METROFERR 2012

Soluções Inovadoras em Telecomunicações Metroferroviárias

Alcedir Goulart

12/09/2011

18ª Semana de Tecnologia Metroferroviária 2012

Alcatel·Lucent

ALCATEL-LUCENT
REALIZING THE POTENTIAL OF A CONNECTED WORLD

"**BROADBAND EVERYWHERE** is speeding up life and business. It takes **NO TIME** to go from having a **NEW IDEA**, to **TOUCHING PEOPLE'S LIVES**. We must innovate – and **HELP OUR CUSTOMERS INNOVATE** – at the speed of ideas."

Ben Verwaayen
Chief Executive Officer

FAST FACTS

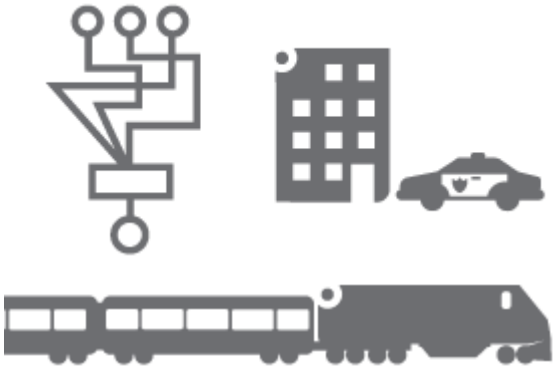
- Headquarters: Paris, France
- Annual revenues: approx. €**15.3** billion
- Employees: approx. 76,062
- More than 130 countries
- R&D budget: €**2.4** billion
- Active patents held: 29,133
- Patents awarded in 2011: 2,655
- Nobel Prizes won: 7

CUSTOMERS WE SERVE

SERVICE PROVIDERS

A leader in mobile, fixed, IP and optics technologies, and a pioneer in applications and services, we offer complete solutions that help service providers and their customers realize the potential of a connected world.

STRATEGIC INDUSTRIES



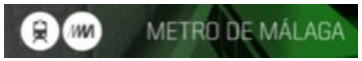
We provide end-to-end turnkey communications integration that improve quality of life through better **energy** management, efficient **transportation** and improved **government** services.

ENTERPRISES

We help our enterprise and government customers worldwide interconnect their networks, people, processes and knowledge to make money and save money.

A Growing Customer Base

- Metros
  - s-Bahn Berlin – Germany
  - ATM Milano – Italy
  - FGV – Valencia Spain
  - Amsys (Amsterdam Metro)
  - Metro de Malaga
  - Metro de Panama
  - Metro of Stockhholm
  - Metro de Shangai
  - Metro de Shenzen
- Mainline Raliways
  - ADIF – Spain
  - Trafikverket – Sweden
  - Jernbaneverket – Norway
  - Deutsche Bahn (Arcor) – Germany
  - Transtelecom – Kazachstan
  - REFER Telecom – Portugal
  - Trains Kazakstan
  - MAV (Hungary)
  - Bulgarian Railways



Alcatel-Lucent Communications Solutions for Rail

Massachusetts Bay Transportation Authority

Network Rail
UK

AlpTransit Gotthard San Gottardo
Switzerland

KAZTEMIRTRANS

NRIC Bulgarian railways

chicago transit authority
transitchicago.com

BOTNIABANAN AB
Sweden

RATP
Paris metro

Romanian railways

Belgium railways

BANVERKET
Swedish rail authority

ADIF
Spanish railway infrastructure operator

MPK-ŁÓDŹ Spółka z o.o.
Lotz tramway Poland

北京地铁 Beijing Subway
Beijing metro

Alcatel-Lucent Equipment, Solutions and/or Services present in 60% of the largest Metros worldwide

Bangladesh railways

DB
German railways

Istanbul metro

ZSR
Slovak railways

Shanghai metro

FERROCARRIL SUBURBANO
Un Mejor Tren de Vida
Mexico

Taiwan Railways Administration

रेलटेल RAILTEL
Railtel Corporation of India Ltd

PKP
Polish railways

Tianjin Metro

दिल्ली मेट्रो रेल कॉरपोरेशन लिमिटेड
DELHI METRO RAIL CORPORATION LTD.

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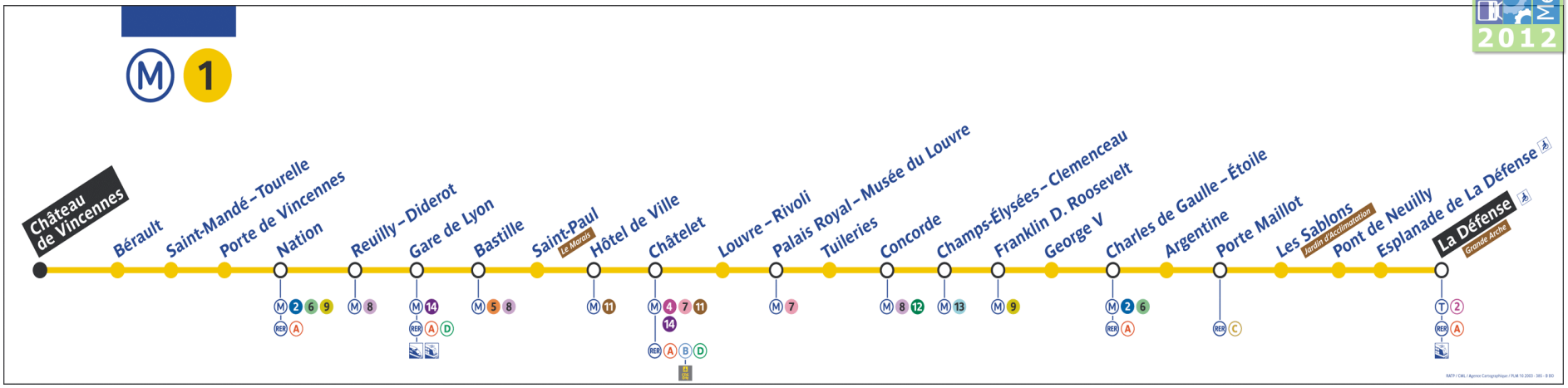
Swedish Transport Administration

TRAFIKVERKET

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

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

Paris
Linha 1 – Paris Driverless



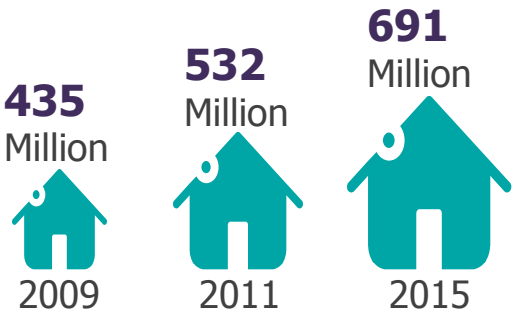
A RATP está modernizando a linha 1 do Metrô de Paris e para este projeto a ALCATEL-LUCENT implantou, em regime Turnkey, uma solução de comunicação banda larga entre terra e trem, sendo que as aplicações para esta rede banda larga são:

- 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)

INDUSTRY MARKET TRENDS: SIX MAJOR DRIVERS

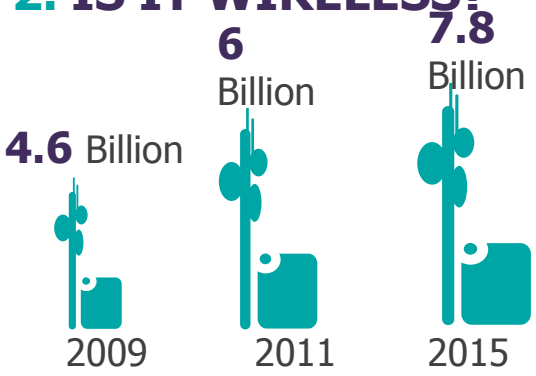
WHERE IS DEMAND COMING FROM?

1. IS IT BROADBAND?



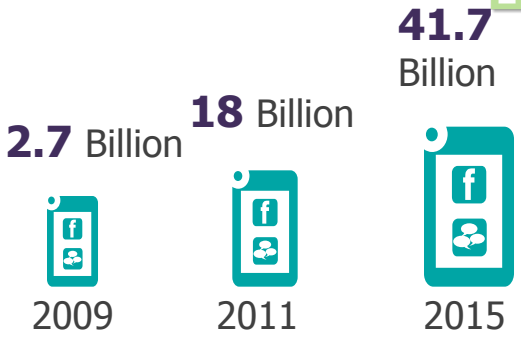
Fixed broadband connections

2. IS IT WIRELESS?



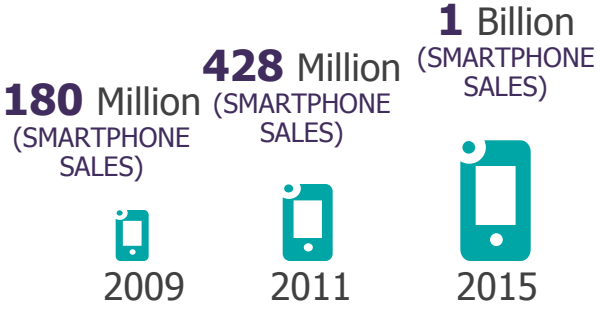
Mobile connections

3. IS IT CONTENT/AP



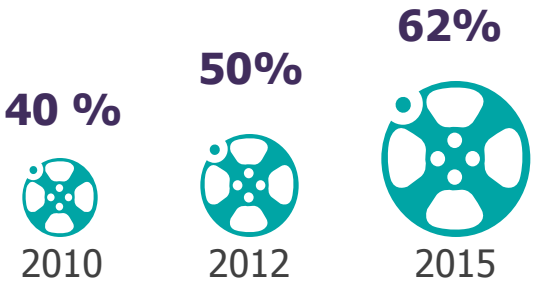
Applications downloads

4. IS IT DEVICES?



Smartphones

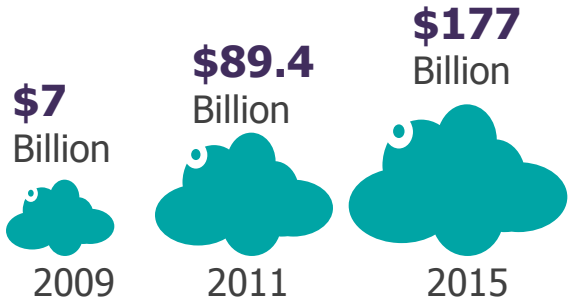
5. IS IT VIDEO?



