GMPLS Network Management: Challenges and Solutions

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Fundamental Question

Why is network management so important to the success of GMPLS/UCP?

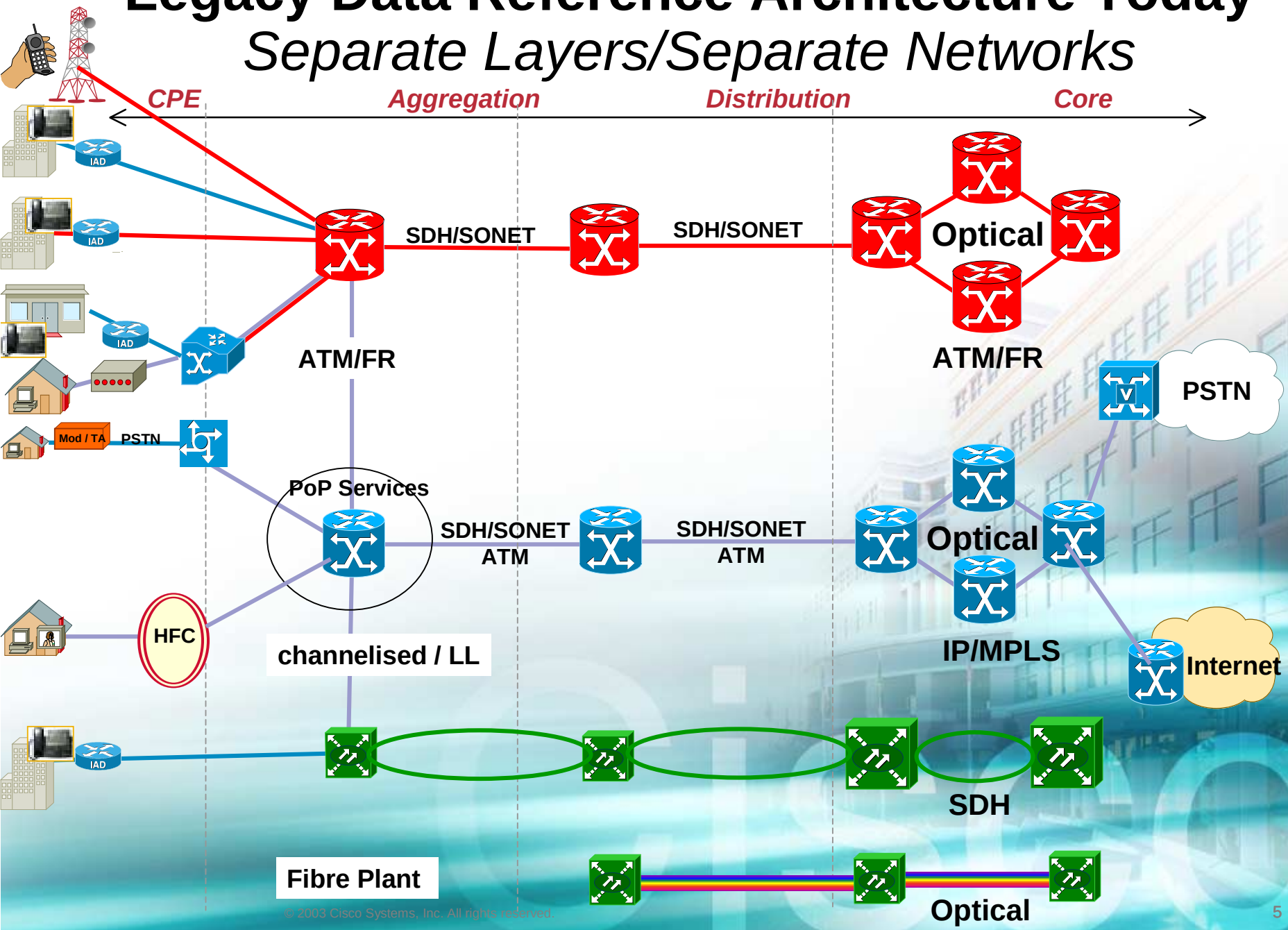
Agenda

- Motivations and Challenges
- Solutions
- Questions
- Closing Remarks

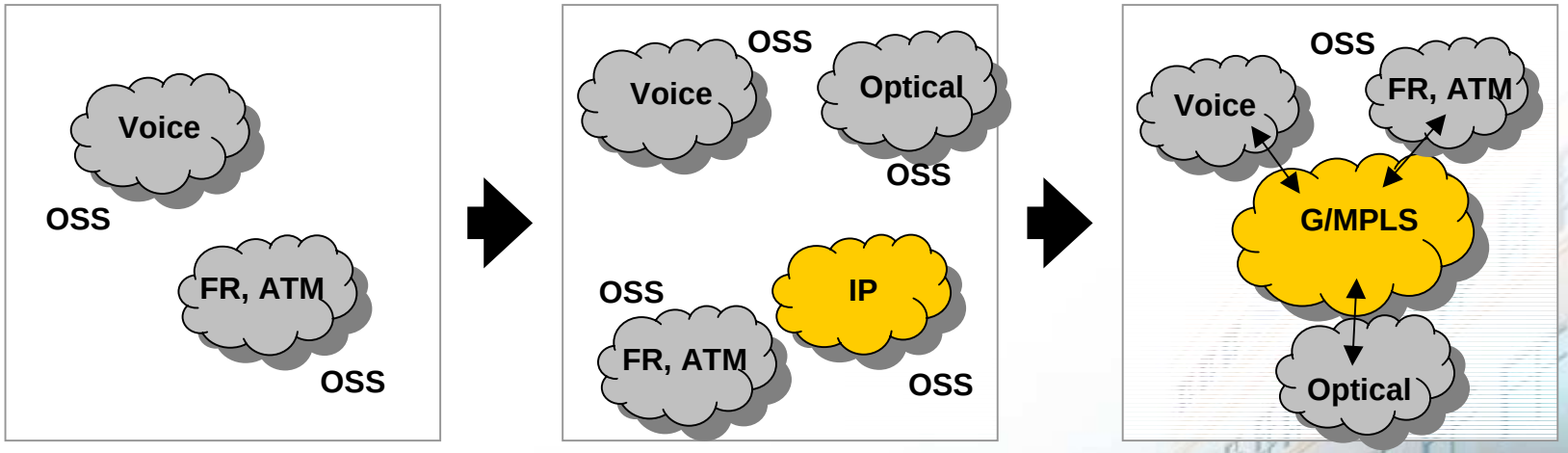
Motivations and Challenges

Legacy Data Reference Architecture Today

Separate Layers/Separate Networks



Next Generation Network Goals
Systems Approach to Solutions



- **Operational Efficiencies**

  Increase management automation and availability using a single/unified and *evolutionary* approach that is *standards-based*.

  Manage and consolidate traditional and emerging disparate networks networks as one.

