From MPLS to GMPLS:
Adopting an evolution approach to Intelligent Core Networking

Mark.Vanderhaegen@alcatel.com

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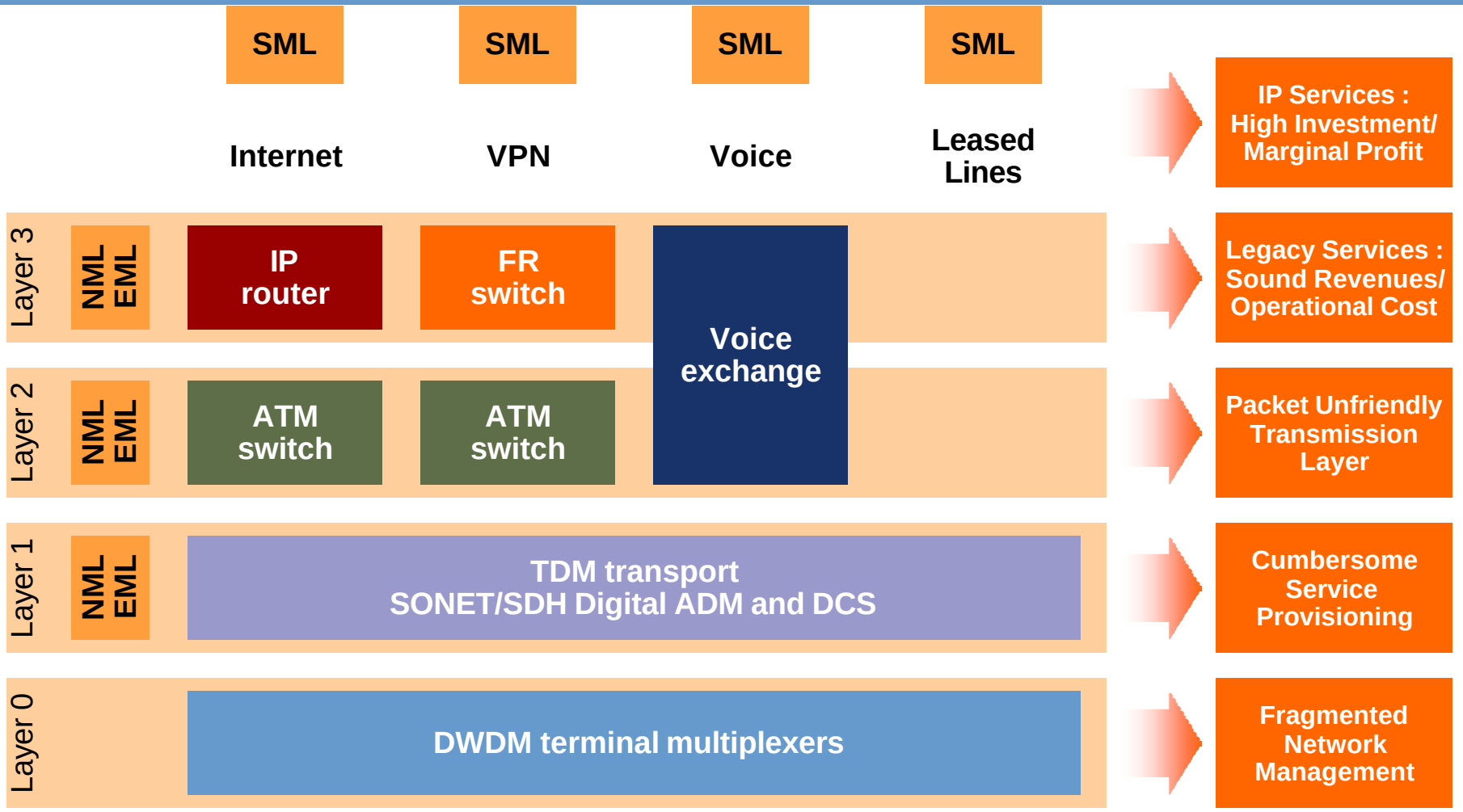
Thessaloniki, 19 February 2003