Internet video share of consumer Internet traffic

90% forecast to be the sum of all forms of video traffic by end 2015 (TV, video on demand [VoD], Internet, and P2P)

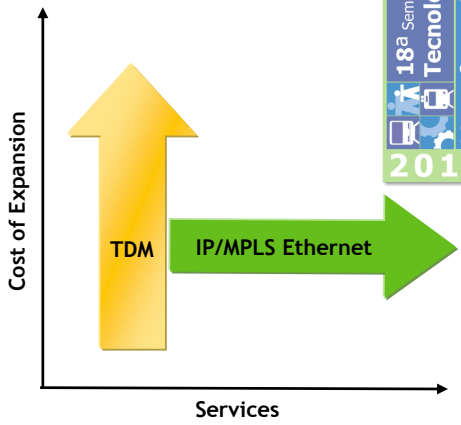
6. IS IT CLOUD?



Public cloud revenue

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



- **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

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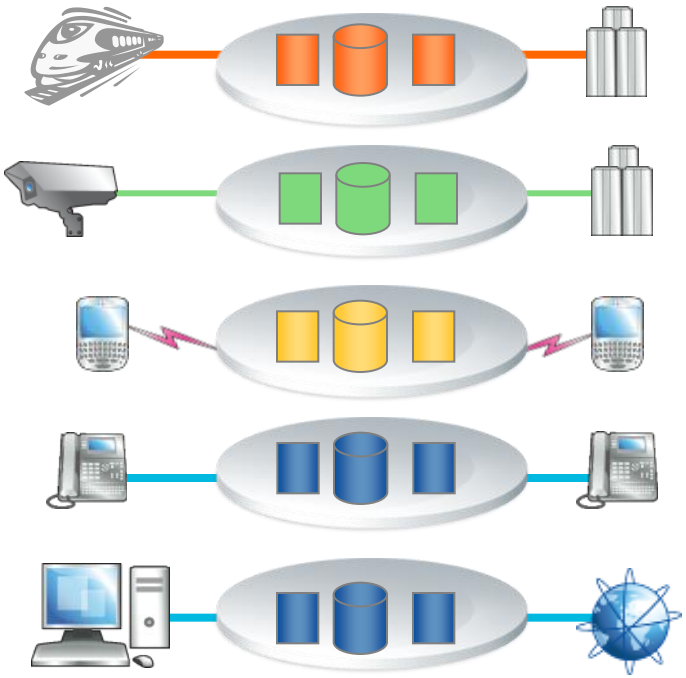
From separated service networks



Each Service has its own Network

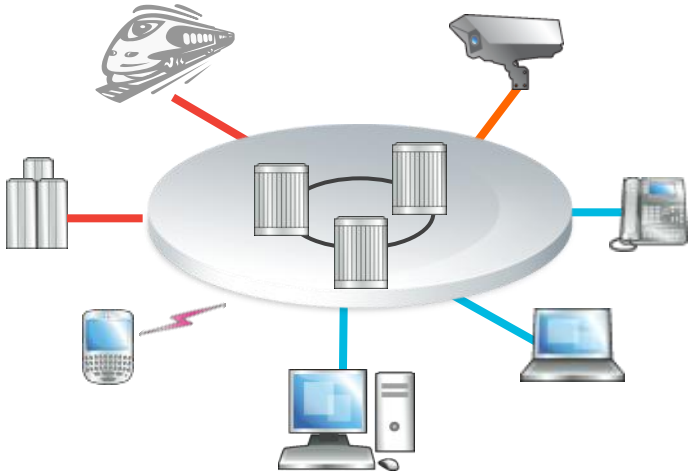
-> Each have different characteristics

-> Each have different management systems

Optimization

Simplification

To converged multi-service network



All Services on a unified network

-> A converged, highly resilient network

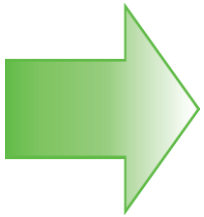
-> Managed by a single management system

One network for all services is the target for the future

Network Optimization

Reducing Footprint and Power Consumption

TDM Platform



7705 SAR-8

Tremendous savings in rack space, power consumption, operation simplification and CAPEX

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

Wireline

Common statements regarding IP/MPLS

1. IP/MPLS is made for carriers — Wrong
2. IP/MPLS is made for high bandwidth — Wrong
3. IP/MPLS is expensive — Wrong
4. IP/MPLS is for large networks — Wrong
5. IP/MPLS is complex — Wrong*

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

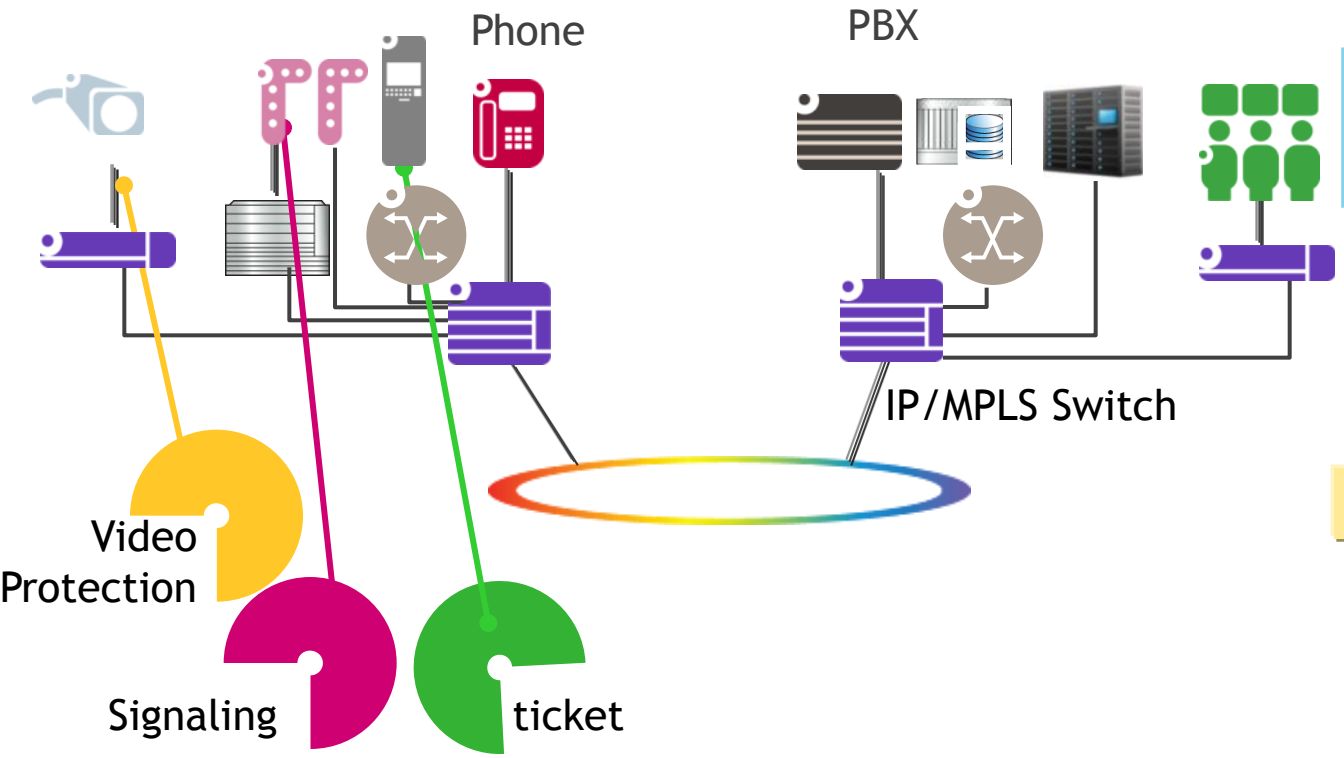
	Ethernet /IP	IP / MPLS
High Availability	Convergence time around 5sec-10+sec for L2 Traffic	<50ms failover
Security	Not traffic isolation in the core	Traffic isolation (VPNs in the core
Enhanced QoS	Yes	Yes (same as Ethernet enhanced with traffic engineering and Hierarchy)
Multi-services networks	IP 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 .

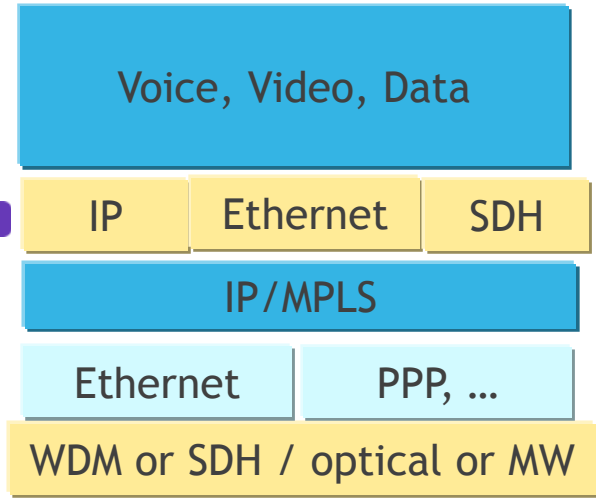
A Brief look at requirements

	SDH	IP	IP/MPLS
Reliablity	Yes. Anticipated	Yes – Reactive	Yes - Fast ReRoute <50ms
Predictability	Yes	No	Yes - H-QoS; Traffic Engineering RSVP-TE
Traffic Isolation	Yes – containers	No	Yes - Point to Point, P2MP : L2, L3
Multiprotocol	Yes-but not optimized for IP and Mcast	No	Yes - IP, IP Mcast, Data (Vmware, ..), TDM
Flexibility	No	Yes	Yes - Based on OSPF / ISIS

Where does IP/MPLS play a role ?

