

A man in a white shirt and red tie is holding a large red optical fiber cable that arches over a landscape. The background is a stylized, textured blue and yellow sky. The text "Cisco's Enterprise Optical Networking Solution" is overlaid in white.

# Cisco's Enterprise Optical Networking Solution

2001. 9.



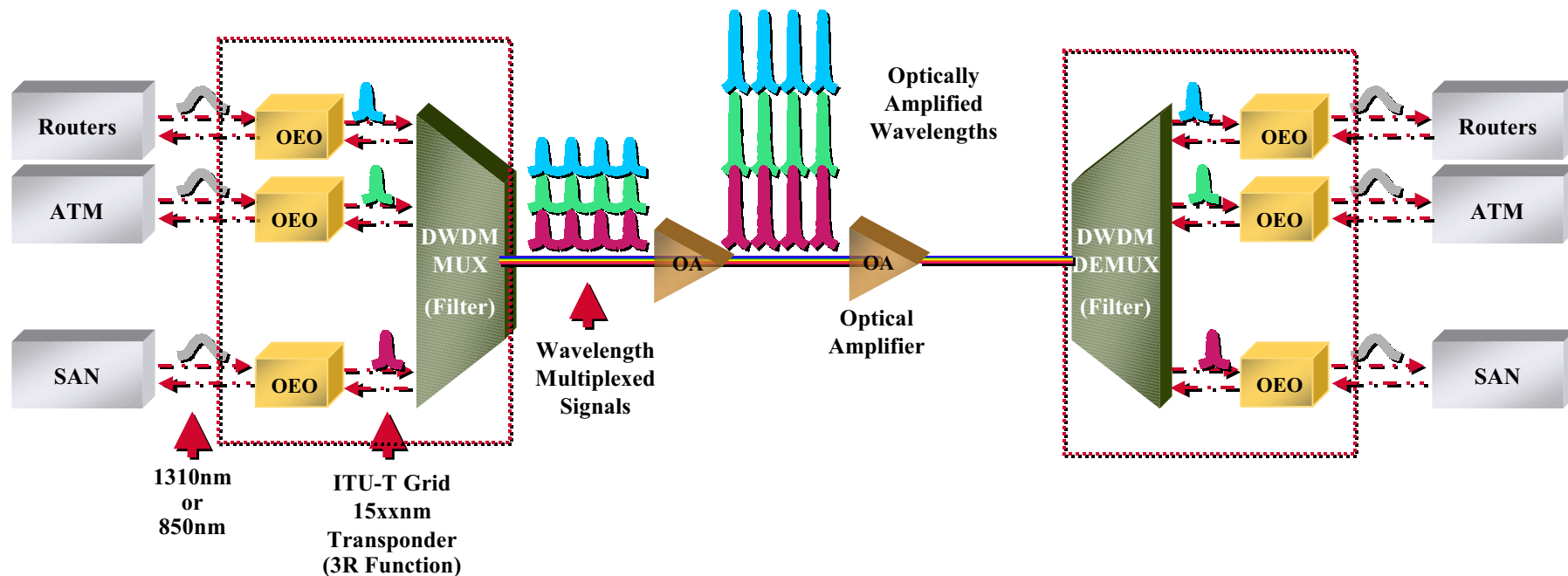
# 목 차

- ❖ Metro Optical Network
- ❖ Cisco Product & Solution
- ❖ Reference Site Study



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- ❖ **Metro Optical Network**
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  - ❖ **Reference Site Study**

# (D)WDM 개요



- CPE(Customer Premise Equipment)에서 1310nm 단일 공용파장으로 OEO Transponder로 접속 15XX nm대로 파장변환을 한 후,
- 이 광신호들을 다중화하여 하나의 Optical fiber상으로 전송함.
- DWDM(Dense Wavelength Division Multiplexing)은 통상 8개 이상의 파장을 다중화함.  
Ultra WDM : 64ch ~ 다중화 가능
- 각 파장은 서로 다른 신호(CPE Data)를 전송하며 이들은 하나의 Fiber 내에서 완전히 별도의 line을 쓰는 것과 같다.
- 두 DWDM 장비간 link를 위해서는 budget(signal level)산정이 중요한 Design issue. 장거리 전송을 위한 Amplifier /Generator 등이 사용됨.

# DWDM Key Benefits

Time division multiplexing(ADM)

Multiple channels on Single wavelength per fiber

DS1~OC12 channels on OC48

\*\*\* Sum of Channel < Trunk

Wavelength division multiplexing(WDM)

Multiple channels Multiple wavelengths per fiber

DS1~OC12, OC48 channels on a wavelength

\*\*\* Sum of Channel >> Trunk

Fast, Dynamic Broadband provisioning

Simplifying High Speed Networking connectivity

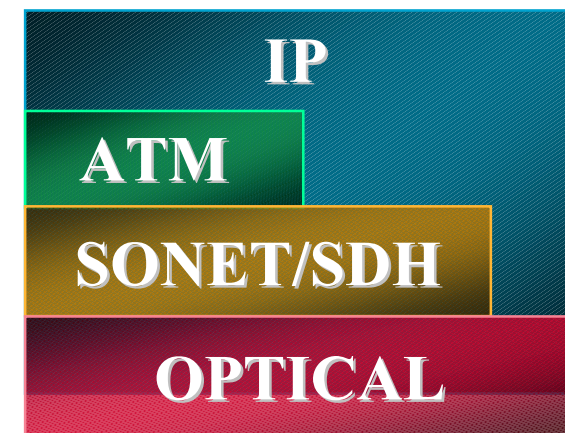
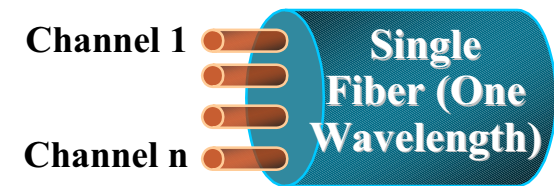
Simplified architecture

Transparency (Protocol Independence)

Scalability

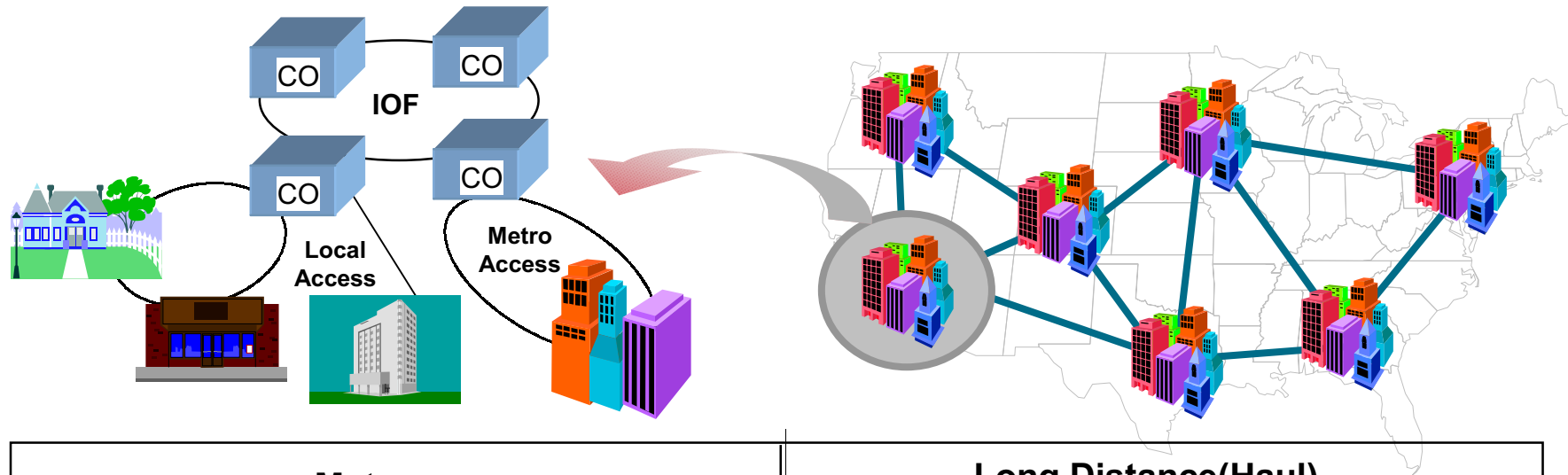
Reducing unnecessary layers of equipment