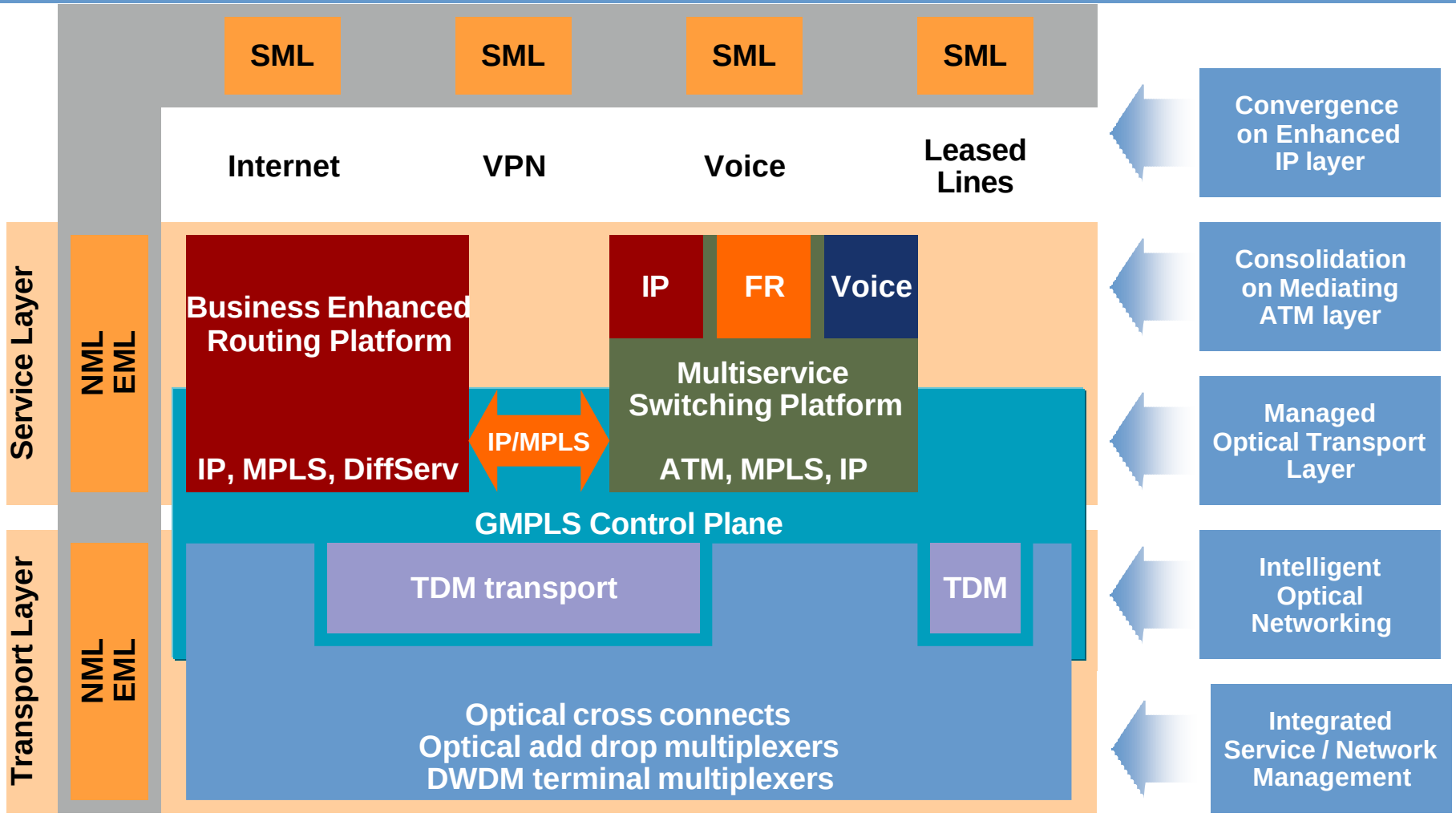
Introduction
Sound business ……..……Network Challenges

Introduction
Traditional Network Architecture



EML: Element Management Layer NML: Network Management Layer SML: Service Management Layer

