

Dynamic Communications for Urban and Main Line Rail

Make each journey on time, safe and connected



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Agenda

Rail operators challenges and the role of telecommunications
Alcatel-Lucent's promise and value to rail operators
Dynamic Communications for Urban and Main Line Rail - Overview
Critical WAN Infrastructure - In Depth
How operators are using Critical WAN Infrastructure
References and takeaways

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Rail Operators' Challenges

The strategic role of telecommunications



Railways face increasing pressures

1. Government is looking to rail as part of the solution for the environment

- Rail instead of building roads / part of an efficient economy

Rail from a customer perspective

- Passenger comfort features (in station, on board, via mobile)
- Personal security and safety, video surveillance (in stations, on board)
- Comprehensive real-time information

Rail as a service

- On time running, new competition (other rail operators, other modes of transport)

4. Rail as a business

- OPEX reduction
 - Telecommunications contributing heavily to competitiveness
 - Legacy technologies incrementally more expensive to maintain
 - Labour - management, cost and retention
- New revenue sources
 - Sell telecommunications capacity to ASP and ISP customers

Need to be leaner, more efficient and more commercially aware

Railways need flexibility for the future - Telecommunications is critical

1. Life expectancy

- Acceleration in telecommunications in last 30 years - contrasts with rail where “only change it when absolutely necessary” is prevalent
- Existing systems are old, some poorly documented, change can be risky

 **Standards** - safety and interoperability standards in addition to traditional telecoms standards (e.g. GSM-R vs. GSM)

 **Environment** - more controlled physical and electrical (EMC) environments

 **Next Generation Signalling Requirements** - complex signalling/comms interactions (radio-based...)

 **Next Generation Control and supervision** - in control of the system at all time

Railways must deliver safety critical applications

Mission critical control

Signaling, Interlocking, SCADA, doors

Security

CCTV, Access Control, Fire Detection, Emergency Systems, Connections to Police or emergency services

Communications

Driver communications, TETRA, GSM-R, passenger comms, corporate LAN, telephone and call centers

Other operations and maintenance

Predictive asset management

Passenger Information and comfort

Ticketing, Passengers Information and Display Systems (PIDS), Public Address Systems (PAS), Web portals, entertainment

Safety Systems ■





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Alcatel-Lucent's Value and Promise

Optimize operations, guarantee safety and security, enhance passenger experience

Make Each Journey on-time, safe and connected

Railway operators' goals	Communications solution
Optimize operational efficiency	<ul style="list-style-type: none">• A single, converged network• Integrated, multivendor management of the end-to-end network• Integrated control and management system
Guarantee safety and security	<ul style="list-style-type: none">• Interconnected signaling, train control, telemetry and SCADA systems• CCTV monitoring in stations, along the tracks and on the trains• Reliable and seamless communications everywhere, including in tunnels
Enhance passenger experience	<ul style="list-style-type: none">• Real-time arrival and departure information• On-board communications and entertainment services• Automated ticketing and payment services

Guarantee Safety and Security Example S-BAHN Berlin

Objective: Real-time video control of carriage door shutting by train drivers

- Higher passenger safety and saving of platform personnel

Project roll-out

- Delivery of an integrated IP/MPLS network for video management, travel information announcements and automatic dispatching of driver course
- Provision of Wi-Fi ground-to-train wireless communication system covering the full Rapid-Transit Railway of Berlin Deployment
- Deployment of video application in master stations (pilot phase)
- Deployment of all 169 stations of the full Berlin rapid-transit railway lines



Enhance Passenger Experience Examples

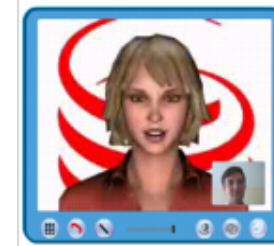
- Interactive Digital Signage in Stations