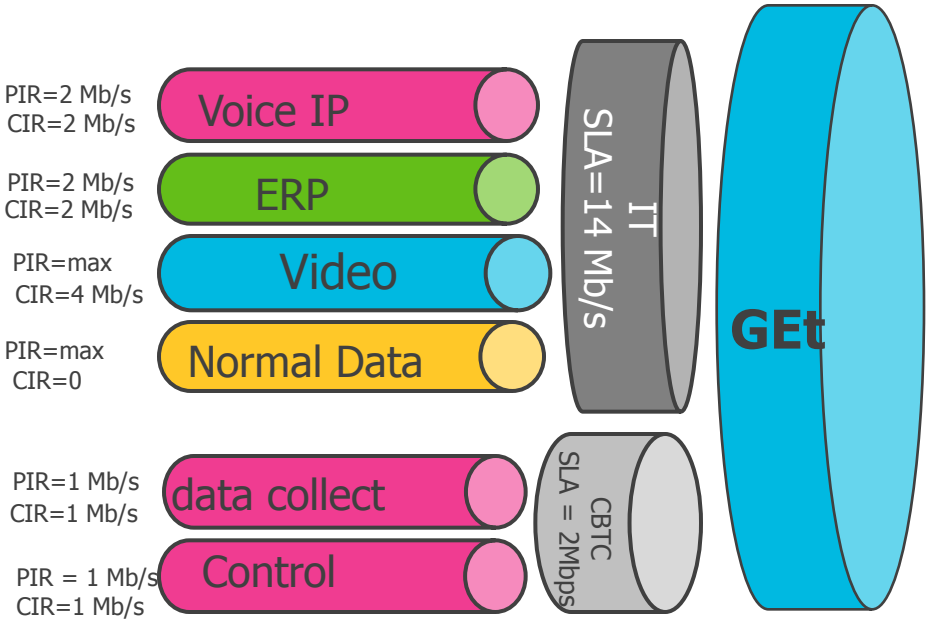
- Stardard Technology by IETF
- IP/MPLS is a Multi Protocol transport technology.
- IP/MPLS allows transport of TDM, IP or Ethernet traffic
- IP/MPLS can be transported over Ethernet or a Layer 2 protocol (PPP, …)





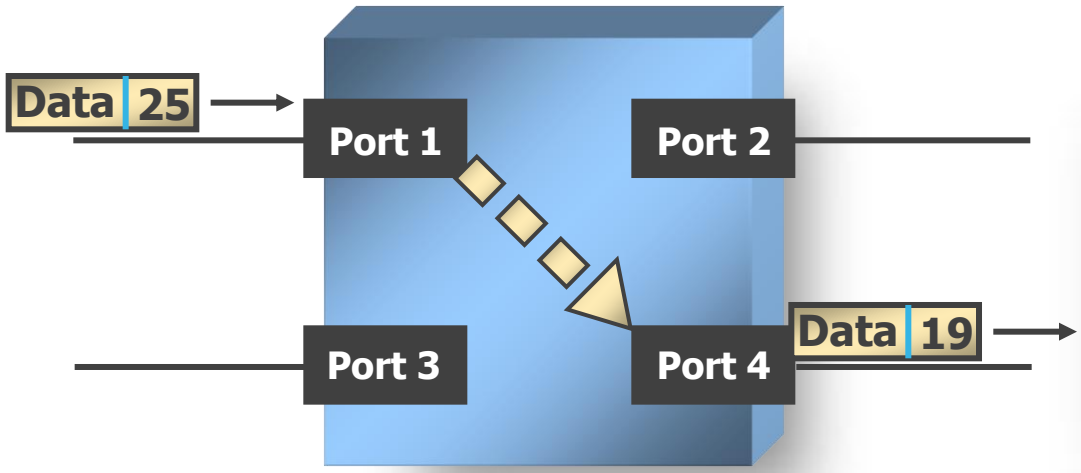
Traffic Differentiation
Advanced H-QoS (Hierarchical QoS)

- 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

MPLS (Multiprotocol Label Switching)

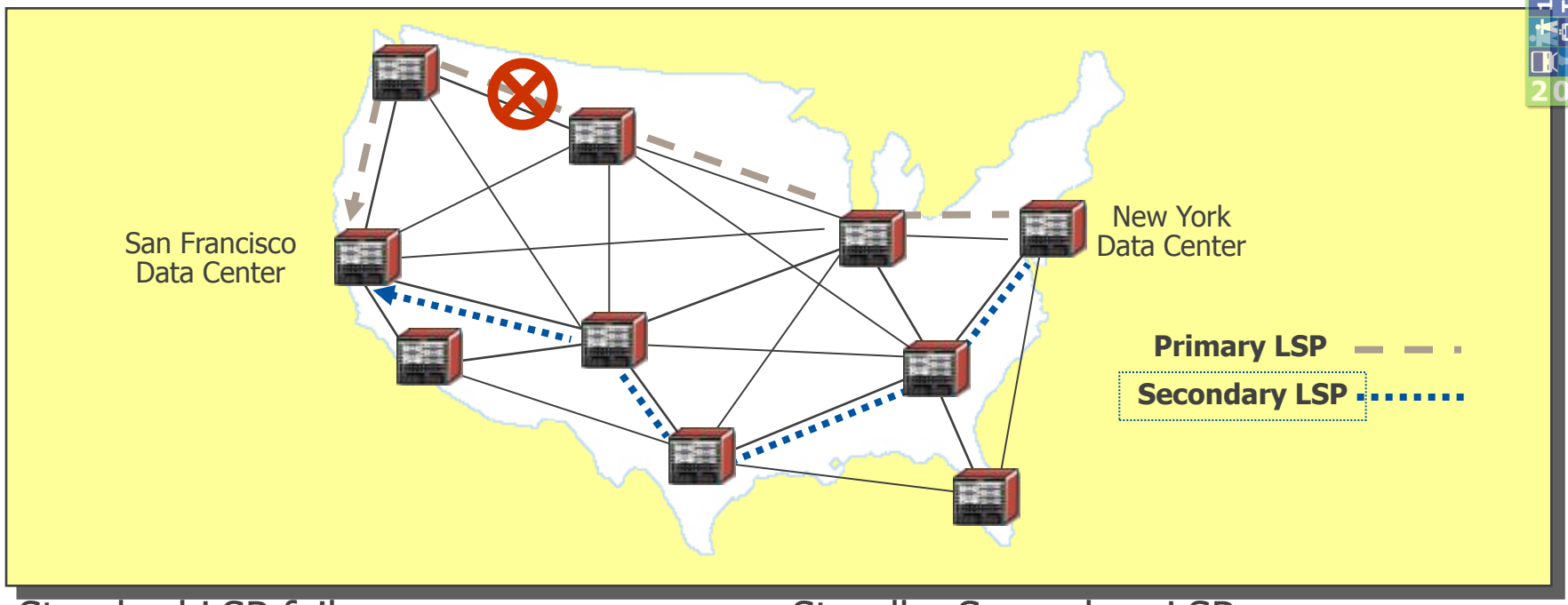


Connection Table

In (port, label)	Out (port, label)	Label Operation
(1, 22)	(2, 17)	Swap
(1, 24)	(3, 17)	Swap
(1, 25)	(4, 19)	Swap
(2, 23)	(3, 12)	Swap

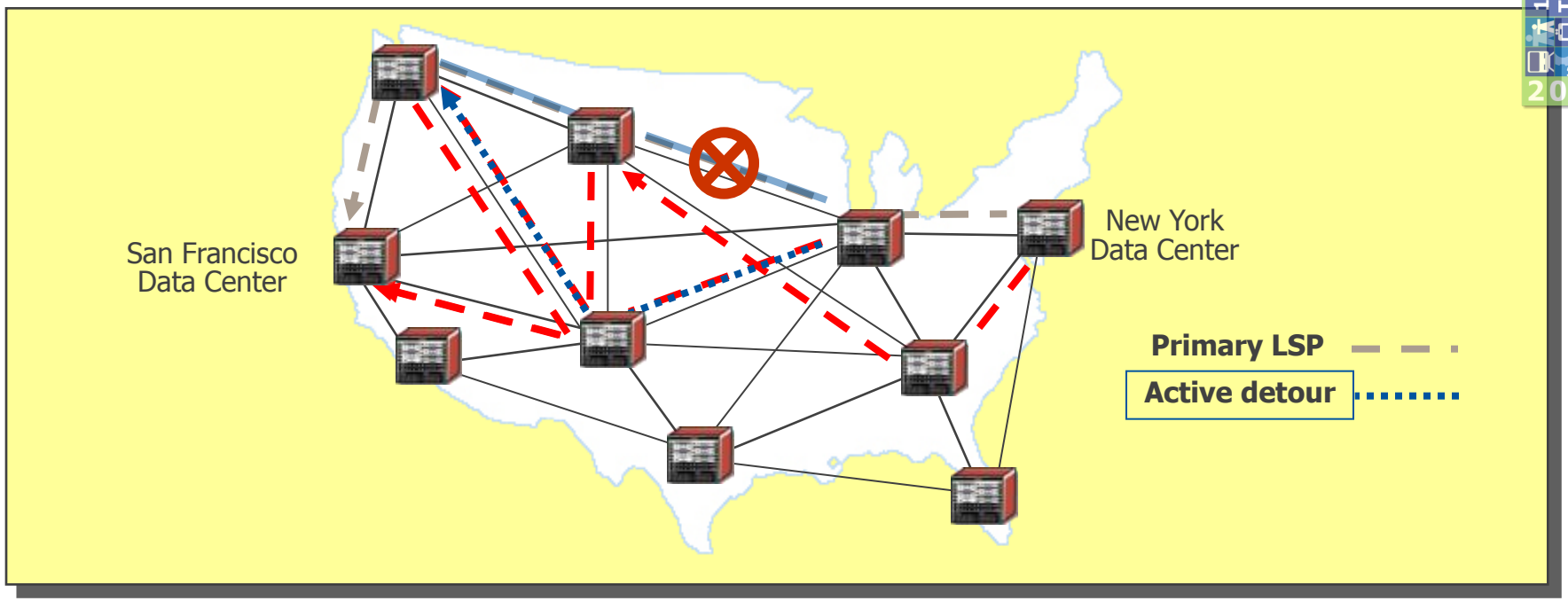
- Label Swapping
  - Connection table maintains mappings
  - Exact match lookup
  - Input (port, label) determines:
    - Label operation
    - Output (port, label)
  - Same forwarding algorithm used in Frame Relay and ATM