Introduction
Future Proven Architecture



Intelligent Optical Networking

Key Concepts

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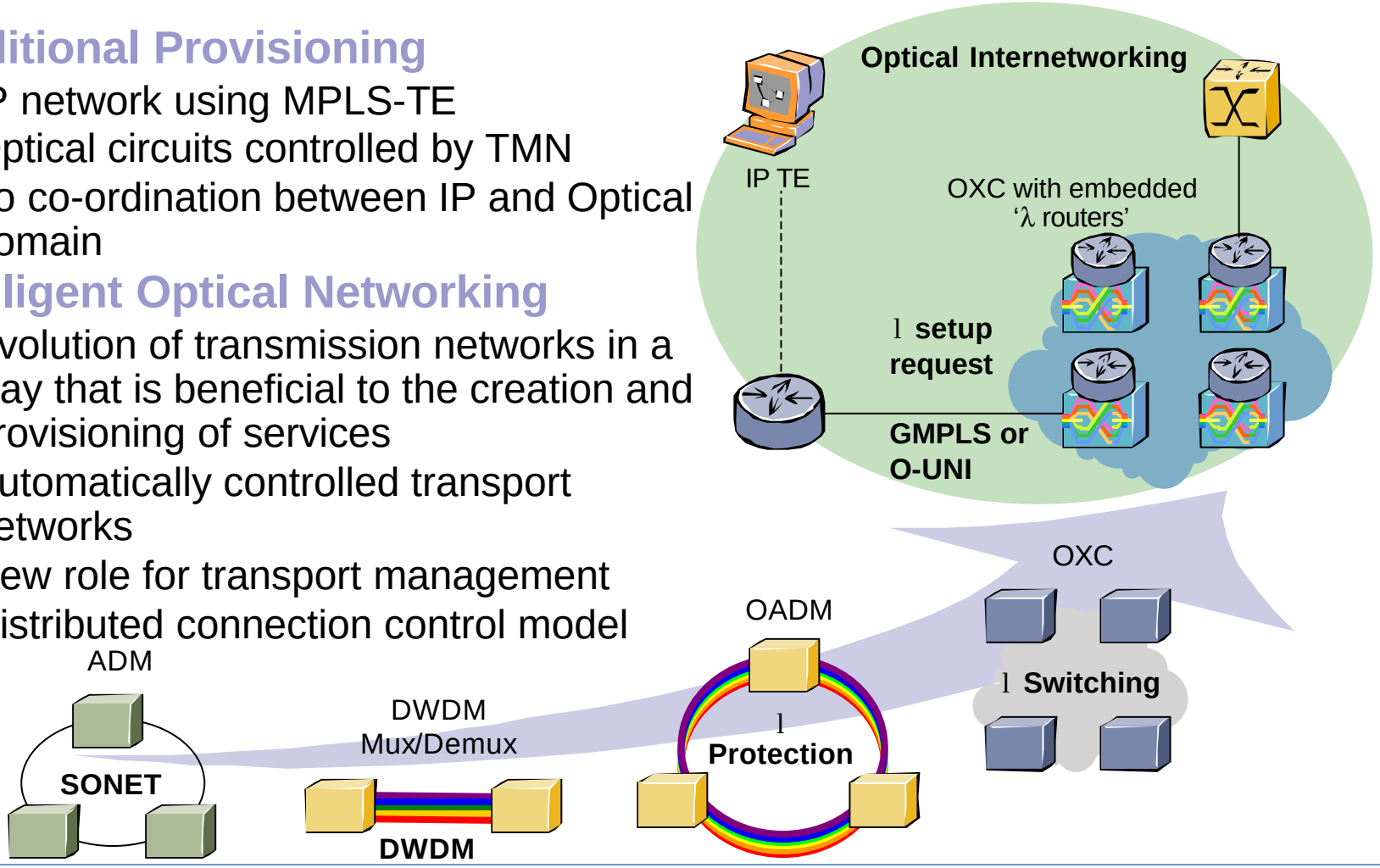
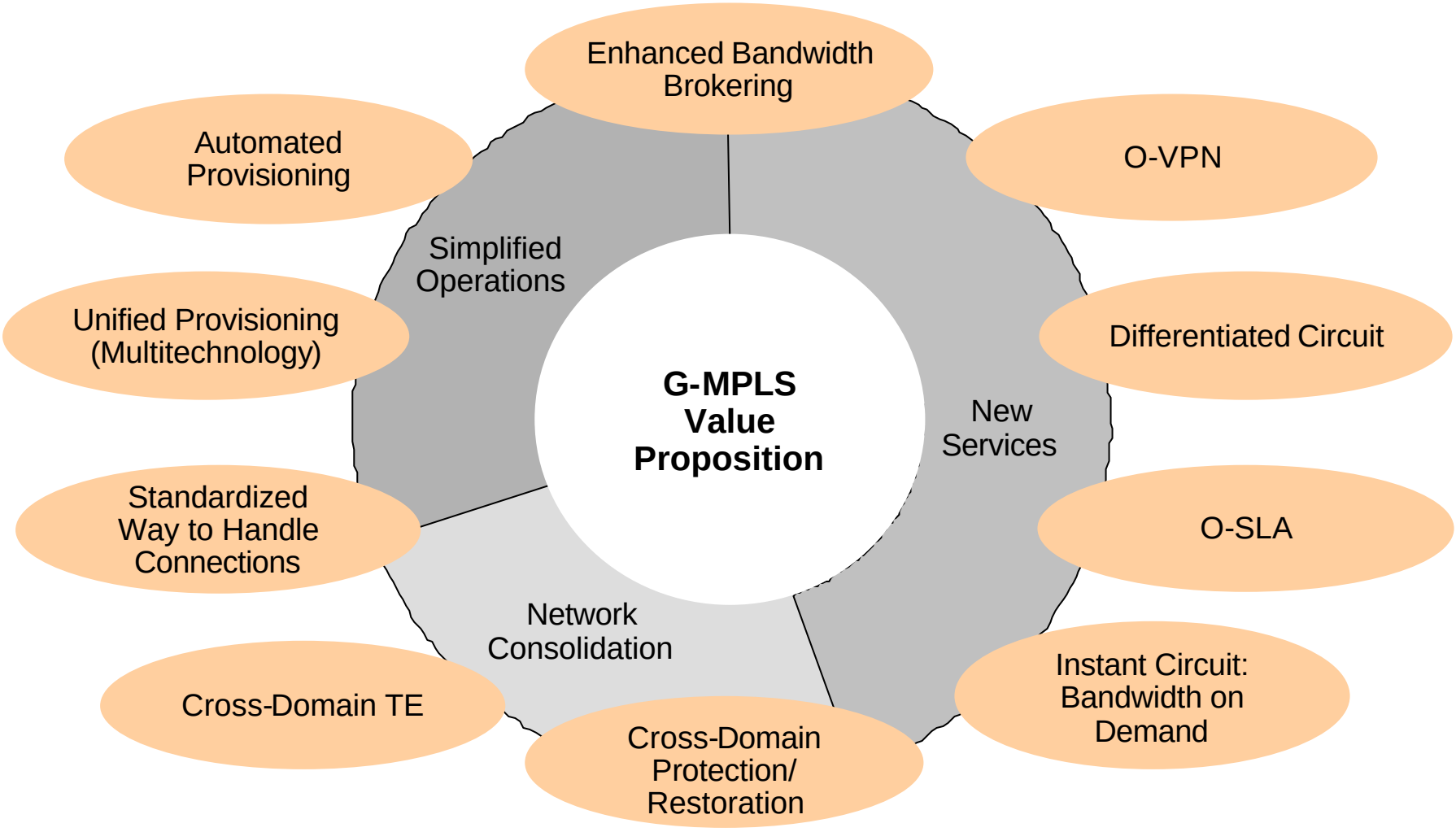
Intelligent Optical Networking
A New Networking Paradigm

- ✓ **Traditional Provisioning**
  - IP network using MPLS-TE
  - Optical circuits controlled by TMN
  - no co-ordination between IP and Optical domain
- ✓ **Intelligent Optical Networking**
  - Evolution of transmission networks in a way that is beneficial to the creation and provisioning of services
  - Automatically controlled transport networks
  - New role for transport management
  - Distributed connection control model



