



Cisco IP+Optical

DEOK-KYU CHOI
System Engineer

목 차

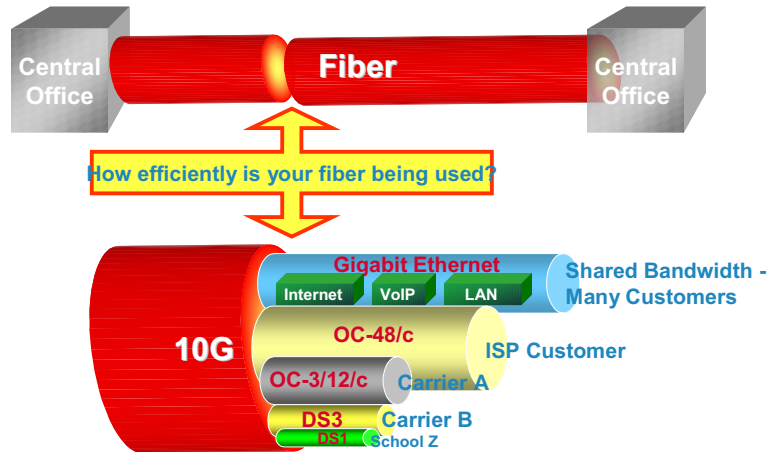
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- **New Trends from IP + Optical**
- **Metro Transport Solutions**
 - NG-MSPP
 - DWDM
 - Ethernet over dark fiber
- **Storage Networking Solutions**
 - IP Storage (iSCSI)
 - IP + Optical Storage

Customer Needs – Why Optical ? Efficient Bandwidth Utilization

Cisco.com

- **Pack the Bandwidth You Deploy**



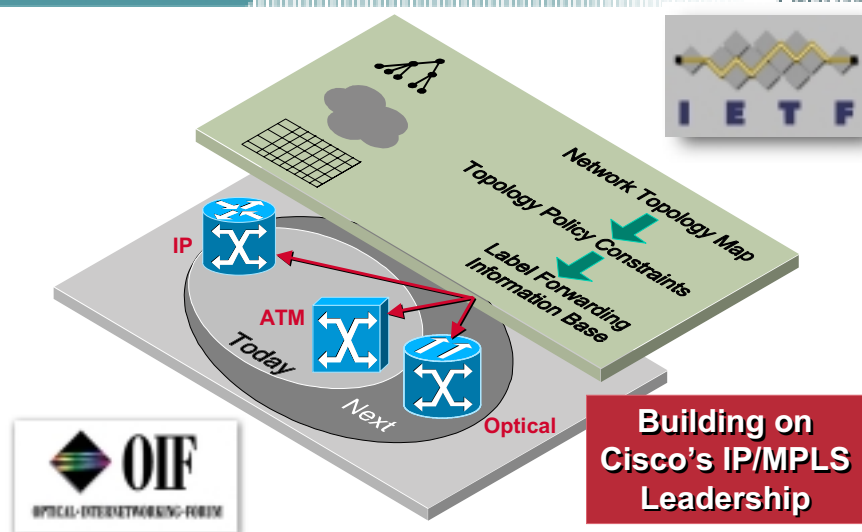
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Cisco's Strategy for an IP-Based Unified Control Plane

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Requirements and Benefits

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- **Scalability and Performance**
 - ✓ Service scalability
 - ✓ Port density
 - ✓ Line rate performance
 - ✓ Line rate QOS
 - ✓ Over-subscription on uplinks
- **Service Enablers**
 - ✓ New services = new profits
 - ✓ Service differentiation
 - ✓ Security
 - ✓ IPv6, Multicast
 - ✓ Flexible Accounting infrastructure
- **Operational Efficiencies**
 - ✓ Lower cost = higher profit
 - ✓ Volumetric efficiency
 - ✓ Simplified operations
 - ✓ Faster time to market
 - ✓ Investment protection
 - ✓ Accounting/Billing flexibility
- **High Availability**
 - ✓ Improved SLAs
 - ✓ No revenue interruption
 - ✓ Expands addressable market
 - ✓ Differentiation

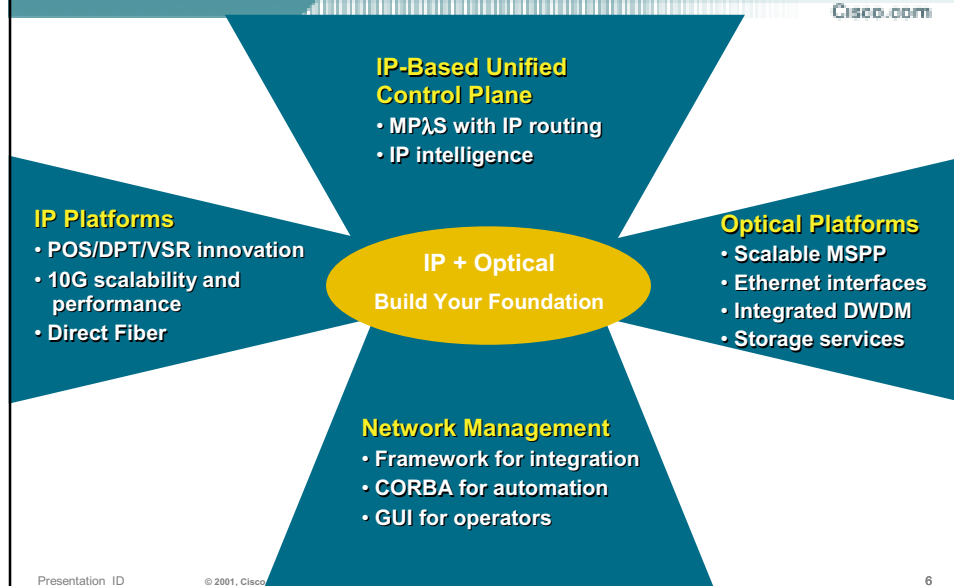
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Cisco IP+Optical Combining All the Elements

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- **New Trends to IP + Optical**
- **Metro Solutions**
 - **NG-MSPP**
 - **DWDM**
 - **Ethernet over dark fiber**
- **Storage Networking Solutions**
 - **IP Storage (iSCSI)**
 - **IP + Optical Storage**

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What does it means, **NG-MSPP** ?

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- **NG-MSPP is Next Generation Multi Service Provisioning Platform :**
Traditional SONET/SDH + IP (Ethernet Layer 1, 2 ,3)
+ DWDM MUX/DEMUX)
- **Traditional SONET/SDH :** Multi-Service TDM T1,T3, OC3, OC12, OC-48, OC192, UPSR/BLSR
- **DWDM Optical :** OC-48, OC-192 Lambda Wave
- **Ethernet :** Layer 1, 2 & 3, VLAN
- **IP Control Plane (Future):** MPLS, DPT

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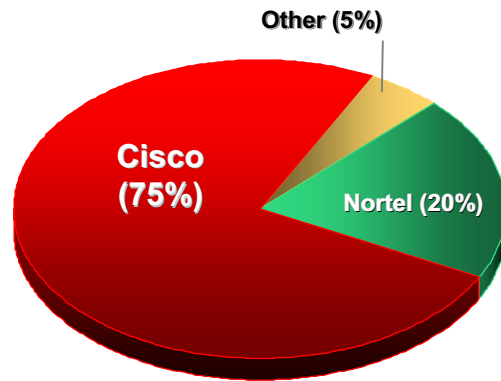
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Next Generation **MSPP** Cisco Worldwide Leader in MSPP Market Share

