DYNAMIC COMMUNICATIONS FOR URBAN AND MAIN LINE RAIL

Ensure on-time, safe and connected journeys

Alcatel·Lucent

AT THE SPEED OF IDEAS™

Railway operations are becoming increasingly automated and integrated through Information and Communication Technology (ICT). Advanced signaling, asset management and improved video security all put tremendous pressure on existing networks. Meanwhile, your passengers are demanding to be connected, informed and entertained. As a railway operator you need to deal with these complexities – improving capacity, maintaining punctuality and enhancing safety while reducing costs and carbon footprint.

The solution: Dynamic Communications for on-time, safe and connected journeys.

DYNAMIC COMMUNICATIONS FOR URBAN AND MAIN LINE RAIL

With more people taking trains, and more trains running under aging, disparate infrastructures, many railway operators find themselves struggling to balance the operational efficiency, safety and passenger priorities that span every aspect of their organizations.

- **On Time:** Passengers want to know that their trains are running on time and expect to get scheduling information anytime, anywhere – from multiple sources and on any device. Unscheduled maintenance and on-track breakdowns must be avoided, with potential problems being automatically detected and addressed immediately.
- **Safe:** A higher volume of trains means they need to run faster, on time and more safely on the same tracks. 360-degree situational awareness, including closed-circuit television (CCTV) and other systems, has become a safety and security "must-have" in the station, along the tracks and on the trains. Cyber-security is an increasing threat in a world where advanced systems are all inter-connected.
- **Connected:** Passengers today expect always-on, anywhere, real-time multimedia services available at their fingertips.

Meeting escalating passenger needs and expectations while ensuring efficient operations with outdated and disparate systems is further straining railway personnel and budgets. To remain relevant, railway operators need to do everything they can to manage obsolescence while cost-effectively increasing operational efficiency. To increase and diversify revenue, they need to tap into new and non-traditional sources.

As railway operators look for ways to address their challenges, they increasingly are realizing the essential role of communications in optimally managing their rail infrastructure and operational assets.

Rail is vital to the well-being of Europe's society and the strength of its economy. To maintain and develop this role in the future, the sector has identified the significant challenges that it needs to meet to protect the social, economic and environmental fabric of society and develop rail as a transport mode.

SOURCE: UIC ENEWS 334 – FEB 2013

-60%
CUTTING EUROPE'S CARBON EMISSIONS IN TRANSPORT BY 2050
European Commission objective