Intelligent Optical Networking Value Proposition



Intelligent Optical Networking
Control plane requirements

- ✓ It should be sufficiently flexible to accommodate different service models, depending on the service provider business model
  - Peer and Overlay (hybrid) instead of Peer-vs-Overlay
  - Parallel evolution of UNI and peer operation standards
- ✓ It should be applicable to all circuit switched networks, e.g. OTN, SONET/SDH, and PDH
- ✓ It should support legacy services and multiple client types (IP, ATM, …)
- ✓ It should facilitate network interoperation and integration between networks with different data plane technologies
- ✓ A consensus has emerged in the industry on utilizing IP-based protocols for the optical control plane.
  - signaling and routing mechanisms developed for IP traffic engineering applications could be adapted to support provisioning and restoration of lightpaths in optical networks.
  - Leverages operational experience with MPLS-TE

Intelligent Optical Networking
MPLS Evolving ……

Current:

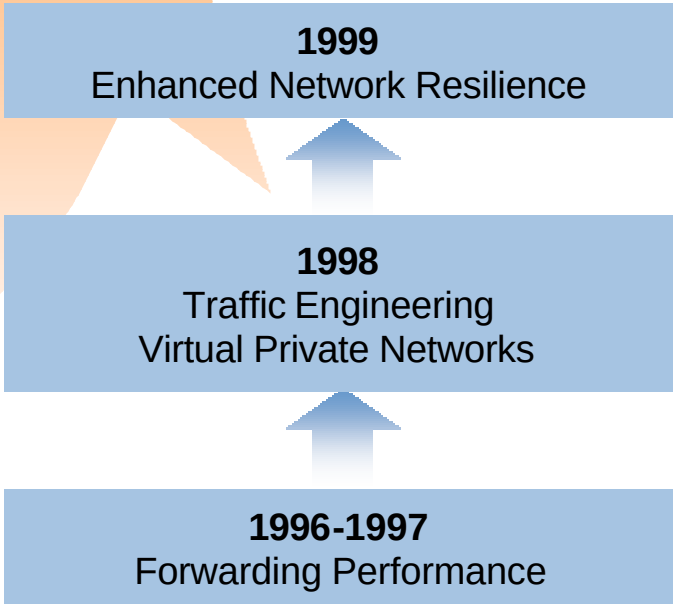
> Service enabling the edge
  - IP-VPN
  - L2 VPN

> Business enabling the core
  - MPLS-enhanced network resilience
  - MPLS-enhanced QoS

> Infrastructural optimization
  - traffic engineering
  - hierarchical core design

Past:

> Enhance forwarding performance of router networks



MPLS Standardization Activities

Intelligent Optical Networking
MPLS Evolving ……GMPLS Promising

Future: Network Convergence

- Convergence of data and IP
- Data/transport interworking with GMPLS

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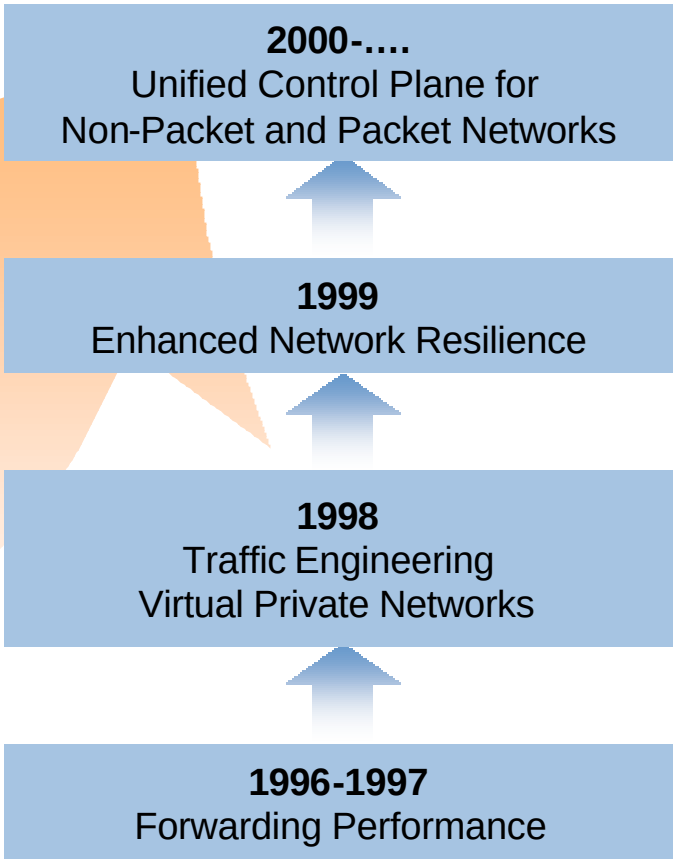