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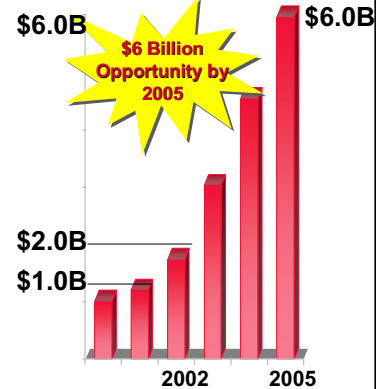
2000 Worldwide MSPP Market



Total = \$1B

Source: IDC

Worldwide MSPP
Revenue Growth



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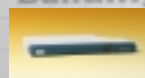
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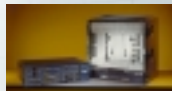
Cisco Optical Product Portfolio : NG-MSPP, DWDM

ONS 15201 + 15252

- Lowest first cost λ to building solution
- OC-N, GE, bit-rate independent



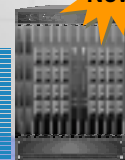
ONS 15216 + 15454/15327



- 500+ customers
- #1 Ethernet over Sonet
- #1 OC48

ONS 15540 ESP

- Dense ESCON, FC, GE
- EMC, IBM, ..
- Transparent, bit-rate independent interfaces



New

NG-MSPP

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Next Generation **MSP** Cisco ONS 15454 Deployment Update

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✓
Customers: 600+ Across All Segments

✓ Independent LEC

✓ Competitive Carriers

✓ International, National Carriers

✓ Cable TV Carriers

RBOCS



30,000+ Systems Shipped / In-Service

No. 1 in OC48 shipments in CY2000 (RHK Jan 2001 report)

Projected to be No. 1 in Metro WDM Market in CY2001

30,000 Ethernet and Fast Ethernet Ports Shipped/In-Service

3,000 Gigabit Ethernet Ports Shipped/In-Service

All Network Topologies and Configurations Deployed

First Cost and Life Cost Leader!

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Next Generation **MSP** ONS 15327 Today

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• SONET cross-connect / processor

XTC-14

14 DS-1s

XTC-28-3

28 DS-1s

3 DS-3s



• Optical interfaces

OC3 IR, 4 port

OC12 IR, + OC12 LR

OC48 IR, + OC48 LR

• Data interfaces

10/100BaseT, 4 ports

Additional Enhancements

+ 2-fiber BLSR

+ Industrial temperature

+ CTC enhancements

+ Mechanical enhancements

+ IPPM

+ In-service Upgrades XTC-14 to XTC-28-3

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Next Generation **MSPP** ONS15454 Interface Cards

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TDM Interface

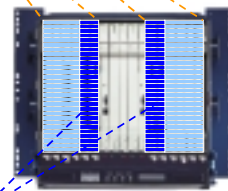
- 14 port DS1 Card
- 12 port DS3/E Cards
- 6 port DS3 Transmux Card
- 12 port EC-1 (STS-1E) Card

Optical Interface

- 4 port OC-3 / STM-1 Card
- 1 port OC-12 Card
- 1 port OC-48 Card
- 1 port OC-48 ITU ELR Card

- TDM interface
- Optical Interface
- OC-48 interface

Any of the 12 Service Slots



- 10G interface

Any of the 4 High Speed Service Slots

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Next Generation **MSPP** 100GHz ITU DWDM Grids - OC48ELR, 10G

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• OC-48ELR Optical Interface Card

1 port per card, 12 OC48 per shelf

37 ITU wavelengths

Allows supports for third party vendor passive filters

Up to 80Km over un-amplified SMF28 links

• OC-192 / STM-64 Optical Interface Card

1 port per card, Up to (4) OC-192 per shelf

80Km reach over SMF fiber

Provisionable for SONET/SDH support

Requires XC10G Cross Connect Card

Operates in any high speed slots

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Next Generation **MSP** In-Service Upgrade to OC-192



- Simple Card Upgrades vs. Forklift to Cascade Boxes!

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Next Generation **MSP** Gigabit Ethernet Transport

Layer 1 Gig-E Card

Provides 4 port Gigabit Ethernet Transport

STS1/3c/6c/12c/24c & 48c per port selectable for configuration

802.3z Flow Control, Ultra Low Latency Ethernet Transport

Switched Ethernet Interface

12 port Ethernet/Fast Ethernet Card

2 port Gigabit Ethernet Card

Per Ethernet broadcast domain : 8000 MAC addresses, 519 VLANs

RFC 1619 encapsulation , IEEE 802.1D Spanning Tree Protection

2 level priority IEEE 802.1p, Logical VLANs IEEE 802.1q

Flow Control with IEEE 802.3X

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Next Generation **MSP**

Hybrid Ethernet : Point to Point, Shared Ethernet

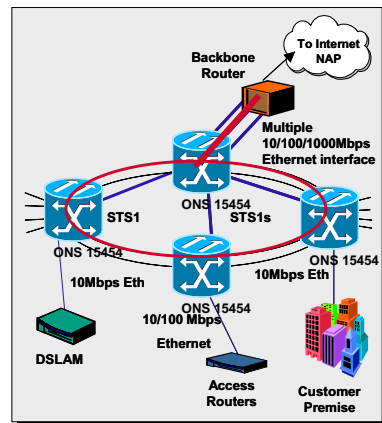
CISCO.COM

Point to Point Ethernet

- Provides STS segregated traffic for VPN/TLS
- Separates user management to STS granularity

Shared Ethernet

- Efficiently utilizes bandwidth by aggregating multiple users into an STS-1 to STS-12c flow, while segregating user traffic, Decreases the number of backbone router interfaces
- Simplifies the number of provisioned services



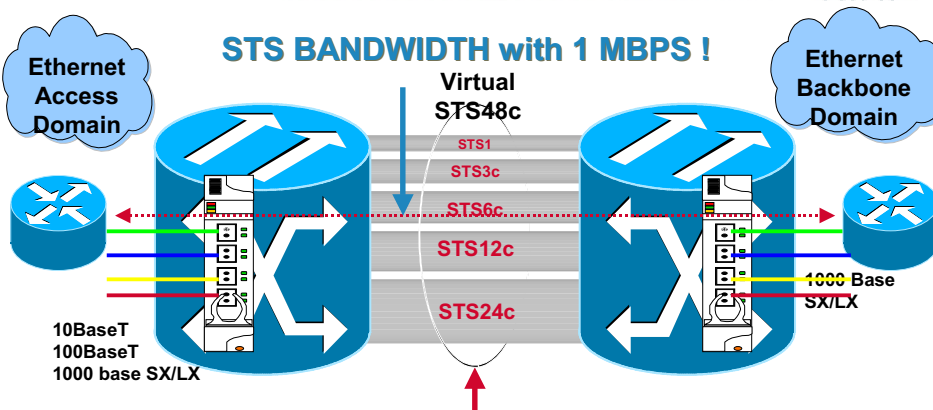
- Point to Point mapped circuits
- Shared Ethernet

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Bandwidth Scalability : 1Mbps Service Level Agreements

