IP+Optical Seminar
Core Network Solutions

Why IP+Optical

- Service Providers' # 1 challenge is scaling the Internet to meet demand
- Service Providers need simultaneous reduction of costs and acceleration of profitable new service revenues
- Optical Networking's radical economics alone create commoditization; no benefit to Service Providers
- Optical alone isn't the answer. It's IP+Optical:
  - IP enables value-added services
  - Optical radically lowers costs

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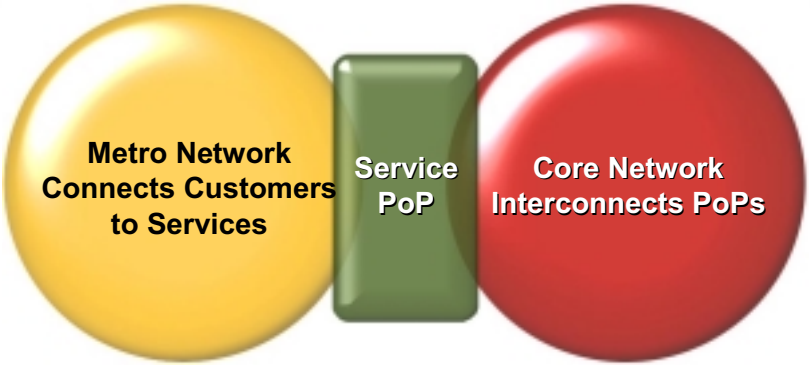
IP+Optical Architecture



- Core network addresses point to point traffic patterns
- Technology advancements to drive down cost per Gb/km
- Logically peered traffic
- Predominantly SONET/SDH rings today

Core Network Solutions Agenda

- Introduction to the Core
- Addressing Customer Requirements
- Core Product Solutions
- Core Network Summary

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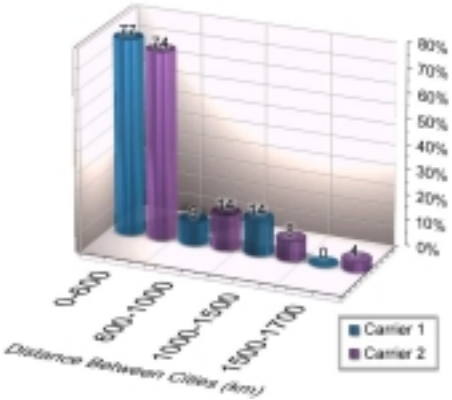
Core Network Solutions

Introduction to the Core

Core Network Characteristics

- 95% of traffic terminates within 1500 km of origination point
- 2.5Gb/s and 10 Gb/s today
- Migration to 40Gb/s as dispersion is managed

Core Optical Network



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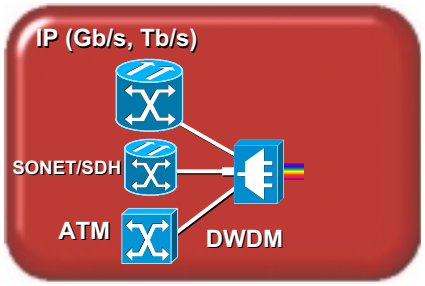
Core Network Architectures



Emerging Carrier Networks

- Single service or overlays
- 1-16 Channels
- IP and SONET/SDH restoration

Incumbent Carrier Networks

- Multiservice environment
- 16 – 160 Channels
- IP, SONET/SDH and ATM switching for services
- Various types of restoration
- Evaluation