MPLS Standardization Activities

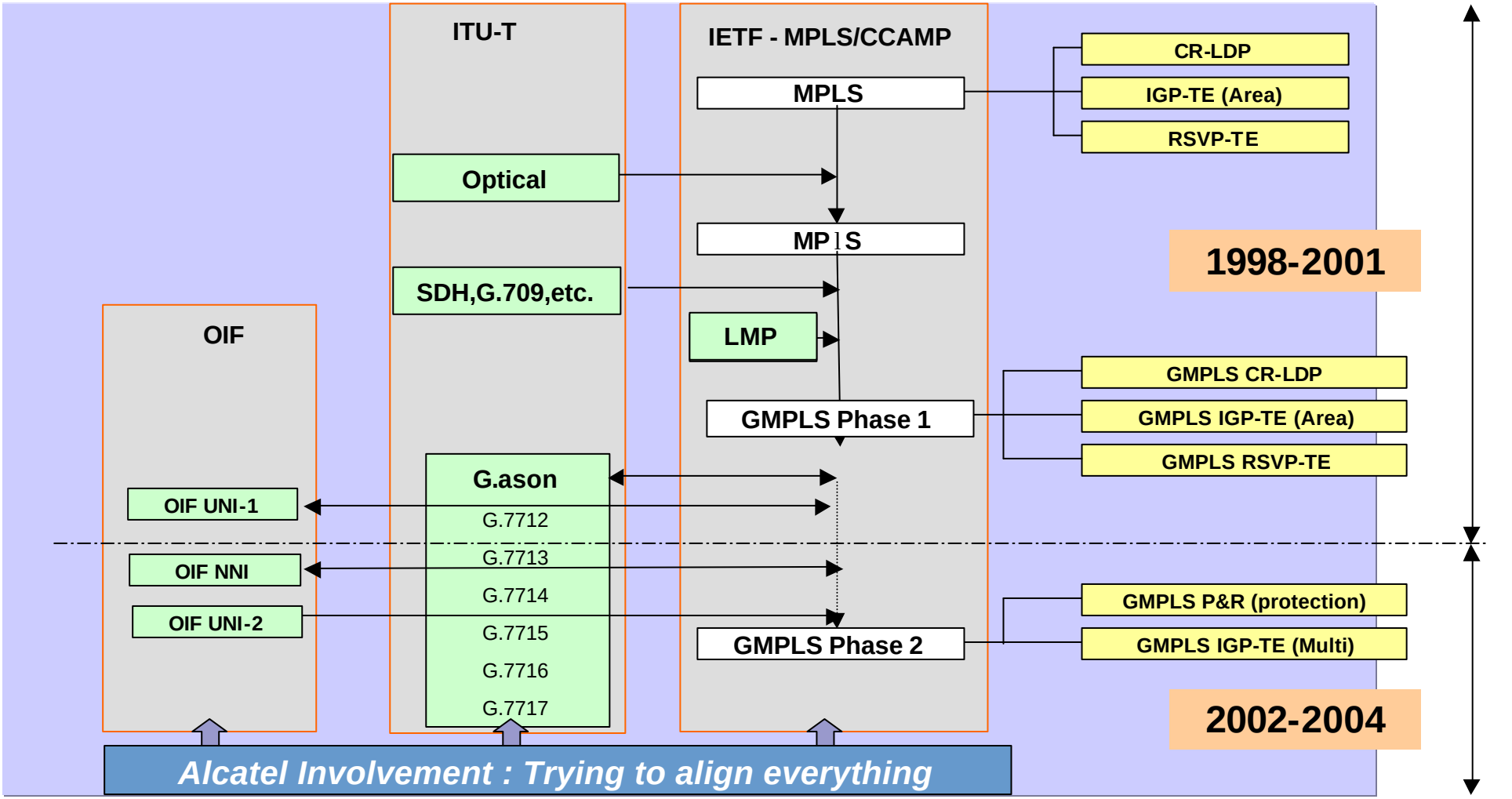
Intelligent Optical Networking
GMPLS Control Plane

- ✓ Based on extensions to well-known IETF signaling and routing protocols
- ✓ Based on TE extensions to MPLS
  - GMPLS extends IGP routing protocols that were already extended for TE
    - extended to disseminate non-Packet Switch static and dynamic characteristics
    - e.g., link descriptor (encoding and transmission rate), available and reservable bandwidth, protection and restoration related characteristics (link protection type, SRLG), …
  - Path computation
    - Proprietary algorithms for distributed and centralized computation
    - Is essentially a constraint-based routing problem
  - GMPLS extends RSVP-TE and CR-LDP
- ✓ Introducing the new LMP protocol
  - IP Control Channel configuration and maintenance
  - Neighbour discovery
    - Link Verification (incorrect wiring detection)
    - Link Property Correlation (Link bundling - TE Link)
  - Fault Management
  - Service Discovery