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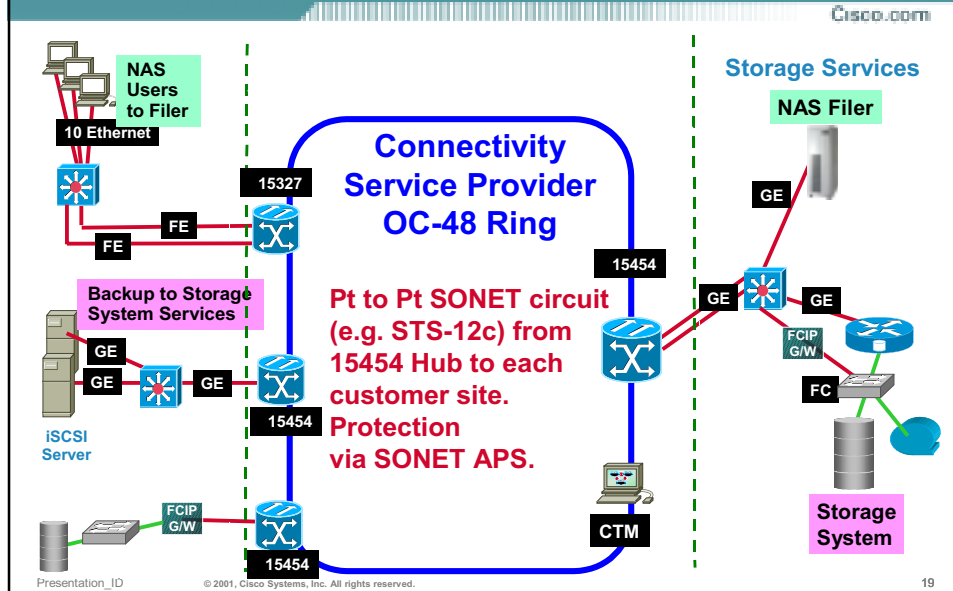


- **STS BANDWIDTH SCALABILITY WITH A-Z PROVISIONING !**
- **Multiple STS Combinations to Efficiently Pack Lambda's !**
- **Support for Channel-Bonding, when Gigabit Is not Enough!!IDEAL for InterPoP Applications !**

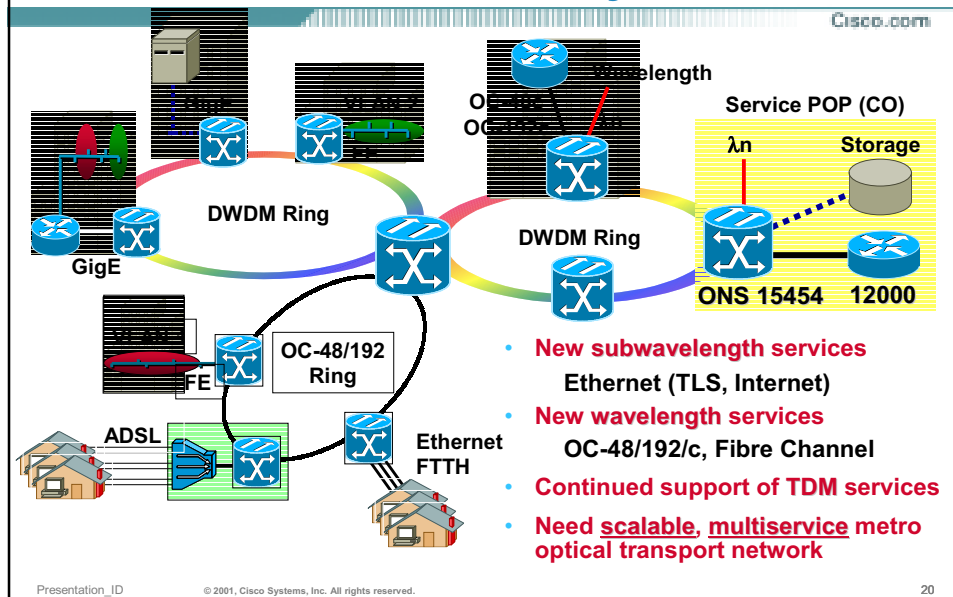
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Next Generation **MSPP** ONS 15454/15327 Ethernet Architecture



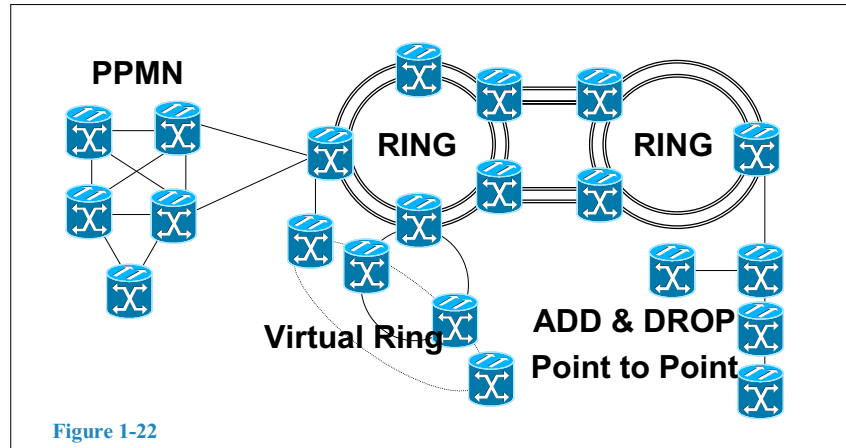
Next Generation **MSPP** Multiservice & Scalability Drivers



Next Generation **MSPP** Optical Design Technology : **Hybrid Topology**

Cisco.com

Hybird Topology Design



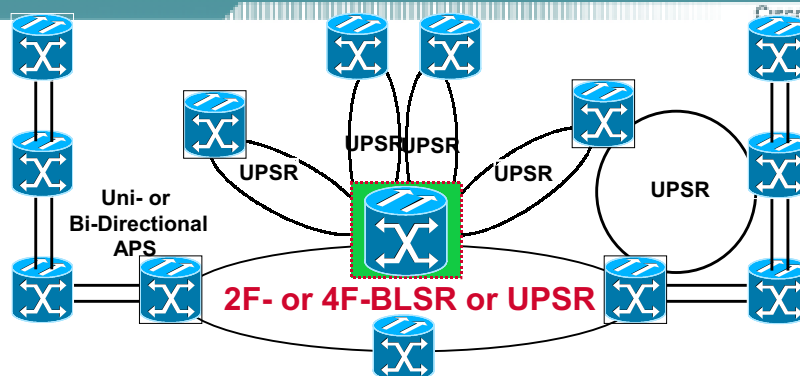
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Next Generation **MSPP** Optical Design Technology : **UPSR & BLSR**

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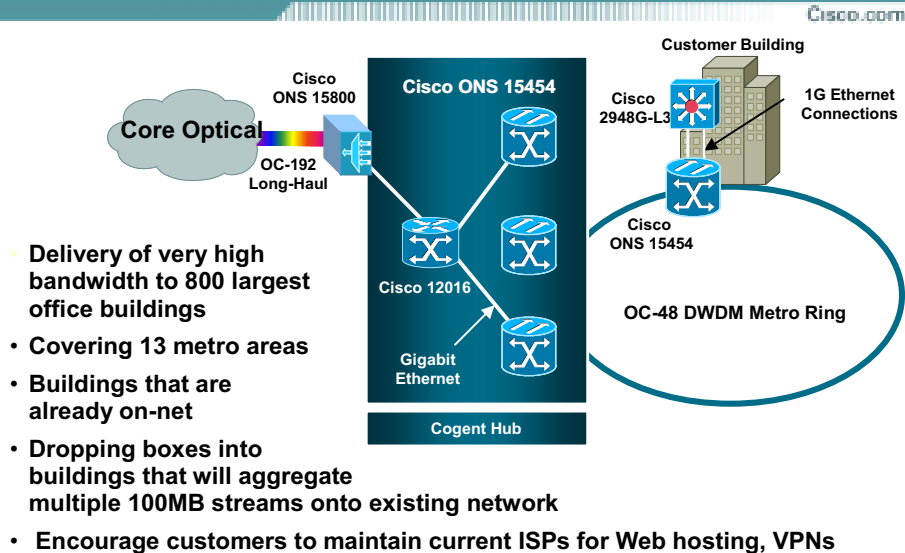
- Up to 5 rings or 10 linear connections hosted per shelf
- All Ring Types : UPSR, 2 Fiber BLSR, 4 Fiber BLSR
- 2 x 2F BLSR support on a single shelf