- Better passenger experience
- Reduce perceived waiting time



- Multimedia Information Kiosks & Augmented Reality

- Passenger assistance 24/7



- Multimedia Advertising in Tunnels

- Generate new business
- Selling more Ad space



- Onboard Infotainment

- Multimodal scheduling info
- VoD services



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Alcatel-Lucent's Critical WAN Infrastructure Solution

Optimize operations, guarantee safety and security, enhance
passenger experience

Alcatel-Lucent Dynamic Communications for Urban and Main Line Rail

End-to-End solution includes

Critical WAN Infrastructure

- SDH/IP MPLS tested with interlocking, GSM-R and SCADA
- Value added services (design build, operate and maintain)

Ground-to-Train Communications

- GSM-R, TETRA, Tunnel Coverage, LTE

OSS and Supervision

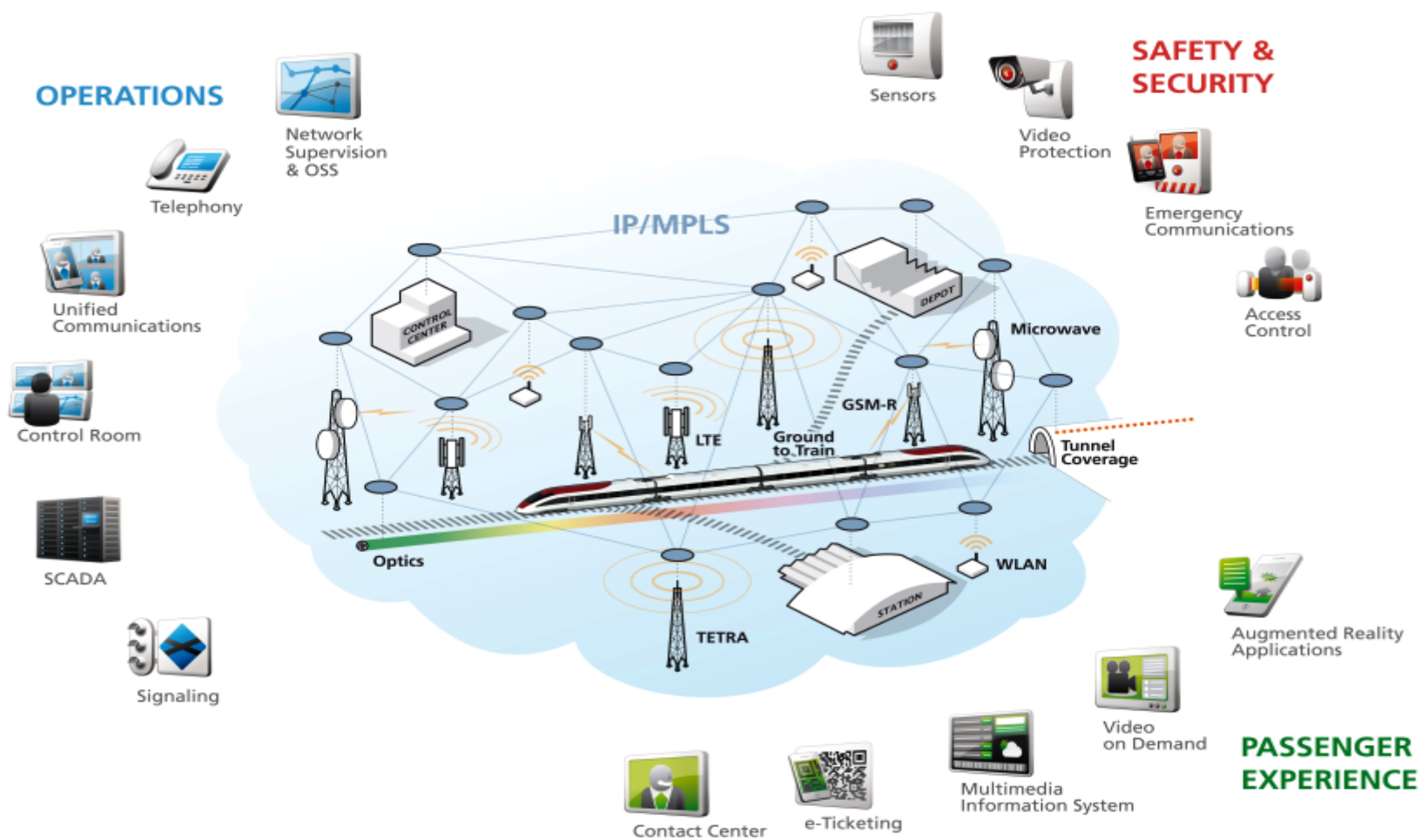
- Operational Support Systems
- Integrated Communications Management System (ICMS)