Lowers equipment/operational cost





# Metro vs. Long Distance Networks



Metro	Long Distance(Haul)
Local area access, mesh and centrally-homed configurations	Inter-city connectivity
< 50km between COs	>> 50km between COs
Cost driven, low cost SONET/DWDM Equipment	Capacity driven, employs expensive DWDM technology
Fiber typically leased and readily available	Severely fiber constrained (expensive route-of-ways)

# Network Modeling Objectives

## **Economics**

**Topology : Mesh, Ring, P2P**

**Cost saving of Fiber infrastructure**

## **Network Architecture**

**Designing Core/Pop/Access**

**Interconnection/Migration**

## **Availability**

**Simulate network traffic**

**Identify choke points & potential bottlenecks**

**Network stability**

**Protection : Fiber/Client**

# Network Modeling Objectives

## **Scalability**

**Optimize network expansion**

**Equipment requirements**

**Link budget provisioning**

## **Multi-service Integration**

**Data, Voice, Video...**

## **Bandwidth Control of Service**

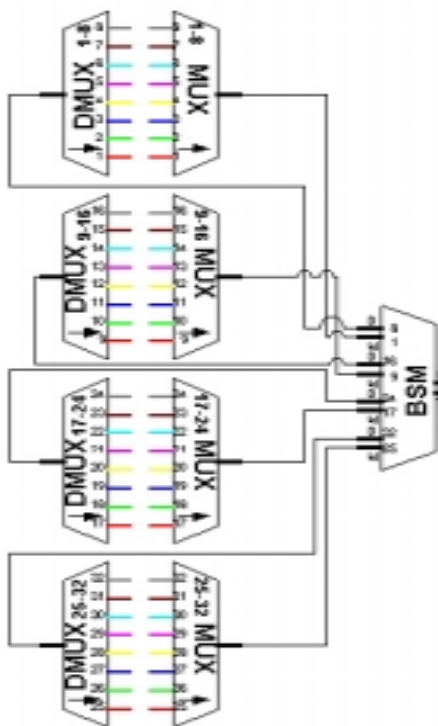
**Full bandwidth**

**Partial bandwidth per customer request**



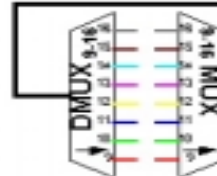
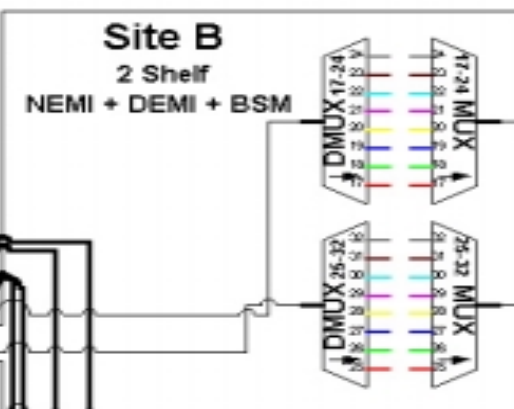
# Budget Design

**Site A**  
4 Shelf  
NEMI + DEMI + BSM + NEMI + DEMI

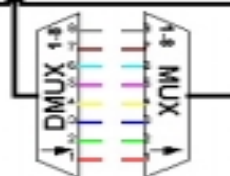


**Point to Multipoint Based Topology**  
**Optical Budget Calculation**  
Site A 2dB for BSM + Site B 2dB for BSM  
**Total Internal Loss = 4dB**  
Fiber Budget = 26dB - 4dB = 22dB  
OC48 Fiber Budget = 21dB - 4dB = 17dB