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

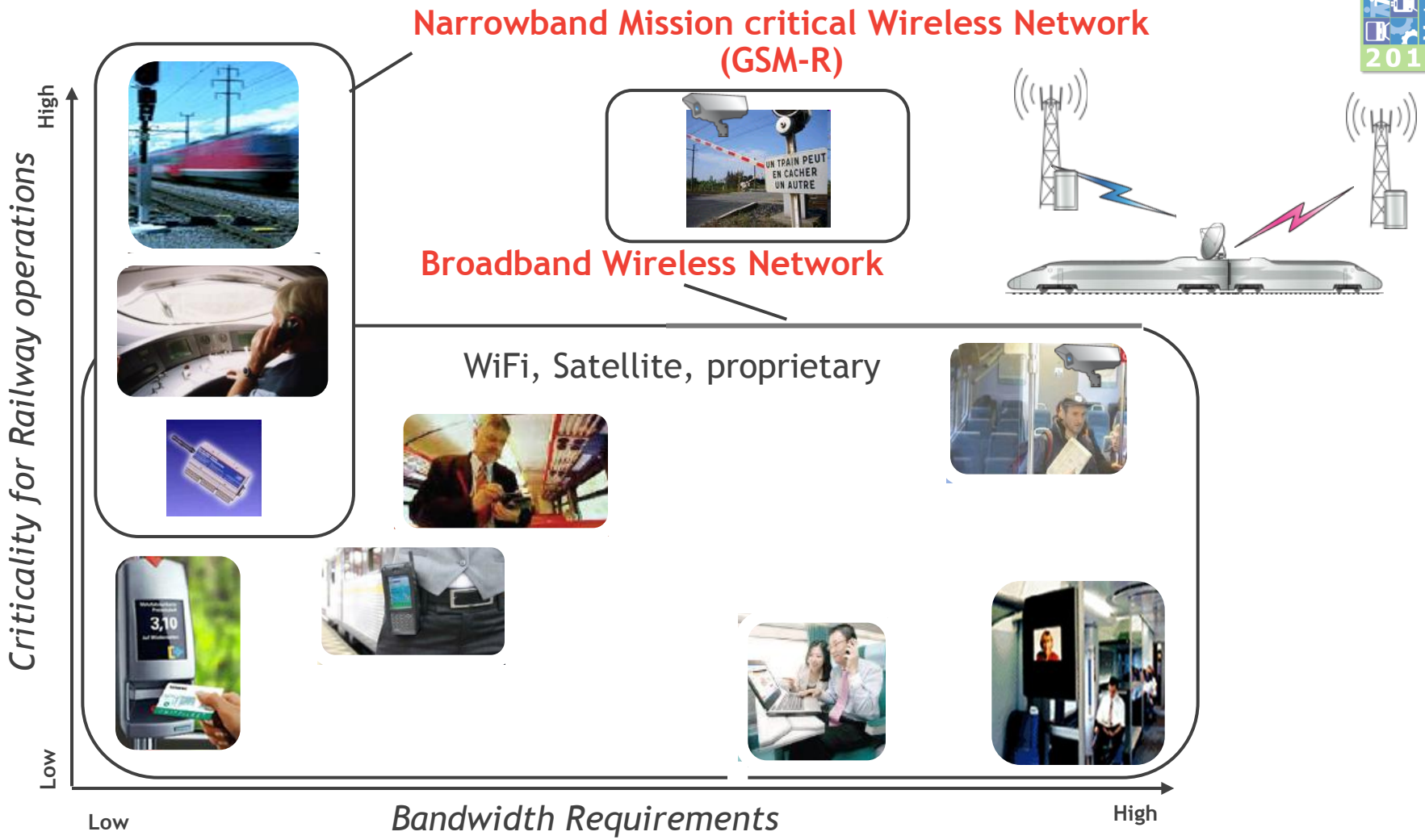


- Ingress signals fast reroute during LSP setup
  - Each LSR computes a detour path (with same constraints)
  - Supports failover in <50 mSec

Wireless

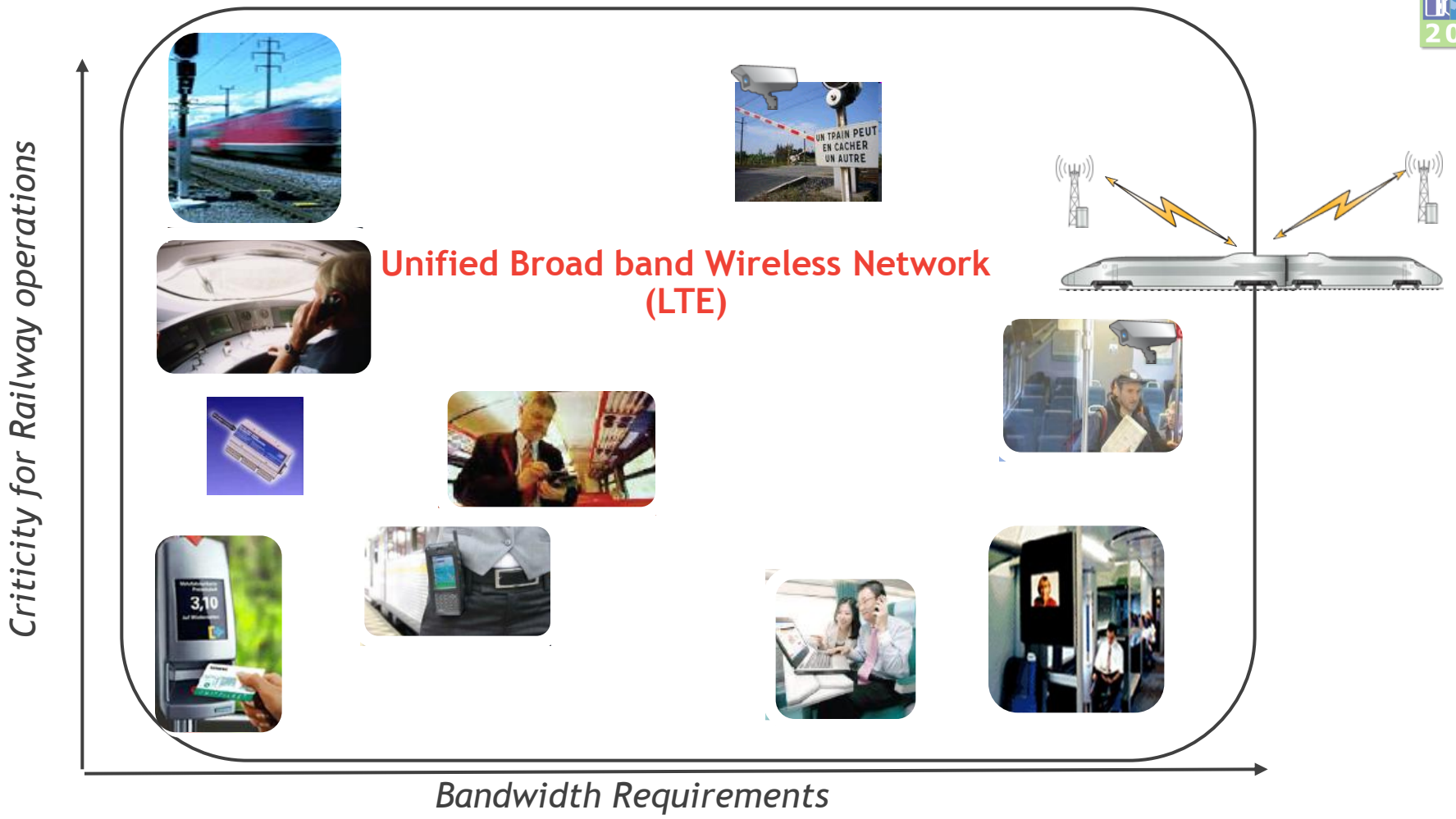
Wireless Networks – What next?

Applications and bandwidth (dedicated networks)



Reasons for a change...

Applications and bandwidth (convergence)



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

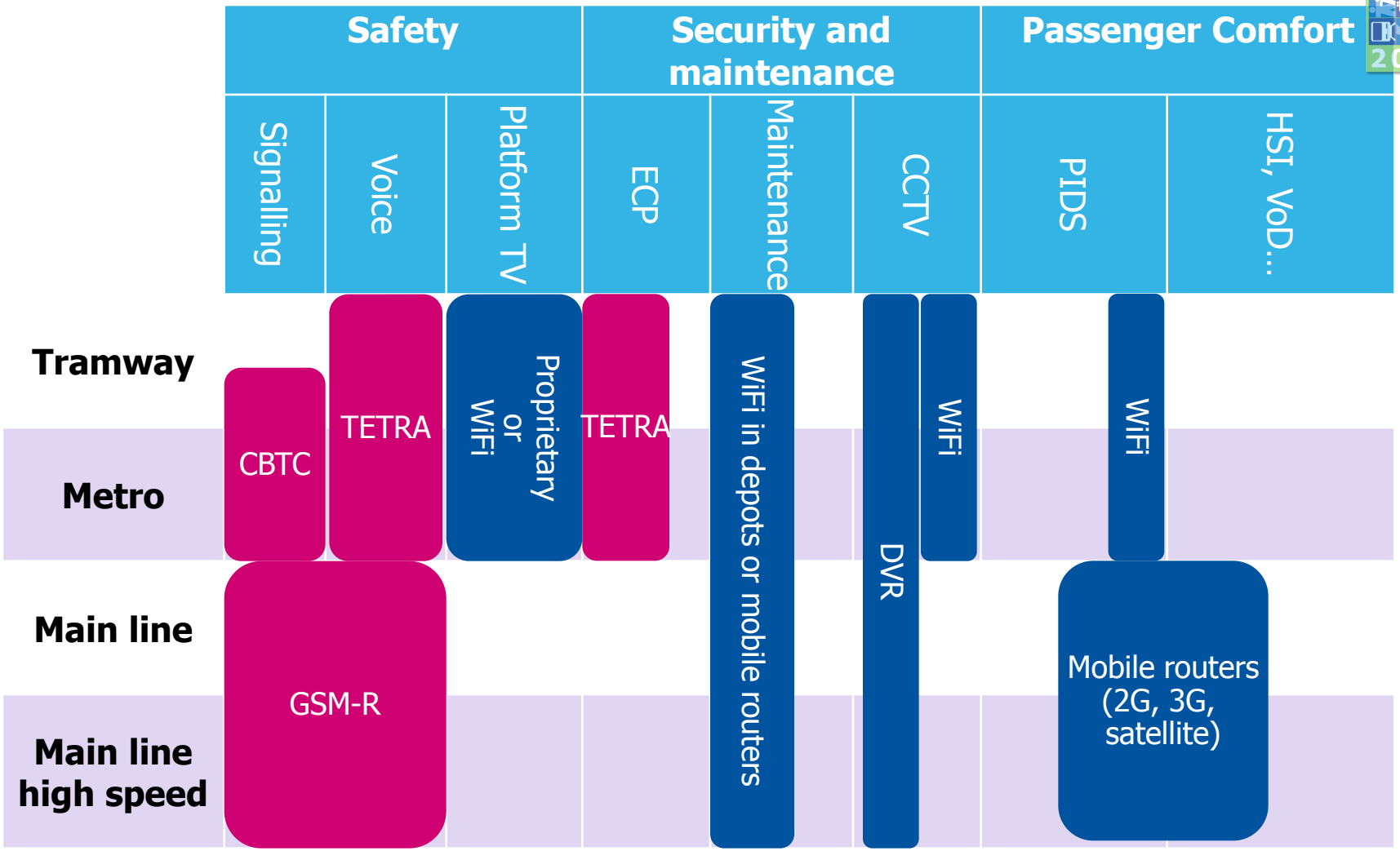
  - Performance (20MHz)
    - Peak speed of 120 Mbps / user
    - Very low latency: ~ 25ms

  - <u>New applications, reduced cost</u>
    - 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