Third party integration

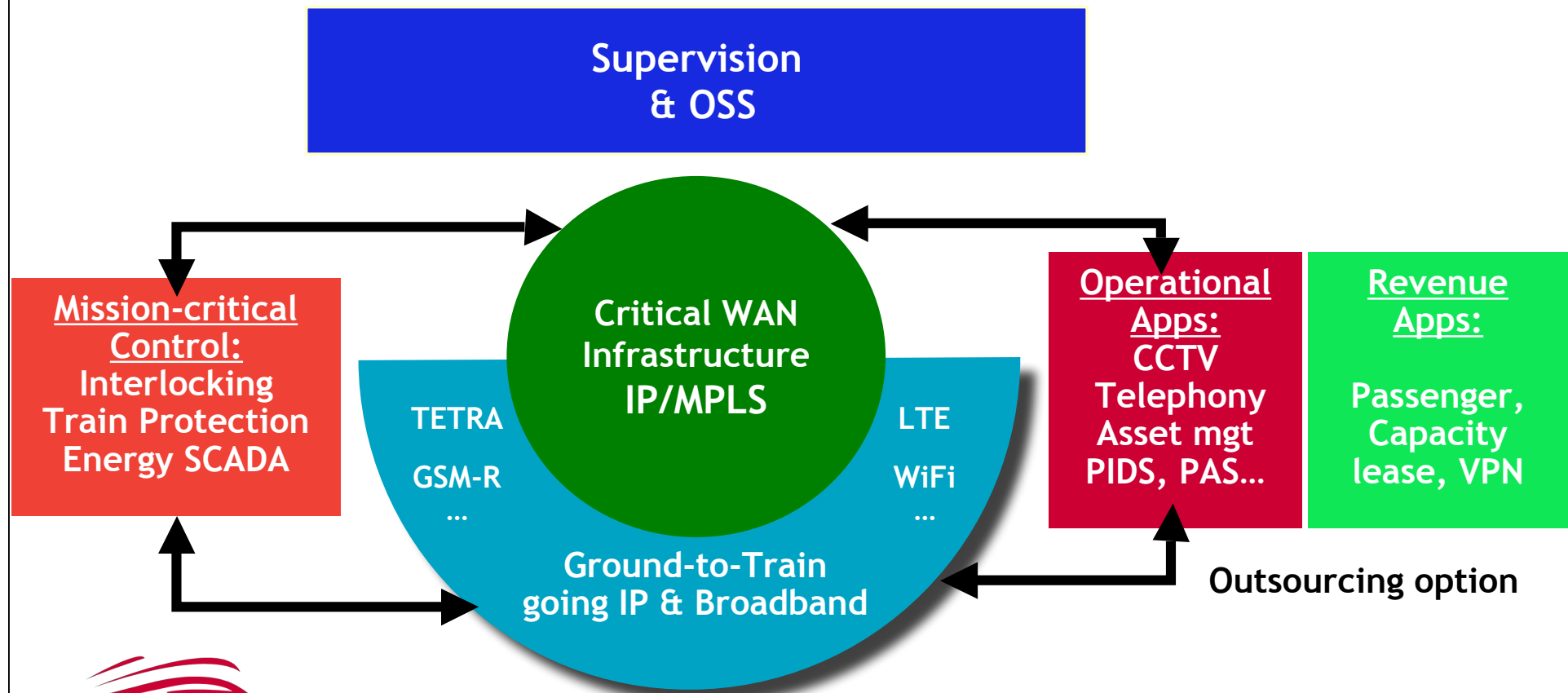
- CCTV, Passenger Information Display, public address....)