Use Attenuator or  
Amplifier/Regenerator

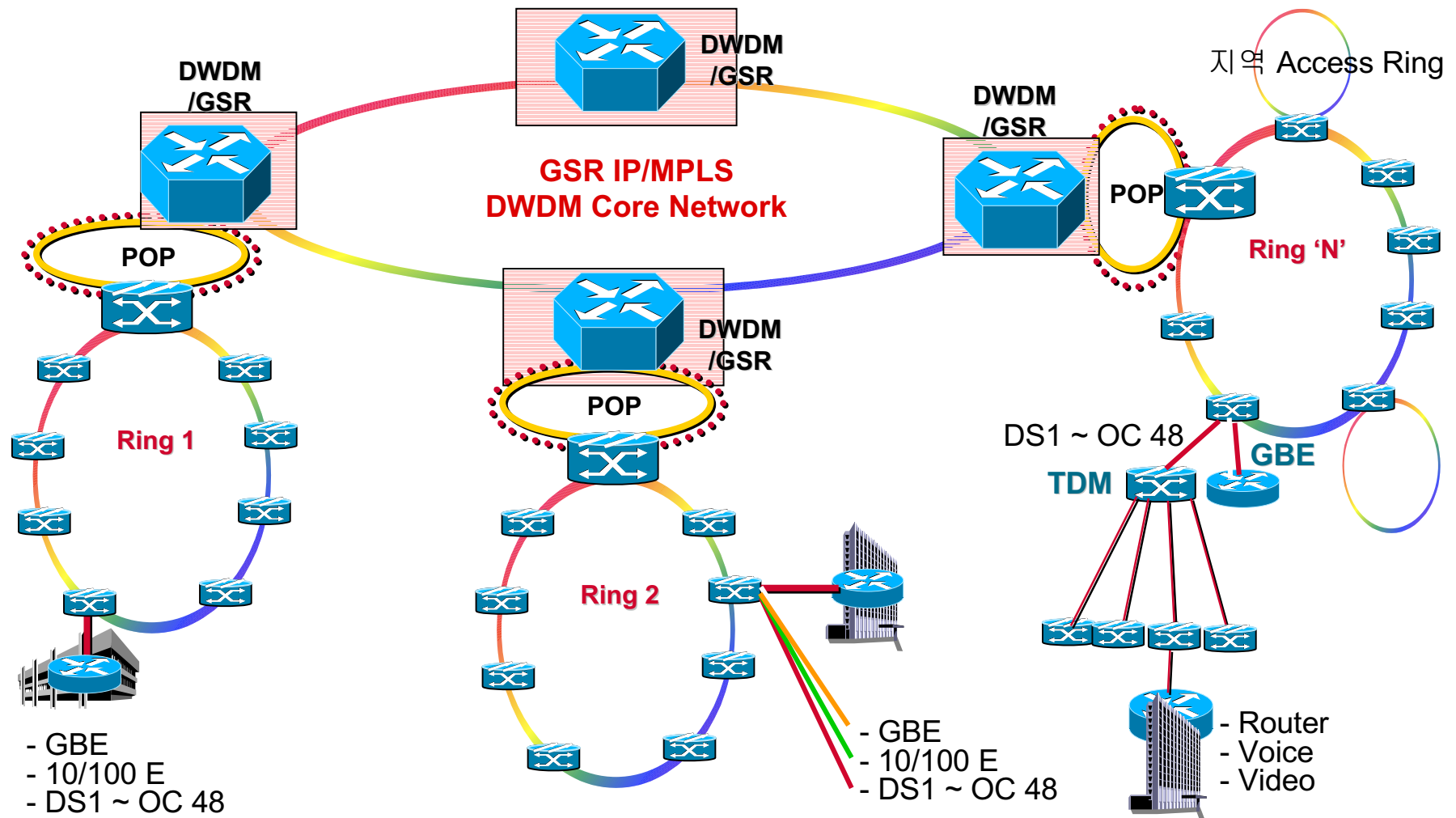


**Site D**  
1 Shelf  
NEMI

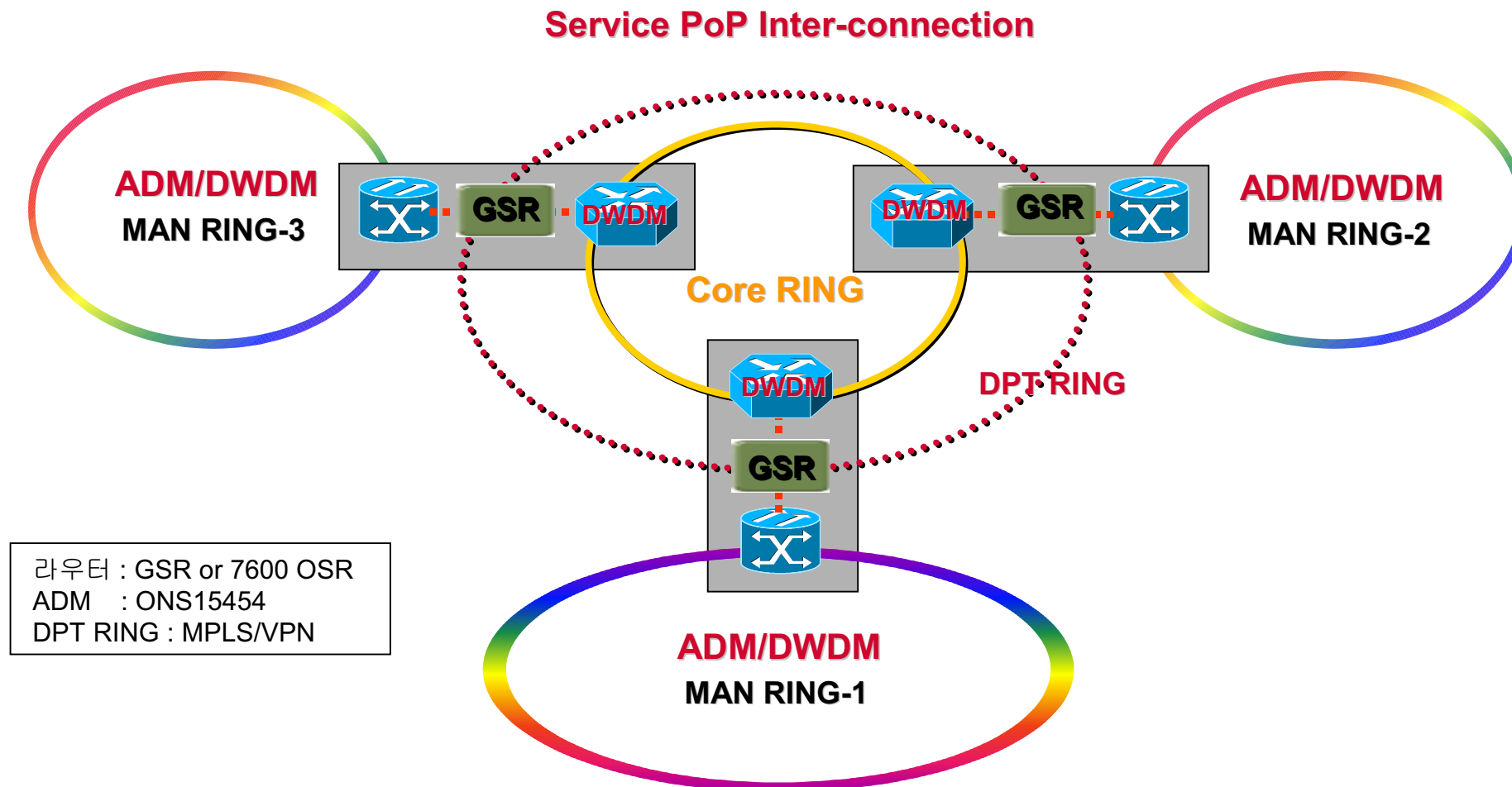


**Site C**  
1 Shelf  
NEMI

# Integration into Core Network Architecture



# Service POP Inter-connection





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# Cisco Product Mapping

## ONS 15201 + 15252

- Metro Optic Network
- lowest first cost  $\lambda$  to building solution
- OC-N, GE, bit-rate independent

$\lambda$   
To The  
Building



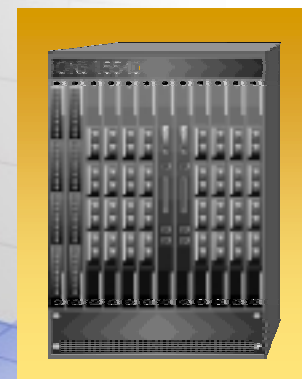
## ONS 15216 + 15454/15327



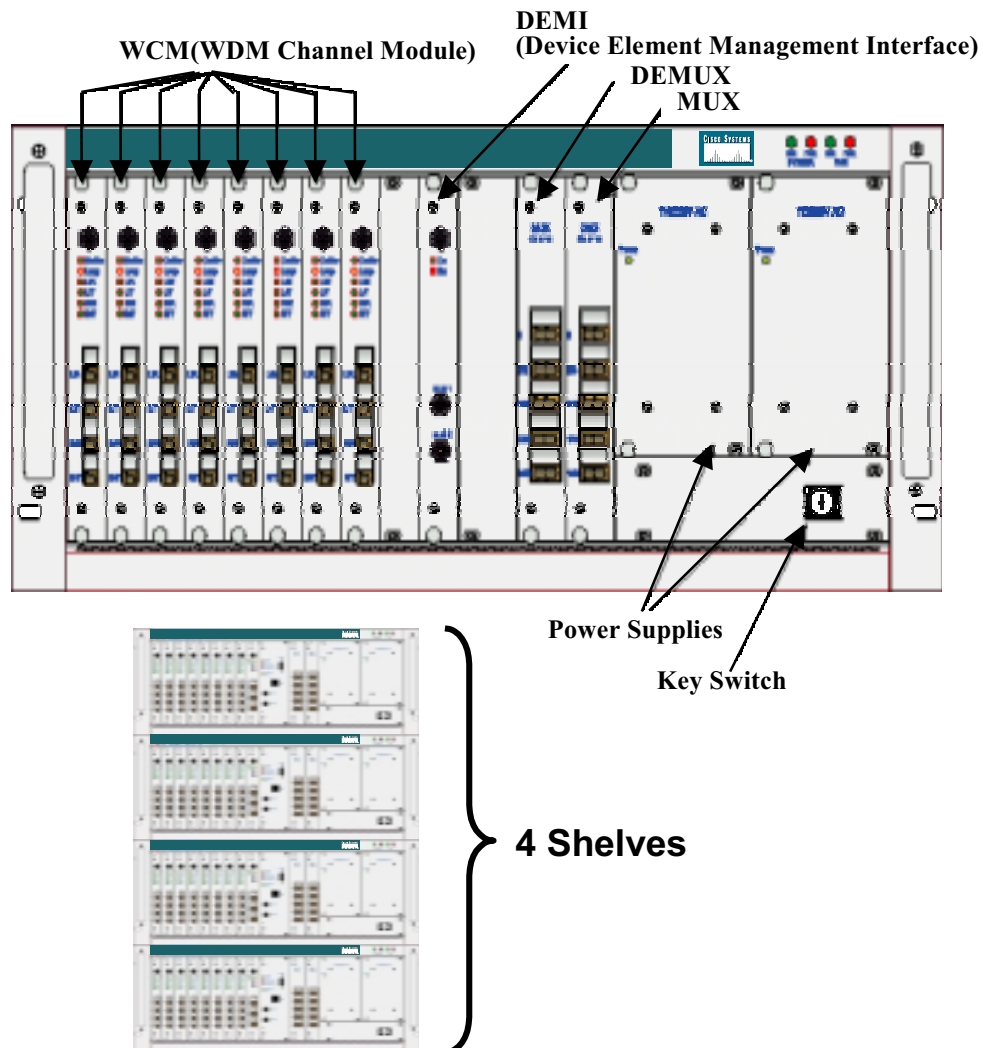
- Multi Service Platform
- 500+ customers
- #1 Ethernet over SONET (CIR)
- #1 OC48 (RHK)