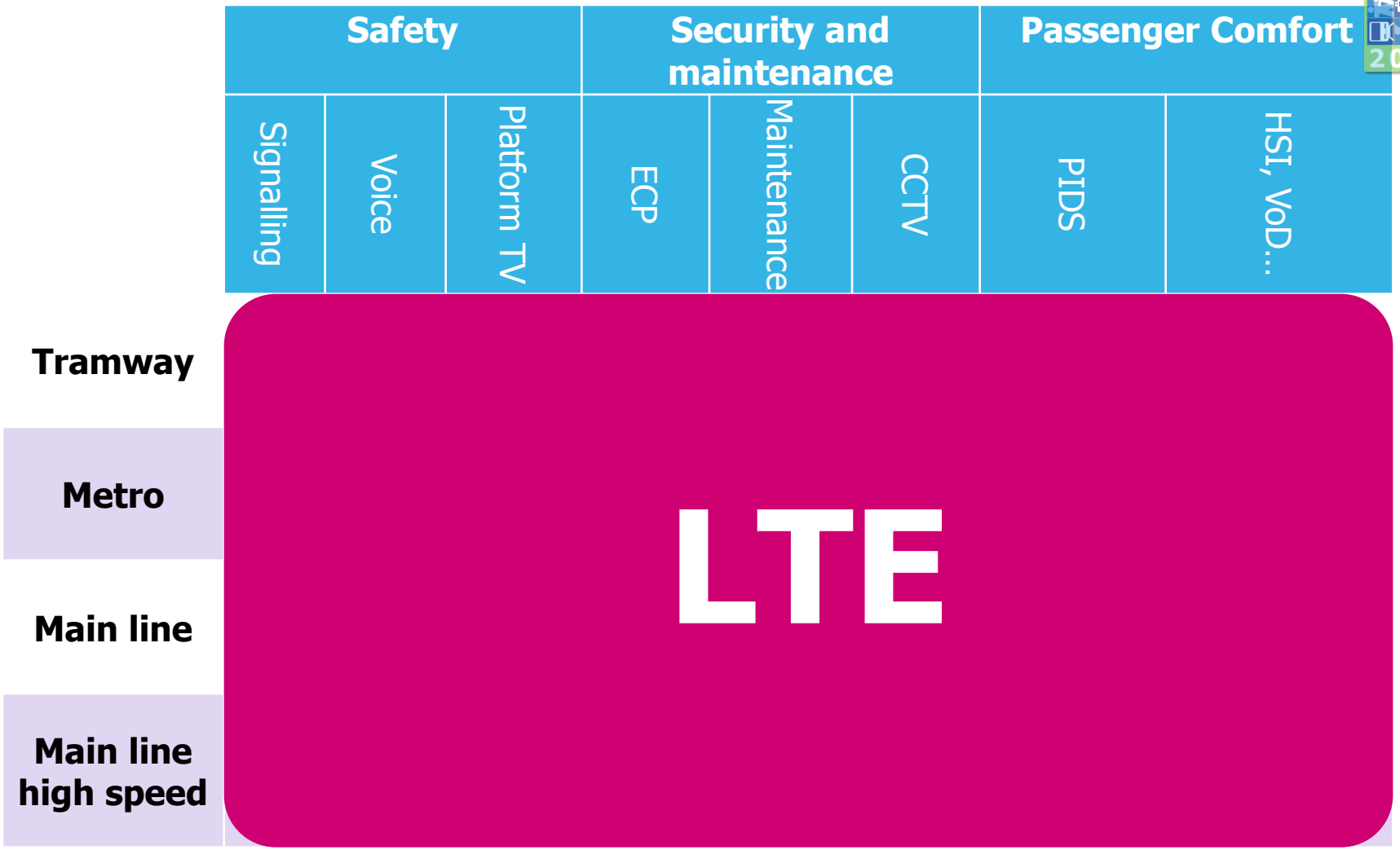
Ground to Train Communications

From a variety of (proprietary) solutions…



Ground to Train Communications

… to a unified standardised solution



LTE use cases for Railways
Efficiency in operations (1)

- **Ground-to-train radio system rationalisation**

  From dedicated and specialised systems to a unique standard system

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

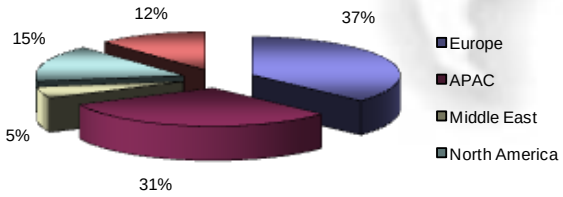
verizon CONTRACT
Sprint CONTRACT
BIG RIVER CONTRACT
CHARLOTTE CONTRACT
SHENTEL CONTRACT
CROSS CONTRACT
DTV CONTRACT
LEAP CONTRACT
c spire CONTRACT
WEST CENTRAL WIRELESS CONTRACT
at&t CONTRACT

orange TDD CONTRACT
SFR
IDC CONTRACT
Telefónica 2.6GHz
TIM Small cells
TDD STC CONTRACT
TDD
TDD TDD TDD
etisalat CONTRACT
smile CONTRACT

VimpelCom CONTRACT
TDD TDD TDD Shanghai Large-Scale TD-LTE
中国移动通信 CHINA MOBILE
Chunghwa Telecom
maxis. TDD
SingTel

América Móvil CONTRACT
Telefónica 700MHz & 2.6GHz
TDD TDD
oi
antel CONTRACT

Trials split per region



25+ LTE Contracts

70+ LTE Trials

TDD TD-LTE trials or contracts

World's largest service providers have chosen Alcatel-Lucent

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

Bahn Berlin
Deutsche Bahn Gruppe

RATP

stm

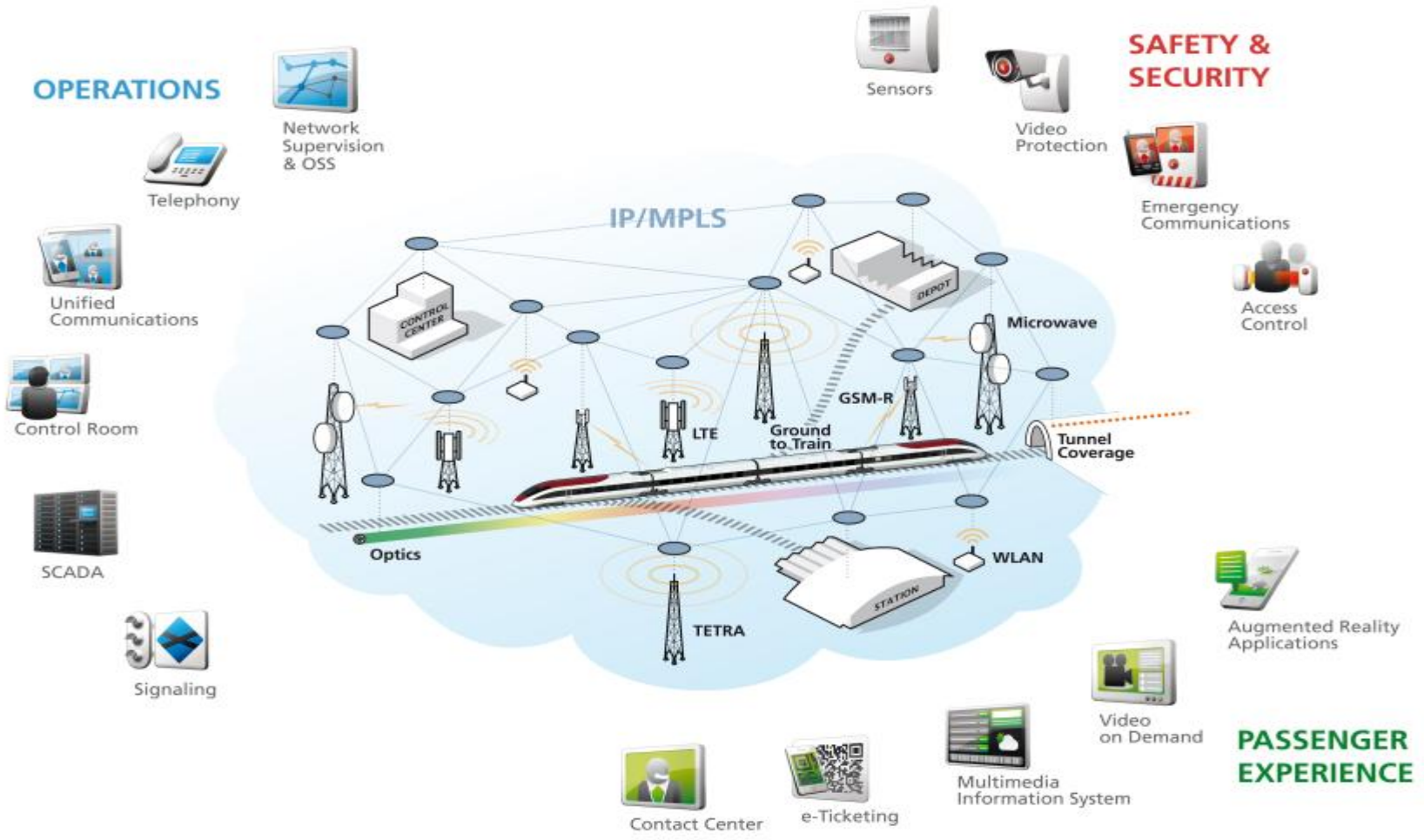
ANSYS

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

  - Examples of Metros planning LTE networks

ANSYS

End-to-end solution overview



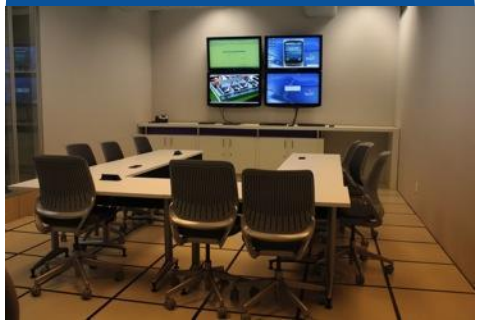
Dinamic Communications for Railways Video

WORLD CLASS EXECUTIVE BRIEFING CENTER
SÃO PAULO, Brazil

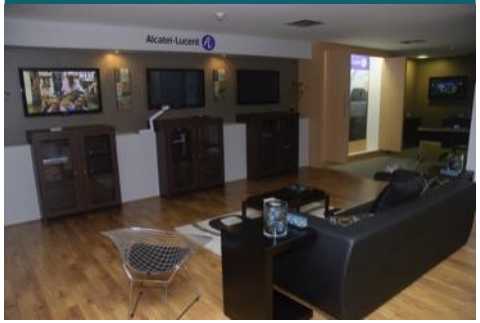
Live state of the art demonstrations and applications supported by **LTE**