Core Network Solutions

Addressing Customer Requirements

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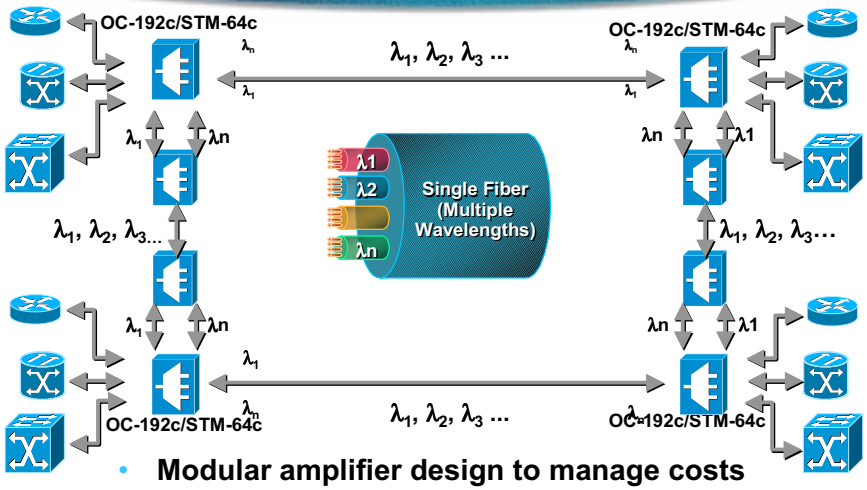
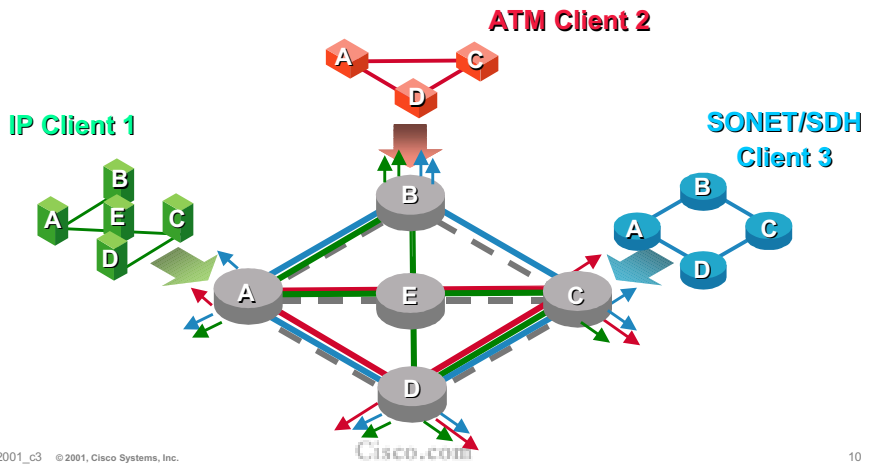
Requirement: Build Cost-Effective Core Solutions that Scale



- Modular amplifier design to manage costs
- Economical, scalable bandwidth growth
- Maximizes the installed fiber base

Requirement: Support Multiservice Networks

Accommodate Multiple Clients and Multiple Services on an Optical DWDM Infrastructure



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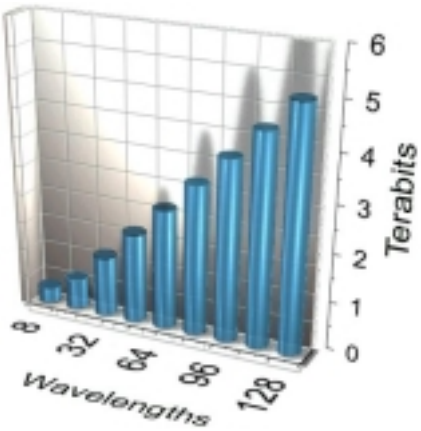
Requirement: Scale Channel Capacity to 100+

Out of Band Forward Error Correction (OOBFEC)

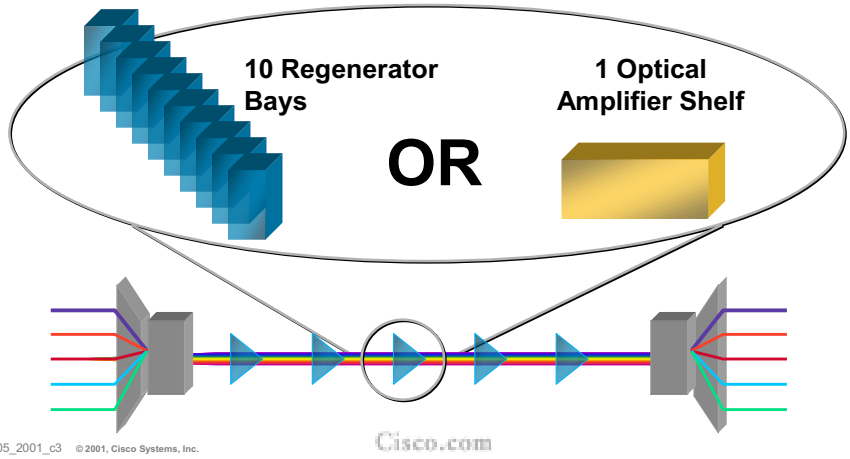
- **Transmission Benefits:**
  (1) increased span length / channel number, which decreases cost; (doubled channel capacity),
  (2) decreased Bit Error Rate (BER) & enhanced system performance
- **Monitoring Benefits:**
  (1) ability to monitor BER performance parameters,
  (2) preventive diagnosis for link degradation