2x
DOUBLING THE MARKET SHARE OF PUBLIC TRANSPORT WORLDWIDE BY 2025
UITP strategy

By 2050, **70%** OF EVERYONE ON THE PLANET WILL BE AN URBANITE.
United Nations

2%
COST OF CONGESTION OF THE NATIONAL GDP
UNIFE

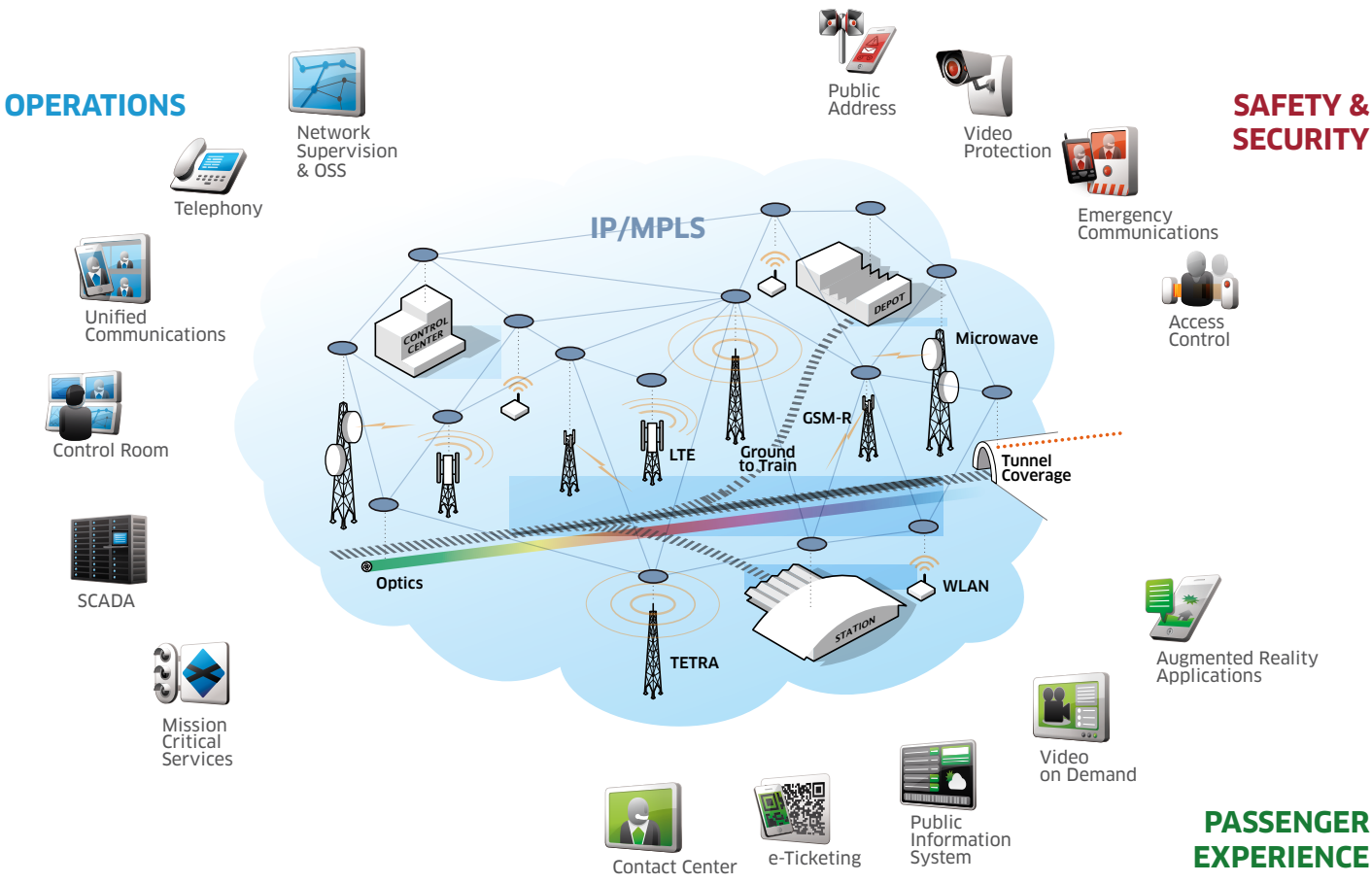
THE CRUCIAL ROLE OF COMMUNICATIONS IN URBAN AND MAIN LINE RAIL

Now more than ever, communications is a strategic asset for all railway operators and is central to their evolution. Over time, railways have built single-purpose networks to support specific applications. Now, with employees retiring and suppliers ending their support, operating and maintaining multiple legacy networks has become complicated and costly. In addition, with applications such as CCTV, passenger infotainment systems and advanced signaling and control systems moving toward IP-based communications, the bandwidth and management burden on existing networks grows. These networks were simply not built to handle the high traffic, and they provide little flexibility for integration of new services including video, data and voice.

Today's leading railway operators recognize the benefits of moving to a fully converged, scalable and multiservice communications infrastructure based on IP and Multiprotocol Label Switching (MPLS). For some, the first step in the migration to an all IP network lies in extending their existing Synchronous Digital Hierarchy (SDH), Synchronous Optical Network (SONET) optical infrastructure, or moving to a hybrid communications infrastructure that combines SDH/SONET and IP/MPLS.

Shifting away from multiple application-specific networks to a single, converged communications infrastructure creates a strong foundation for integrated communications and applications across all areas of railway operations.