End-to-End Solution Overview



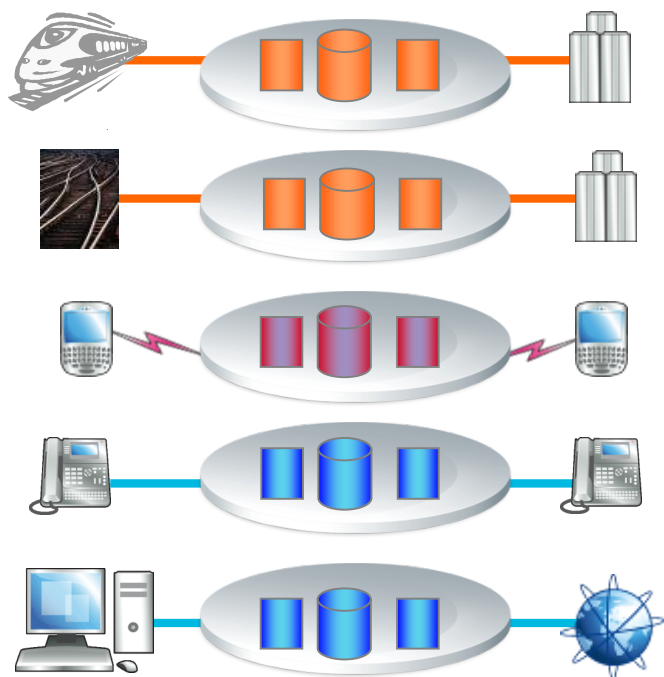
Critical WAN Infrastructure Core - Enables mission-critical services



Telecommunications network:
- ensuring mission-critical control
- enabling new services and revenue opportunities

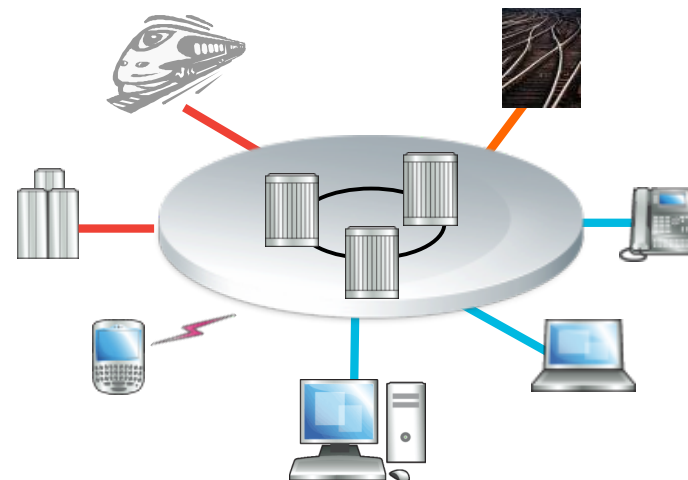
Moving to an All Packet Core - Flexibility

From separated service networks



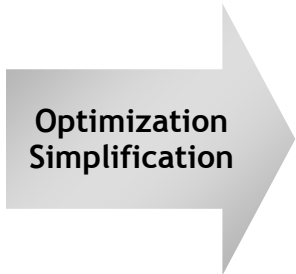
Each service has its own network
A mix of networking technologies

To converged multi-service network



IP-MPLS

All services in one network



Reduces operations costs, increases flexibility & operational efficiency,
lowers total cost of ownership