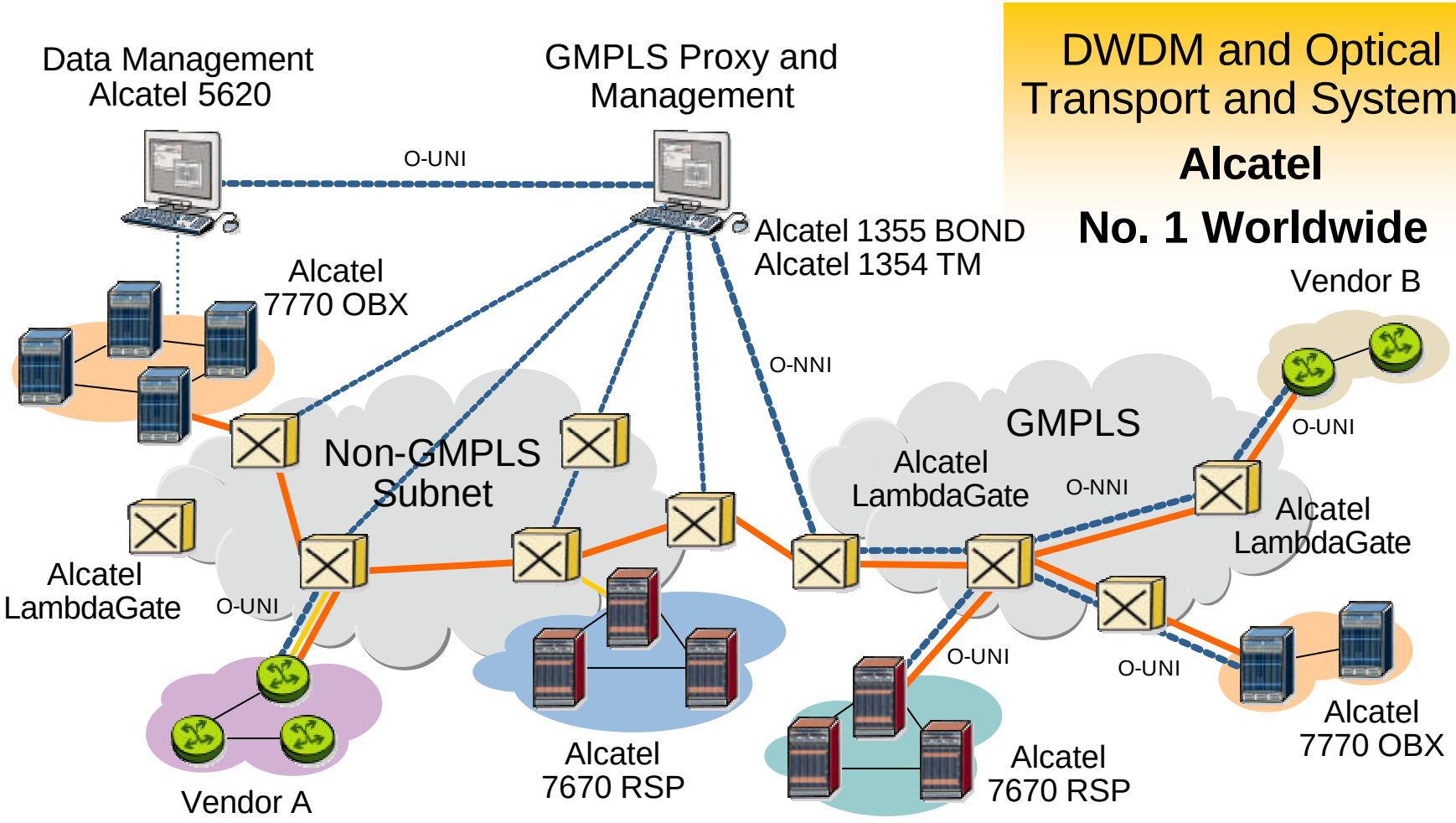
Intelligent Optical Networking
G-LSP establishment

- ✓ PATH/Label request message
  - Generalized label request
    - LSP encoding type (e.g., SONET, SDH, …)
    - Payload type (client layer)
    - Requested local protection on each link (1+1, 1:N)
    - requested concatenation and transparency (only for SONET/SDH)
  - ERO object
    - may be completed by first optical node (e.g., Overlay model)
    - extended to support unnumbered interfaces and labels as abstract nodes
  - Requested bandwidth
  - Upstream label
    - Only in case of a bi-directional LSP establishment
  - Suggested label / label set restrictions
- ✓ RESV/Label mapping message
  - Generalized label object

Intelligent Optical Networking
GMPLS The Standard Story



Intelligent Optical Networking
Alcatel's Evolutionary Approach



DWDM and Optical Transport and Systems

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No. 1 Worldwide

Business Enhanced IP Services Layer

Key Concepts

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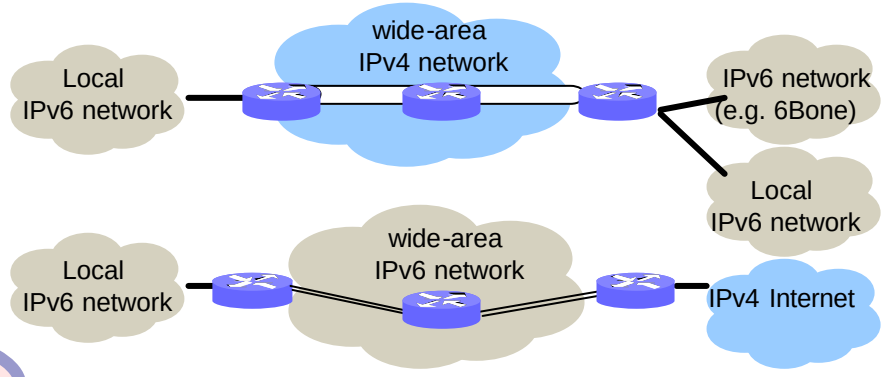
Business Enhanced IP Services Layer
A New Networking Paradigm

- ✓ **Managed optical internetworking**
  - Automated and fast provisioning
  - Cross layer traffic engineering
  - Coordinated protection and recovery
- ✓ **Smart investing**
  - Scalable and Flexible Platform
  - Scalable Performance
  - Scalable Links
- ✓ **Proven carrier grade networking**
  - Redundant Hardware
  - Modular Software
  - High availability routing

