Optical Solutions
Product Update
Session 3009
Agenda

- Optical Internetworking Overview
- Cisco 12000 Series
- Cisco ONS 15454
- Cisco ONS 15800
- Cisco ONS 15900
- Summary

IP Services over Optical Networks

- Carrier-class IP services
- Scalable capacity
- Lower equipment cost
- Lower operational cost
- Simplified architecture
Building the New World IP POP

Cisco ONS 15800
Cisco ONS 15900
Cisco 12000 Series

POP Interconnect

WDM
WDM

Web Service Gateways
DSL/Dial Aggregation
Leased Line/SP Aggregation
Voice Service Gateways

Content Providers
Frame/ATM/VPN
ISDN/POTS/xDSL
SONET Circuit Emulation
DS1-GE-Channelized

Cisco ONS 15454
Cisco 12000 Series
Cisco ONS 15800
Cisco ONS 15900

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- Cisco ONS 15454
- Cisco ONS 15800
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### Cisco 12000 Product Family

<table>
<thead>
<tr>
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### Cisco 12000 Series Architecture

**Carrier Class Design**

- **NEBS compliant**
  - SR-3580, GR-63-CORE, GR-1089-Core
  - NEBS criteria level 3, physical protection, EMC and safety
- **Redundancy**
  - Dual-route processors
  - Switch fabric redundancy
  - Redundant power supplies
  - Redundant cooling systems
  - Line card protection
- **Automatic Protection Switching (APS)/Multiplex Section Protection (MSP)**
- **Online Insertion and Removal (OIR)**
- **Separate maintenance bus**
- **Extensive environmental monitoring**
Packet Flow Routing Updates

Distributed Cisco Express Forwarding (dCEF)

Routing Update

Routing Tables Calculated and Fibs Created

Forwarding Information Base Distributed to Each Line Card via IPC

Packet Flow Data Packets

Address Lookup in Local Forwarding Table and Packet Queued in VOQ to Forward Through Fabric and Avoid HOL (See COS Section For More Details)

Request Sent to Scheduler to Set Up Cross Connect During Next Clock Cycle
Cisco 12016—Scalable to 320 Gbps and Beyond

- Switching performance
  16-slot system, 20 Gbps switching capacity/slot
  320Gbps total switching capacity
  Up to 375 million pps
- High-speed and denser interfaces
  New interface cards: OC-192c and QOC-48c
  Support for existing line cards
- Service enablers
  Silicon queuing engine for QoS
  Optimized multicast support
  MPLS Support
- Carrier class/robustness
  Multiple levels of redundancy
  NEBS/ETSI

All Line Cards Can Be Used in Cisco 12016

Scaling to Terabits

- Requirements for terabit routing platform:
  Support high-bandwidth PoP requirements
  Support existing capabilities of internet control plane
  Scale services breadth
  Lower operational costs
- Outcome: Cisco 12000 Terabit System!
  Utilizing Internet-proven Cisco 12000 platform
  Building on extensive control plane and service enablers in Cisco IOS™
  Simple scalability from 320 Gbps to 5 Tbps
  Investment protection
Cisco 12000 Series Architecture
Scalable to Terabits

Cisco 12016

- Line Card 1
- Line Card 2
- Line Card 15
- RP
- Terabit Scalability Module
- 256 x 256 Crossbar

Standalone Cisco 12016
Replace Switch Fabric with Terabit Scalability Modules
Install Terabit Fabric Interconnect
Add Additional 12016 Nodes

All Line Cards Can Be Used in Cisco 12000 Terabit System

Cisco 12000 Interface Overview

- Industry leading interface breadth
- Optimized for queuing and forwarding
- Hardware assist for high-performance switching
- Silicon queuing engine for QoS
- Multiple optics
Cisco 12000 Software Overview

- Broad support for routing protocols
  BGP, OSPF, IS-IS, RIP
- MPLS functionality
- Admission control
  Access Control List (ACL), Extended ACL (EACL)
- Packet classification and rate limiting
  Committed Access Rate (CAR)
- Congestion control and avoidance
  Weighted Random Early Detection (WRED)
  Modified Deficit Round Robin (MDRR)

Cisco 12000 Summary

- Internet proven with worldwide deployments
- Terabit scalability
- Carrier-class reliability
- Premier IP services
- Leading interface breadth
Agenda

- Optical Networking Overview
- Cisco 12000 Series
- **Cisco ONS 15454**
- Cisco ONS 15800
- Cisco ONS 15900
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Cisco ONS 15454 Highlights

- All SONET/SDH bit rates
  OC-3/STM-1 to OC-192/STM-64
- Integrated DWDM
  OC-48 and OC-192 ITU optics
- Electrical TDM interfaces
- High-speed data interfaces
- Analog/digital video interfaces
- Integrated Cisco Transport Controller
- Smallest OC-48/OC-192 footprint in the industry
- Acquired from Cerrent
Cisco ONS 15454 Successes