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Next Generation **MSPP** Case Study : Cogent Network

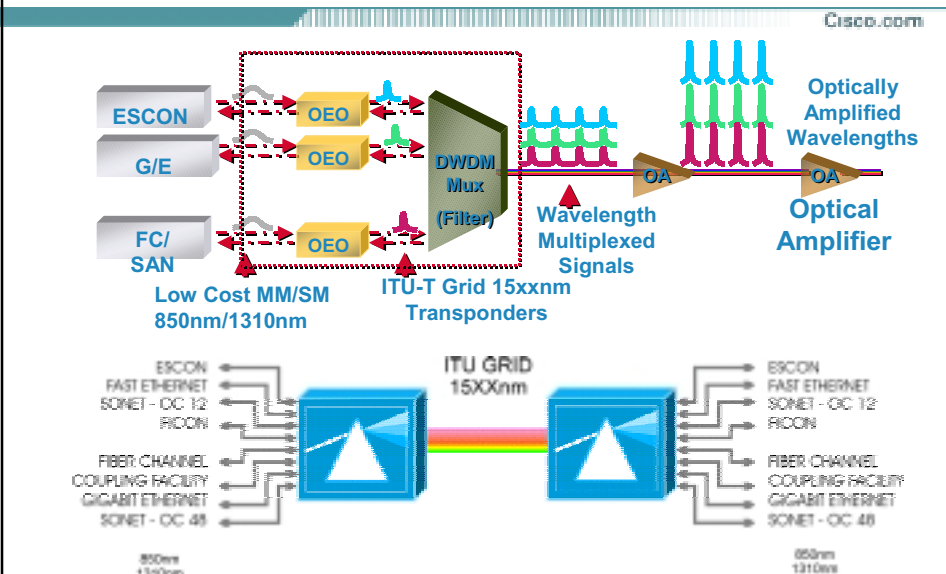


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DWDM Principles



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Cisco DWDM Solutions

Summary (Metro DWDM)

• Metro DWDM

- ✓ lowest cost , 1 or 2 lambda service for small remote :
- ✓ Variable interface : SDH/SONET, GE, ESCON, FICON

- ✓ 8 Channel lambda, 2.5G
- ✓ Optimized PTP application with Low price
- ✓ Variable interface : SDH/SONET, GE, ESCON, FICON

- ✓ Optimized Ring application
- ✓ Interface : SDH/SONET, GE/10GE
- ✓ High Port Density : 96 lambda/rack

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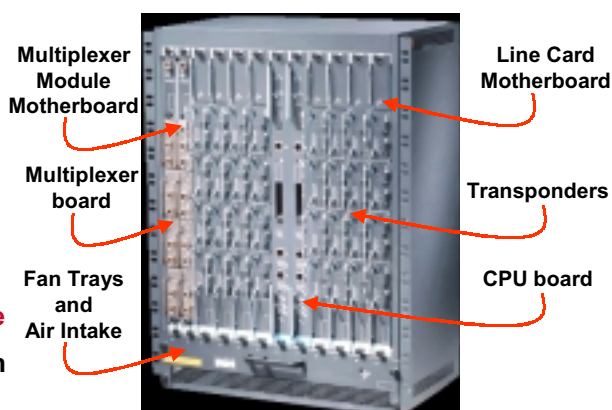
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Cisco Metro DWDM ONS 15540

- Ring based Metro DWDM
- 32 lambdas/fiber;
96/rack
- Transparent mode
- switched mode
- 10GE, GE, ESCON, FICON, FC, SONET/SDH
- 2.5 G and 10 G wave
- Pt-Pt, ring and mesh
- High Availability
- NEBS

ONS 15540



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Cisco Metro DWDM

ONS 15540 - Summary

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Storage Services

- ☒ Backup Services : Disk, Tape, Both
- ☒ Fast Restore Services : Disk
- ☒ Data Archival
- ☒ Primary Data Storage - NAS (TBD)
- ☒ Primary Data Storage - SAN (TBD)
- ☒ Business Continuity - synchronous
- ☒ Business Continuity - adaptive
- ☒ Point In Time Copies for various applications

Connectivity Services

- ☒ Managed Wavelength
- ☒ Fiber Channel
- ☒ ESCON, GDPS: coupling facility, sysplex timers
- ☒ FiCON
- ☒ Fast Ethernet
- ☒ GE
- ☒ SONET/SDH, ATM

Optical Connectivity Topologies

- ☒ Pt to Pt
- ☒ Rings
- ☒ Future Mesh

Key Product Components

- ☒ ONS 15540
- ☒ SN5420
- ☒ Cisco Security Products

Testing and/or Certification

- ☐ EMC & IBM - 15540 (in progress)
- ☐ MFN & AT&T Soln testing (in progress)
- ☒ SN5420 - Brocade & IBM IGS certified

Enables

- ☒ Storage Consolidation
- ☒ Remote Storage Across Metro
- ☒ Server to Disk, Server to Tape
- ☒ Server to Server (NAS)
- ☒ Disk to Disk
- ☒ IP access to FC storage
- ☒ Native Storage I/fs over Optical
- ☒ FC SAN island interconnect over IP

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Cisco Metro 1500

Cisco.com

Metro 1500

32 Ch. DWDM Platform

- Protocol & Bit-rate independent
- SNMP & CiscoWorks Support
- Fault Tolerant Redundant Links
- 32 Wavelengths
- 4 Chassis per system
- 8 Ch. Per chassis
- Up to 2.5 Gbps B/W per Channe.
- Up to 80 Gbps System B/W
- Compact Design - Easy to Provision



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Cisco ONS 15216 Release 2.1

32 Channel 100GHz DWDM Solution

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ONS15216 DWDM Filter



16λ Red band



16λ Blue band

ONS15216 EDFA



ONS15216 OADM



1λ OADM – 32 versions



2λ OADM – 16 versions



4λ OADM – 8 versions

ONS15216 OPM



Note: Photos shown for illustrative purpose only.

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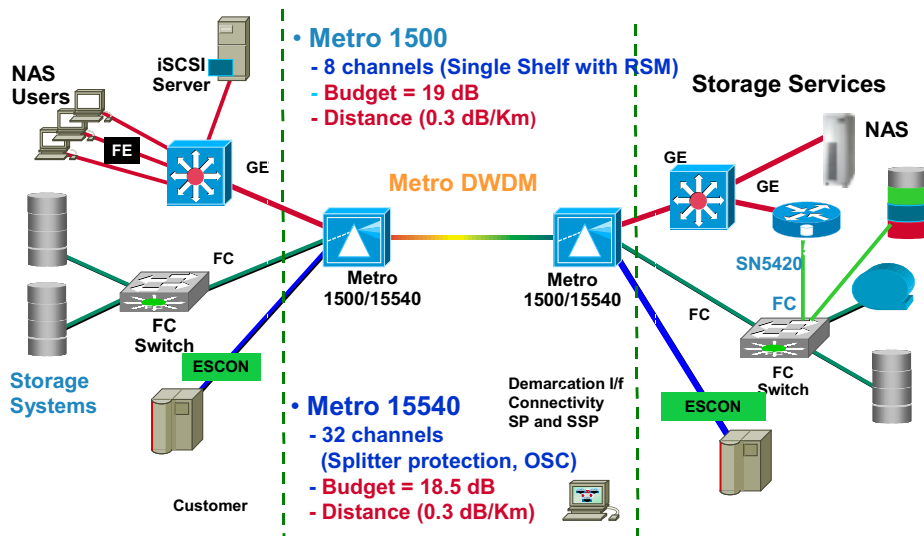
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DWDM Point to Point Architecture

