#### **METROFERR 2014**



### SOLUÇÕES INTEGRADAS EM TELECOMUNICAÇÕES METROFERROVIÁRIAS



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### AGENDA

- 1. Introdução
- 2. Comunicação Fixa
- 3. Gerenciamento de Rede e Serviços
- 4. Comunicação Móvel
- 5. Video



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### ALCATEL-LUCENT THOUGHTS FROM THE CEO



"Alcatel-Lucent is an unrivalled leader in the telecommunications industry with an immense array of talent and capabilities in Research and Development. As a team, we are focused on delivering the innovation our customers need in this highly disruptive and rapidly changing industry. We are also fully focused on achieving our transformation to a sustainably profitable business for our customers, employees and shareholders."

Michel Combes Chief Executive Officer



### ALCATEL-LUCENT AT A GLANCE



### **OUR CUSTOMERS**



#### **TELECOM NETWORK OPERATORS**

- Telephone Companies
- Mobile Network Operators
- Internet Service Providers
- Cable Providers



#### PUBLIC AND PRIVATE ORGANISATIONS

- Healthcare
- Hospitality
- Education
- Finance
- Retail
- Manufacturing
- Transportation
- Energy
- Public Sector



### **Alcatel-Lucent Communications Solutions for Rail**



### Reality with traditional transport networks today

#### - Multiple networks to serve different applications

- Operators have to maintain multiple networks in parallel
  - Duplicate hardware and physical infrastructure
  - Duplicate personnel and operation systems

- High OPEX



Services

#### - Limited capability to support next generation application requirements

- Limitation in bandwidth and expensive to scale bandwidth needs WILL grow
- Limited flexibility for adapting to different network topology requirements
- TDM based network are statically configured and suited for low bandwidth, low delay applications
- Justification for continued or new line investment in traditional networks is weak
  - Obsolete hardware/software components building a medium/long term problem and cost
  - End user application moving towards IP/Ethernet based (e.g. IP based CCTV Camera)



# The foundation for deploying modern transport communications



#### **One network for all services is the target for the future**

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### **Network Optimization** Reducing Footprint and Power Consumption



**TDM Platform** 

Applicable also to other legacy platforms – ATM, Frame relay, etc.



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# **Comunicação Fixa** Rede convergente multiserviços IP/MPLS

### What are those trends leading to ?

- Today, an organisation has 2 choices to build an infrastructure to interconnect its stations :
  - Native Ethernet / IP
  - IP/MPLS

	Ethernet /IP	IP / MPLS
High Availability	Convergence time around 5sec- 10+sec for L2 Traffic	<50ms failover
Security	Not traffic isolation in the core	Traffic isolation (VPNs in the core)
Enhanced QoS	Yes	Yes (same as Ethernet enhanced with traffic engineering and Hierarchy)
Multi-services networks	IP application only can be transported (or through complex tunneling)	Multiservice support. IP and non IP (TDM,), can be transported
Standard technology	Can Use Ethernet, MW, SDH end to end in the backbone	Can Use Ethernet, MW, SDH end to end in the backbone

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### Where does IP/MPLS play a role ?

- Stardard Technology by IETF
- IP/MPLS is a Multi Protocol transport technology.
- IP/MPLS allows transport of TDM, IP or Ethernet traffic
- IP/MPLS can be transported over Ethernet or a Layer 2 protocol (PPP, ...)



### Traffic Differentiation Advanced H-QoS (Hierarchical QoS)

- Less overall bandwidth required
- Lower overall cost
- Priority and best-effort traffic are equally well-served
- Voice and video do not always consume all the reserved bandwidth
- Example :
- VPLS service with four forwarding classes
  - Reserve 2 Mb/s for voice and 2 Mb/s for ERP
  - Enforce 14 Mb/s PIR for overall service
  - Allow critical and best-effort traffic to burst up to 14 Mb/s if bandwidth is available
- Reserve 2Mbps for CBTC applications



CIR: Committed Information Rate PIR: Peak Information Rate

### **Urban Railway Services – Recommendation**

Service	Service Type	Remark
CBTC Signaling Blue	VPLS	Layer 3 features in core or Control Center for security. Requires adaptation to MAC@ mobility
CBTC Signaling Red	VPLS	Same
Ticketing, telephony,	VPRN (or VPLS)	Layer 3 feature in core or in CC
Interlocking, Scada,	VPLS	
CCTV, Digital	VPLS with IGMP Snoop	IGMP Snoop in VPLS and LANs for optimized traffic delivery
Alarms 📋 🚹 🧿	Dry Contact port to SNMP Alarm	Integrate dry contacts into management tools.
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### MPLS (Multiprotocol Label Switching)