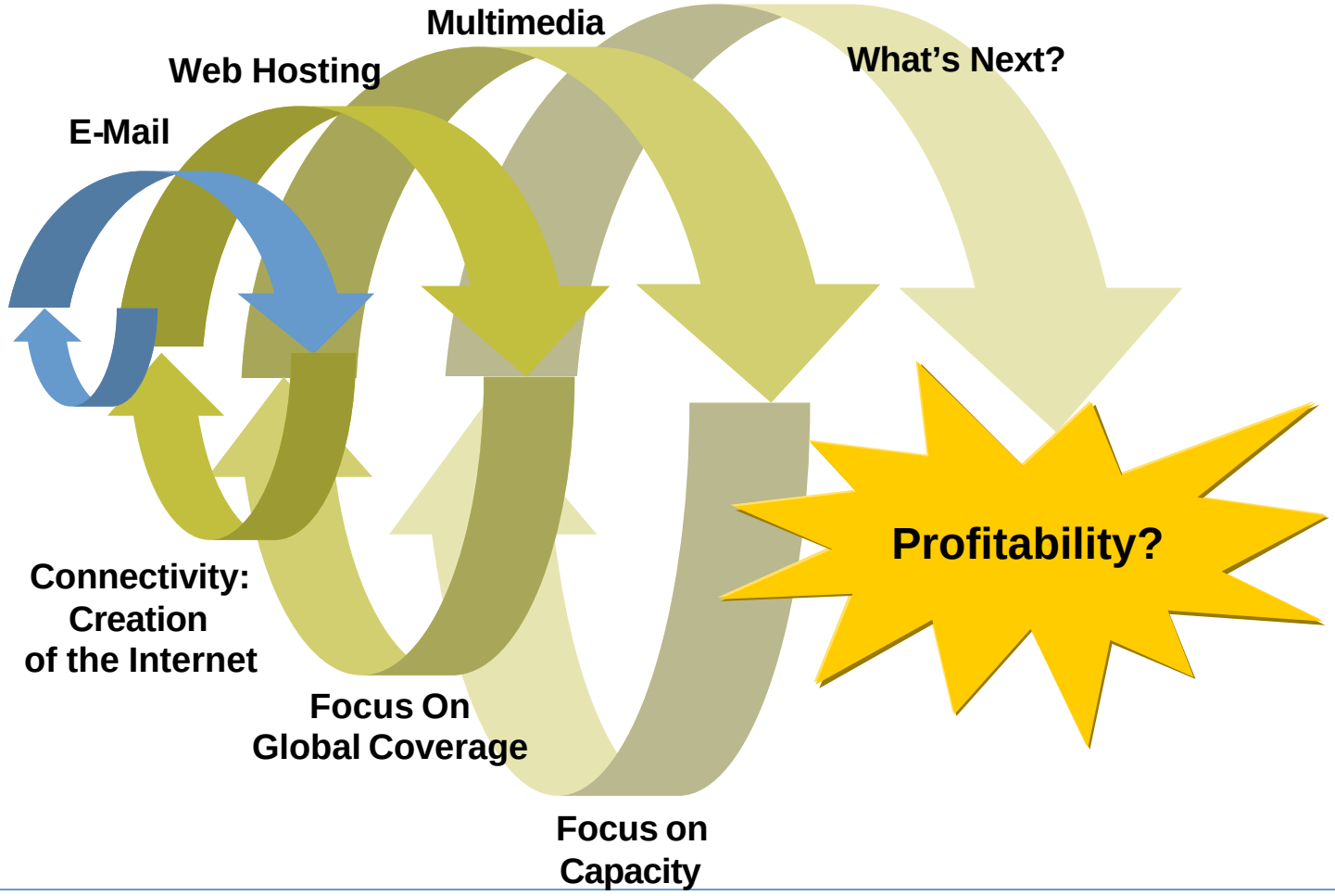
IP V6 Enabled

> Dual stack IPv4/IPv6
> Tunneling of IPv6 over IPv4 network



Architected with ACEIS™

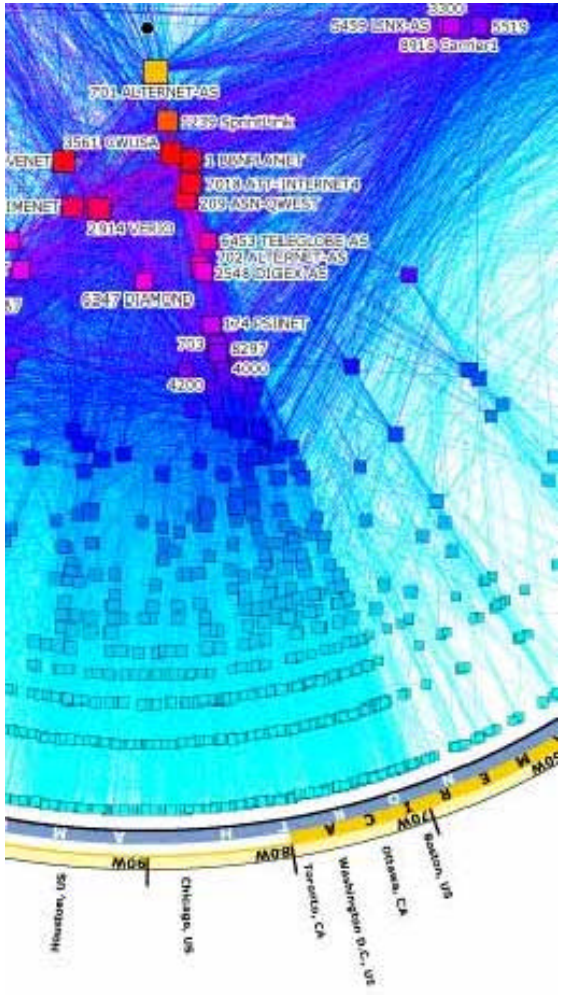
Business Enhanced IP Services Layer Value Proposition



TeleChoice quote:

"Although IP services have been a high-growth area for most service providers, IP service businesses are almost universally operated at a loss. The problem has been compounded with increasing broadband adoption, with broadband users representing exponential increases in IP traffic load without representing corresponding increases in revenue."