Metro 1500/15540

Cisco.com

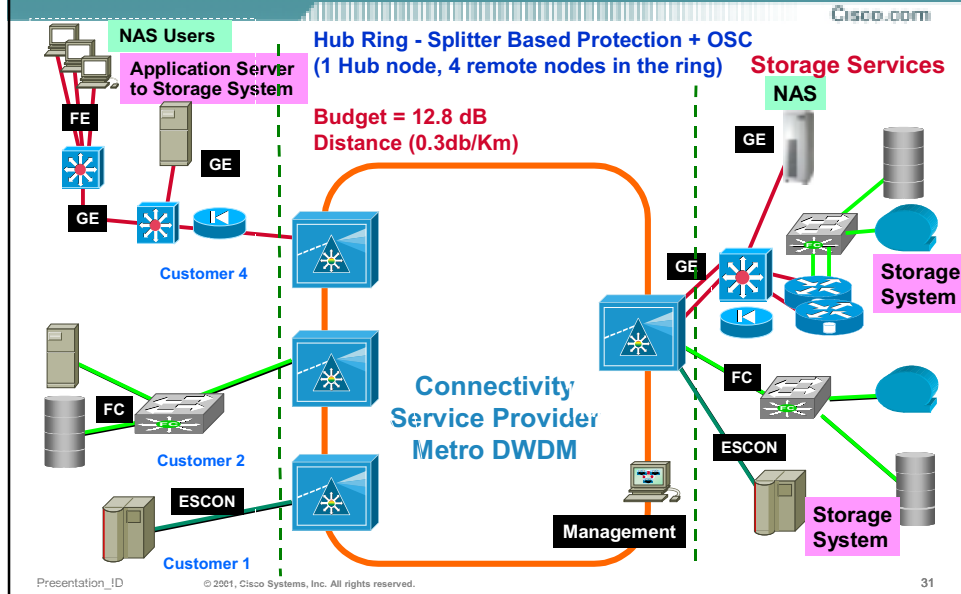


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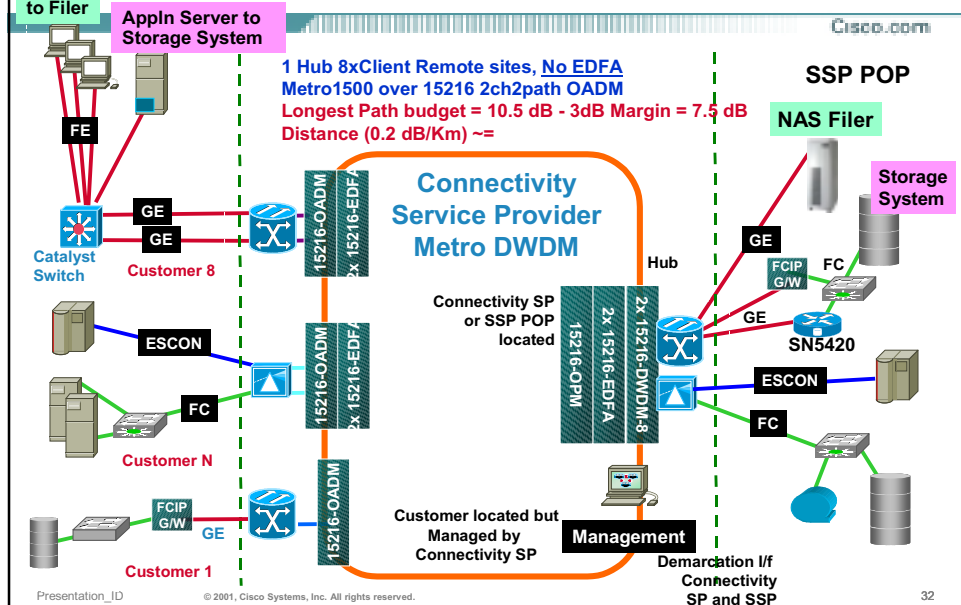
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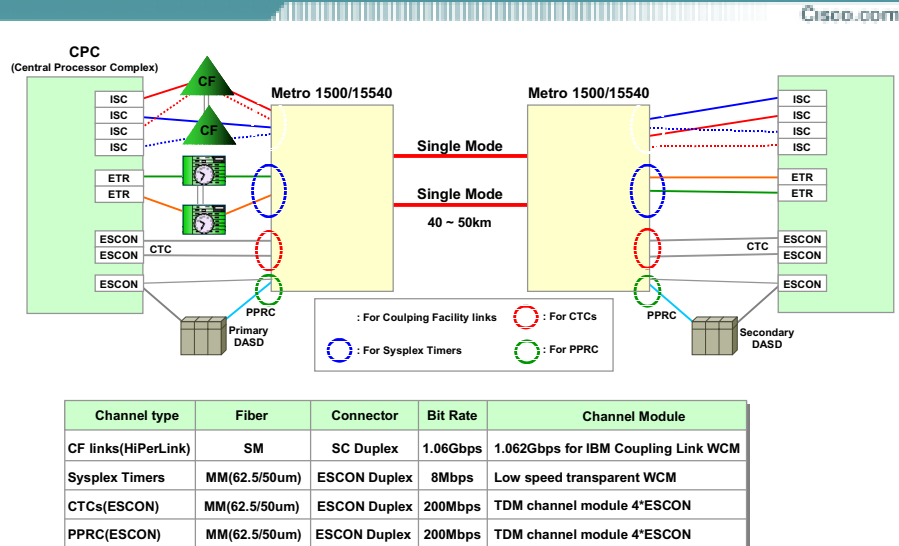
DWDM Ring Architecture ONS 15540



DWDM + MSPP Ring Solution ONS15454 & Metro1500 over 15216 OADM



Application : DR 구성방안 - GDPS 구성

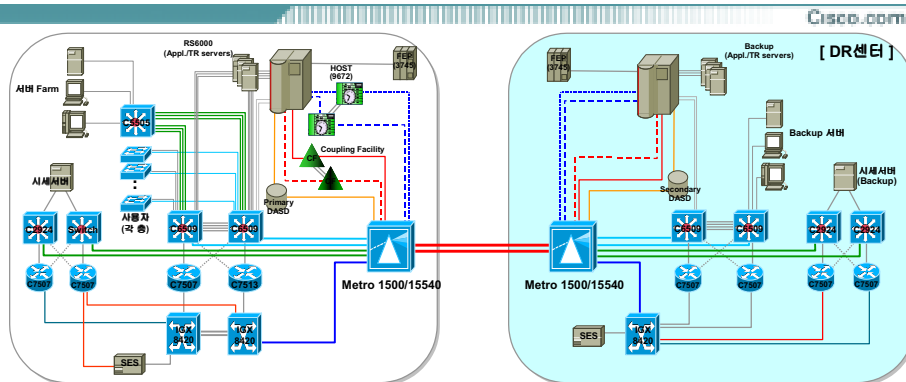


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Application : DR 구성방안 - Channel(Port)수 산정



윗 그림을 예를 들면, 한 지역에서 필요한 Channel(Port)은

- Gigabit Ethernet(High speed WCM) : 4
- ATM OC-3(Low speed WCM) : 1
- CF(1.062Gbps for IBM Coupling Link WCM) : 2
- Sysplex timer(Low speed WCM) : 2

Total 9 channel(port)이 소요되고, 나머지 23channel은 ESCON으로 사용될 수 있다.