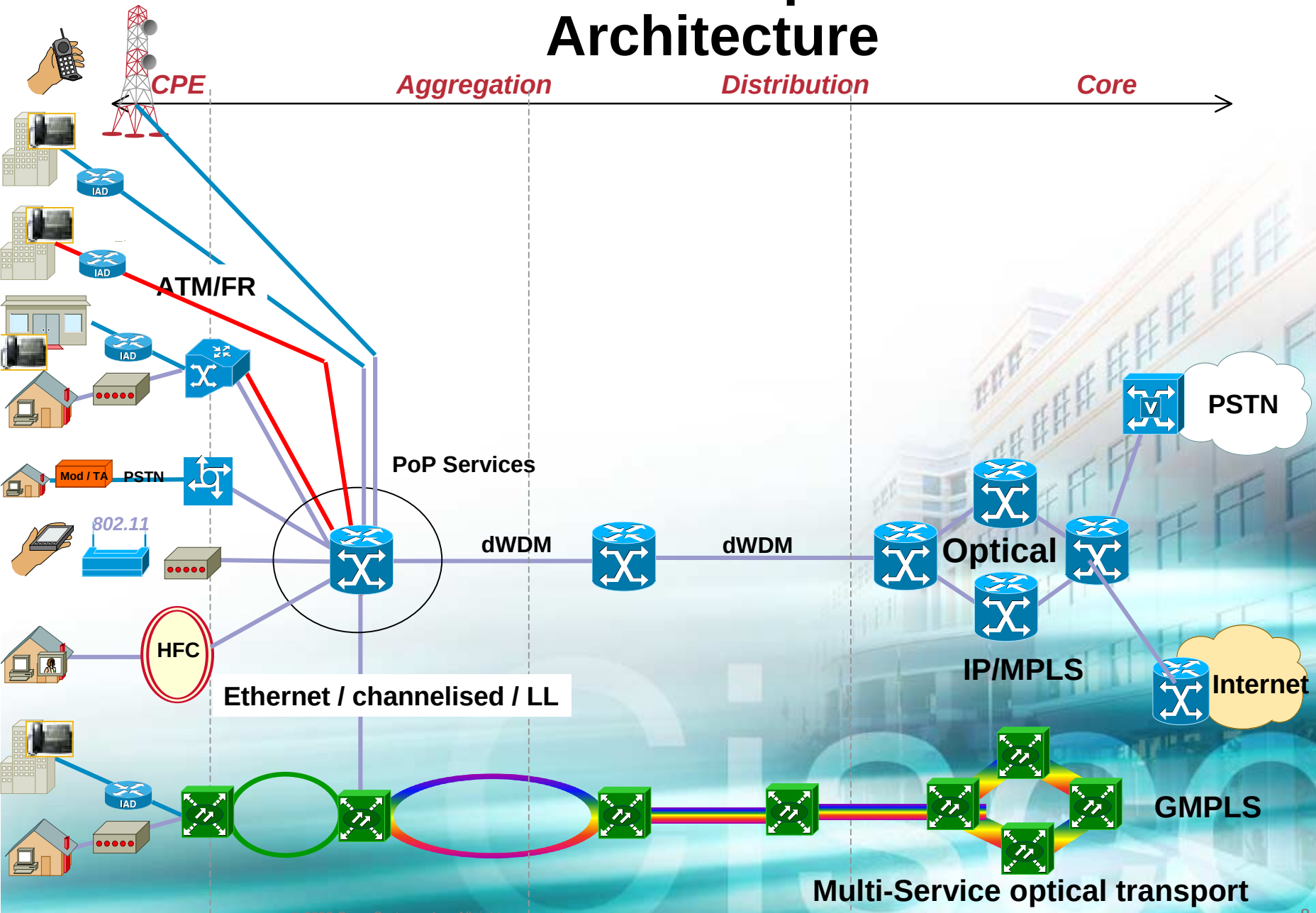
- **New Services Provisioning**

  Enable competitive differentiation and customer retention through profitable and value-added bundled services.

What the Industry is Looking for
Next Generation Optical Control Plane

- Protocols to control and consolidate transport networks
  - Leverage new advancements in optical technology
  - Data optimized architectures
    - handle unpredictable data traffic
    - economical
  - Improved Management Functions
    - Fast/automated/policy-driven Provisioning
    - Consistent Trouble-shooting.
- Protocols to increase providers revenue & profit
  - New differentiated service and business models
  - Simplified, automated operational processes & systems
  - Future-proofed, open architectures in the tradition of the Internet