Business Enhanced IP Services Layer
Control plane requirements



- > **Routing problems are well understood**
- > **Unreliable**
  - control protocol is the most important and least resilient for IP routing
  - lots of FUD – high availability, hot/warm standby, GR, etc. (FUD = Fear, Uncertainty and Doubt)
- > **Failures not isolated to the node**
  - requires long distance restoration, not local
  - IP control complexes designed to recover from, not prevent failure
- > **Perception that reliability is expensive**
  - can achieve significant CAPEX reduction over today's model
  - dual router solution has proliferated because of inherent unreliability

Business Enhanced IP Services Layer
Non Stop Routing

InfoWorld LEAD WITH KNOWLEDGE

Alcatel gets serious about IP

IDG .net

Alcatel to smooth out IP network delays

hot/warm

e

on, not local

to recover

ensive

LIGHT READING

Alcatel Unveils New Routing Technology

IP Wireline & Wireless Week

Alcatel Un-Veils non-stop Routing Architecture

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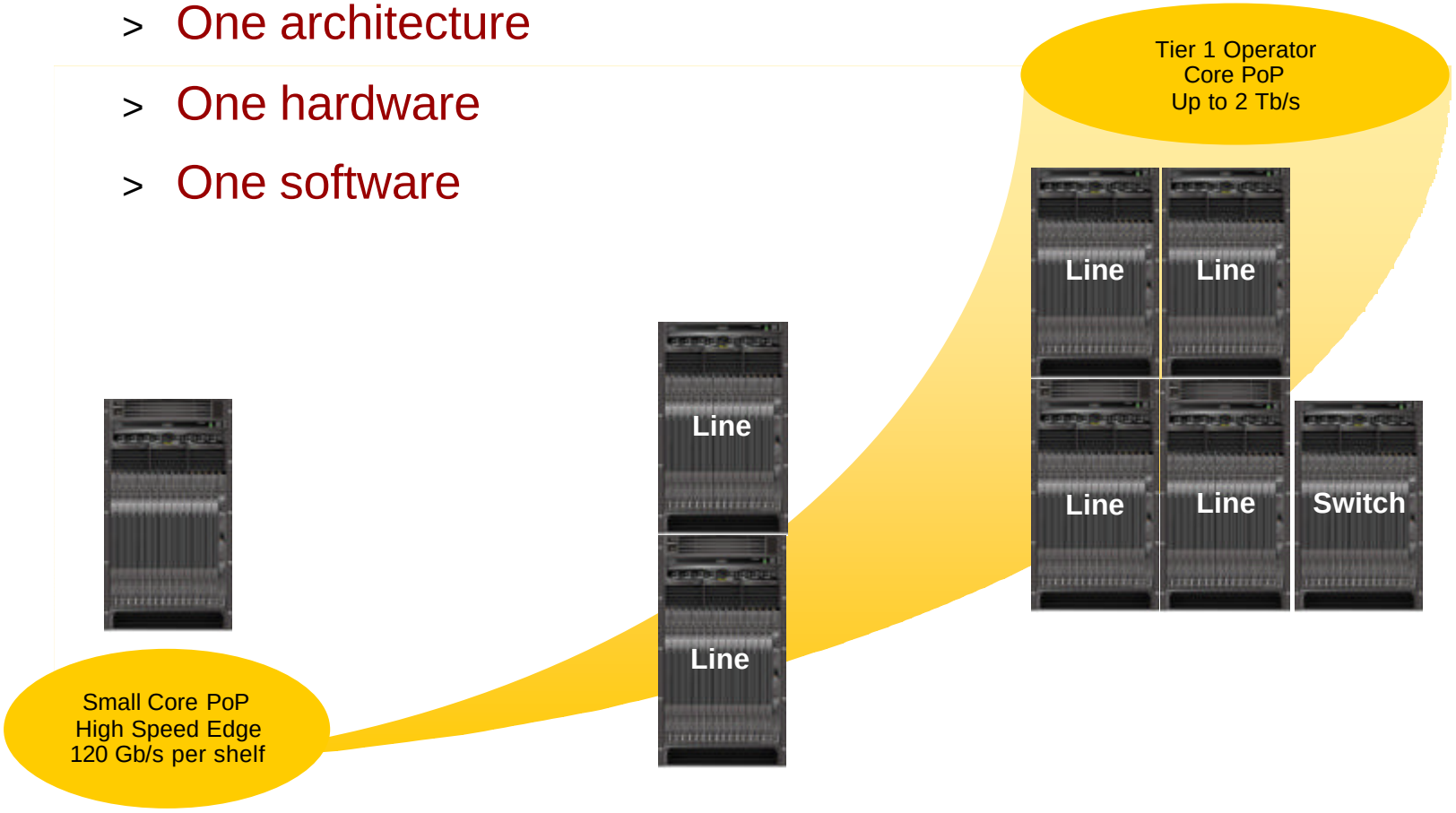
Business Enhanced IP Services Layer
Alcatel's Evolutionary Approach

- One architecture
- One hardware
- One software



Conclusions
Sound business and Solutions for the Network Challenges

Questions
Thanks

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