Advanced Services enabled by GMPLS in Digital Optical Networks

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Outline

- Photonic Integration and Digital Optical Networking
- GMPLS in Digital Optical Networks
- Applications
  - Layer1 VPN
  - GMLPS UNI for Dynamic Bandwidth Reconfiguration

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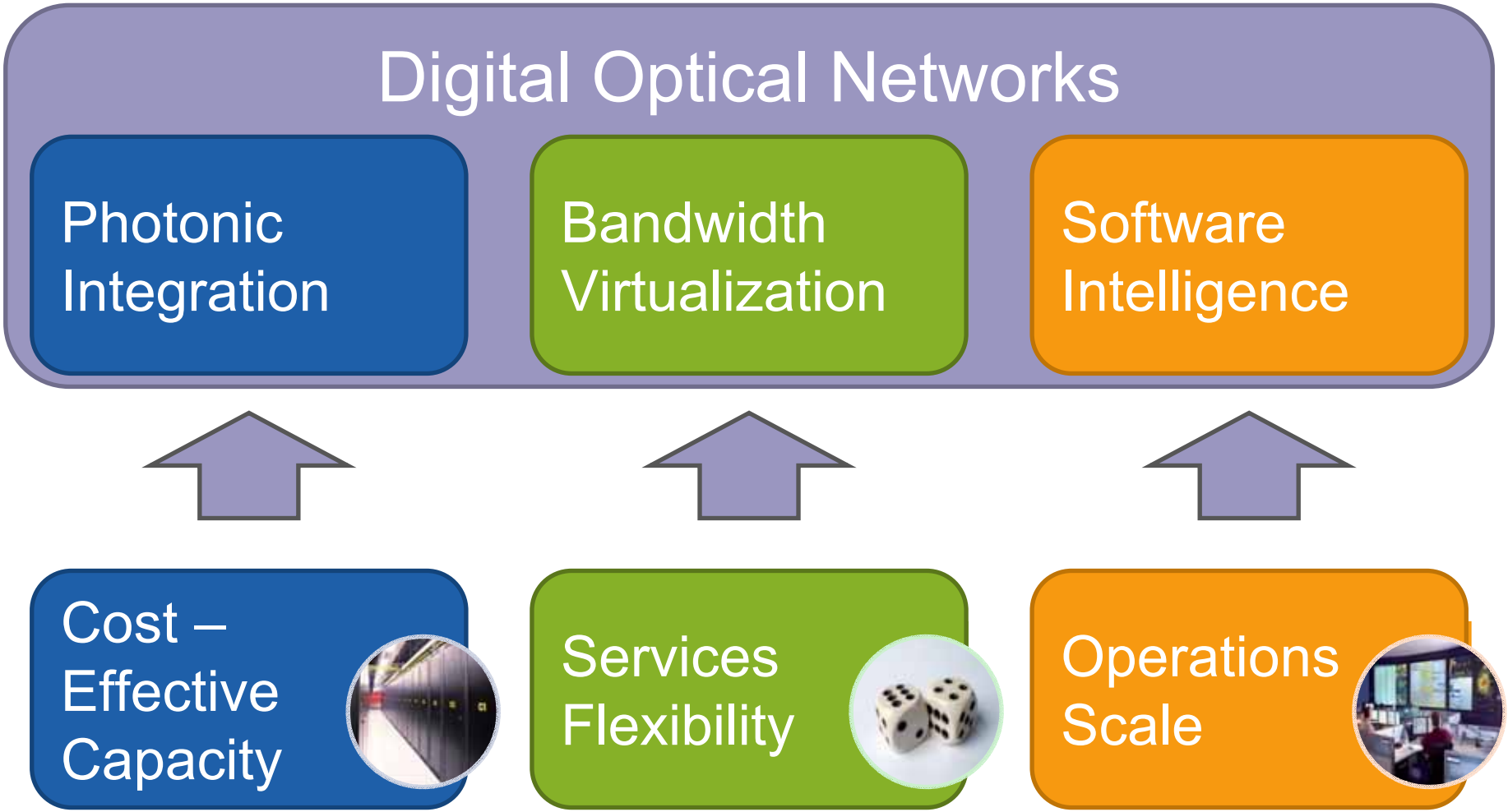
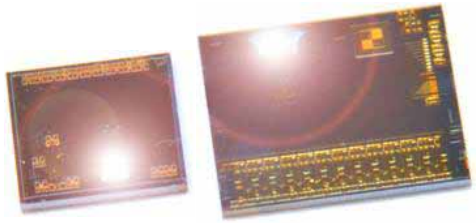
Digital Optical Networks