NGN IP + Optical Architecture

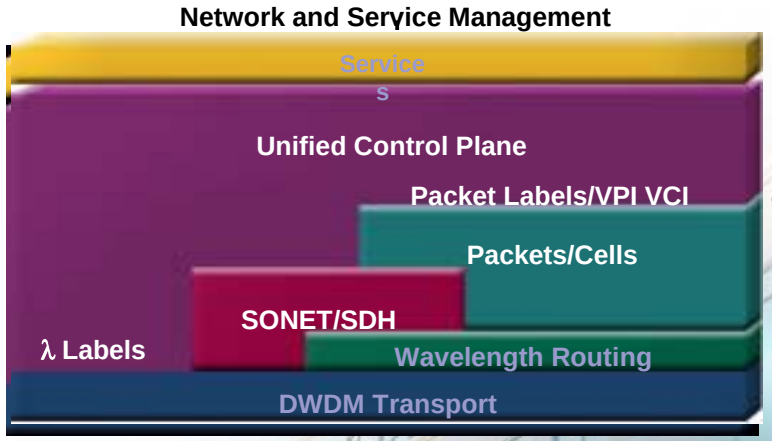


Solutions
The Unified Control Plane and GMPLS

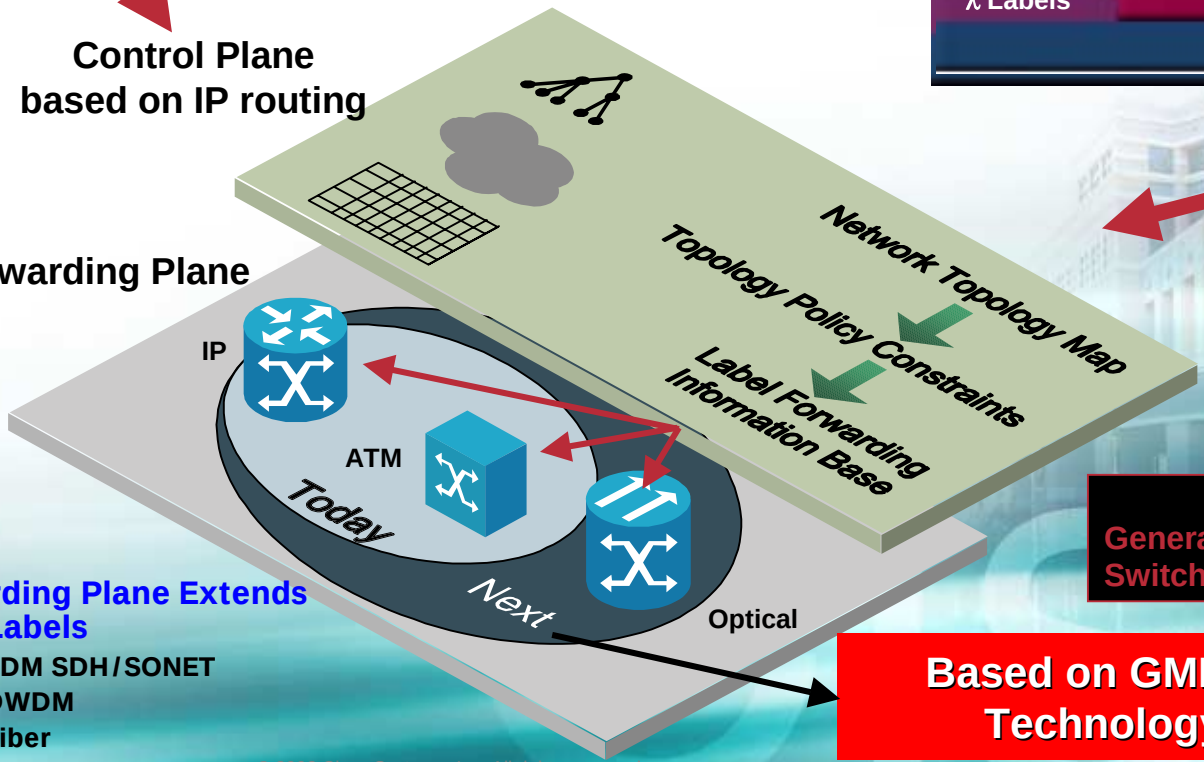
Unified Control Plane (UCP) General Definition

Control Plane Extends MPLS-TE

- OSPF-TE & IS-IS routing
- RSVP-TE for signaling
- Adds in-band & out-of-band control channel support
- LMP- Link Management Protocol



Control Plane based on IP routing



Mgmt & Control Address OTN specific needs

- Physical vs. Logical
- Transport requirements (e.g., P&R, Explicit I/Fs, etc.)