- **Numbers of wavelengths increasing**
- **OADM enables efficient add drop in optical domain**

Requirement: Capitalize on WDM Economics

- **Compelling case for WDM based on fiber exhaust and regenerator replacement**



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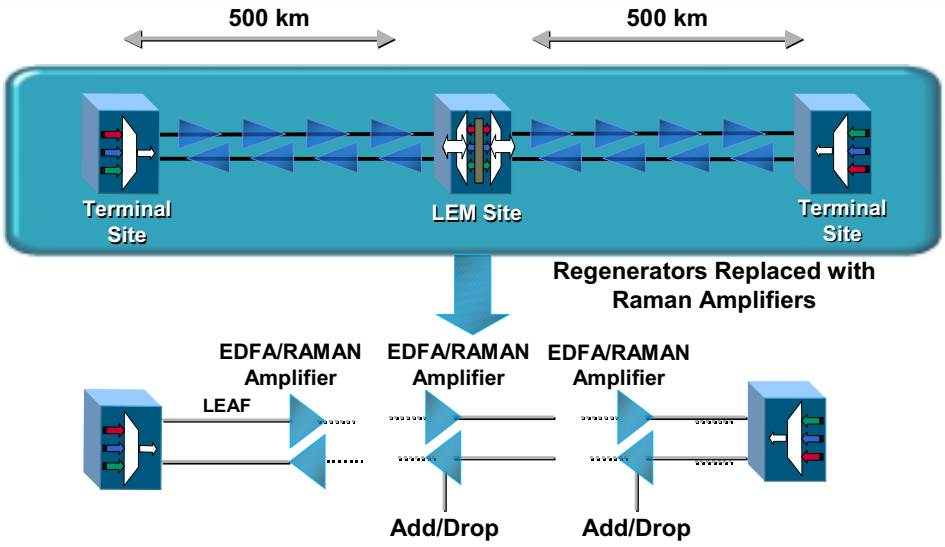
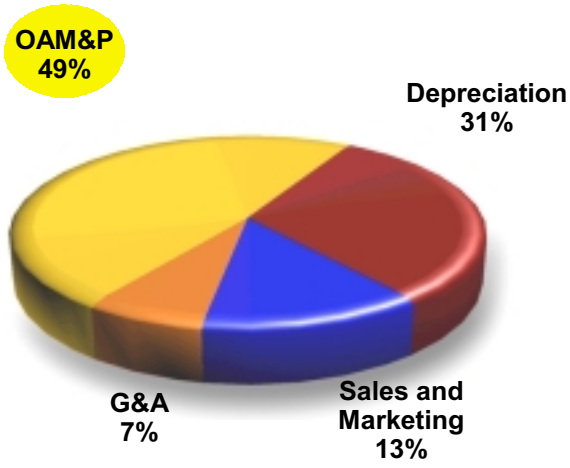
Requirement: Further Cost Savings with Extended Long Haul



Requirement: Manage OAM&P Expense to Benefit the Bottom Line

- OAM&P cost dominates most service provider's budgets



Source: ARMIS 43-01 Reports and Probe Research, Inc.

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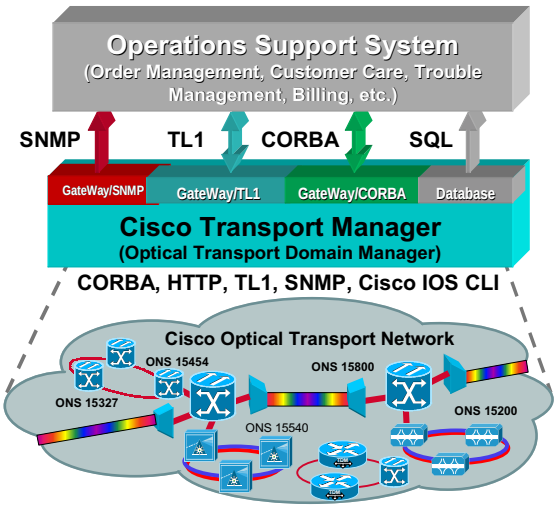
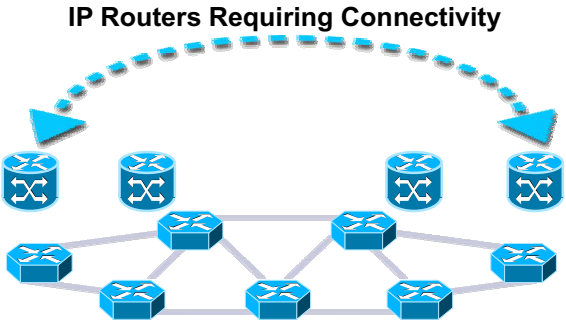
Management Layer Integration