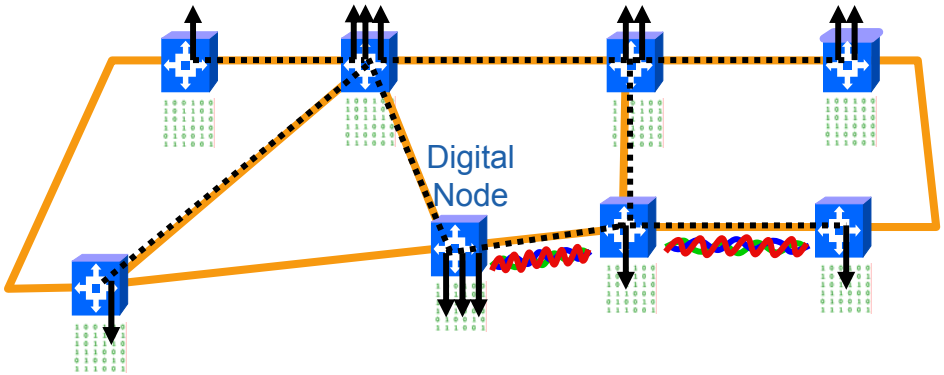


Photonic Integration and Digital Optical Networks

Photonic Integrated Circuits → Digital Optical Networks



100Gb/s Receive 100Gb/s Transmit



Don't Eliminate OEO…Make it Cheaper

Photonic Integrated Circuits

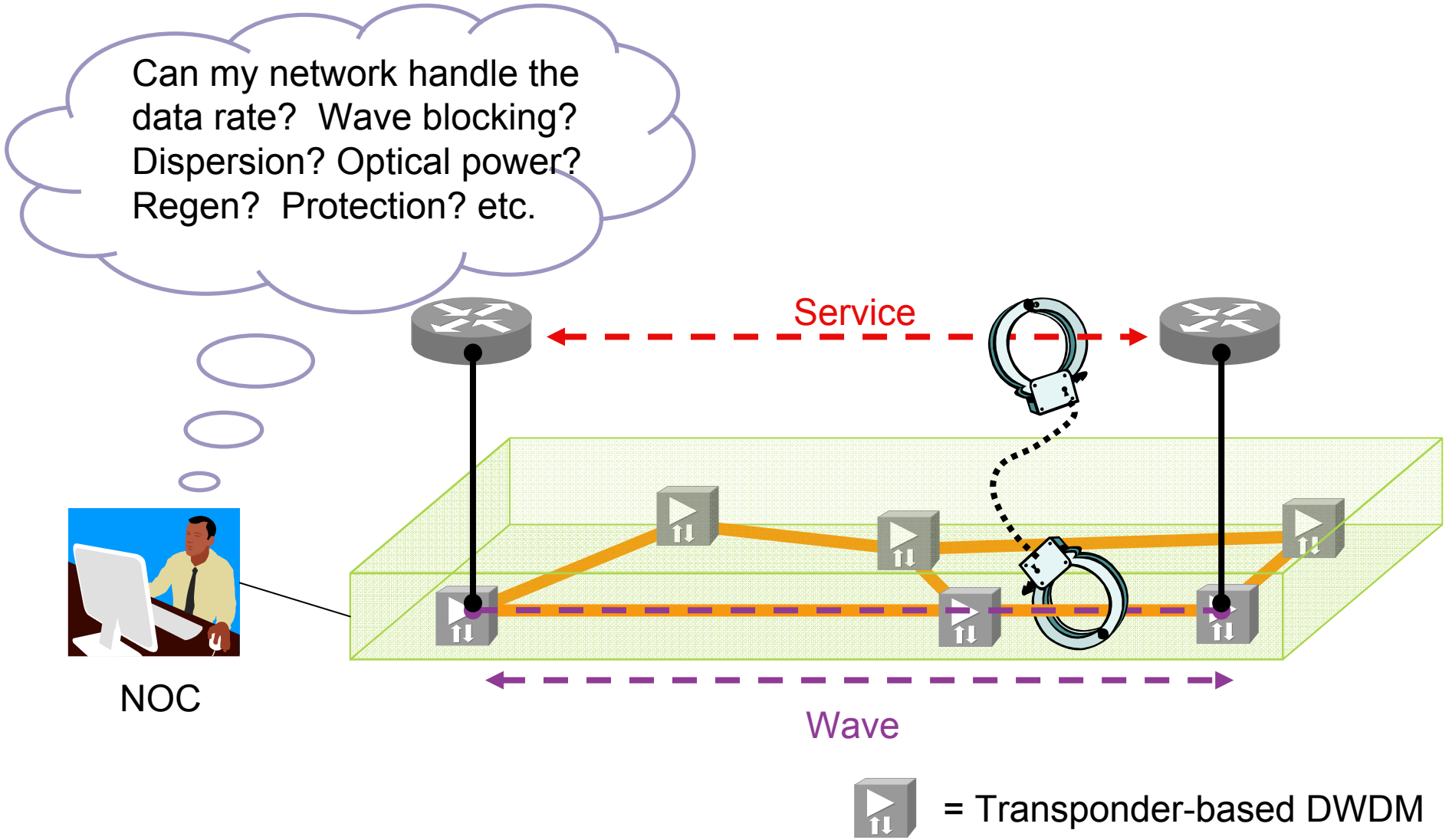
Direct Benefits:

- Lower cost OEO
- Lower power
- Higher density
- More reliable
- Fewer line cards
- Simpler system design

