 4G, or multi-WWAN

High Bandwidth
- 300 Mbps wireless 802.11n

Fast Roaming
- Controller-based Turbo Roaming for sub-50 ms handovers to transmit real-time video streams and data from trains to the OCC

## Enable Live CCTV Streams to the OCC Via Wi-Fi While on the Move

To enable seamless roaming over an average distance of 200 meters, trackside wireless APs are essential. The trackside radios, key components in this architecture, connect to ruggedized trackside backbone switches via fiber-optic connections for reliable and efficient communication.
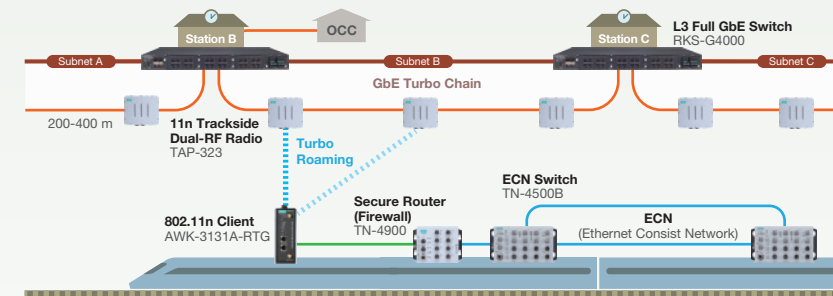
## Achieve Real-time Cellular Cross-regional Connectivity

Trains crossing different geographical regions will need to transition seamlessly between multiple regional network carriers.

Moxa's T2G computing platform meets the demand for resilient connectivity through support for up to three cellular modules and one Wi-Fi module. Designed for multi-network and transnational services, it enables seamless switching between carrier networks, ensuring uninterrupted data streaming and reliable connectivity for the train's operational and communication needs.
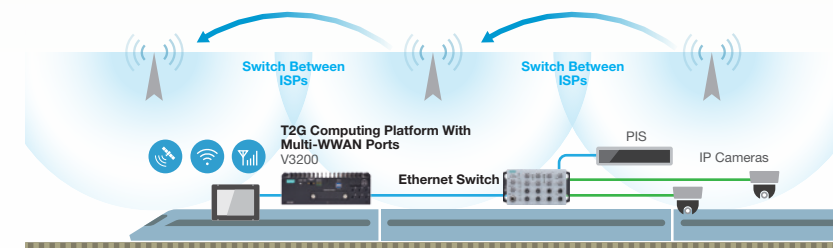
Offload CCTV Data to Stations/Depots via Wi-Fi

When entering a station or returning to the depot, the train offloads all onboard data via Wi-Fi. The 802.11n clients on the train connect to strategically placed APs at the station or depot to quickly offload all data to the local control center. Wi-Fi streamlines data transfers and reduces carrier service charges by minimizing cellular data usage during the offloading process.
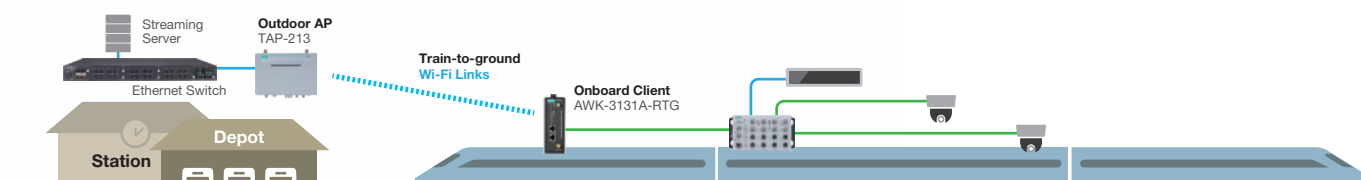
Resilient Redundancy Backbone

Broad Choice of Interfaces
- L3/L2 Ethernet switches with high-density 10GbE/GbE/Fast Ethernet/PoE+/fiber-optic connectivity

Solid Redundancy
- Gigabit Ethernet recovery times under 50 ms with Turbo Ring
- Unrestricted, flexible topology expansion with Turbo Chain

Robust Cybersecurity
- IEC 62443 security devices
- Vulnerability management

Build Resilient and Reliable Networks

To monitor the traffic and environmental conditions in real time, it's necessary to build resilient Ethernet networks with reliable backbone switches and data communication equipment to connect the various train subsystems such as station CCTV and AFC systems.
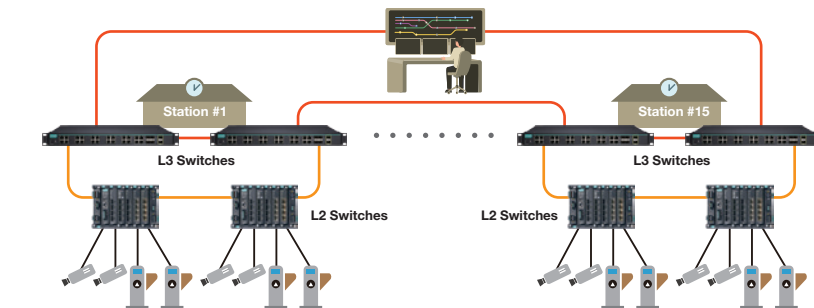
Simplified OCC & ISCS Communication Management