- 200+ customers
  LECs, national carriers, RBOCs
- Telcordia GR-253 certification
  Network compatibility—DSn, protection switching
  SONET physical layer—OC-48, OC-12, OC-3
  SONET logical layer—overhead, surveillance
  Synchronization
  Memory administration
  User access
  Human factors
- Telcordia report released in August 1999
  R2.01 release enhances feature content, functionality and resilience

NEBS Certification

- NEBS Level-3 compliant
  As defined by Telcordia SR-3580
  GR-63-CORE, Issue 1, Oct. 1995
  GR-1089-CORE, ISSUE 2, Dec. 1997
- Additional approvals
  UL 1950, 3rd Edition
  CSA C22.2 No. 950-095
  FCC Part 15
  Industry Canada ICES-003
- Collocation approvals
  Bell Atlantic, SBC, Ameritech, GTE,
  BellSouth, Sprint, MCI WorldCom, and US West
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*Not a Complete List
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Cisco ONS 15800 Highlights

- Long-haul, open-system DWDM platform
  - Supports up to 128 channels
- Multiband architecture
- Proven, flexible OC-192
- Integrated wavelength performance monitoring
- Integrated line extender modules
- Non-intrusive SONET performance monitoring
- Managed via craft interface
- Acquired from Pirelli
Cisco ONS 15800 Offers Proven, Flexible OC-192 Transport

- Cisco ONS 15800 supports standard SONET OC-192
- Cisco ONS 15800 supports an open or closed architecture
  - Accepts OC-192 from SONET equipment
  - Accepts OC-192 from IP or ATM equipment
  - WCM is used to map the signal onto correct lane
- Dispersion compensation used at line sites and at receive site
- Cisco ONS 15800 options offer solutions for all fiber types and supports five spans at a nominal 25-dB span budget

Over 10,000 Route Miles of OC-192 Deployed Today
Cisco ONS 15800 Summary

- Scalable DWDM platform
  - Supports from 1 to 128 channels of OC-48 and/or OC-192
  - Provides investment protection
  - Utilizes proven technology
- Flexible deployment options
  - Supports open or closed configurations
  - Operates on a variety of fiber types
  - Supports up to 50% add/drop
  - Supports extended distances through LEMs
- Economical platform
  - Maximizes capacity on a single pair of fibers
  - Minimizes sparing investment through common modules
  - Multi-band architecture allows resource allocation by band

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Cisco ONS 15900 Line Bay

- 128 OC-48/STM-16 line cards per bay
- Hot-swappable cards without fiber swap
- Redundant shelf processors (1+1)
- Protection and restoration options
  - 1+1 APS-based 50 ms
  - WaRP restoration
    - Fast reserved (virtual 1+1path restoration)
    - Fast dynamic (mesh restoration—50 ms)
    - Trail protection
    - 0:1 unprotected
- 7’ H x 23” W x 12” D
Line Subsystem-Based 1+1 Protection Switching

- Preserves up to 50% of system capacity
- Up to 50% reduction in inter-bay cabling

Cisco ONS 15900 Switch Matrix Bay

- Capacity: 256 OC-48s/STM-16s
- Hot-swappable 16x16 switch modules without fiber swap
- Scales in-service
  1024 x 1024 and 4096 x 4096 in size
  Retain shelf, bay, and cabling for in-service matrix upgrades
  Upgradeable to fully-optical core
- Matrix 1+1 redundant
- 7’ x 23” x 12”
Cisco ONS 15900 Administration Bay

- Administration shelf
  Control and timing
  External timing interface
- Craft terminal
  Terminal and keyboard
- System communications bus
  Fully redundant hardware and system bus

Cisco ONS 15900 Summary

- Intelligent wavelength connectivity at DWDM junctions
- Fast, topology-independent wavelength-routed provisioning
- Dynamic mesh restoration
- Perfect complement for IP backbones
- Acquired via Monterey Networks
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IP Services Over Optical Networks

Traditional Model

- IP
- ATM/FR
- SONET/SDH
- Optical

Optical Internetworking

- Carrier-class IP services
- Scalable capacity
- Lower equipment cost
- Lower operational cost
- Simplified architecture
Summary

- Simplified architecture
- Scalable capacity
- Optical integration
- Aggressive system-level cost savings

Objective: Harness the Advances in Fiber, DWDM and High-Capacity Routers to Provide a Scalable, Cost-Effective Infrastructure for Delivering Advanced IP Services

Optical Solutions
Product Update

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Thank You
Please Complete Your Evaluation Form

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