- **Operations:** A robust communications network supports new-generation applications for unified communications and control, including signaling, SCADA, telephony and network supervision.
- **Safety and Security:** Safety and security are enhanced through sensors and video protection throughout the network, as well as through emergency communications and sophisticated access control.
- **Passenger Experience:** Applications for e-ticketing, smooth customer service, on-board entertainment and ubiquitous connectivity enhance the end-to-end passenger experience.



OPTIMIZE OPERATIONAL EFFICIENCY

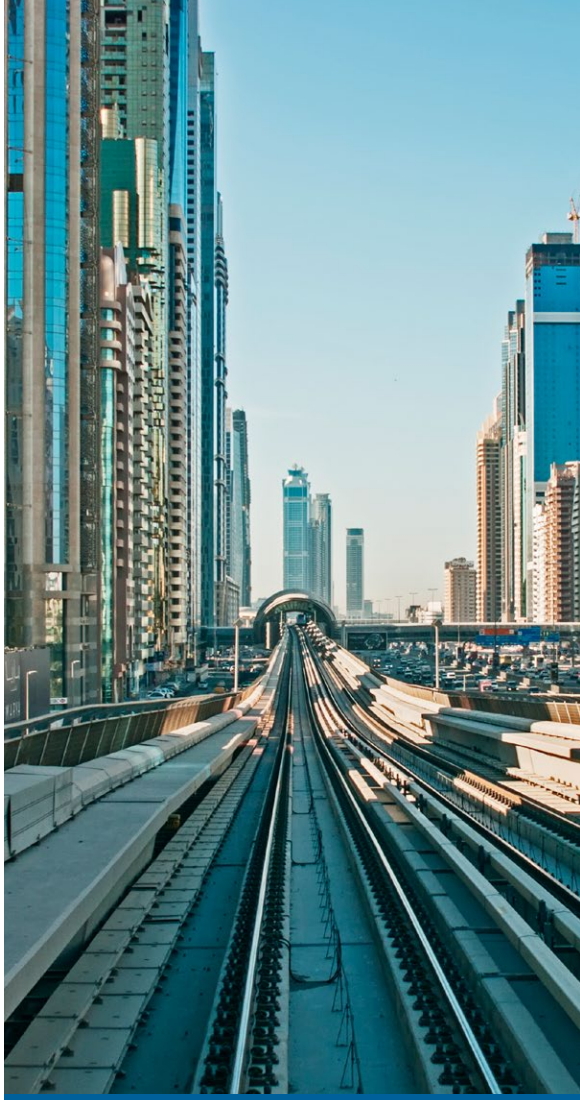
Dynamic Communications ensures reliable service by providing travelers with easy access to schedules, e-ticketing, interactive digital signage, websites, and timely communications via social media, email, phone and SMS – all while delivering to railway operators a highly resilient telecom infrastructure with advanced system maintenance, fault and repair management. A high-speed and high-capacity communications network allows railway operators to take full advantage of real-time information and video to ensure operations run smoothly.

Ground-to-train communications, which rely on wireless technologies (2G/3G/4G, LTE, Wi-Fi) and satellite to tie back into the backbone network infrastructure, enable real-time access from the control center to on-board information, in order to visualize the trains, their route, speed, and to anticipate or detect an emergency situation.

Always-on information and video from track patrol teams allows operators to proactively detect and track performance issues and remotely troubleshoot equipment faults. Other efficiency-enhancing applications and services that benefit from a high-speed and high-capacity communications network include:

- Equipment telemetry
- Rolling stock management and maintenance
- Track management and maintenance planning
- Freight and asset tracking
- Route planning and timetables
- Driver performance assessment and training
- Automated passenger services
- Station crowd management

Unified management of IP/MPLS, next generation wireless networks and the services they enable also increases operational efficiency with automated test suites, real-time statistics and enhanced alarm correlation, allowing managers to quickly pinpoint and resolve problems before they affect railway operations or passengers. An operations support system (OSS) can improve efficiency further by providing a single point of management for the next-generation network as well as for other subsystems such as distributed antenna systems, CCTV monitoring, advanced video analytics, private mobile radio (PMR), public address systems, passenger information displays and telephony systems.