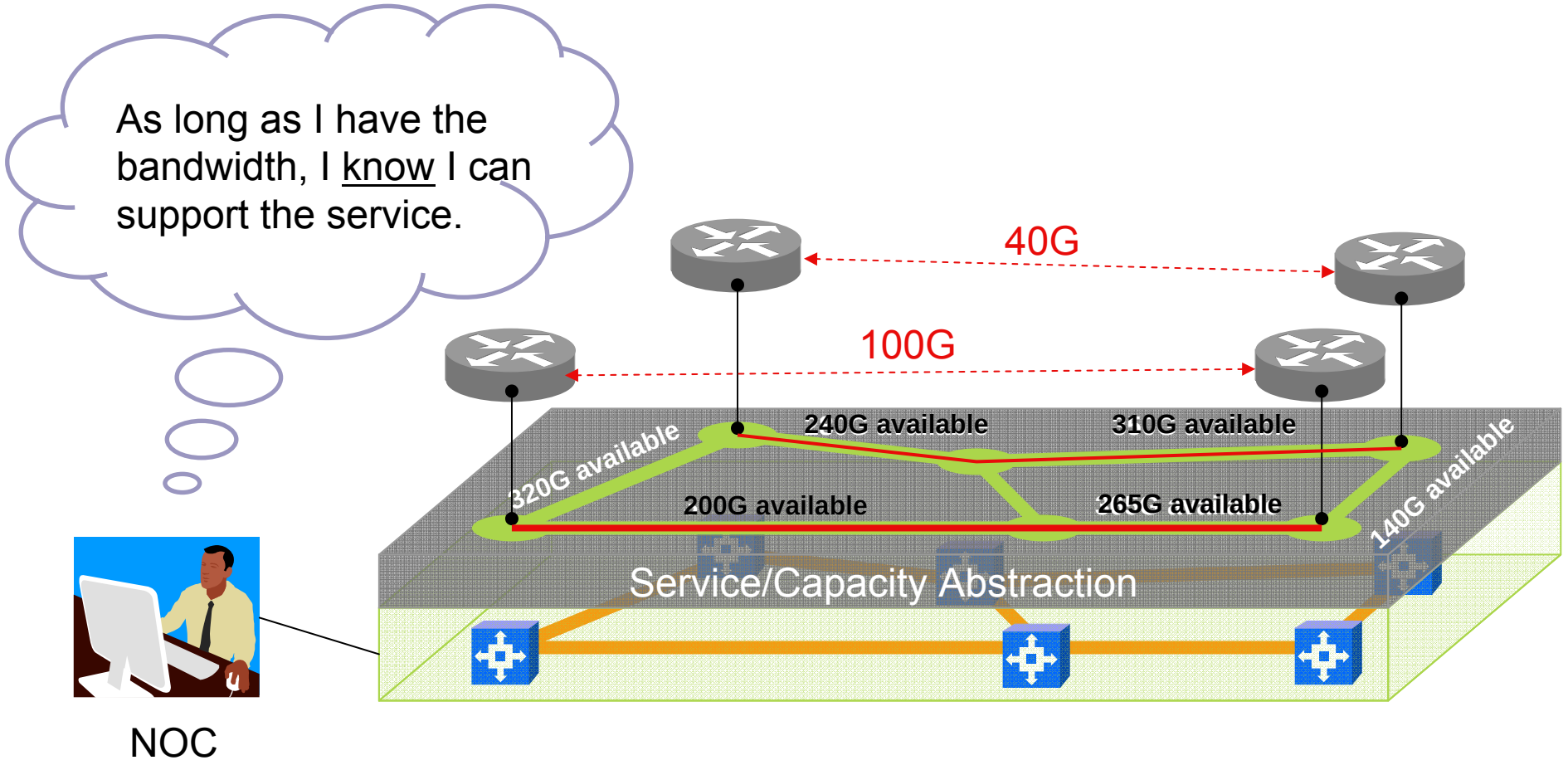
Strategic Benefits:

- Maximize service access
- Digital feature richness at every node
- Software intelligence
- Simplify operations
- Increase flexibility