Innovation & Technology

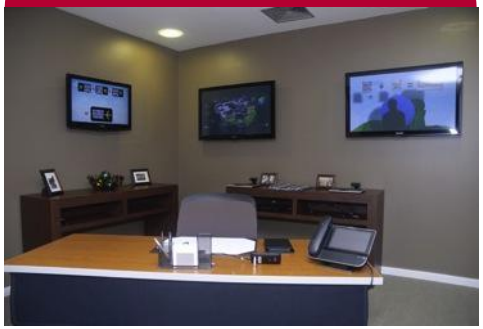
Network Operations Center



Connected Home



Next Generation Office



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

Contato:

Alcedir.goulart@alcatel-lucent.com

Mais informações:

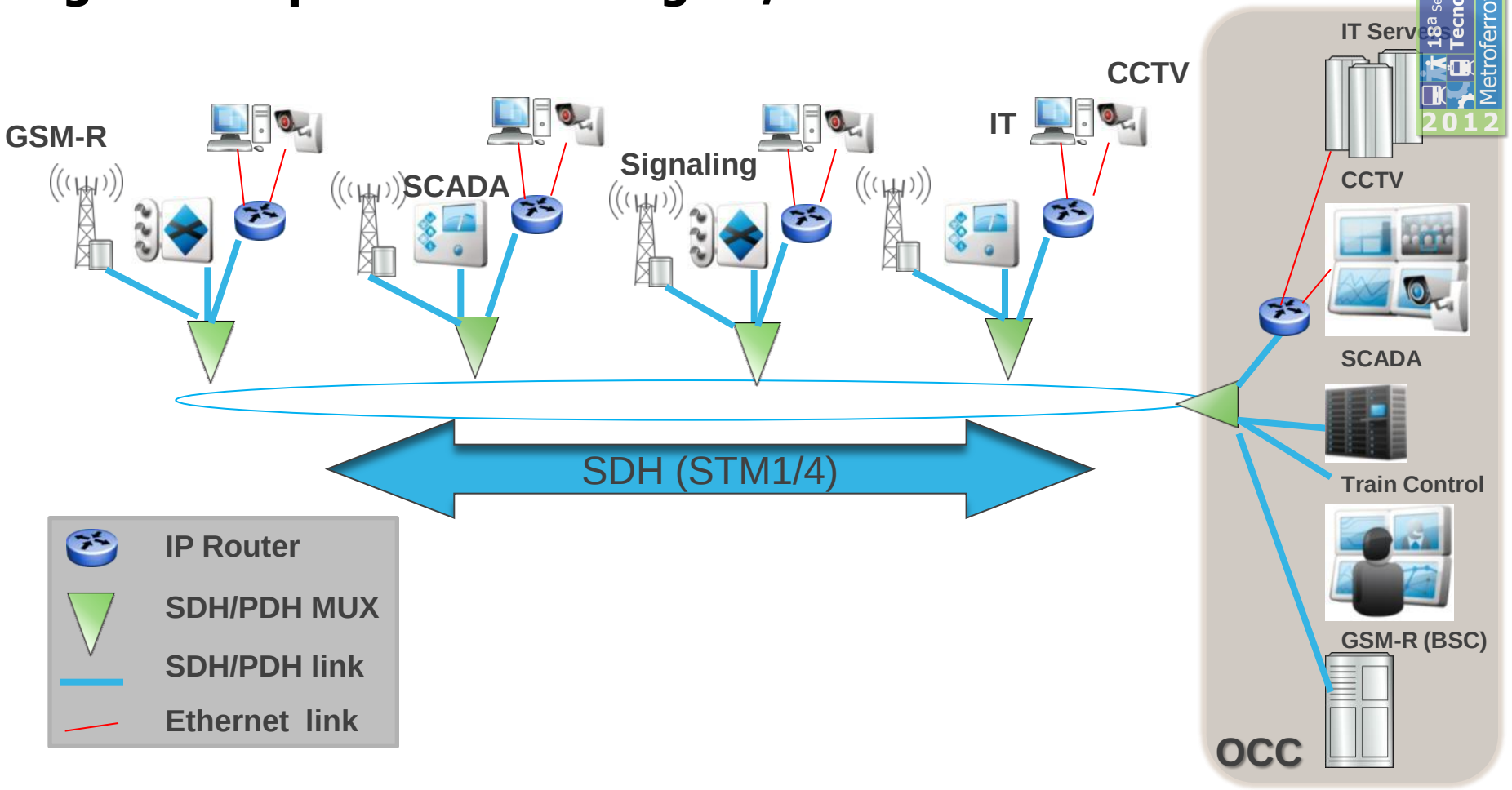
www.alcatel-lucent.com

Backup Slides

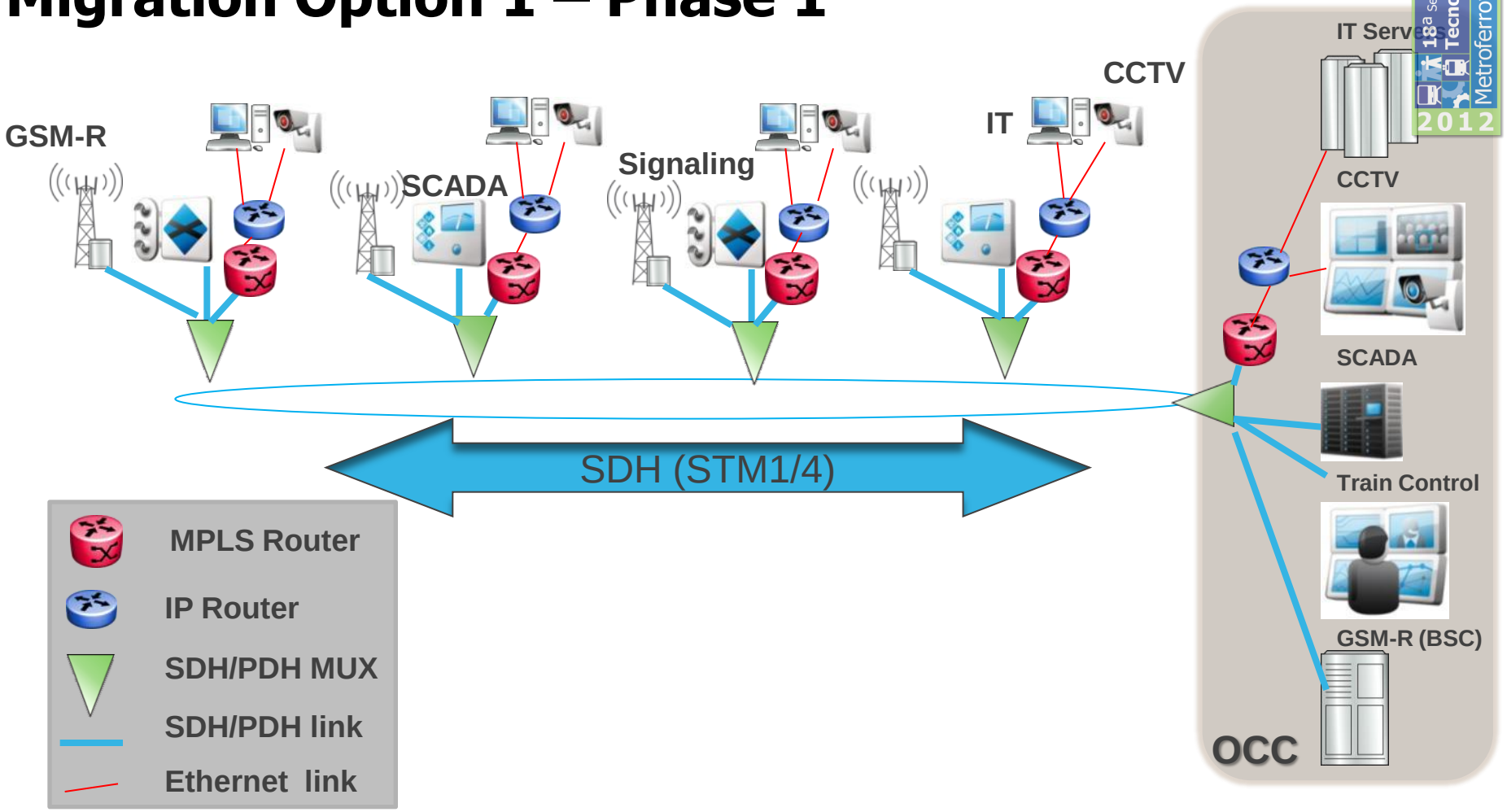
Evolution Strategy

- When planning the future of the communication networks in Railways, a 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.

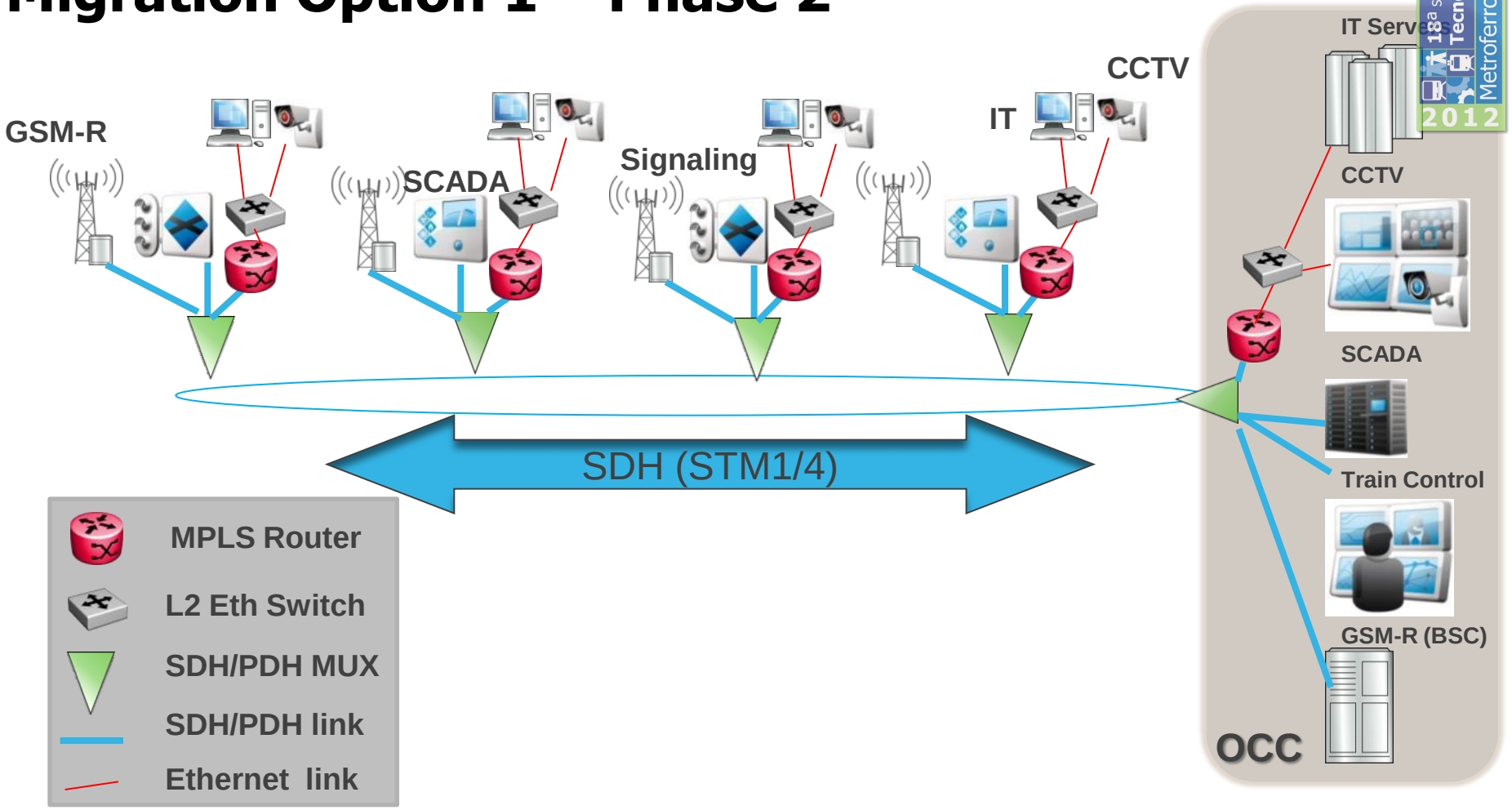
SDH Infrastructure
Migration Option 1: Running IP/MPLS over SDH