## ONS 15540 ESP

- Metro/SAN
- Dense ESCON, FC, GE
- EMC, IBM certified
- Transparent, bit-rate independent interfaces



# Cisco Metro 1500



8 Channels(WCM)/Shelf  
(Max 20Gbps; 2.5Gbps\*8channels)

32 Channel system/4 Shelves  
(Max 80Gbps; 20Gbps\*4 shelves)

Up to 2.5Gbps/channel, bit rate and  
protocol independent

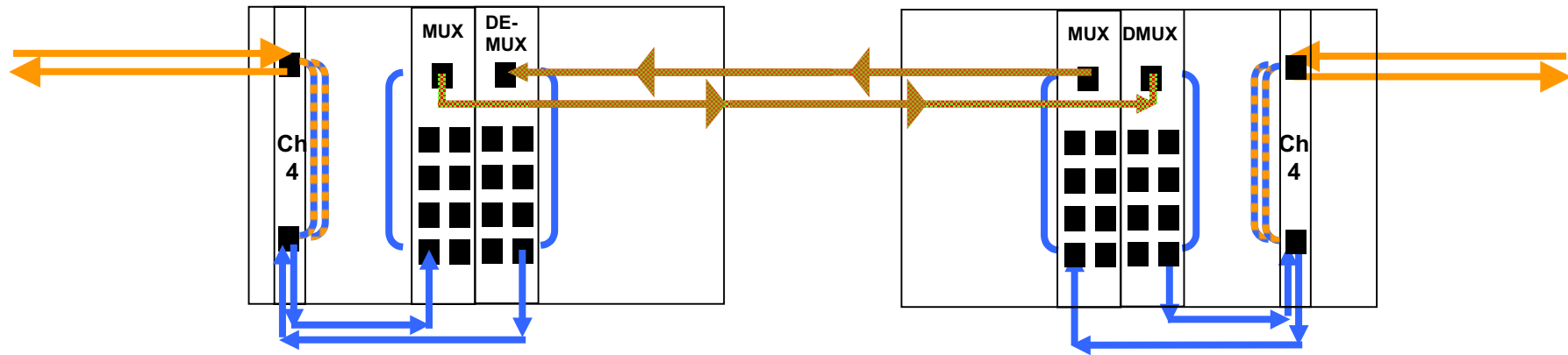
Point-to-Point, Point-to-Multipoint,  
and Hubbed Ring Topology.

1:1 line protection

SNMP manageable



# Cisco Metro 1500 DWDM Operation



- 1) CPE input from std SM/MM laser into channel specific line card
- 2) Remap from std MM/SM  $\lambda$  to DWDM  $\lambda$ , e.g. channel 4
- 3) Transfer from line card to MUX via short external jumper
- 4) Aggregation of all  $\lambda$ s on MUX inputs into a single output connection
- 5) Output from MUX over dark fiber into DMUX, (Up to 100KM)
- 6) Separation of  $\lambda$ s into discrete paths by precision comb filter
- 7) Transfer of channel specific  $\lambda$  from DMUX to line card
- 8) Remap from DWDM  $\lambda$  to std MM or SM  $\lambda$  for connection to CPE

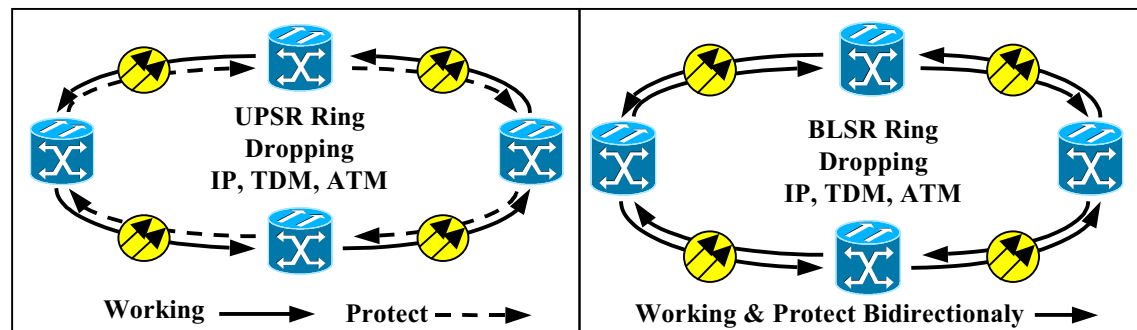
# ONS 15454/15327 MSPP/ADM

## Metro Edge Optical Transport Platform

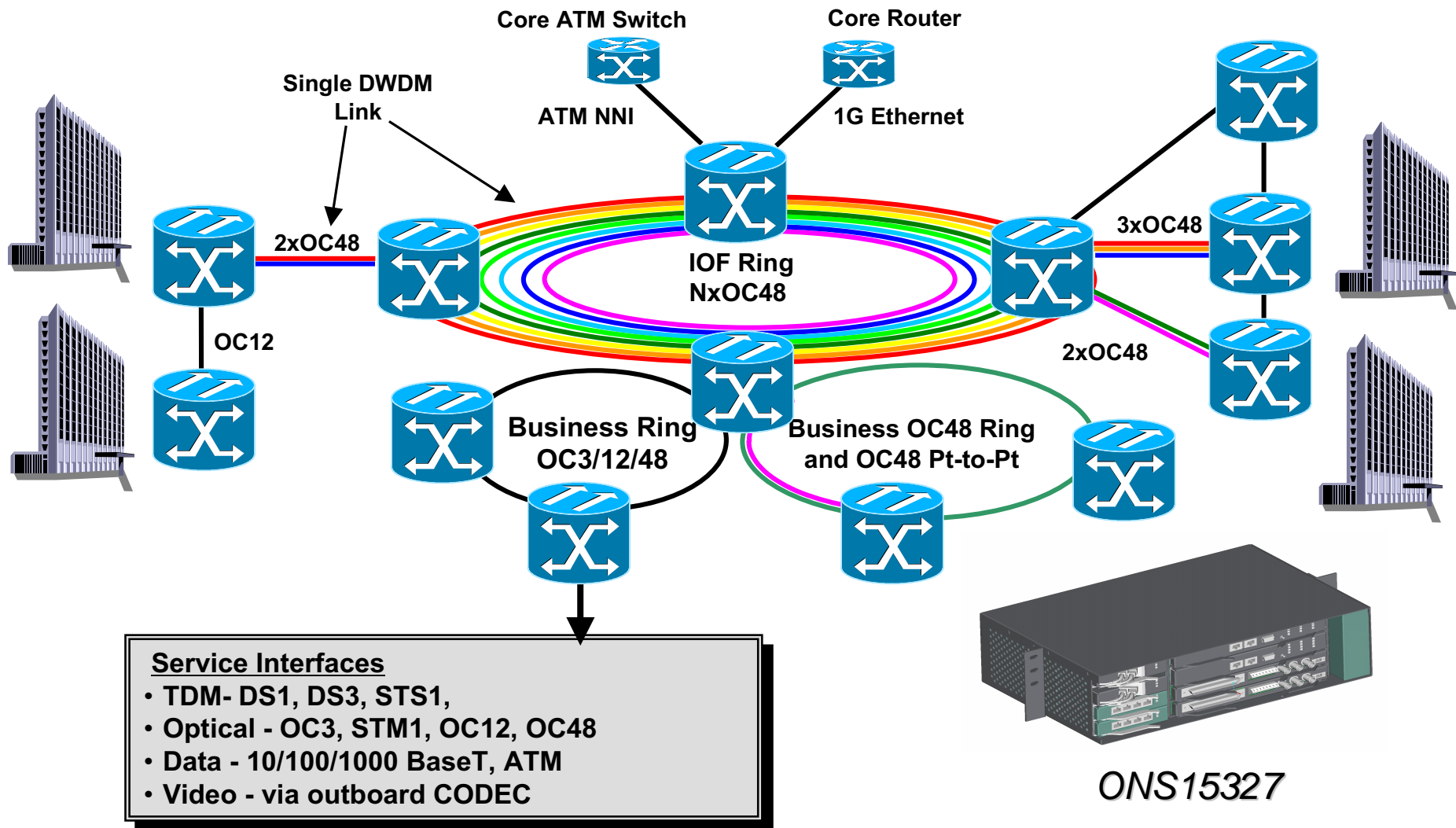
- Multi - Service Platform
- Network Topology
  - Point-to-point/Multipoint
  - Linear Add/Drop Multiplexer
  - Ring
- Protection
  - Fiber
  - 1+1/APS
  - BLSR(Fiber Bi-directional Line Switched Ring)
  - UPSR(Fiber Unidirectional Path Switched Ring)
  - PPMN(Path Protected Meshed Network)
  - Channel - 1:1, 1:N