"The ability to progressively and efficiently migrate all traffic from several legacy data and voice networks to a single, more efficient network will help us offer the citizens of Sweden an even more efficient and safe railroad network."

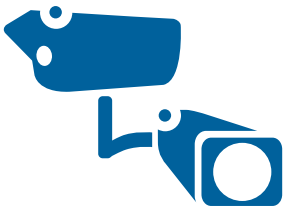
BENGT VIDIN, DEPUTY HEAD OF OPERATIONS, TRAFIKVERKET

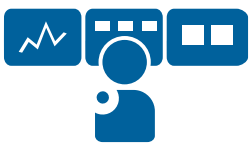
IP technology is irreversible. This is followed by Railways networks, when renewed or when new lines are implemented.

SOURCE: UIC. IP INTRODUCTION TO RAILWAYS – GUIDELINE FOR THE FIXED TELECOMMUNICATION NETWORK – MARCH 2012

"IP-based networks are invaluable in the context of a multi-user network because they allow information to be disseminated easily between stakeholders. An IP/MPLS backbone is also the best way to ensure permanent evolution of the information systems as new security applications emerge."

JACQUES COLLIARD, MANAGER OF SECURITY DIVISION, INTERNATIONAL UNION OF RAILWAYS (UIC)





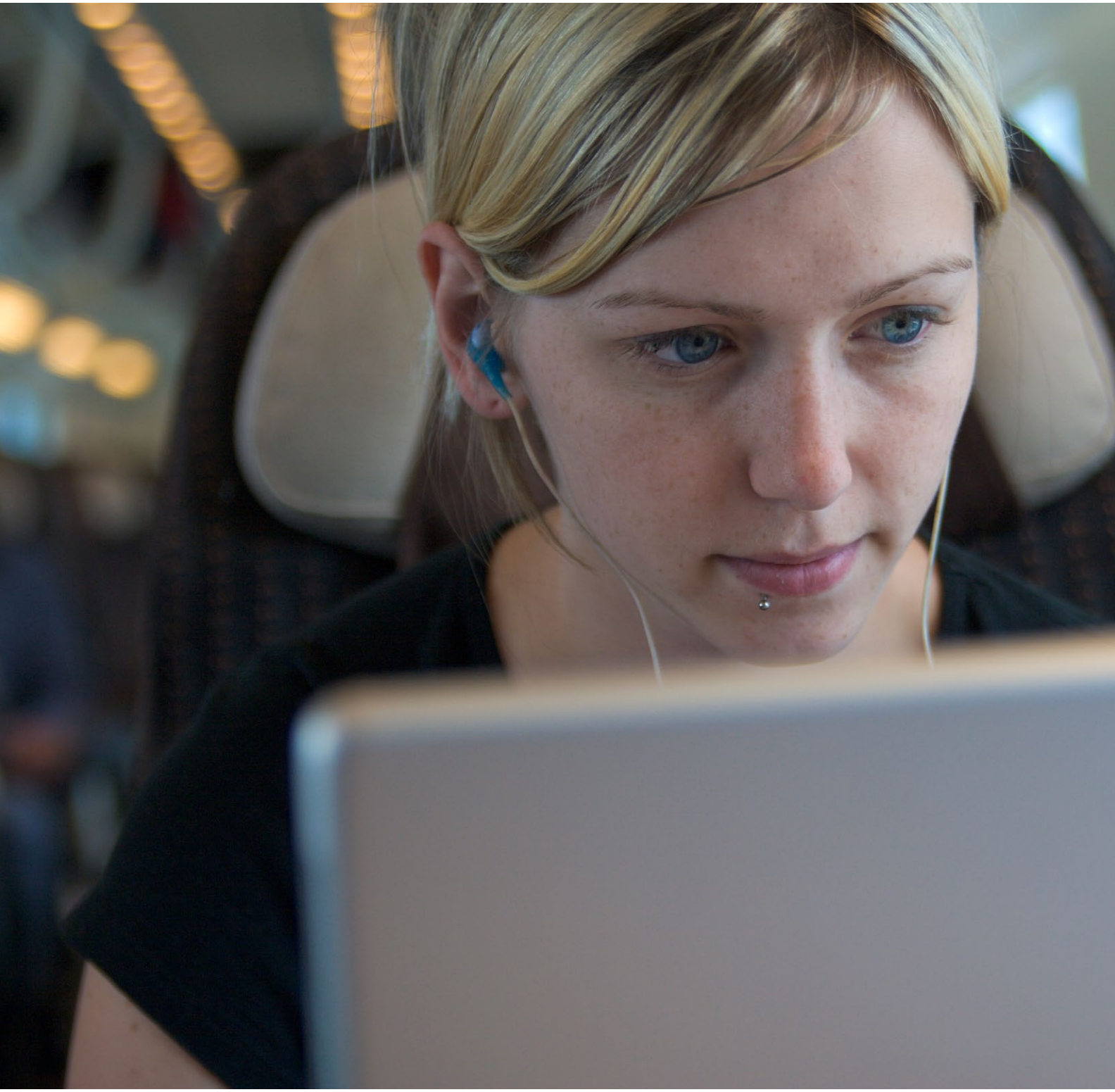
GUARANTEE SAFETY AND SECURITY

The communications network forms the critical link between and among the systems that railway operators use to ensure the safety and security of all aspects of their operations.

- **A flexible IP-based communications network** allows operators to safely run more trains on the same tracks using next-generation signaling systems, communications-based train control (CBTC), such as the European Rail Traffic Management System (ERTMS/GSM-R) telemetry, and Supervisory Control and Data Acquisition (SCADA) systems.
- **A reliable IP/MPLS backbone network** provides fail-safe reliability features, such as fast reroutes around problem areas and the ability to segment the network based on critical priorities. This critical capability allows railway operators to safely migrate control, security and information systems onto a single communications infrastructure.
- **Hundreds of thousands of CCTV cameras**, access controls and general alarms keep people and assets safe and secure, generating high volumes of voice, data, and video traffic that is rapidly and reliably transported back to the operations center for analysis.