Wide Variety of Communications
- Wide media and protocol support
- Serial-to-Ethernet conversion
- L2 and L3 Ethernet switch options

Simplified Network Management
- MXstudio presents all network settings, conditions, and traceable records through a visual, engineer-friendly interface

OCC & ISCS Communication Management

The operations control center (OCC) is the brain that manages the day-to-day activities of transportation operators. Communication management is mission-critical for the OCC to ensure smooth operations, correct user access, and efficient management of local stations.

The integrated supervisory control systems (ISCS) enable centralized, local control as well as remote supervision of electrical and mechanical subsystems at stations.

These subsystems include tunnel ventilation, escalators, air conditioning, power supplies, lifts, fire alarms, lighting controls, and access management.
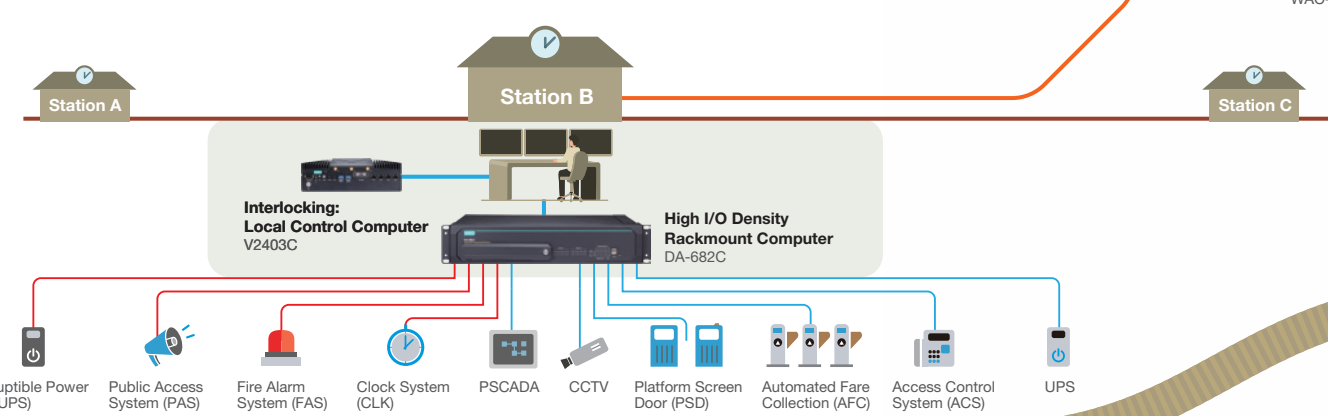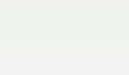

Safe Interlocking Control

High-bandwidth Wired Network
- High-performance 10GbE/GbE wired speeds

Exceed IEEE 1613 Class 2 Requirements
- NoiseGuard™: Wire-speed zero packet loss technology
- Layer 3 to protect against broadcast storms across stations

## Mainline Interlocking Network Communications

Interlocking systems are the core of route control for mainline and urban rail. They provide safe routes (pathways) by managing the condition of signals, points machines, level crossings, and all other field components.

A reliable communication network is necessary to transmit this condition data to the control center, allowing operators to manage these systems efficiently.
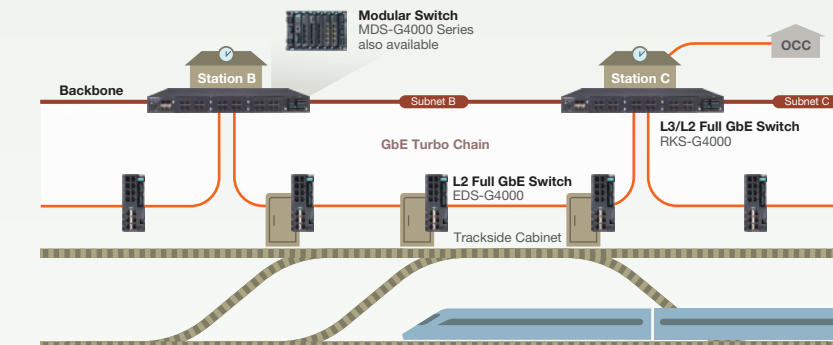
Interlocking Control System