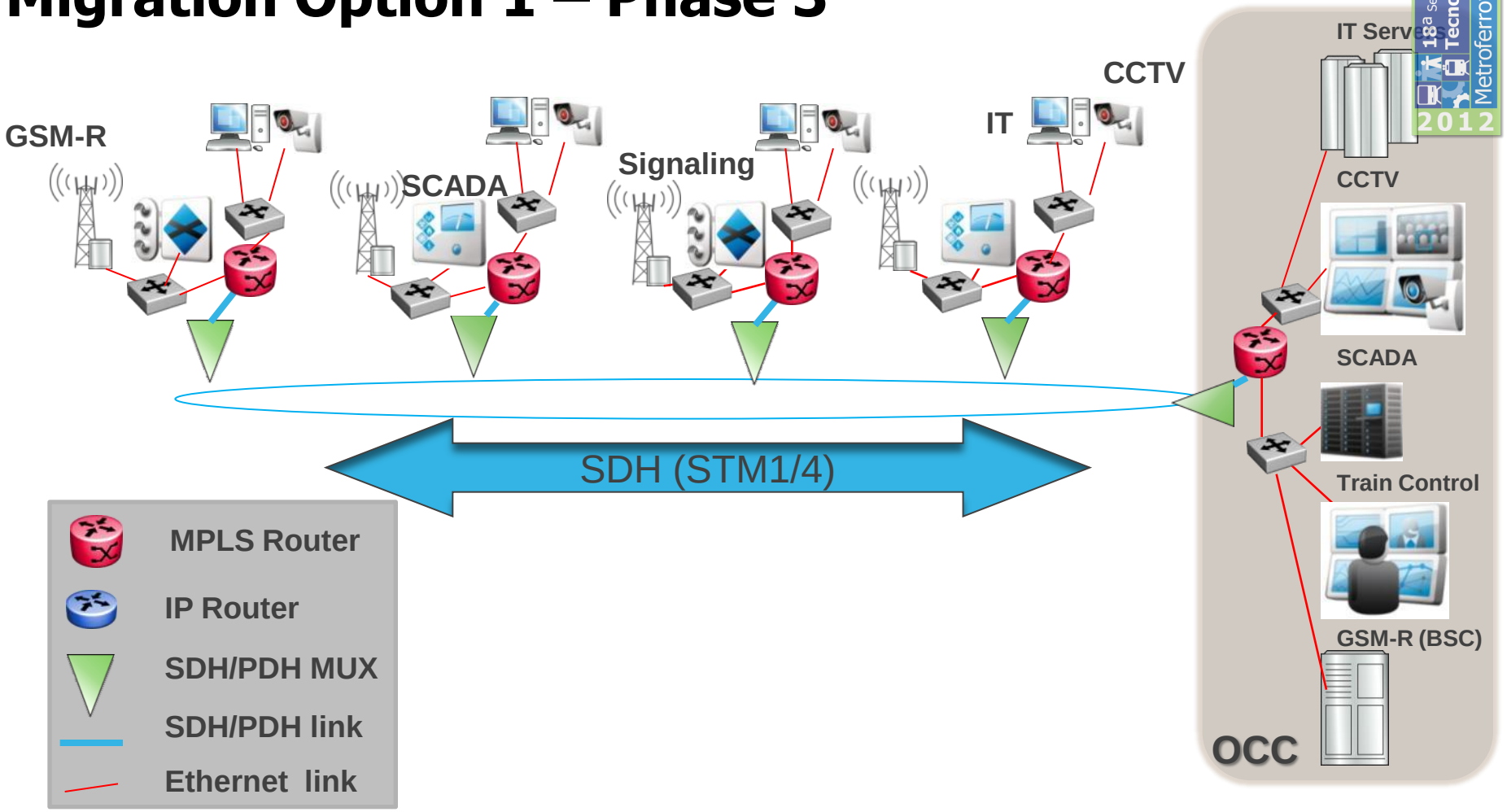
SDH Infrastructure
Migration Option 1 – Phase 1



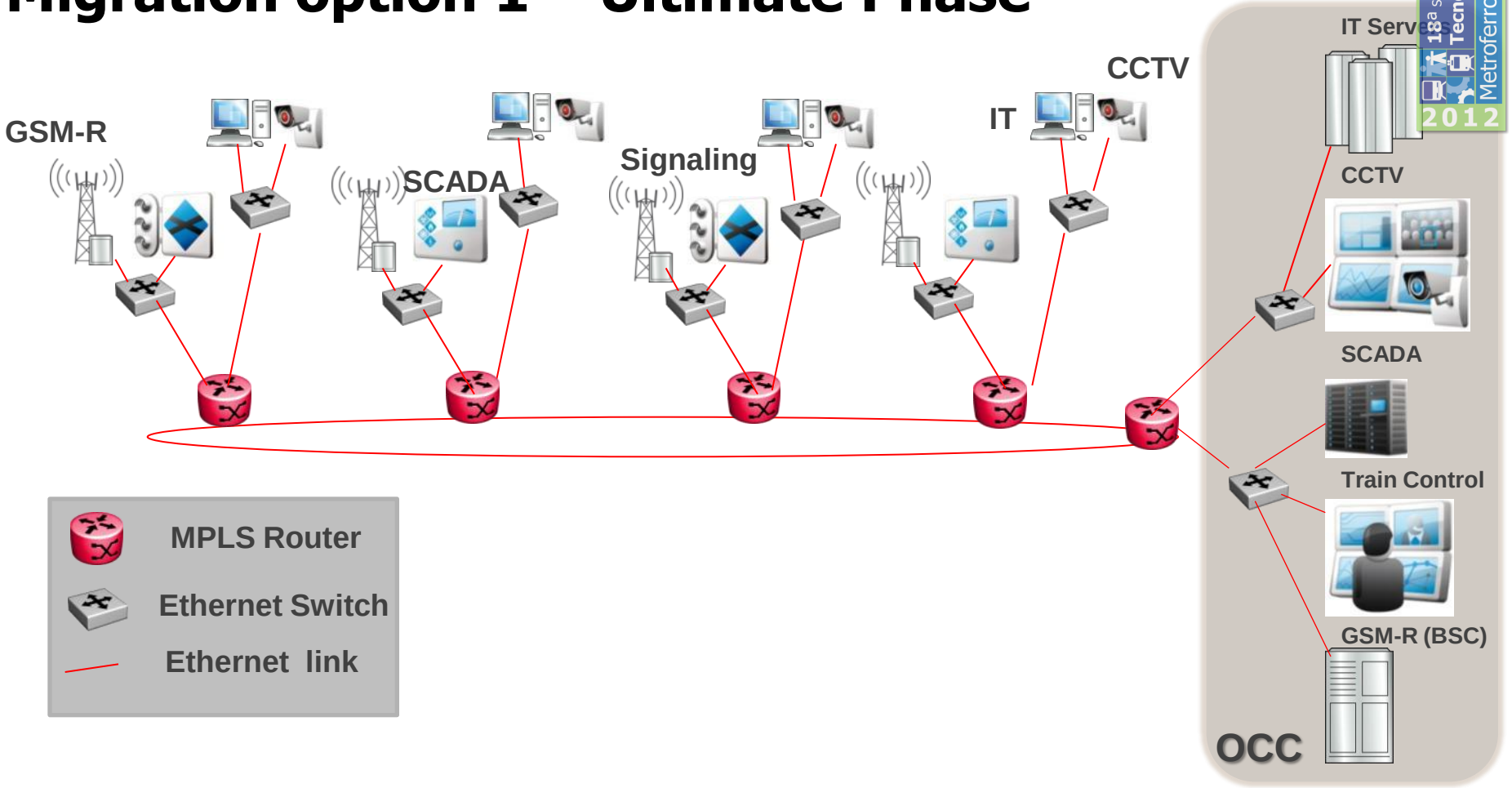
SDH Infrastructure
Migration Option 1 – Phase 2