- **Integrated management capabilities** allow optimal use of CCTV footage, access control breach detectors and fire alarm sensors. Data and video analytics software automatically notifies the security subsystem management platform if it detects images of significance, such as an abandoned bag, a lonely child, loitering, suspicious elements or behavior or an altercation.
- **People and assets are protected at all times** by a communications network that interconnects motion detectors, Terrestrial Trunked Radio (TETRA) and P25 mobile radio communications, help points, fire protection systems, tunnel ventilation, environmental control systems, public address systems and platform doors at stations.
- **Specialized radio frequency (RF) cable antennas in tunnels**, railway operators deliver uninterrupted on-board services and emergency communications – all connected to a single, IP-enabled backbone network.
- **Segmented virtual private LANs with firewalls** separate safety-critical operations, such as CCTV, from non-critical capabilities, such as Wi-Fi for passengers, and provide essential cyber security. Networks comply with all rail security standards and offer very high resiliency, fail-safe modes of operation and rapid recovery from failures.

In today's world, video surveillance in the stations, along the tracks and on the trains is no longer optional. Switzerland's SBB needed to monitor a popular shopping and service area at the largest of its 750 stations. With an Alcatel-Lucent IP-based video surveillance solution protecting this key location, secured surveillance data can now quickly be made available to authorities in case of incidents. The fact that the solution was based on IP was very important to SBB. "Our requirements demanded a system that was fully multimedia-capable, not a hybrid solution."

ANDREAS THURNHEER, DIRECTOR OF SBB'S SERVICE CENTER FOR INTERVENTION AND DISTURBANCE MANAGEMENT



"With many professional radio associations endorsing LTE as the preferred technology for a public safety broadband network, there is huge potential demand for both mission-critical and consumer-friendly applications."