High-speed Services on Conventional DWDM

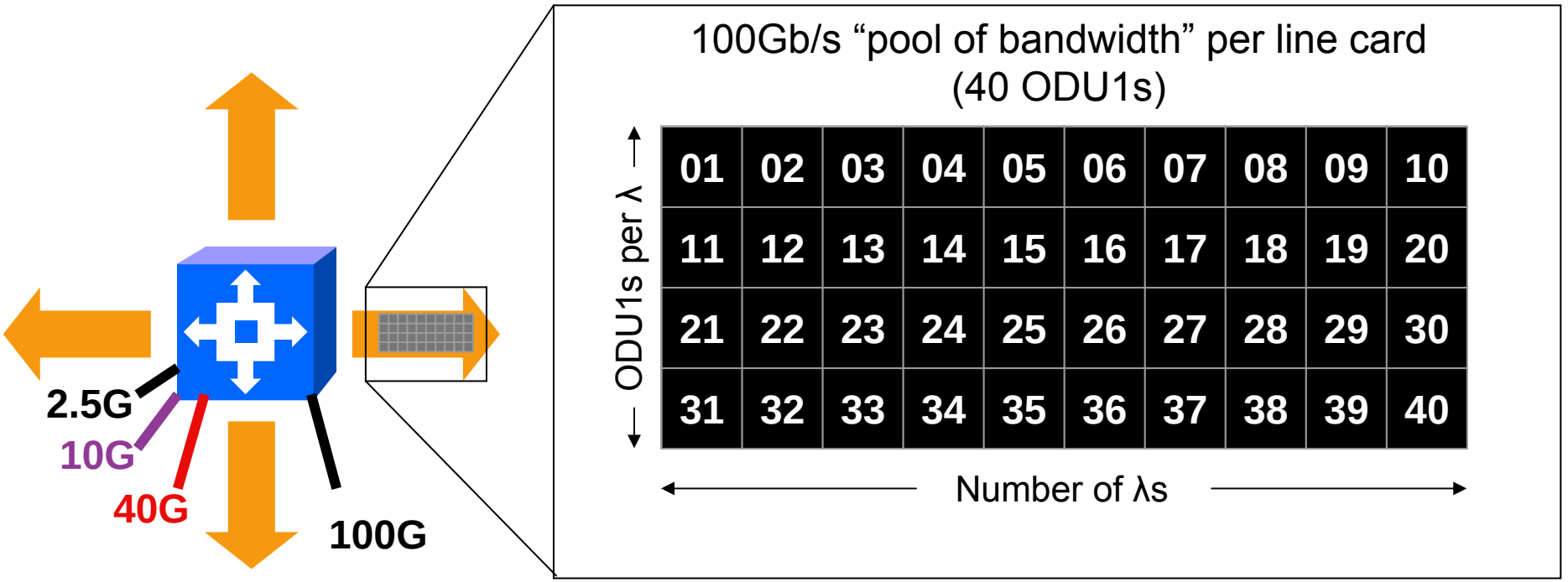


Decoupling Transport Services from Waves



All sites are connected; GMPLS enables Operational simplicity

Digital Bandwidth Management w/ GMPLS



- Enables fractional services (e.g., Fractional 100 GbE)
- GMPLS fully automates bandwidth management

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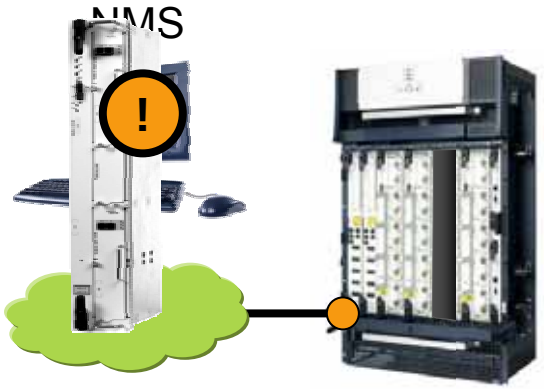
GMPLS in Digital Optical Networks

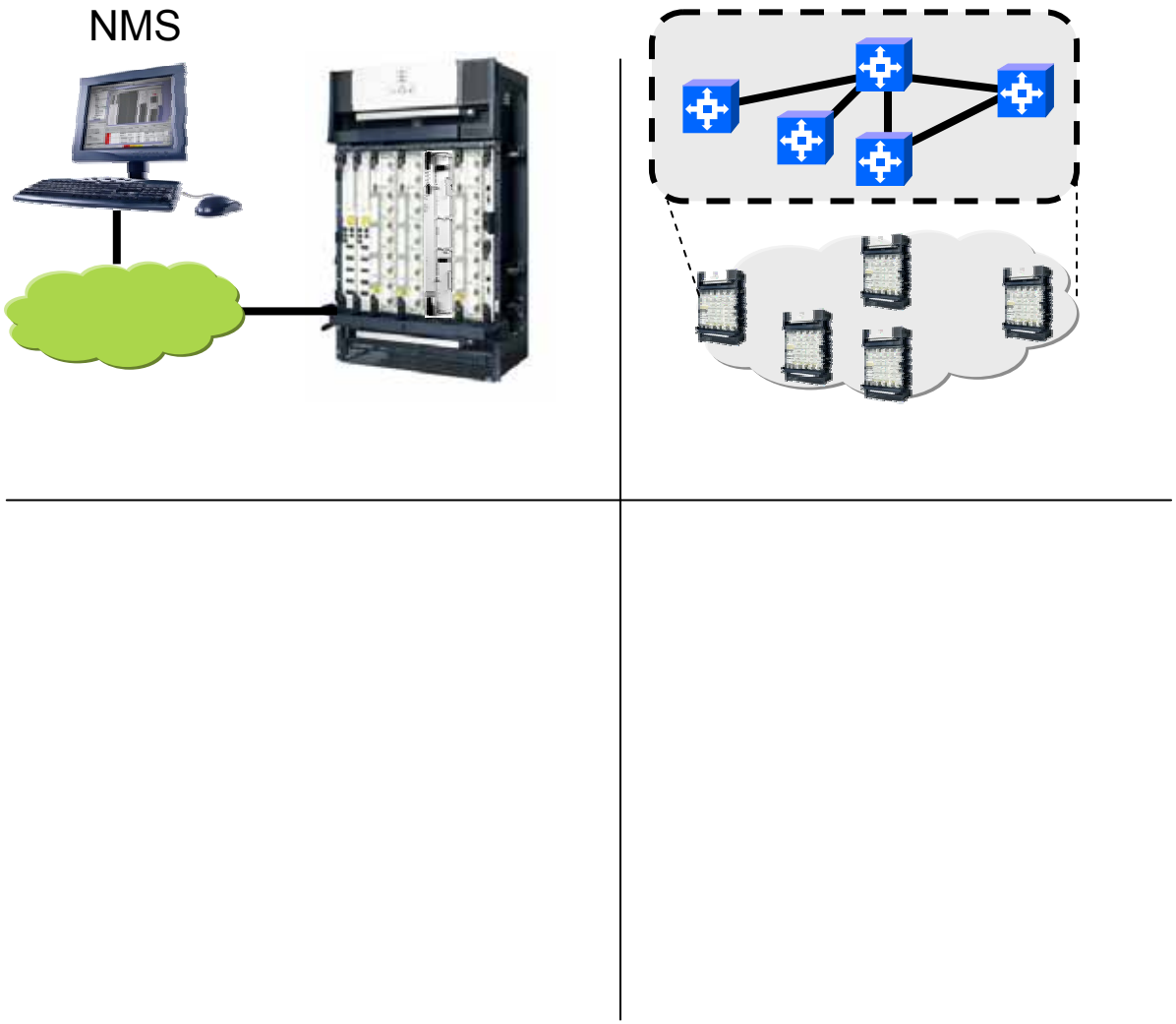
- Integrated bandwidth management in Digital Optical Networks enables end-to-end GMPLS intelligence
- GMPLS enabled services optimize the performance of IP layer
  - Integrated protection and restoration capabilities
  - GMPLS UNI based dynamic bandwidth reconfigurability