여기서 4port TDM ESCON module을 이용하면, Total 92port(23*4)를 ESCON으로 사용할 수 있다.

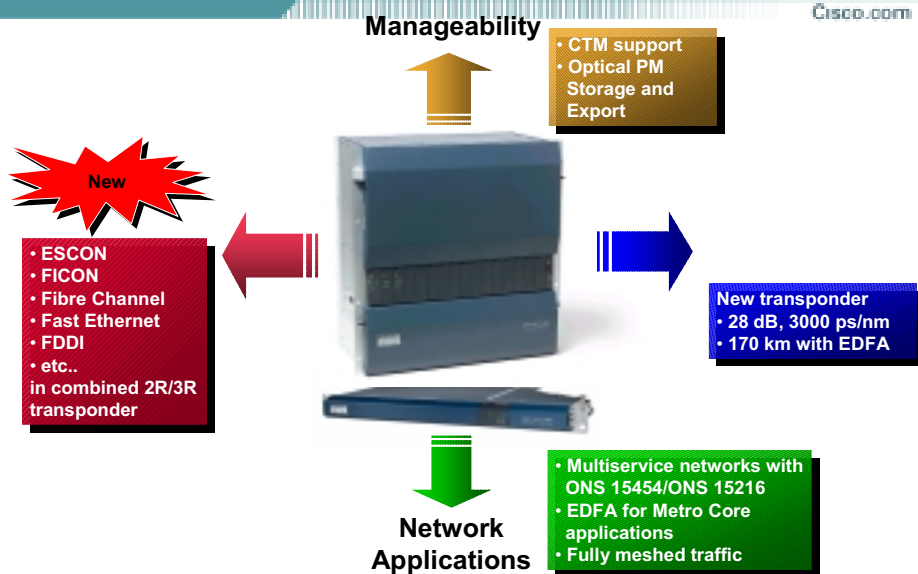
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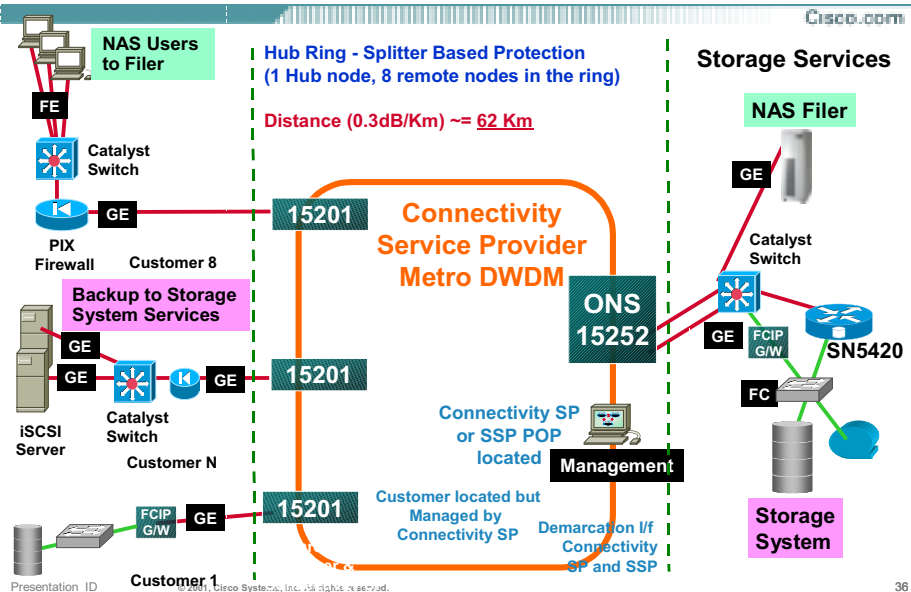
Cisco Metro DWDM

ONS 15252

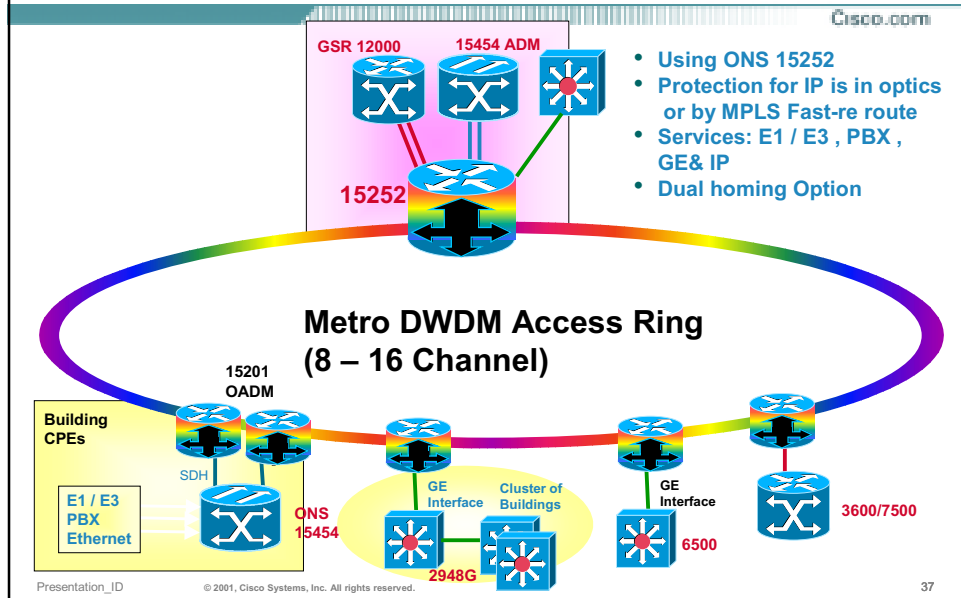


Metro DWDM Ring Architecture

ONS 15252/15201



L2/L3Ethernet + DWDM For Bandwidth Scaling



Cisco's Metro DWDM Vision

• Drive the

Integration of data networking, storage and information streaming over a connectionless ultra high bandwidth intelligent optical infrastructure capable of

Any packet, any wavelength, any platform

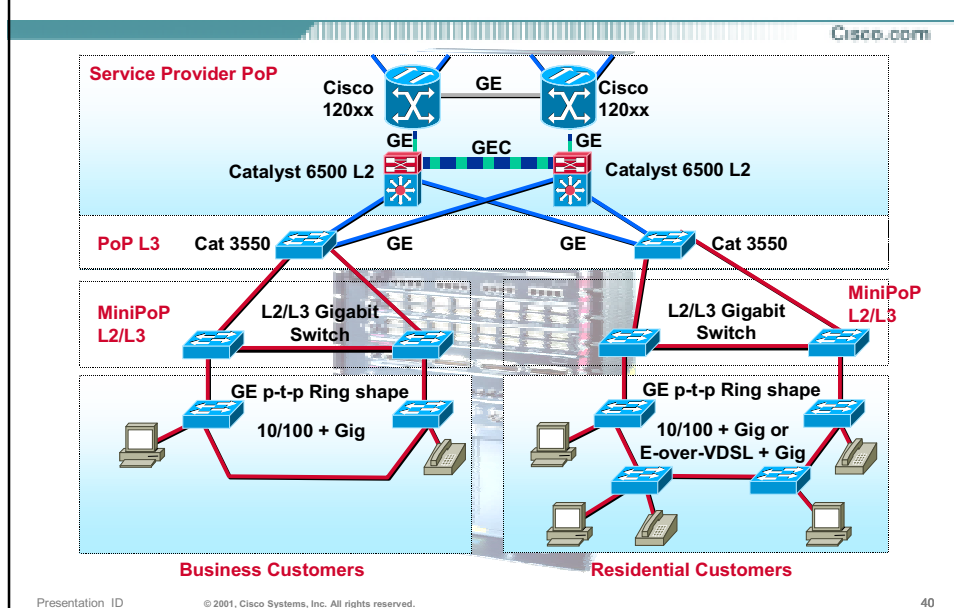


Gigabit Ethernet over Dark Fiber

Ethernet Everywhere



Ethernet Switch Applications



Metro Technology Cheat-Sheet

Cisco.com

	MSPP	DWDM	Ethernet Switch
Native TDM Support	Yes	Yes	No
SONET/SDH like survivability	High (<50ms)	High (<50ms)	Low (<sub-second)
Ethernet Support	Yes	Yes	Yes
Internet Service	Moderate	Moderate	High
EAS Service	Yes	Yes	Yes
Ethernet Bandwidth Control	Yes	planned	Yes