ANTONIO BERRIOS VILLALBA, ADIF'S HEAD OF INNOVATION AND TECHNOLOGICAL DEVELOPMENT

ENHANCE PASSENGER EXPERIENCE

Passengers all over the world want the same thing – a connected journey that is easy, safe and enjoyable. They want trains that run on time, with frequently displayed and accurate schedule information. They also desire and increasingly expect access to communications services that let them stay in touch with colleagues and friends throughout their journey.

With Dynamic Communication solutions, a single smart network enables a fully connected travel experience, putting real-time multimedia services at passengers' fingertips while generating new revenue from advanced and innovative services such as:

- Digital signage, dynamic advertising in stations, on platforms, in tunnels and on trains
- Highly accurate arrival and departure information delivered to any medium and device – from station signage to smartphones and tablets
- On-board communications services, such as continuous mobile phone service and Internet access through the combined Wi-Fi and cellular services for seamless connectivity
- On-board speed and location information from trains on the move
- On-board entertainment, such as gaming and high definition video-on-demand
- Automated ticketing and payment services on a single user-friendly platform, accessible from any device
- Multimodal information and assistance to commuters through multimedia contact centers and interactive kiosks

Wireless broadband technologies, such as Long Term Evolution (4G-LTE), will also increase quality of experience (QoE) further, enabling railway operators to reap additional revenue from premium services and allow them to plan for and sell excess network capacity to ISPs, private industries and cable companies.

PARTNERING IN EVERY STEP OF YOUR RAILWAY'S TRANSFORMATION

As railway operators evolve and modernize their communications network, they need an experienced and trusted partner to accompany them on their journey. Alcatel-Lucent works closely with railway operators to understand their challenges and priorities and to develop a joint strategy for transformation. With over a decade of experience in transportation systems integration, we combine our strength as a global telecommunications leader with our ability to offer local expertise in hundreds of countries around the world. Today, more than 80 railway operators worldwide, including the largest metro and the longest rail tunnel operators, are successfully running mission-critical communications networks built with Alcatel-Lucent's expertise.

Throughout the partnership, we maintain a strong focus on the railway operators' priorities for safety, security, efficiency and connected journeys. Based on a deep understanding of cyber security requirements, we provide security consulting services, advice on selecting and deploying firewalls and gateways and the knowhow required to implement IP-based video surveillance and access control across the communications network.

We also recognize the importance of planning a gradual, flexible and scalable transformation that considers legacy technologies and is based on return on investment. Whether it is the transformation from legacy to full IP based technologies, to Cloud services, to Software Defined Networking (SDN) or Network Function Virtualization (NFV) platform, Alcatel-Lucent designs the turnkey solution which keeps railway operators ahead of the technology curve, enabling passengers to travel safely, on time and with maximum operational efficiency. To increase the value of the partnership, our capabilities include helping railway operators establish new processes and train their workforce to support new technologies and processes – an end-to-end service approach.

"Alcatel-Lucent's solution offered us simplicity of installation, robust equipment, and added value for our customers because it meant we could offer services that were not possible with the old system."

JOHN KEEFE, COMMUNICATIONS DIRECTOR, EUROTUNNEL

ALCATEL-LUCENT COMMUNICATIONS SOLUTIONS FOR URBAN AND MAIN LINE RAIL

Alcatel-Lucent is the trusted transformation partner of railways operators around the globe, having managed more than 2,300 network migration projects across multivendor platforms. With a global expertise, local presence and a history of successful deployments in highly challenging mission-critical environments, Alcatel-Lucent leverages the unrivalled technical and scientific expertise of Bell Labs, one of the largest innovation powerhouses in the communications industry.

As network integrator, Alcatel-Lucent provides the expertise, leadership and breadth of capabilities needed to design, integrate, deploy and maintain communications solutions that meet the requirements of each and every railway project.

A trusted partner, Alcatel-Lucent understands the stringent requirements of urban and main line rail operators like no other and brings to each project an unrivalled expertise in customizing mission-critical communications systems. By working with Alcatel-Lucent, railway operators are guaranteed a project schedule on which they can depend, a single point of contact and improved risk management to develop and customize the best possible solution.

www.alcatel-lucent.com/railways

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