Operations Scale with GMPLS



Inventory Management

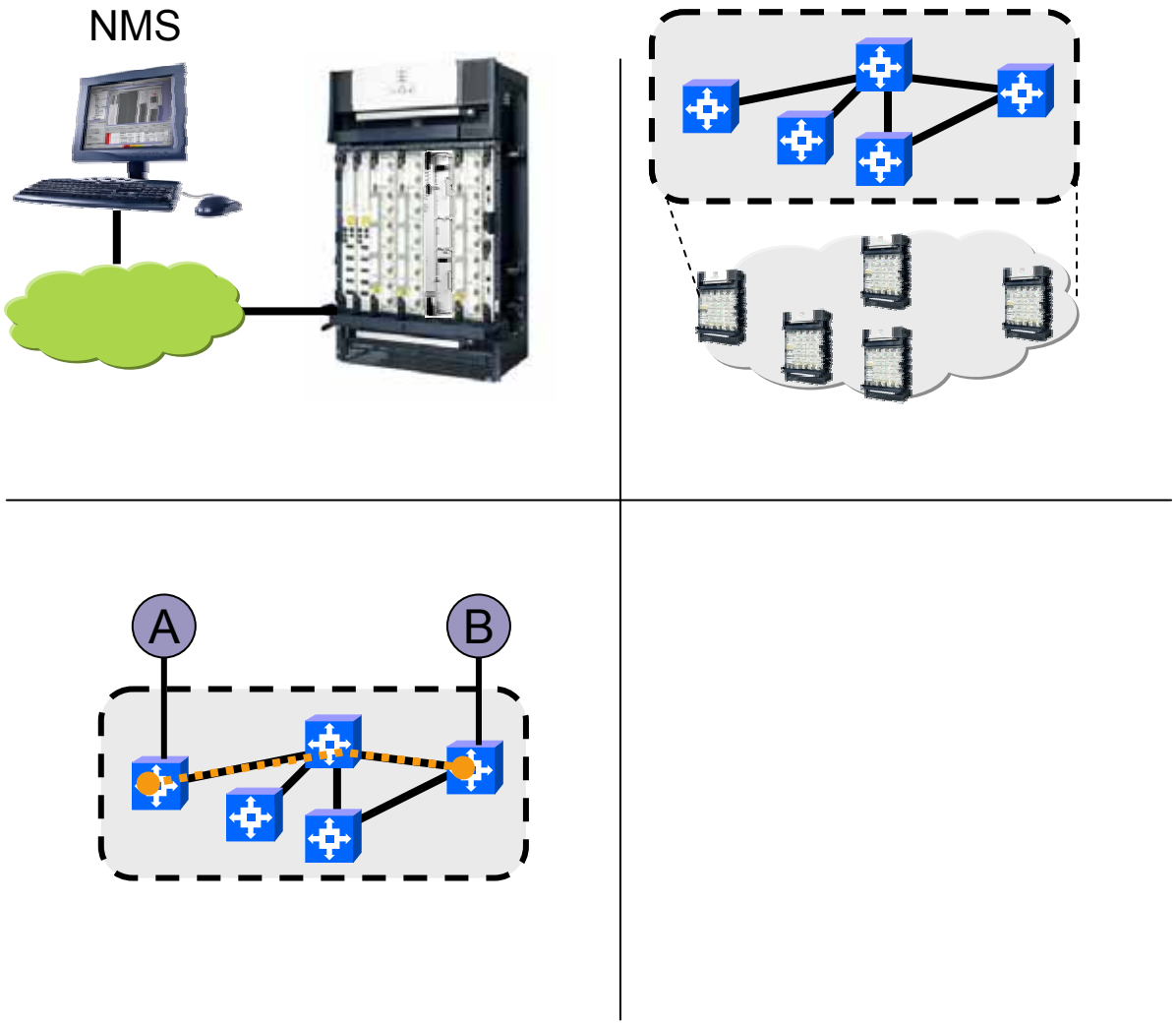
Operations Scale with GMPLS



Inventory Management

Topology Discovery

Operations Scale with GMPLS

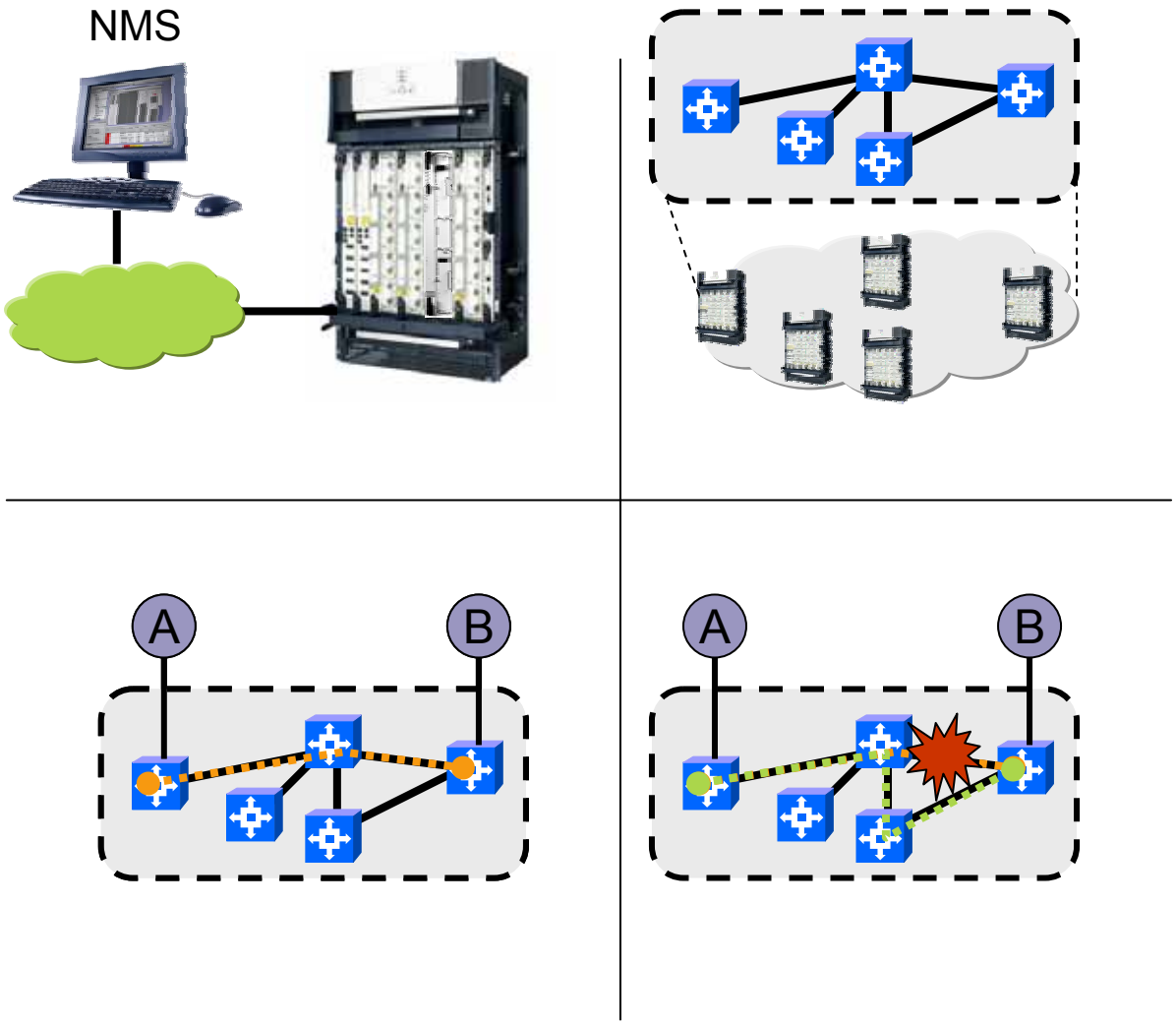