Forwarding Plane Extends MPLS Labels

- TDM SDH/SONET
- DWDM
- Fiber

Generalized Multi-Protocol Label Switching (GMPLS)

Based on GMPLS Technology

UCP/GMPLS Keys to Success Automatic and Interoperable

Optical UCP/GMPLS can only be successful if..

- ***Management systems migrate from proprietary network circuit provisioning to automated provisioning***
- ***Use distributed intelligence (for scale)***
- ***Standards-based protocols (signaling, routing, link management, provisioning, …) that are interoperable***

UCP
Real Customer Benefits

- **Fast Provisioning**
  - **Enables end-to-end circuit setup without SP intervention**
    - **reduce provisioning times**
- **Enhanced Scalability**
  - **Network level: Support for thousands of nodes, links and circuits per inter-connected network**
  - **Lightweight EMS: Move from centralized provisioning to distributed, node-level provisioning using signaling (e.g.: GMPLS)**
- **Interoperable vendor implementations**
  - **Reduces EMS/NMS integration / interoperability issues/costs**
  - **Improves provisioning/trouble-shooting capabilities/times**
- **Basic Bandwidth on Demand (BoD) capabilities as policy & billing standards mature**

UCP
Real Customer Benefits (Continued)

- OPEX savings via service provisioning reduction by due to design function elimination
- CAPEX savings due to less RMA (resource management & accounting) reducing engineering headcount; increased flow-through-provisioning services
- Capital conservation - Improve utilization of network capital investment
  - reduced RMAs defers capital expenditures that can be diverted to support that many more services before investing
- Enabling direct customer access reduces operations staff for all available capabilities

UCP
Real Customer Benefits (Continued (2))

- Enables new transport services
  - Shortened provisioning times
  - Destination selection (change my A-Z connection to A-Z')
  - Bandwidth on demand (activate A and connect it to Z)
  - Protection classes (Grades of Service – SLA with mesh support)
- Reduce operations cost
  - Reduced OSS intervention (OPEX reduction) as network is self inventorying, routing, & provisioning etc ..
- Multi-vendor Interoperability
- Enables non-transport & legacy NEs to signal for circuits as well
- Reduced operational costs means quicker ROI

UCP/GMPLS Keys to Success

- **Develop end-to-end, open architecture (OIF/IETF/ITU) by driving standards in this area.**
- **Integrate IP and Optical products via control plane signaling over optical and Ethernet interfaces to deliver new services and enhance existing ones.**
- **Migrate/extend existing MPLS-based NM/OAM tools/techniques into the GMPLS space.**