**ONS 15454**



# ONS 15454 MSPP/ADM



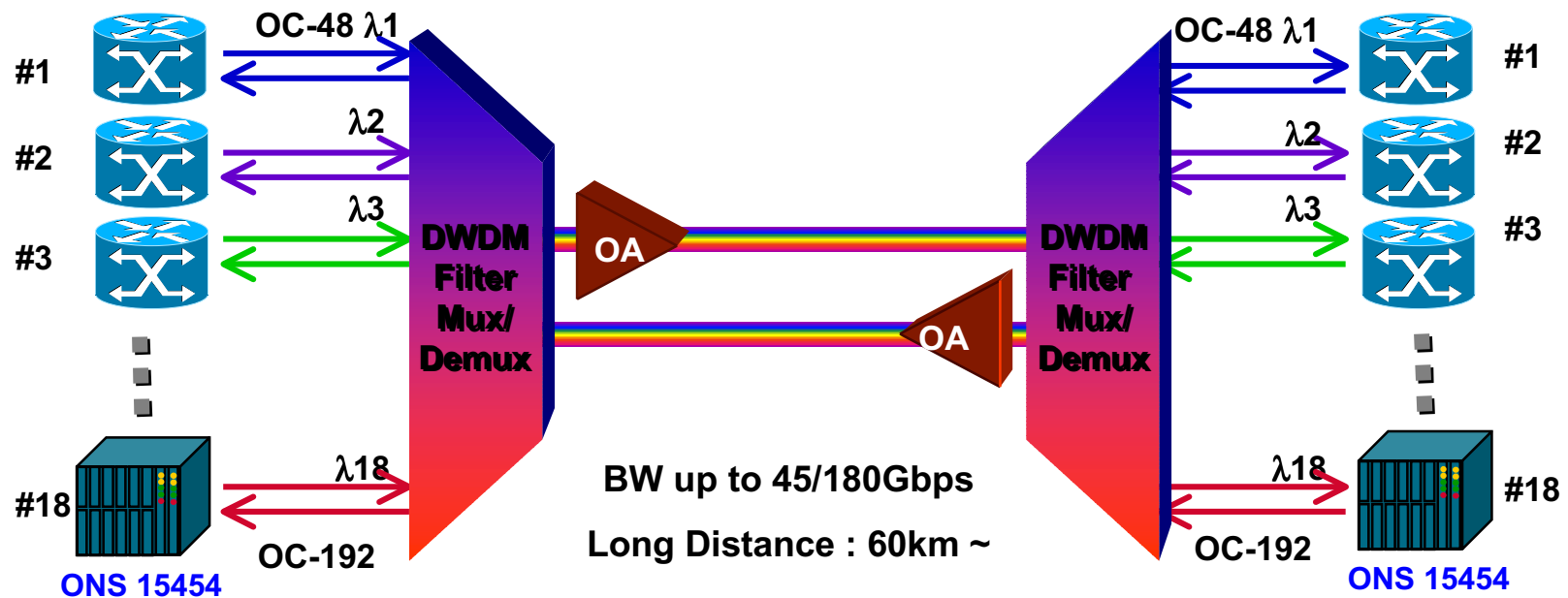


# ONS15516 DWDM Filter

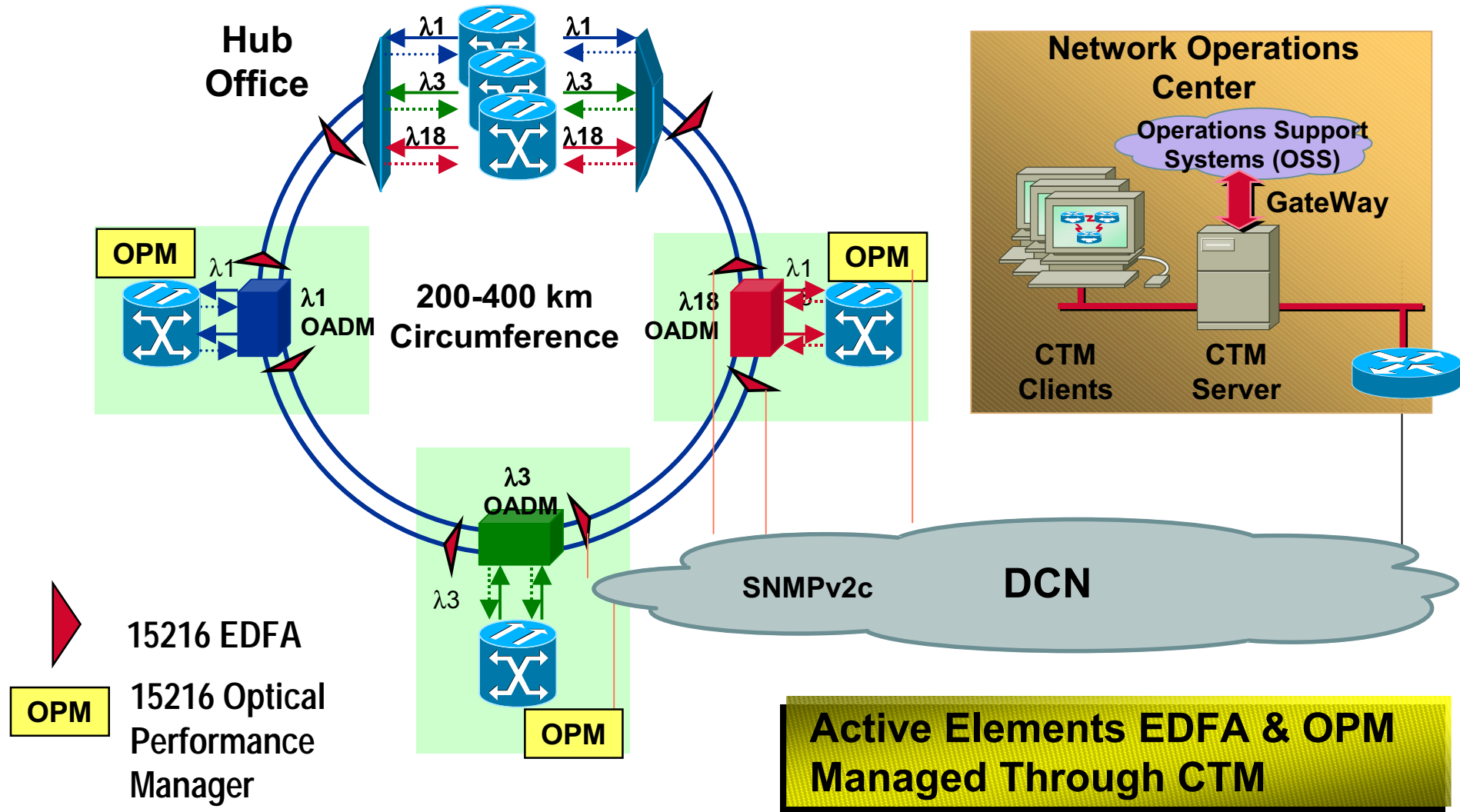
Provide Scalability :  
15454 + 15216 18 ch DWDM  
at lower price