Inventory Management

Topology Discovery

Service Provisioning

Operations Scale with GMPLS



Inventory Management

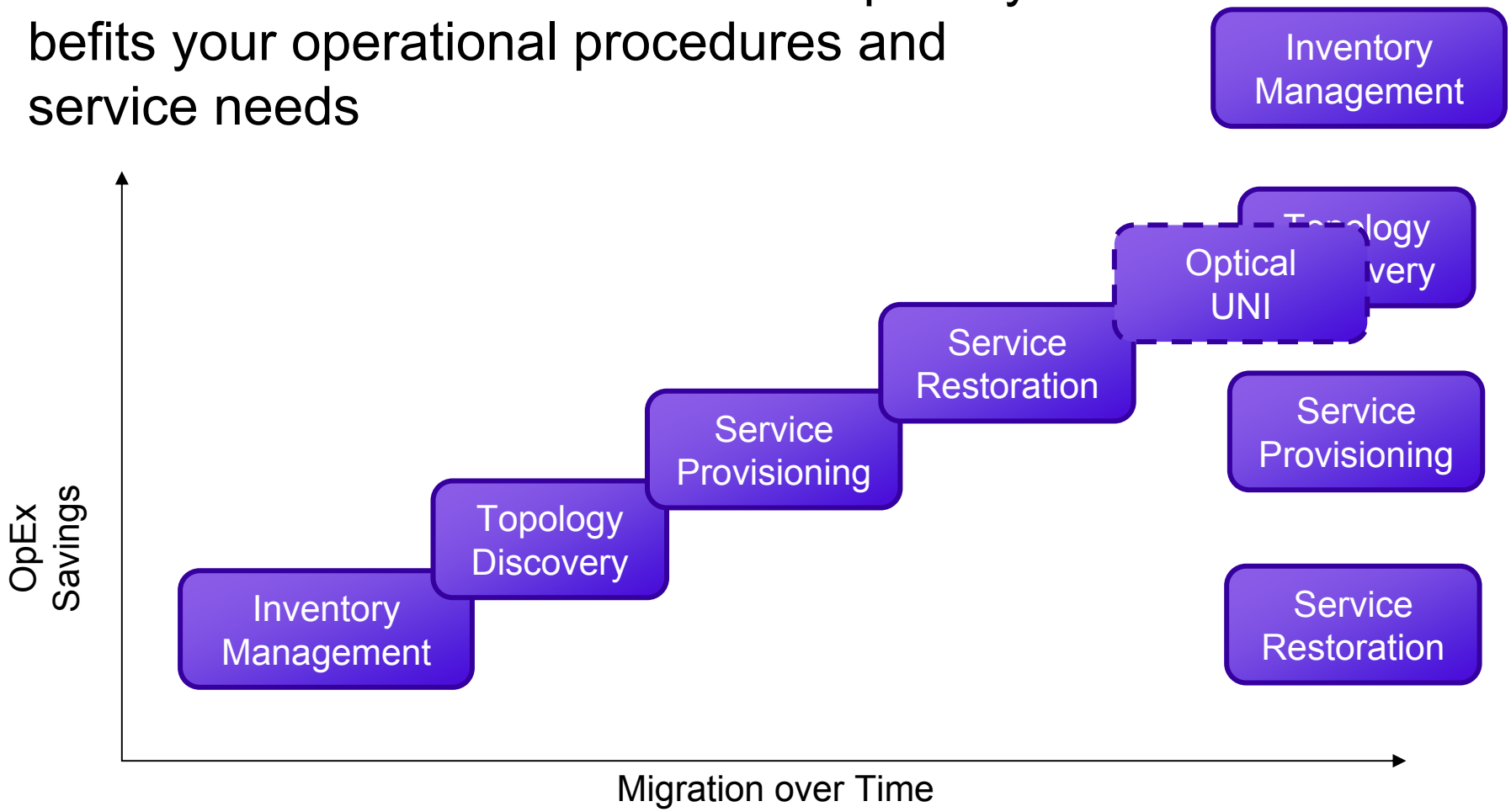
Topology Discovery

Service Provisioning

Service Restoration