UCP/GMPLS Management Needs an Evolutionary Approach

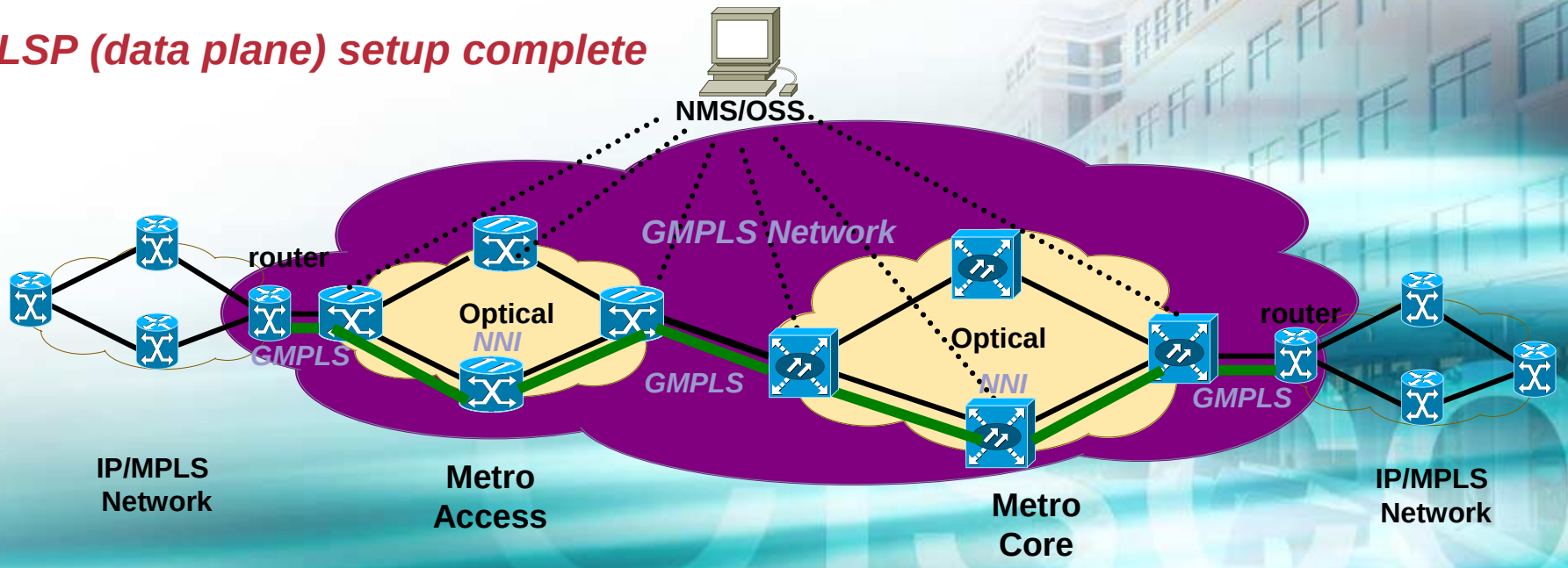
- Drive intelligence (topology, circuit inventory and link characteristics) into the network elements with efficient updates to EMS.
- Retain current network circuit provisioning capabilities (topology, discovery, enhanced circuit management and operations) for backward compatibility
- Single integrated and interoperable embedded management solution that addresses all FCAPS areas.

UCP/GMPLS Management Needs an Evolutionary Approach (2)

- Deliver Obvious Benefits
  - •Need an embedded management strategy that ties things together for all FCAPS areas.
  - •Must extend existing tools/techniques to preserve investment.
  - •Allows GMPLS to leverage applications designed for MPLS.
- Deliver New Benefits
  - New service features not possible today!
    - •Optical VPN
    - •Bandwidth wholesaling
  - Reduce costs, increase revenues, address scale of growing networks

GMPLS Multi-Vendor/SP Network LSP Setup Example

- *Router & Optical NEs belong to a single/multiple OSPF area*
- *routers share topology*
- *head-end router computes path (CSPF) and signals for LSP to destination router IB/OB*
- *Destination router accepts request*
- *Acceptance confirmed to source router*
- *LSP (data plane) setup complete*