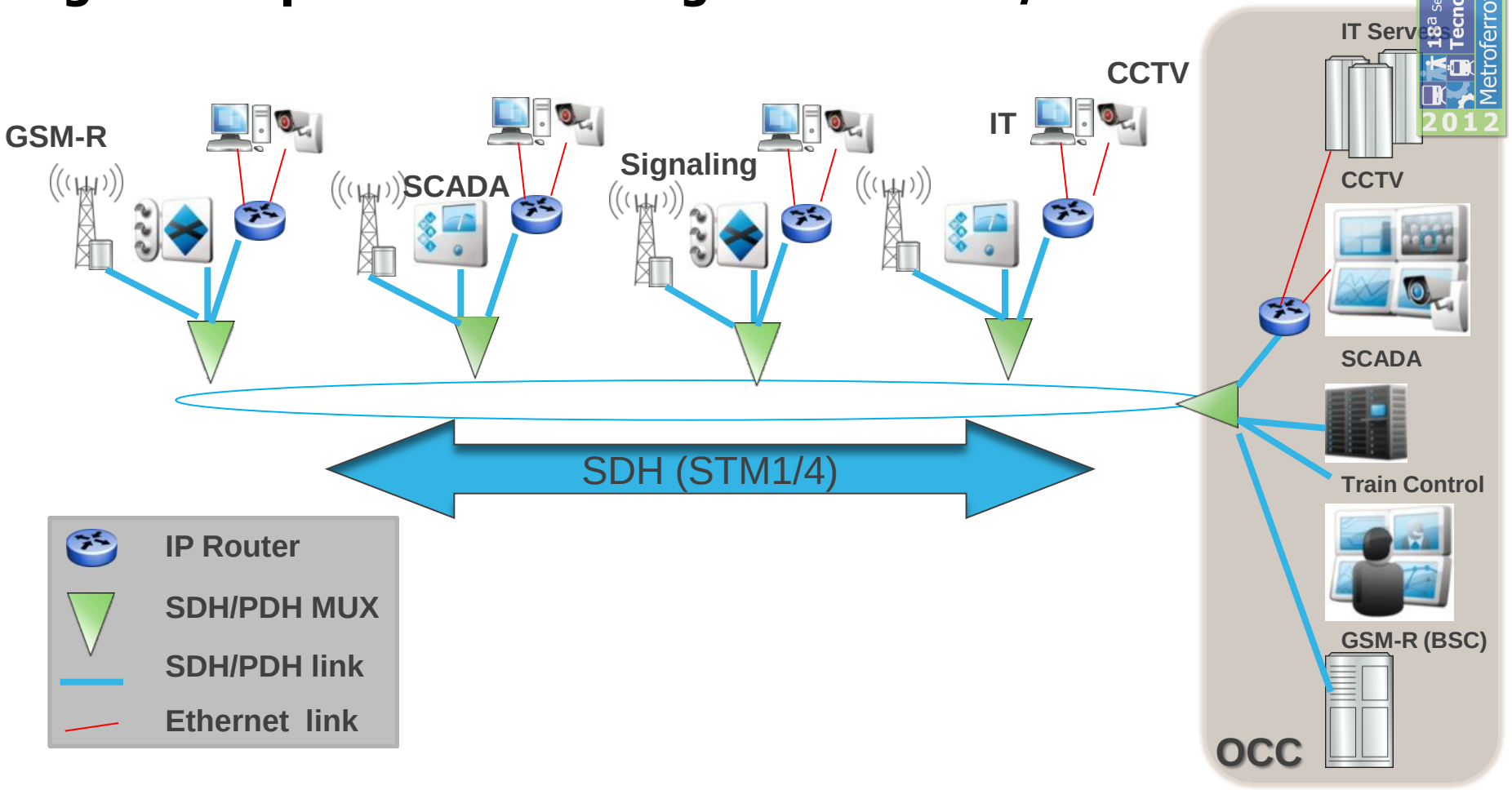
SDH Infrastructure
Migration Option 1 – Phase 3



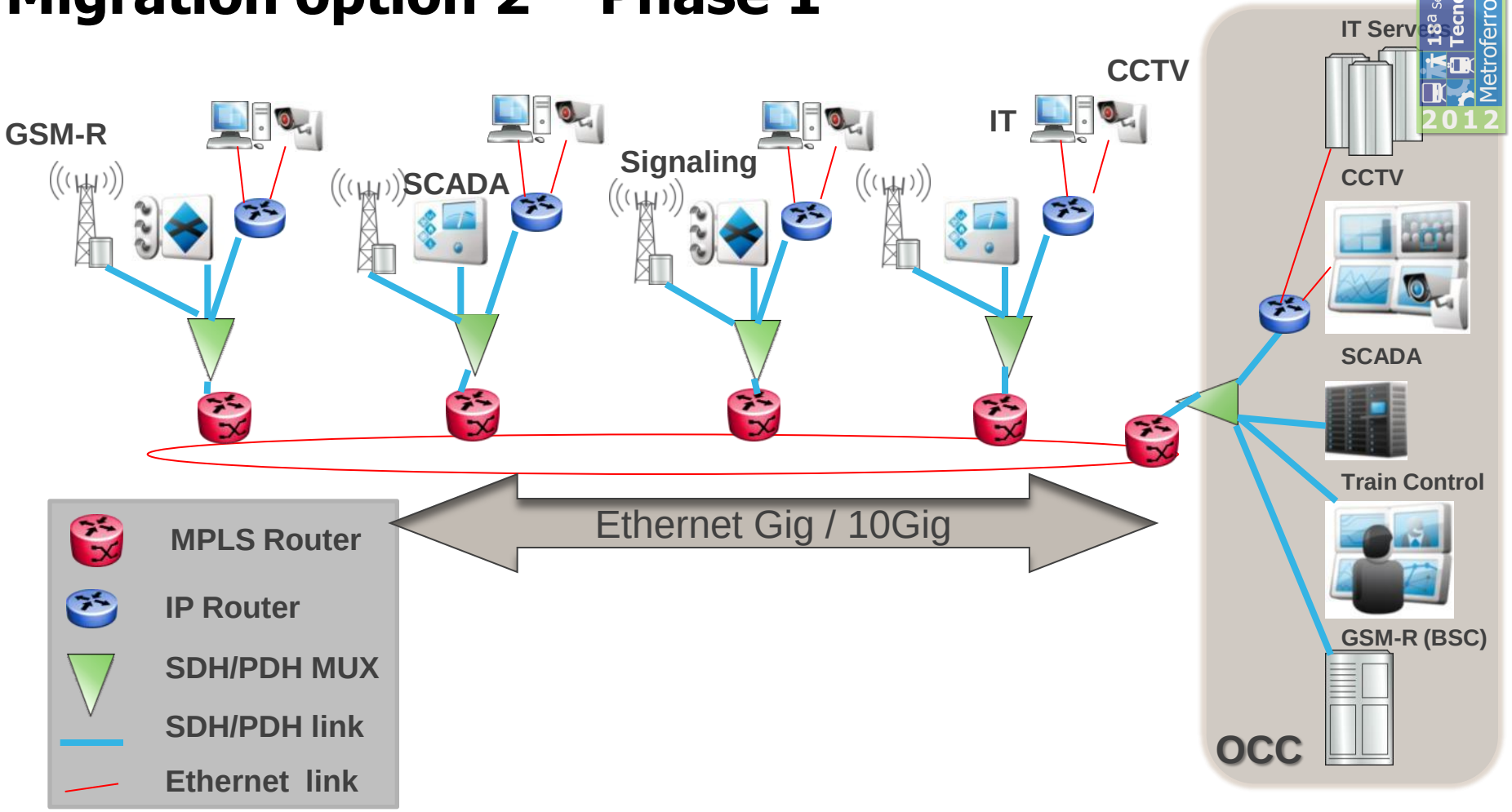
SDH Infrastructure
Migration option 1 – Ultimate Phase



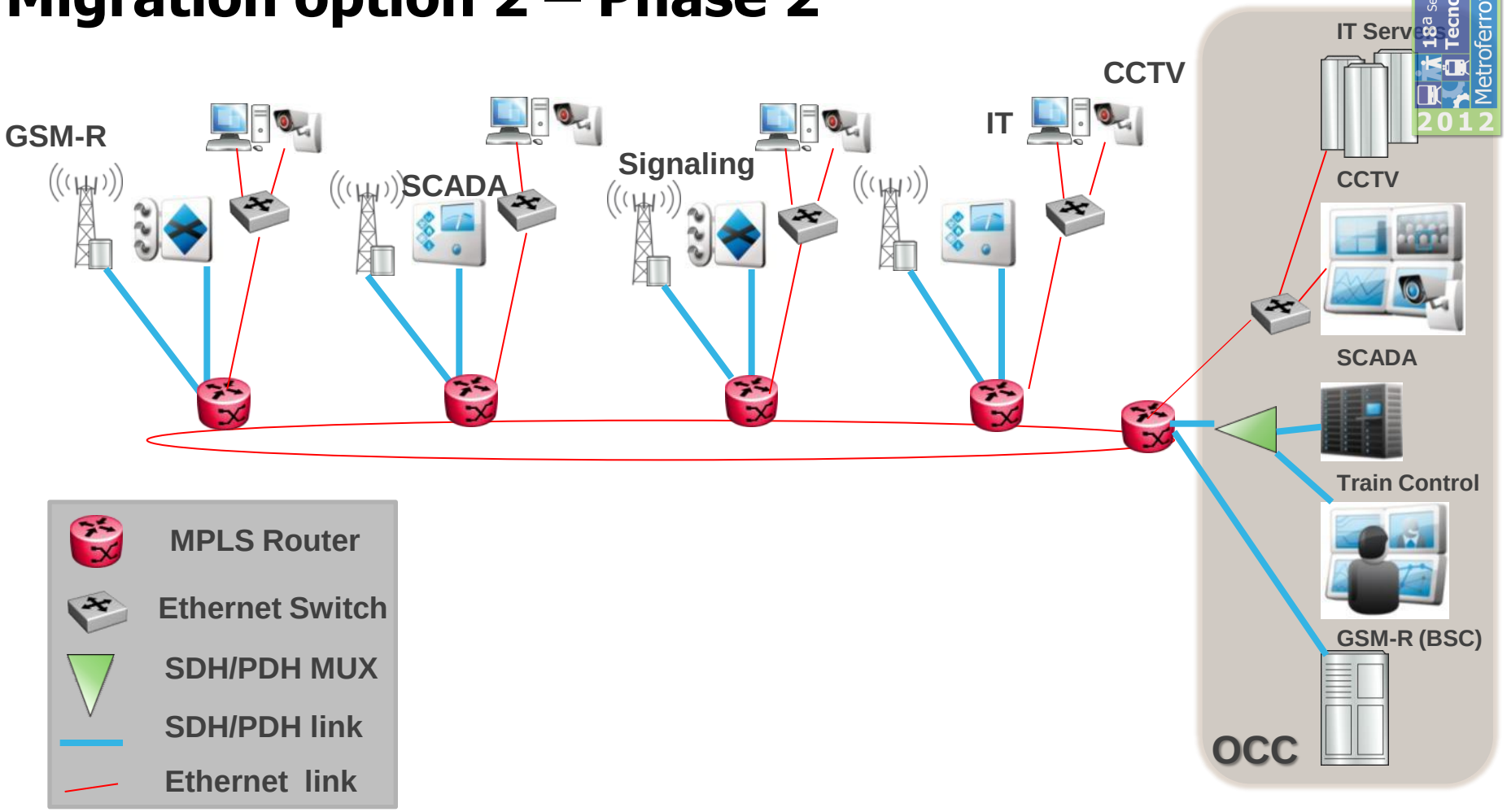
SDH Infrastructure
Migration option 2 – Running SDH over IP/MPLS



SDH Infrastructure
Migration option 2 – Phase 1



SDH Infrastructure
Migration option 2 – Phase 2



SDH Infrastructure
Migration option 2 – Ultimate Phase