GMPLS a la Carte

Use as much or as little GMPLS capability as befits your operational procedures and service needs



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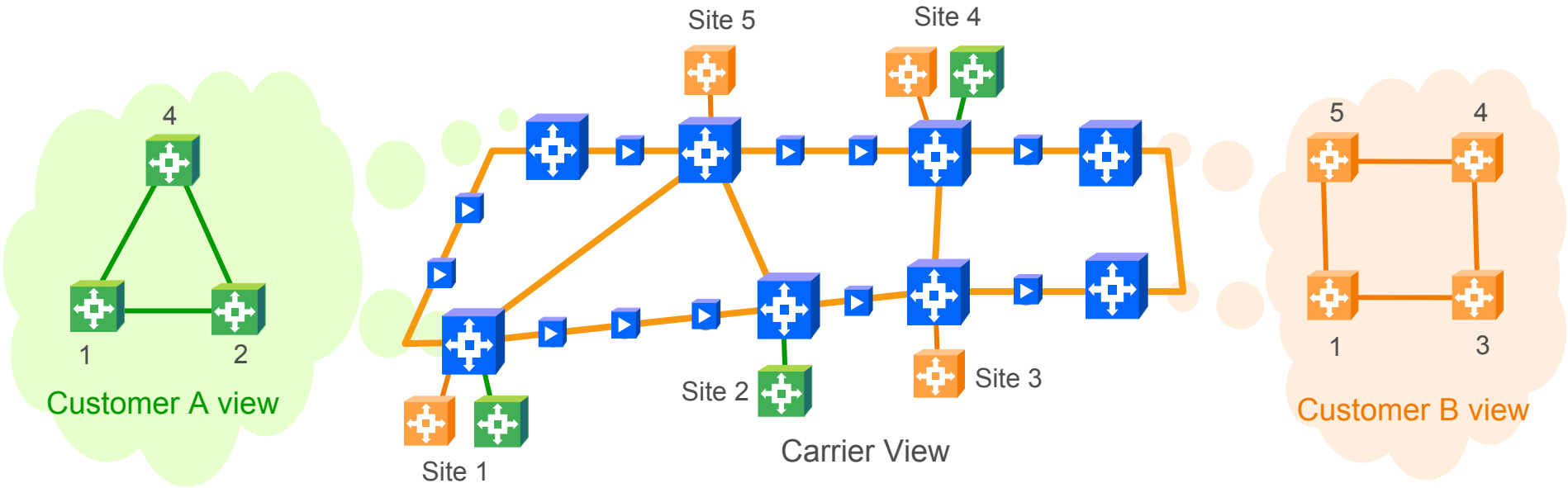
Layer1 VPN - Overview