Red  
Filter  
  
Blue  
Filter



# Applications- Management Through CTM



# ONS 15200 Metro DWDM

Designed for Metropolitan Networks  
Flexibility in interfaces and topology  
Scalability/Reliability/Upgradability  
Rapid Deployment/Cost Savings.  
Ease of installation and configuration  
Combine with 15454 to support heritage traffic  
100MBps ~ 40GBps\* on a single fiber pair  
up to 100 km.(~16ch)  
Protection : Fiber Ring, Channel

ONS 15252 : hub / gateway

Terminates up to 16 channels

ONS15201 : customer prem. / PoP

Terminates a single channel

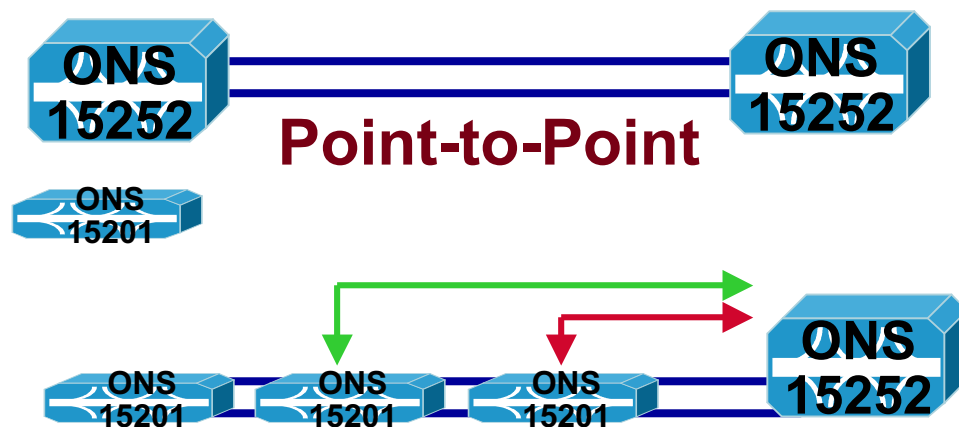
*ONS15252*



*ONS15201*

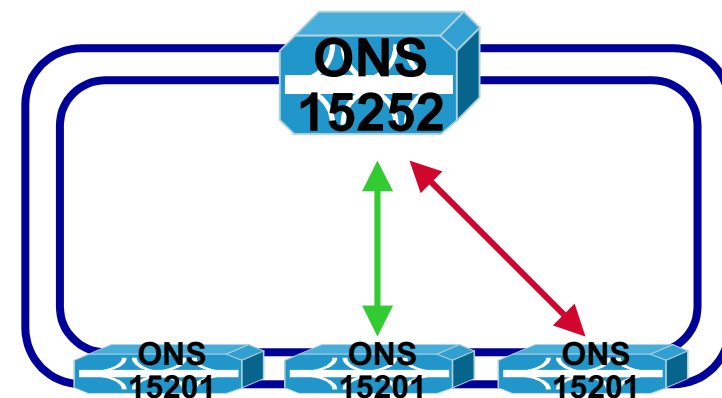


# ONS 15200 Metro DWDM Topology

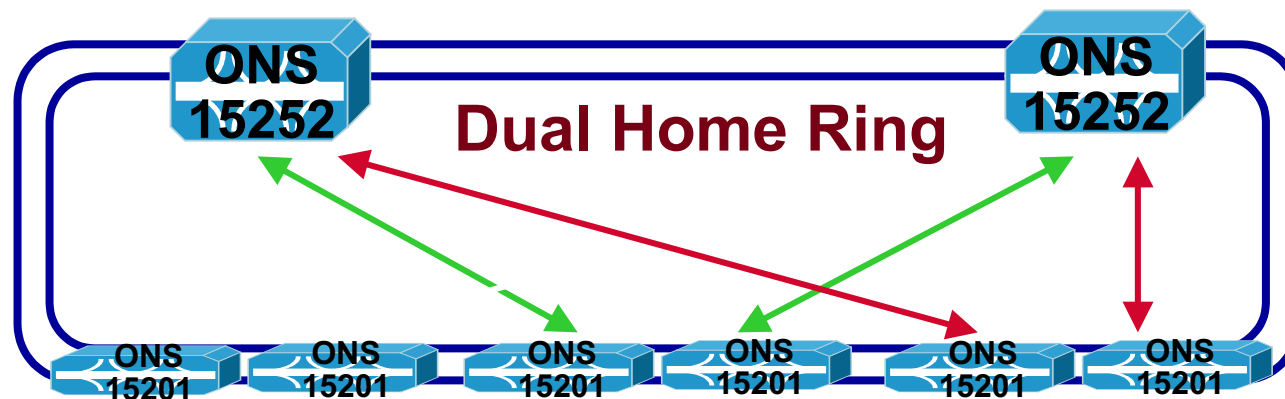


**Point-to-Point**

**Bus**



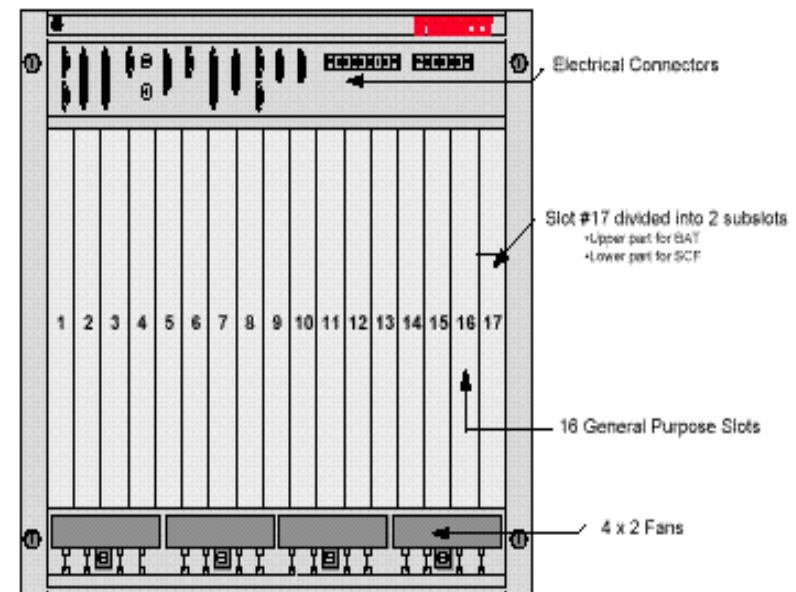
**Hubbed Ring**



**Dual Home Ring**

# ONS 15800 – Long Haul DWDM

Field-proven, Internet-scale, carrier class Optical Transport Platform  
Flexibility, Scalability, Enhanced performance in an economical design  
32ch per rack, Up to 64channels (addition of modules and racks)  
128 channels fit in 4 bays w/o RXTs  
OC-12/STM-4, OC-48/STM-16, OC-192/STM-64  
TCP/IP Ethernet-based craft access  
Each module contains an on-board power converter