- Label Swapping
  - Connection table maintains mappings
  - Exact match lookup
  - Input (port, label) determines:
    - Label operation
    - Output (port, label)
  - Same forwarding algorithm used in Frame Relay and ATM



### **Enhanced Reliability: Secondary LSPs**



Standard LSP failover

- Failure signaled to ingress LSR
- Calculate & signal new LSP
- Reroute traffic to new LSP

#### Standby Secondary LSP

- Pre-established LSP
- Sub-second switch-over



### **Enhanced Reliability: Fast Reroute**



- Ingress signals fast reroute during LSP setup
  - Each LSR computes a detour path (with same constraints)
  - Supports failover in <50 mSec

# IP/MPLS Communications Network for Railways and Metros





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#### **5620 Service Aware Management**



### **Service Management**

- Services can be managed through a filtered list providing simple navigation to configuration & views
- Individual services can be viewed creating a private view to the operator displaying the status of:
  - Sites
  - Access Points (With VLAN Ids)
  - SDP Bindings, ...
- All features can be restricted to a Service :
  - Configuration, Alarms, statistics, ...





# **S-BAHN BERLIN, GERMANY**



#### **Real-time video control of carriage door shutting by train drivers**



CHALLENGES	SOLUTION	BENEFITS
<ul> <li>Increase Safety and Security</li> </ul>	<ul> <li>Integrated IP/MPLS network for video management, travel info announcements and automatic dispatching of driver course</li> <li>Provision of Wi-Fi train-to-ground wireless communication system covering the full Berlin rapid-transit railway</li> <li>Deployment of video application and of all 169 stations of the full Berlin rapid- transit railway lines</li> </ul>	<ul> <li>Higher passenger safety and saving of platform personnel</li> </ul>

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### **About Refer Telecom**

- Wholly owned by Portuguese Railways REFER
- Acting as Licensed Telecom Services Provider
- Provides the following services:
  - Railway Telecommunications Services
  - Operation and Maintenance Services
  - Telecom Solution Services
  - Critical systems Consulting Services
  - Data Center & ITC Help Desk Services
- REFER network covers 2843km of tracks







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### **Swedish Transport Administration**



Sweden's transportation agency is responsible for rail, road, maritime and air transportation systems.



Challenges	Solution	Benefits
<ul><li>Complex network</li><li>No support for new</li></ul>	<ul> <li>Upgrade to single rail communications system</li> </ul>	<ul> <li>Simplified network operation – single easy to use interface.</li> </ul>
services Find of life for older	<ul> <li>Converged IP/MPLS infrastructure</li> </ul>	<ul> <li>Able to safely migrate all traffic from multiple legacy networks</li> </ul>
products	<ul> <li>All IP 10-gigabit national network</li> </ul>	<ul> <li>Carrier grade Ethernet exceeded ITU-T standards</li> </ul>
	<ul> <li>Common management platform</li> </ul>	<ul> <li>New revenue generating opportunities</li> </ul>

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# **Comunicação Móvel** LTE – Long Term Evolution

### Wireless Networks – What next? Applications and bandwidth (dedicated networks)



### **Reasons for a change...** Applications and bandwidth (convergence)



Bandwidth Requirements



### What is LTE?

- LTE: Long Term Evolution
  - An evolution of existing cellular networks
    - GSM->GPRS->EDGE->UMTS->HSPA->LTE
    - Three Pillars: OFDM, MIMO, Flat IP
  - Performance (20MHz)
    - Peak speed of 120 Mbps / user
    - Very low latency: ~ 25ms
  - New applications, reduced cost
    - Video Conference Full-Duplex? ("See what I see")
    - Real-Time Video Streaming
    - File Transfer
    - Email
    - Web



Push-to-Talk, VoIP Telemetry Remote Access to databases Transactions on Automatic Database Geolocation Instant Messaging

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### Why LTE for Urban lines? New services drive for new solutions

## **Services**

Safety (signalling, platform TV...)

Security (CCTV, ECP, ...)

Remote maintenance

Passenger information

Passenger entertainment

What is the best fit between services and technology?