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Metro Technology Cheat-Sheet

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	MSPP	DWDM	Ethernet Switch
Bandwidth Utilization	Moderate	Optimal	Moderate
SONET/SDH like survivability	High (<50ms)	High (<50ms)	Low (<sub-second)
Fiber Utilization	High	High	Moderate
Service Efficient	Data Service	High	High
	TDM Service	Moderate	Moderate
	Traffic and Congestion Control	High	High

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EAS Solutions Summary

CISCO.COM

	MSPP	DWDM	Ethernet Switch
서비스 측면	Data, TDM, native Voice 동시 구현에 바람직	Data, TDM, native Voice 동시 구현에 바람직	Data전용 서비스
기존 Infra의 확장	기존 TDM망에서 Data서비스 구현 용이	신규 Data 망 구축이 필요	신규 Data망 구축이 필요
서비스 안정성	< 50ms 망 복구로 장애 손실 최소화	< 50ms 망 복구로 장애 손실 최소화	< 10 s 망 복구로 장애 대책 제한적
고려사항	<ul style="list-style-type: none"> Multi service에 최적화. 안정적인 EAS 서비스 구현 	<ul style="list-style-type: none"> Multi service에 최적화 EAS 서비스 구현 용이 	<ul style="list-style-type: none"> EoMPLS를 통한 TLS 인터넷/EAS서비스 용이
Application	기존의 TDM서비스에 추가로 Data 서비스로 확장하는 SP, Enterprise 의 경우	안정적이며, 대규모로 Data서비스를 구축하는 SP의 경우	기존 Ethernet장비를 통한 소규모의 Data 서비스를 구축하는 SP의 경우

- Customer 의 Network환경에 따라서 각각의 Solution이 통합되어 구현이 필요
- Ethernet의 Broad Bandwidth를 활용한 Value-Add서비스 개발이 필요

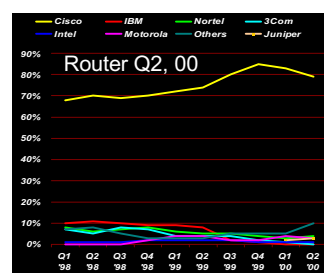
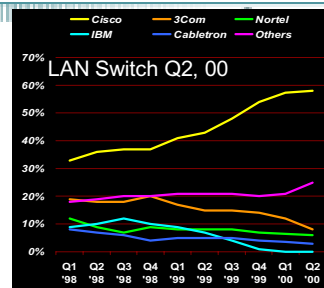
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The Cisco Advantage

- IP/Ethernet leaders
- Strong Next Gen (NG) Optical portfolio
- The Enterprise base
- Features that enables Service
 - Performance
 - MPLS, CoS/QoS
 - L3+ Intelligence
 - Multicast
- End-to-end solution
- Eco System Partners



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- **New Trends from IP + Optical**
- **Metro Solutions**
 - NG-MSPP
 - DWDM
 - Ethernet over Dark Fiber
- **Storage Networking Solutions**
 - **IP Storage (iSCSI)**
 - **IP + Optical Storage**

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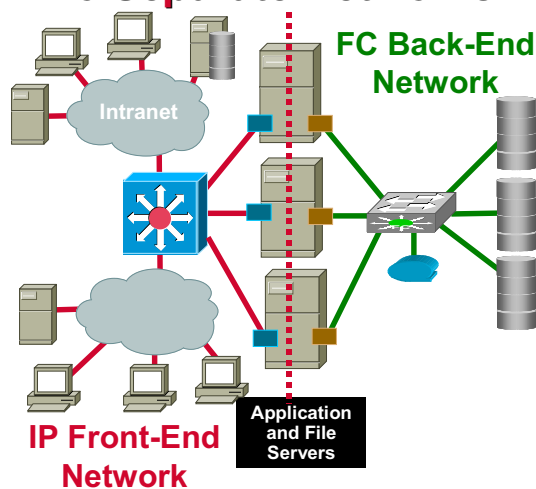
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Current Solutions : SAN and NAS

Cisco.com

SANs Create Two Separate Networks

- **Two different networks**
 - Different Mgt tools
 - Different Monitoring tools
 - Different Security tools
- **Limited Interoperability**
- **Isolated “SAN Islands”**
- **Minimal storage**



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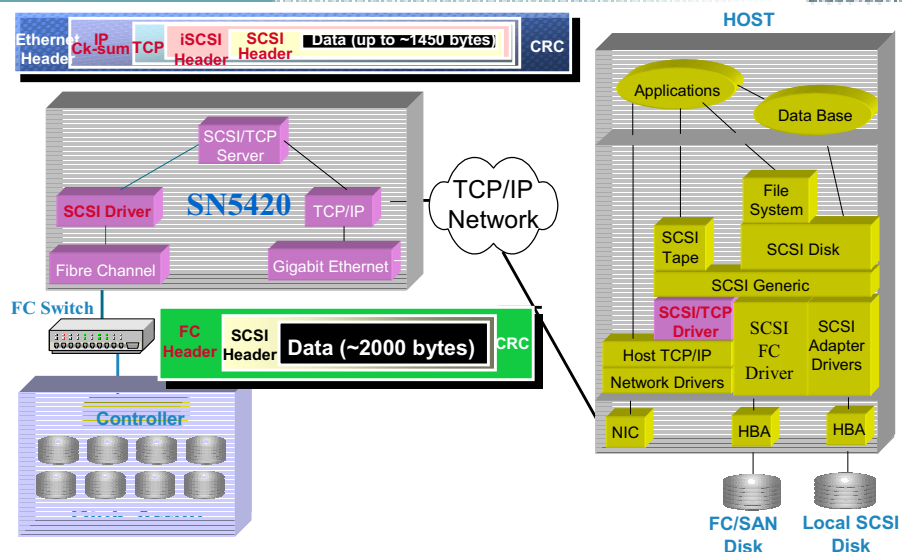
-
- The diagram illustrates the IP-SAN architecture. At the top, a row of server racks is connected via red lines to a central blue circular node labeled "SAN Router SN5420". This router is also connected via red lines to a row of desktop computers. To the right of the router, a purple square icon is labeled "iSCSI Software Driver". Below the router, a green line connects it to a "Fibre Channel Switch" (a rack-mounted unit). The switch is then connected via green lines to two rows of server racks: "Database servers" on the left and "Storage" on the right. A large green banner at the bottom is labeled "IP-SAN". The text "TCP/IP Network" is written in red near the router.