Multiple virtual transport networks on a shared physical network



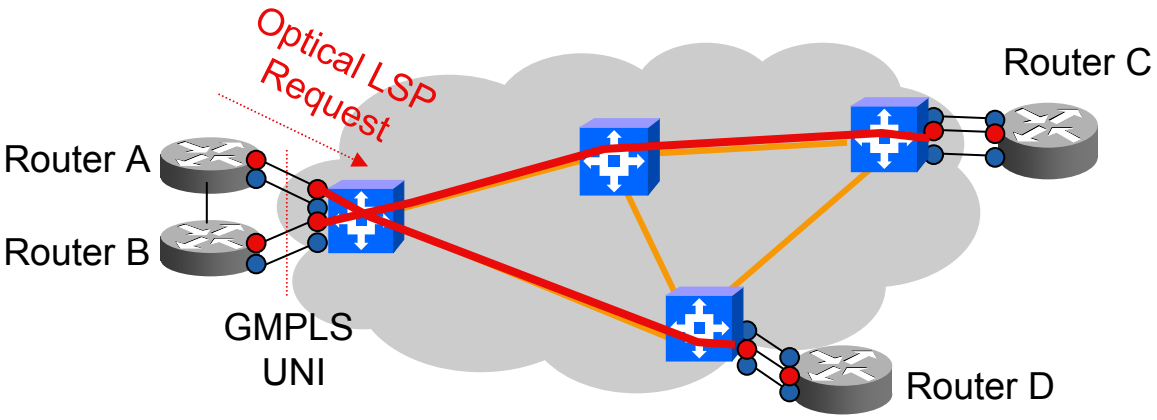
L1VPN - Characteristics

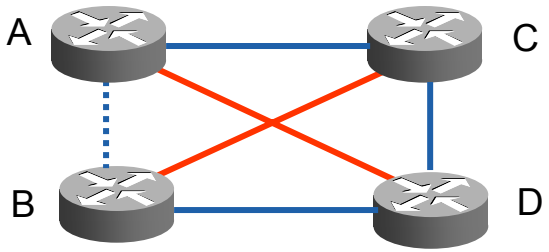
- Data plane isolation from other customers
- Management and control plane separation
- User-controlled circuit provisioning

Key Applications

- External customer offering - Alternative to dark fiber or leased capacity sales
- Internal carrier uses - Separate administrative domains

Dynamically Reconfigurable Bandwidth
GMPLS UNI





IP Virtual Network Topology

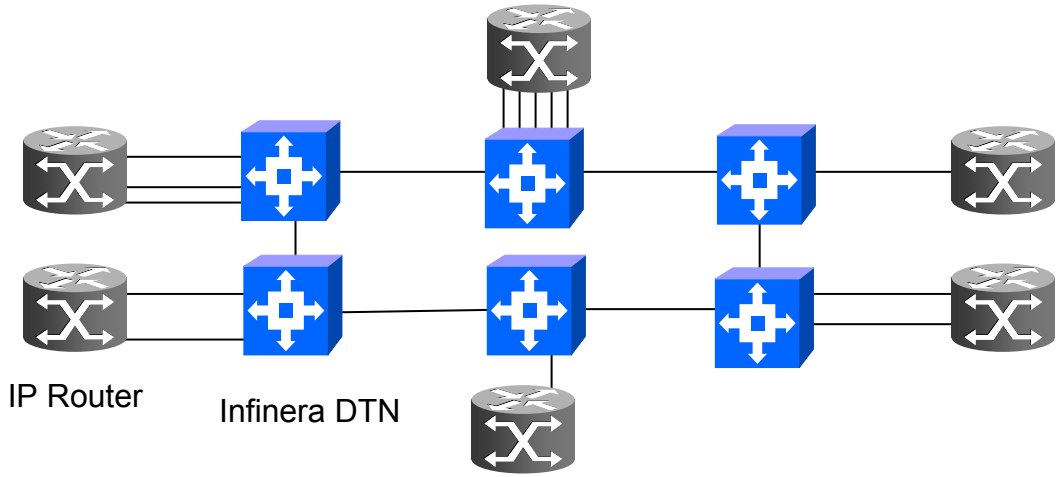
- Applications of dynamically reconfigurable bandwidth
  - Dynamic IP load balancing between routers
  - Multiple circuits to time-share same bandwidth (“Time of day” services)
- Digital Optical Networking unlocks full value of GMPLS UNI
  - 100G+ service-ready capacity on each link
  - Agnostic to transmission constraints
  - 2.5G switching granularity

Value of GMPLS UNI Interoperability

- Provides GMPLS intelligence benefits to a multi-vendor network
  - “Network-is-master” model to ensure data integrity
  - Automated topology discovery
  - Point & Click circuit provisioning
  - Reduction of operating & maintenance costs
  - Facilitation of service delivery
  - Automated restoration capability

GMPLS UNI - Interoperability Demonstration

- Network Configuration
  - 6 Infinera DTN nodes in one core network
  - One overlay Router network with router edge nodes
  - Each has up to 5 links to its (sole) core node.
  - Up to 5 active LSPs per core node
- Functional Areas Tested
  - Addressing
  - Discovery and Link Management
  - Call and Connection Management (Signaling)



Summary

- GMPLS control plane simplifies & automates service provisioning
- End-to-end data plane continuity is key to enabling GMPLS services
- Digital Optical Networks combine bandwidth management with DWDM transport