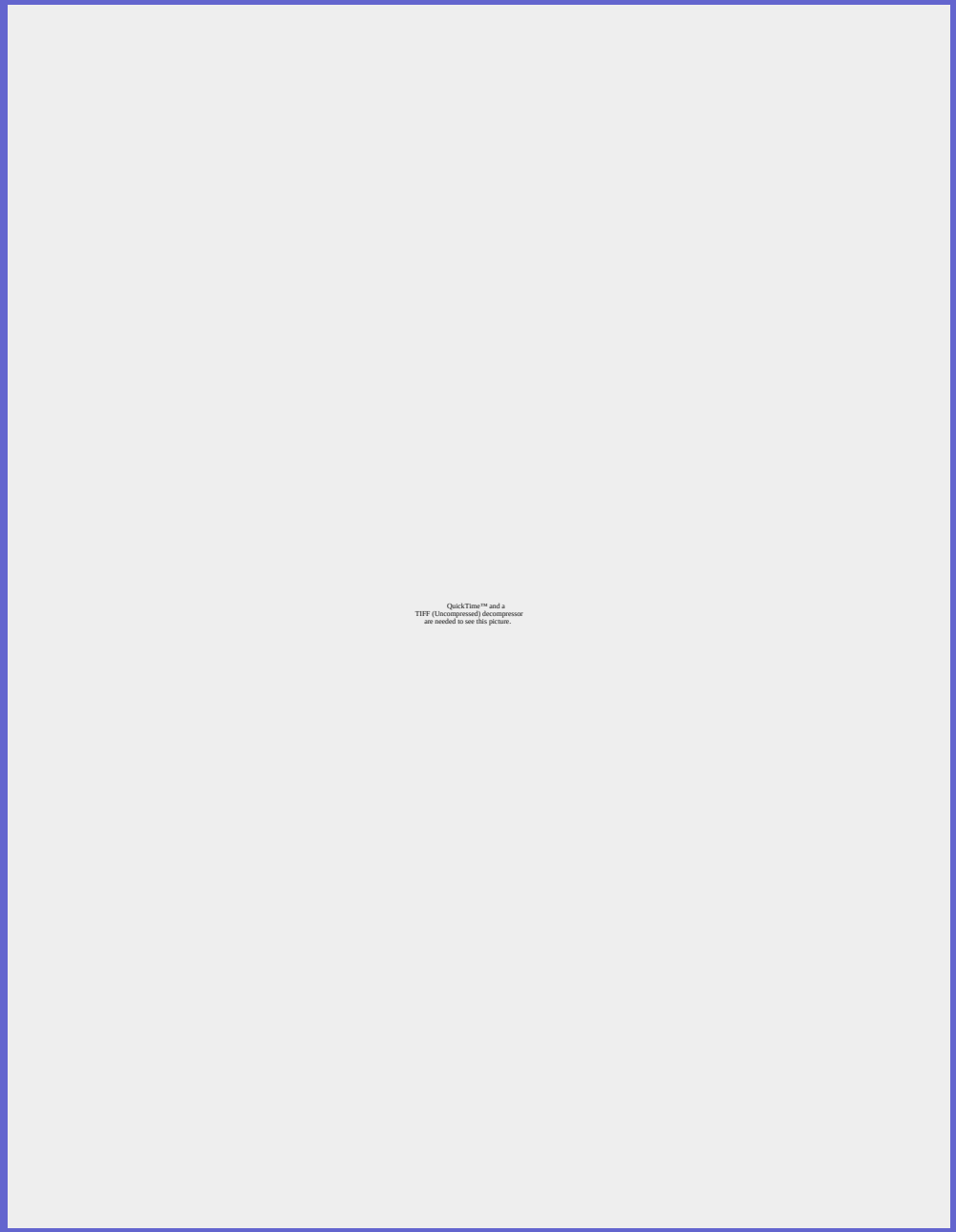
Questions?

Closing Thoughts

Why is network management so important to the success of GMPLS/UCP?

- **UCP/GMPLS as an enabler for NGN**
  - **Standards-based common control plane needed.**
  - **Capitalizes on the work already done with MPLS.**
- **Standards-based interaction between control plane, forwarding, data plane and NMS needed.**
- **Single interface across all network elements**
- **Despite all of this, a unified management solution for FCAPS is essential for success.**

Arigato!



MPLS Network Management: MIBs, Tools, and Techniques (Morgan-Kaufman, 2002)