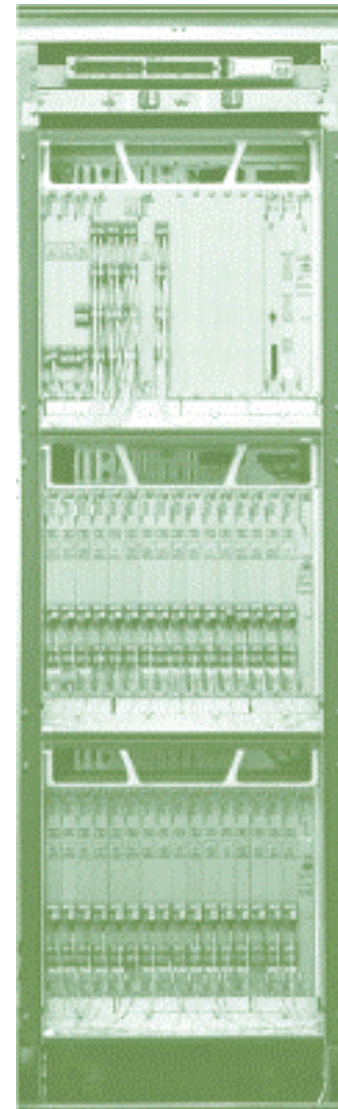
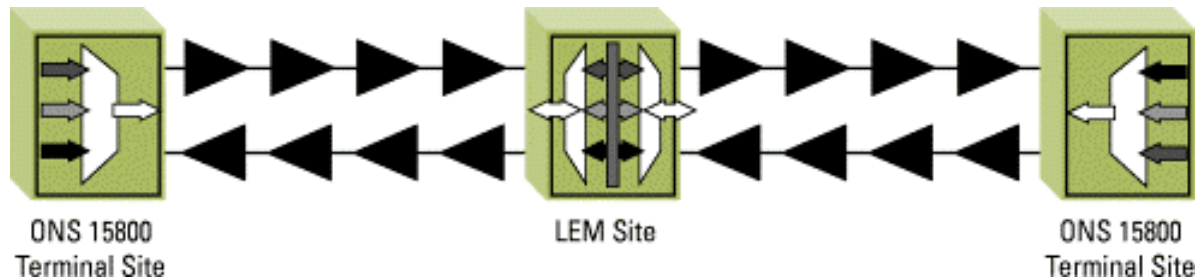


# ONS 15800 – Long Haul DWDM

An optical back plane that minimizes internal system fiber cabling

All fiber network connections are front access

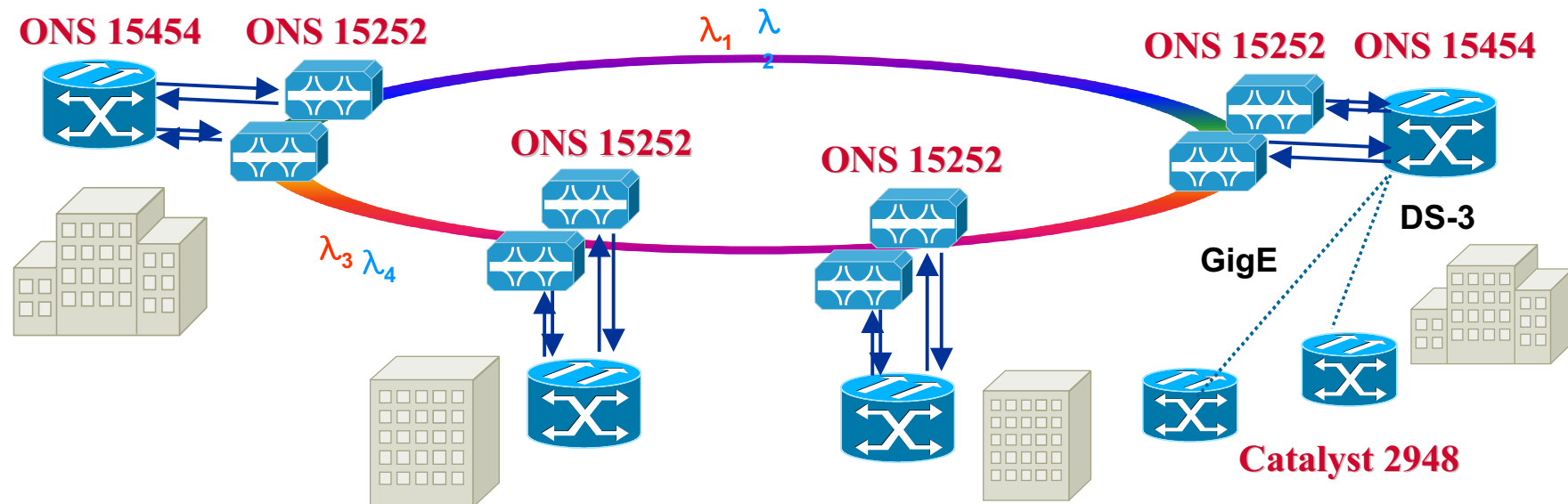
Line Extender Modules (LEM) eliminate SONET Regenerators and Extend a Route up to 6000 km





- 
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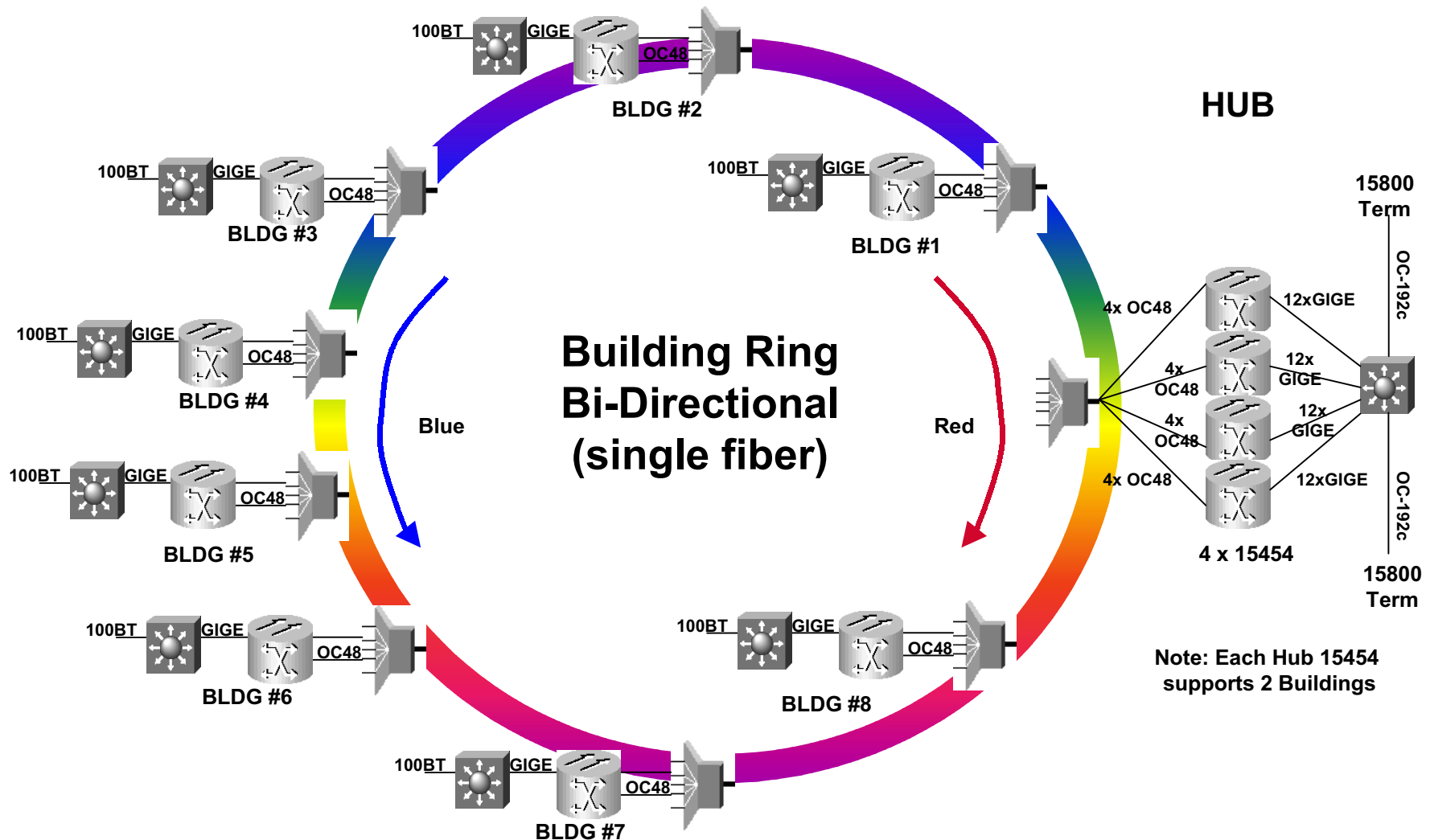
# Touch America Metro DWDM + MSPP