The signal apparatus arrangement prevents conflicting movements in track configurations. Trackside equipment, including turnout control and ATP, connects to a Layer 3 Ethernet switch. The interlocking system, at the core of signaling, gathers and processes data from trackside equipment via the Ethernet switch. It converts this information and transfers relevant data to CTC through networking. The Layer 3 Ethernet switch manages both intra-station and inter-station networking, utilizing routing protocols and VLAN segregation for efficient information flow.
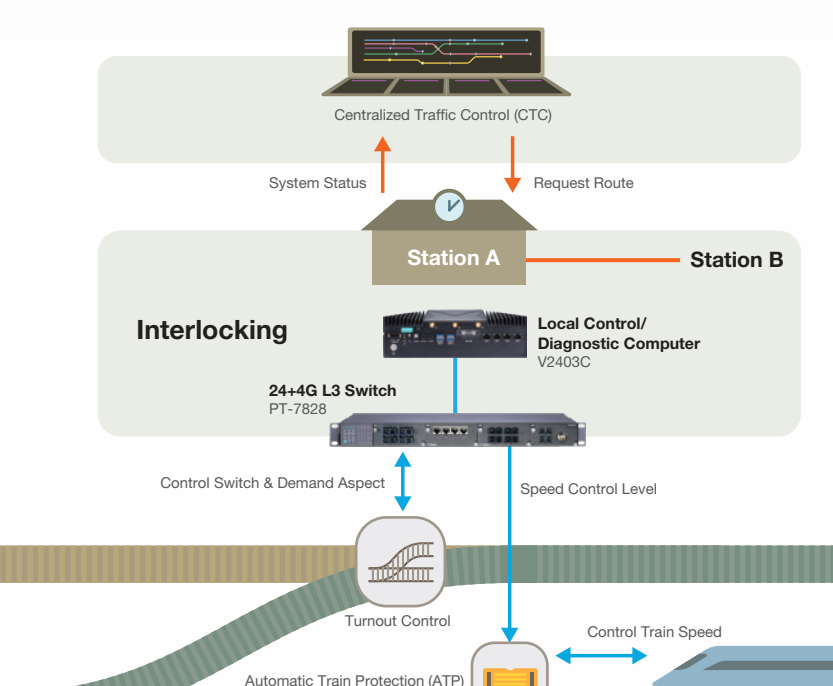
Superior IEC 61850 Substation Deployment Experience

Solutions for IEC 61850 Traction Substations

Primary and secondary traction substation equipment, interface standards, and technical equipment levels vary between different regions. To address this issue, IEC 61850 provides a common standard for substation communication systems. This aims to streamline communication between widely accepted existing standards, achieve interoperability between intelligent electronic devices (IEDs) from different manufacturers, and adapt to rapid developments in communication and application technology.
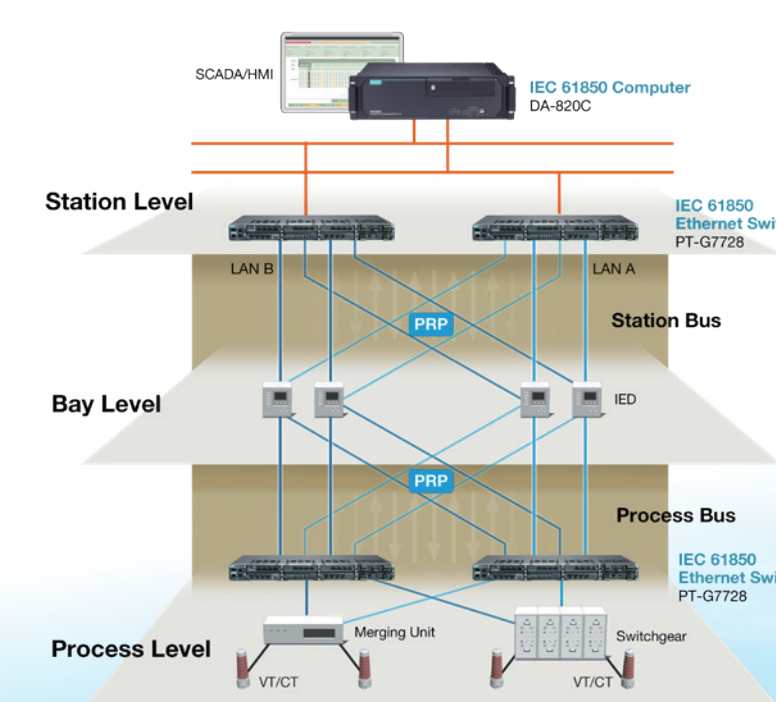
About Moxa Energy
- 15+ years of experience in the energy industry
- 9000+ SAS deployments worldwide
- Dedicated Energy business team
- Participation in international associations and organizations (IEC, WG, CIGRE WG, UCAIug)
- Leader in IEC 61850 and PRP/HSR communication and computing technologies