- Single domain manager all optical transport technologies
  - SONET
  - SDH
  - Metro DWDM
  - Long-haul DWDM



Accelerate Service Velocity/Time to Revenue via Rapid Provisioning

- Create service velocity:
  - Intelligent network elements, and simplified OSS
  - Circuit-routed, Ethernet-like
  - Service-driven topology



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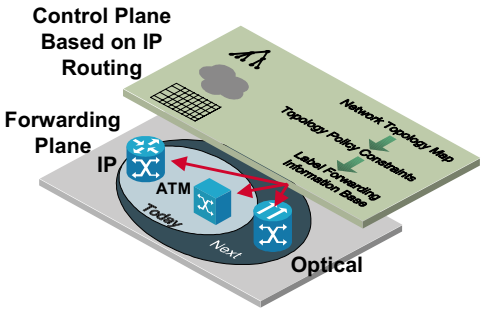
Lower Operational Costs via the Unified Control Plane



- **UCP embeds IP intelligence in optical networks to:**
  - Simplify and accelerate provisioning
  - Enable new services (e.g., O-VPNs)
  - Lays the foundation for new restoration and protection methods
- **Standards based (IETF and OIF)**
- **Delivers real world benefits today:**
  - Lower operations costs
  - Fits within current operational practices and NM strategies

First Public Industry Demonstration of Optical Control Plane at OFC 2001

Cisco UCP – Evolutionary – Standards Based – Available Today

Core Network Solutions

Product Solutions

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ONS15800/1 Platform Highlights

- Dense wave division multiplexing system
  - Existing system scales to 64 x 10Gb/s
- Compatible with SONET/SDH/IP/ATM
- Transparent transport of OC-12/48/192 / STM-4/16/48
  - Flexible design supports optical add/drop
- 23 Customers world wide

10Gb/s Leadership

- Shipping OC-192/ STM-64 product since 1998
- Efficient operation over seven different fiber types
- Over 3,000 10Gb/s channels shipped to date
- 15800 combined with 10Gb/s on industry leading 15454 platform is winning combination

Proven Product Platform Insures Network Service Delivery On-time

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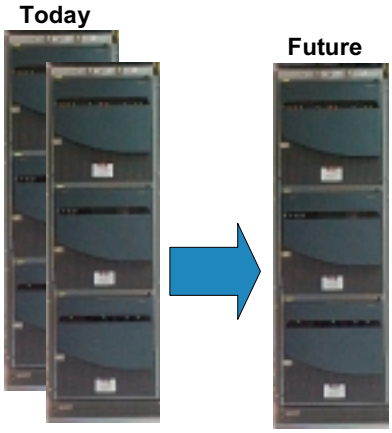
"L" Band Advantages

- Reduced footprint
- Increased channel count
- Single slot interfaces
- Common mechanics for ETSI and ANSI
- Up to 280 Gbps/bay with extended "L" band
- Improves footprint by 150%



ONS 158xx Planned ELR Feature

- Integrated extended long-reach capability
  - Optimized for "sweet spot"

    1600 to 2000 km
  - Flexible span budget supported by software tool for planning/growth
  - OADM capable

    25% of the capacity

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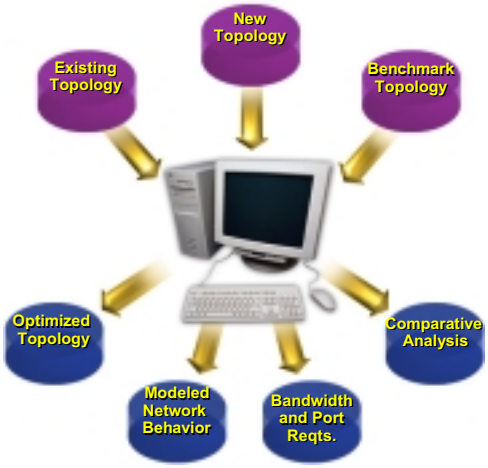
ONS158XX Platform Positioned for 40 Gbps and Beyond