### **Technologies**

WiFi and alike TETRA GSM-R LTE Mobile router

# **Transport modes**

Tram, Metro, Bus, Mainline



### **Ground to Train Communications** From a variety of (proprietary) solutions...



### **Ground to Train Communications**

... to a unified standardised solution



### Why LTE for Urban lines? Example of needs per train

Applications	G2T	T2G
Signalling	10 to 100 kbps	10 to 100 kbps
Voice dispatch	10 to 100 kbps	10 to 100 kbps
Platform TV	~2 to 4 Mbps	< 50 kbps
Maintenance	Up to 100 kbps	Up to few 100 kbps
Emergency Call Point	10 to 100 kbps	10 to 100 kbps
On-board CCTV	~50 kbps	~2 to 6 Mbps
PIDS	~100 kbps	~10 kbps
High Speed Internet	2 to 8 Mbps	500 kbps to 2 Mbps

G2T: Ground to train (or downlink) T2G: Train to Ground (or uplink)

Need for several Mbps, Real-Time, High availability, Multi-service.



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#### LTE in Rail LTE For All Operational Applications & Passenger Services

LTE for Urban Lines



#### LTE for Mainlines



#### Today, validation of Alcatel-Lucent LTE solution by major Telcos Tomorrow, applicable to Strategic Networks such as Rail



World's largest service providers have chosen Alcatel-Lucent

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### Solutions for broadband ground to train communications

• Projects in implementation and for the near future



- Examples of Metros that are implementing or planning networks WiFi





- For medium and long term projects
- Working with the Anatel and government agencies to enable dedicated LTE frequency



- Examples of Metros planning LTE networks

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#### **Ground to Train communication**



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### Paris Linha 1 – Paris Driverless



A RATP está modernizando a linha 1 do Metrô de Paris e para este projeto a ALCATEL-LUCENT implantou, em regime Turnkey, uma solução de comunicação banda larga entre terra e trem, sendo que as aplicações para esta rede banda larga são:

- Monitoramento em tempo real das câmeras de bordo do trem
- Aplicações multimídia a bordo do trem (TV, Propaganda)
- Telefonia sobre IP (para ser usado como backup da rede Tetra)





### Turnkey greenfield build - Shanghai Metro, China

#### **SHANGHAI METRO: CHINA**

#### Deploying an Integrated Communications Solution for a new metro line

 Multi-service comms network and over a dozen subsystems: voice network, dispatch telephones, police and fire-protection radio systems (including leaky cables and RFS repeaters for a TETRA network), PA/GA system, PIDS system, copper cabling, LAN and video surveillance.



- Prime contractor: Alcatel-Lucent
- Project scope:
  - Network deployment: 21 months
  - Network maintenance: 2 years

"For the Shanghai Line 9 metro, Alcatel-Lucent handled a tough on-site environment, complicated interfaces and tight deadlines, delivering an integrated communications solution and achieving our goals, while demonstrating strong project management skills."

Gordon Lam, General Manager of the Railway System Department, HKM (Shanghai Hong Kong Metro) Construction Management Co.





### **End-to-end solution overview**





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# Dinamic Communications for Railways Video



### WORLD CLASS EXECUTIVE BRIEFING CENTER SÃO PAULO, Brazil



Live state of the art demonstrations and applications supported by LTE



To schedule a visit, contact your Alcatel-Lucent Account Executive or andre.gomes@alcatel-lucent.com





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# **Backup Slides**



# **Evolution Strategy**

- When planning the future of the communication networks in Railways, an evidence appears :
- THE FUTURE WILL BE PACKET BASED NETWORKS
- The question should not be : "what is my next technology in the communication networks for railways ?" but rather "when and how can I migrate ?"
- There are however two different ways of evolving the network towards IP/MPLS because of the flexibility of the protocol :
  - Running IP/MPLS over SDH
  - Running SDH over IP/MPLS

.....

• Of course there are multiple scenarios in between those.



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#### SDH Infrastructure Migration Option 1: Running IP/MPLS over SDH





### SDH Infrastructure Migration Option 1 – Phase 1





### SDH Infrastructure Migration Option 1 – Phase 2





### SDH Infrastructure Migration Option 1 – Phase 3





### SDH Infrastructure Migration option 1 – Ultimate Phase





#### SDH Infrastructure Migration option 2 – Running SDH over IP/MPLS





### SDH Infrastructure Migration option 2 – Phase 1



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### SDH Infrastructure Migration option 2 – Phase 2





### SDH Infrastructure Migration option 2 – Ultimate Phase





#### LTE for security forces

Real-time information access and sharing

#### • A picture is worth 1,000 words...

Example: Transmission delay of High Res picture (2 MB)



# • ... if it arrives on time!

### **LTE for Security Forces** Live video access (mobile and/or fixed)

#### Video transmission at cell edge (uplink)





Video over TETRA 10 kbps (4 fps, 128x72) Video over LTE (BW=1.4 MHz) 512 kbps (25 fps, 630x250)



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