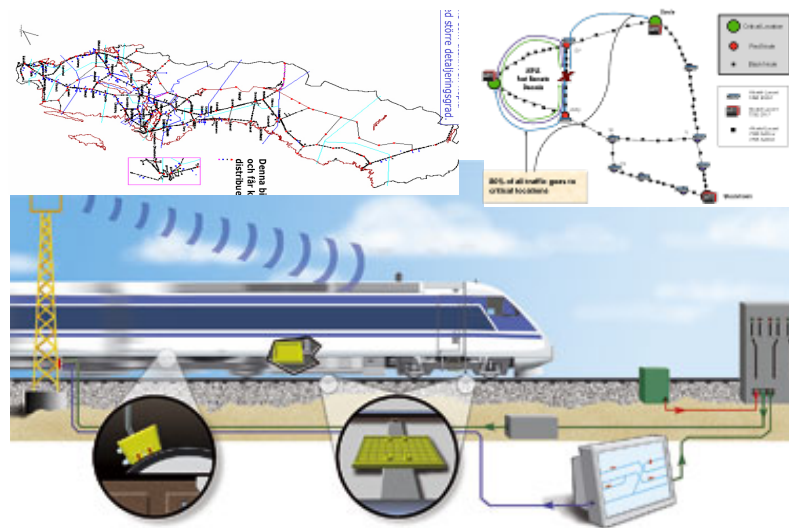
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Case Studies

CWI real world examples



Sweden Banverket (Trafikverket)



Picking the right partner

- **Rock-solid synchronization distribution for GSM-R over Synchronous Ethernet - exceeded targets in rigorous, customer-audited testing**
- Strong networking resiliency in platforms and networking e.g. FRR
- Unified, intuitive management

The Challenge

- Consolidating IT, Telecoms and Signaling networks on a modern infrastructure
- Efficient and safe rail operations are critical
- Embarking on a strategic technology shift to a nationwide IP-network
- Evolution must be smooth with simple, powerful management

The Solution

- Nationwide fibre network - 10 Gbps
- Migration path for legacy equipment
- Interlocking system on Ethernet
- Capacity for resale

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References and key takeaways

Alcatel-Lucent is running effectively in more than 80 mission-critical railway networks around the world

- ADIF, Spain
- RATP, France
- SNCF, France
- Network Rail, UK
- Canadian Pacific Railway, Canada
- SBB, Switzerland
- Banverket, Sweden
- Botniabanan, Sweden
- MPK, Poland
- TCDD, Turkey
- S-Bahn, Germany
- Deutsche Bahn, Germany
- CFR, Romania
- Seoul Metro, Korea
- SNCB, Belgium
- Dehli Metro Rail Corp., India
- NRIC, Bulgaria
- ZSR, Slovakia
- Raitel Corp., India
- MAV, Hungaria
- AlpTransit, Gotthard, Switzerland
- Istanbul Metro, Turkey
- Trenitalia, Italy
- PKP, Poland
- St Petersburg Metro, Russia
- Taiwan Railways Administration
- Cairo Metro, Egypt
- Chicago Transit Authority, USA
- Massachusetts Bay transportation Authority, USA
- Arlanda Express, Sweden
- REFER Telecom, Portugal
- Norfolk Southern, USA
- Manila Light Railway Transit, Philippines
- Tianjin Metro, China
- Beijin MTR Construction, China
- Shanghai Rail Transit, China
- Guangzhou Metro, China
- Ferrocarril Surburban, Mexico
- SNCFT, Tunisia
- JSC Transtelecom, Kazakhstan
- Copenhagen metro, Denmark
- Dublin LRT, Ireland
- ATM Milano Subway, Italy
- Delhi Airport Metro express Private limited, India
- Changchun metro line Co., China
- Shenzhen metro line Co. Ltd., China

Key takeaways

1. The telecoms world has been moving exponentially fast in recent years and has produced some fantastic technologies that are now available to Rail Operators
2. Business is changing for Rail Operators - now is the time to make the technological shift to the next step of efficiency with IP/MPLS,
3. Alcatel-Lucent's Critical WAN Infrastructure solution delivers the flexibility to make the shift safely

Alcatel-Lucent is the partner of choice:

**Technological Leader thanks to the Bell Labs,
Turnkey integrator for designing, building, maintaining
and operating mission-critical networks supporting
Rail Operators core business**

www.alcatel-lucent/tracktalk.com