- IP applications expanding to voice and wireless
- Broadband access proliferating in the loop
- E-business expansion continues

All Drivers for Increased Backbone Bandwidth

Cisco Optical Network Planner

- Sophisticated GUI-based network span design
- Create an initial topology
- Modify an existing topology
- Optimize topologies to lower costs



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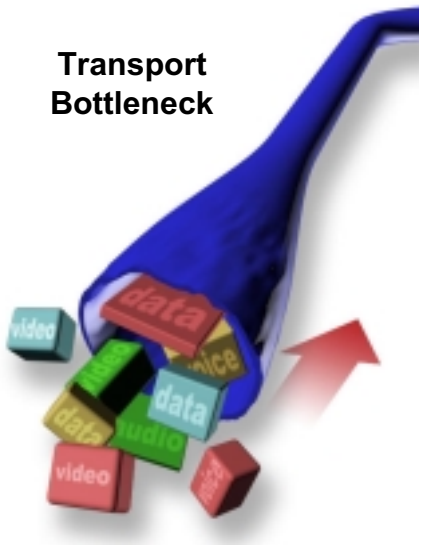
Core Network Solutions

Core Network Summary

High-Capacity Service Is Driving Core

- Line speed interfaces
- OC-48/STM-16 and OC-192/ STM-64 dominate
- AT&T reported eight weeks to setup 18 OC-48s/STM-16s on highest priority (source: RHK at June ’00 OIF)
- Point click technology significantly lowering operations costs

Transport Bottleneck



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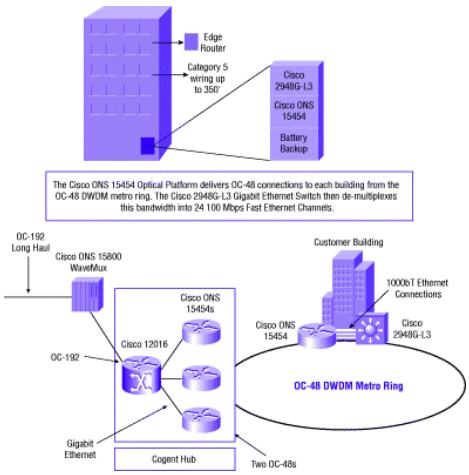
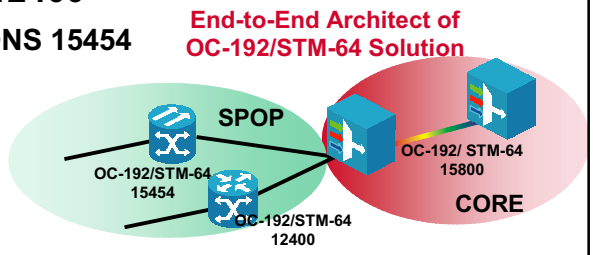
Cogent Communications Model Radically Changes the Playing Field

- An IP+Optical network
- A specialized ISP offering 100Mbps Ethernet for $1,000/month
- Turnkey Cisco Powered Network using ONS 15800, 15454, and 12016
- Scalable network with room to grow



Executing on Core DWDM Plan with the ONS 15800

- 23 customers worldwide
- 10 new customers added in FY '01
  - Over 3,000 OC-192/STM-64 modules shipped to date
- ONS 15800 OC-192/STM-64 leadership can now be extended to two other Cisco platforms:
- Market leading 12400
  - Market leading ONS 15454
- Stay tuned…



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Real World Core Networking Solutions for Real World Customers

"We need massive bandwidth capabilities to meet the needs of customers, both today and into the future. The Cisco ONS 15800 provides not just the bandwidth, but the flexibility we need.

Pierre Masson, WDM Engineering
Project Director, France Telecom

Cambrian's deployment of the 15800 as part of our integrated IP+Optical network brings us numerous advantages. Number one, you've got the tremendous economics of DWDM. Number two, we have one network solution with one network manager. And number three, we have transparent, long-haul transport of the many different services we're aggregating in our metro networks."

Joe Cecin, COO
Cambrian Communications

Core Networks Summary

- Rapid end-to-end provisioning and service creation without layers of technology and network management
- Scalable and modular technology allows you to scale bandwidth by adding new channels only as they're needed
- Radical economics with point click provisioning provides savings in equipment costs and ongoing operations costs
- Provides connection between services PoPs to complete Cisco portfolio

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