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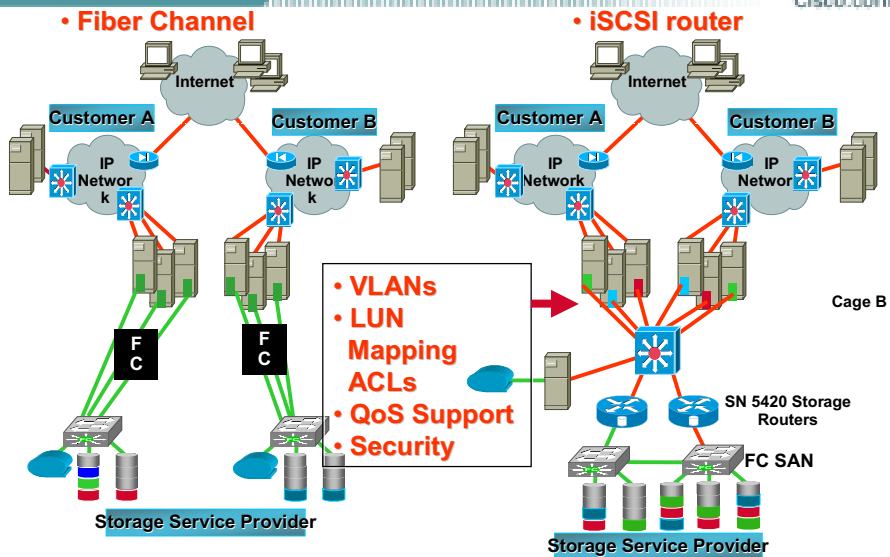


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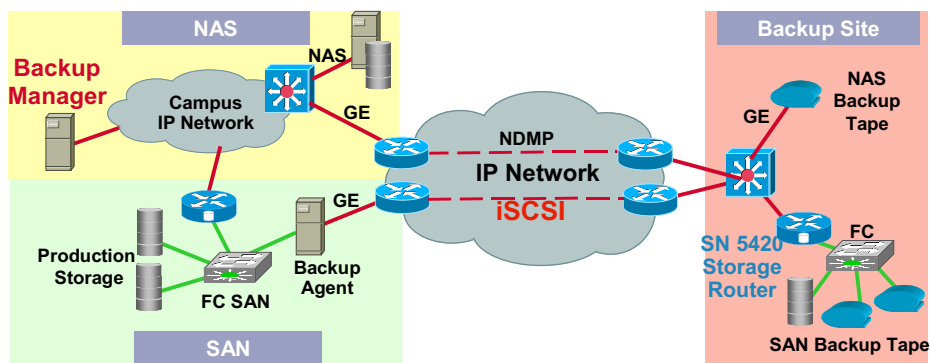
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SSP Co-location Solution - Fibre Channel vs iSCSI Storage Router



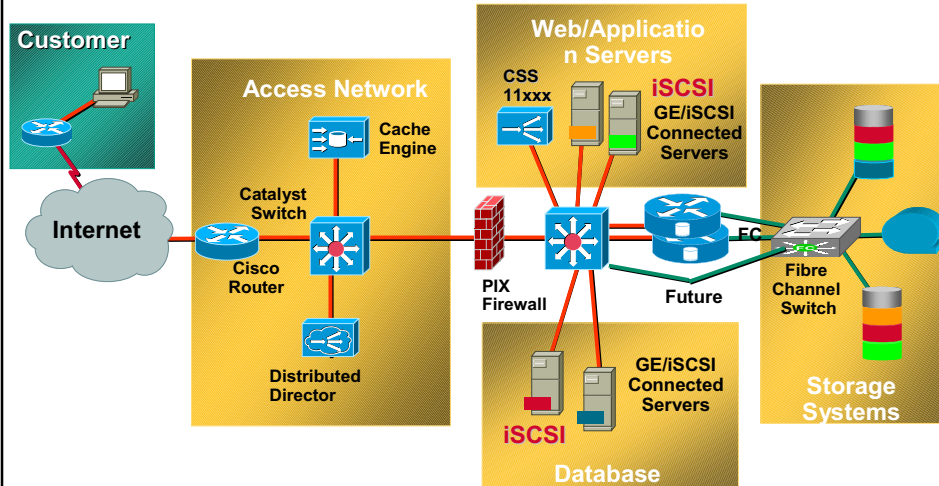
Application 1: Remote Backup SAN and NAS



Application 2 : Hosting Provider: iSCSI Router Solution

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Storage Consolidation



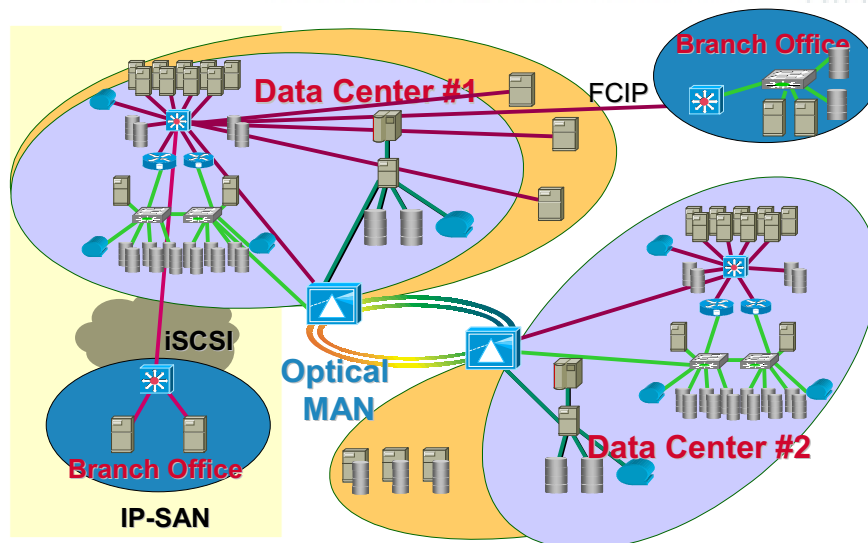
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I-Storage Enterprise

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Case study -ARSENAL

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SAN Sharing Among Distant Application Servers

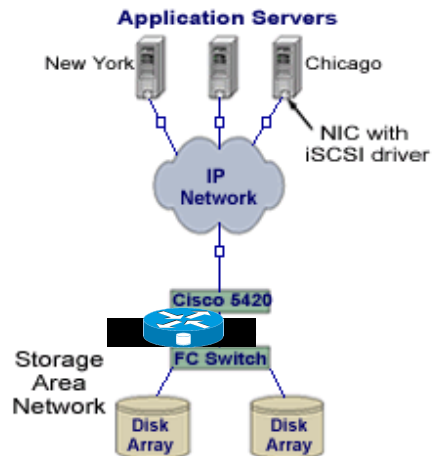


Figure 2: SAN Sharing Among Distant Application Servers

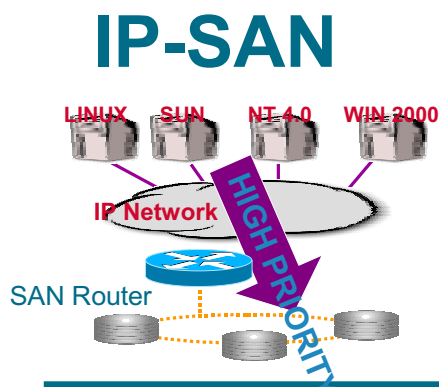
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IP-SANs enhance FibreChannel SANs

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- Leverage existing Fibre Channel Storage
- Interoperability
- Scalability, Familiarity
- Virtual & Wide Area Access
- Security
- Management
- Quality of Service

- Addressing security by working with **Standard IP security functionality:**
IPsec, 3DES, firewalls, ACLs, VLANs

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