- Combination of ONS 15252 & ONS 15454
- Point to point connections between each site
- Services: Current - DS-3 and GigE  
Future - Offering flexibility DS-1 to OC-48.
- Winning Point : One lambda drop, Equipment Size, Power Consumption



# Cogent Metro Access Ring Topology



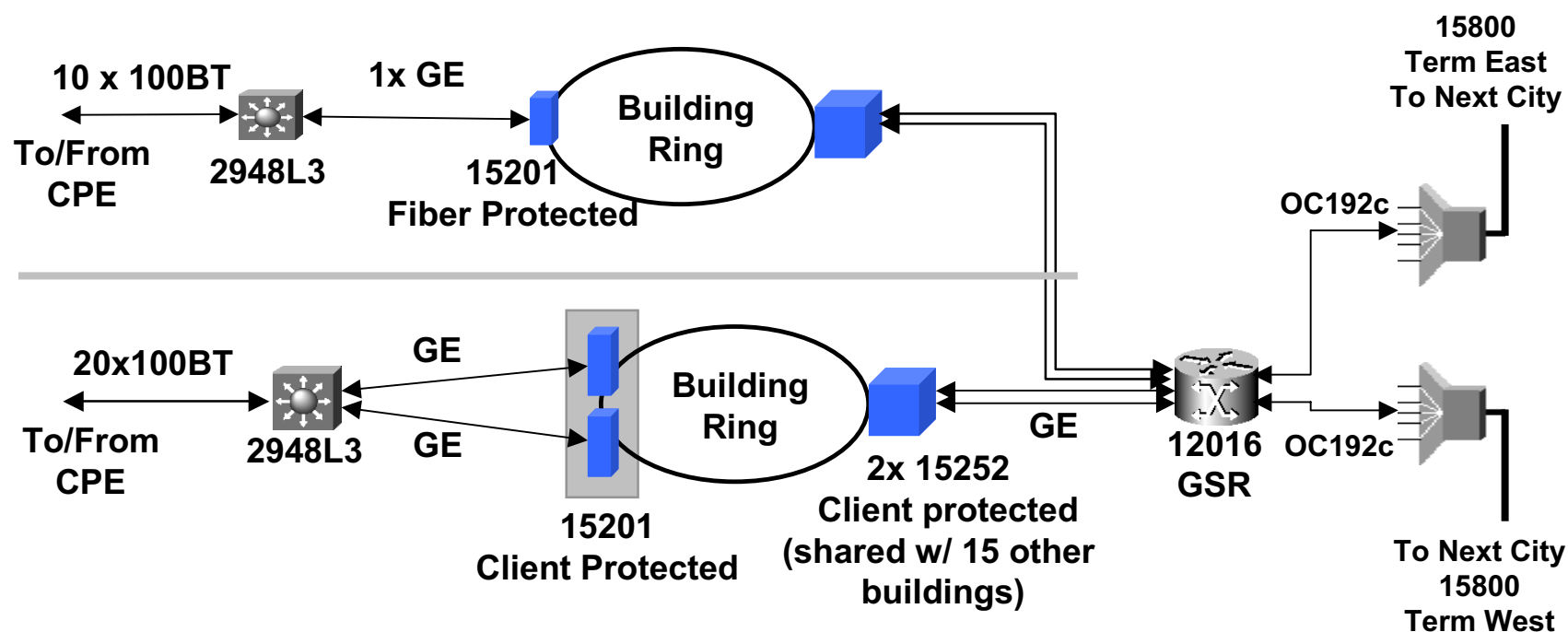


# Cogent

## Direct GE to 15200 in the Building

**Fiber protected** : 10 customer with 100 Mbit/s each.  
A total of 15 Gbit/s in the building ring.

**Client Protected** : 20 customer with 100 Mbit/s each.  
A total of 30 Gbit/s in the building ring.



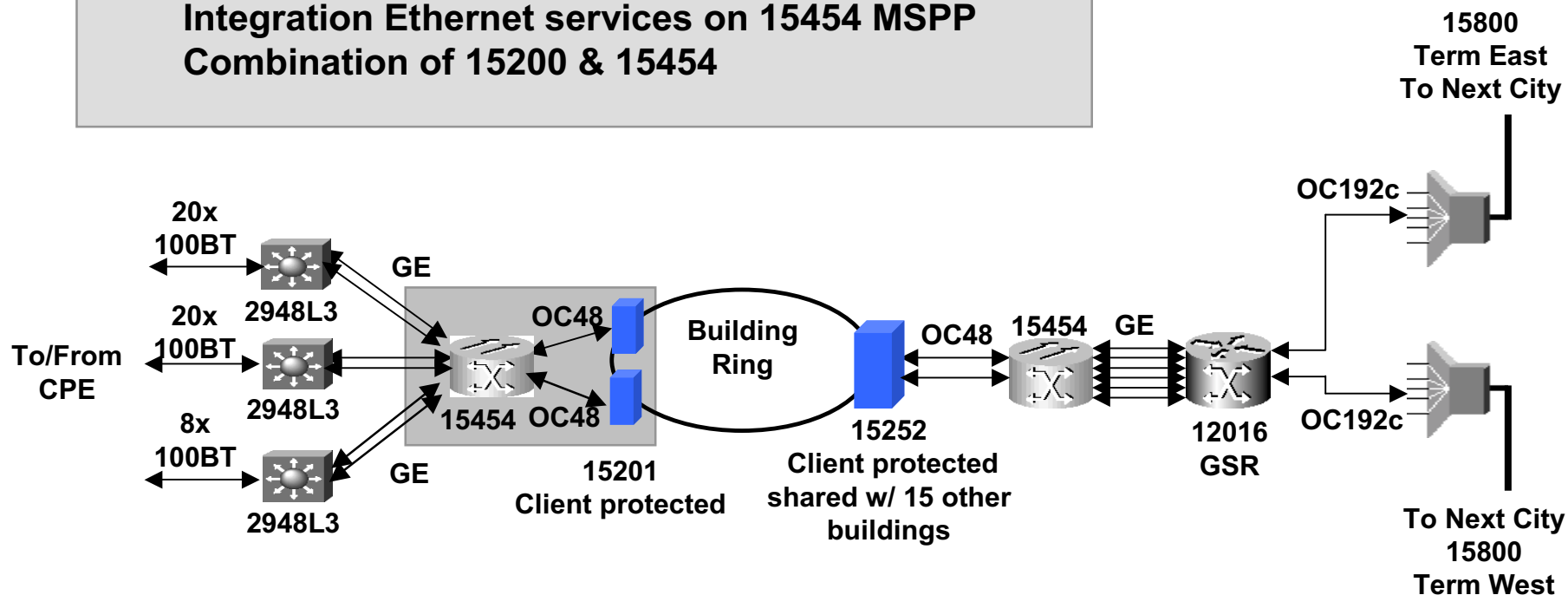
# Cogent

## Direct GE to 15454 in the Building

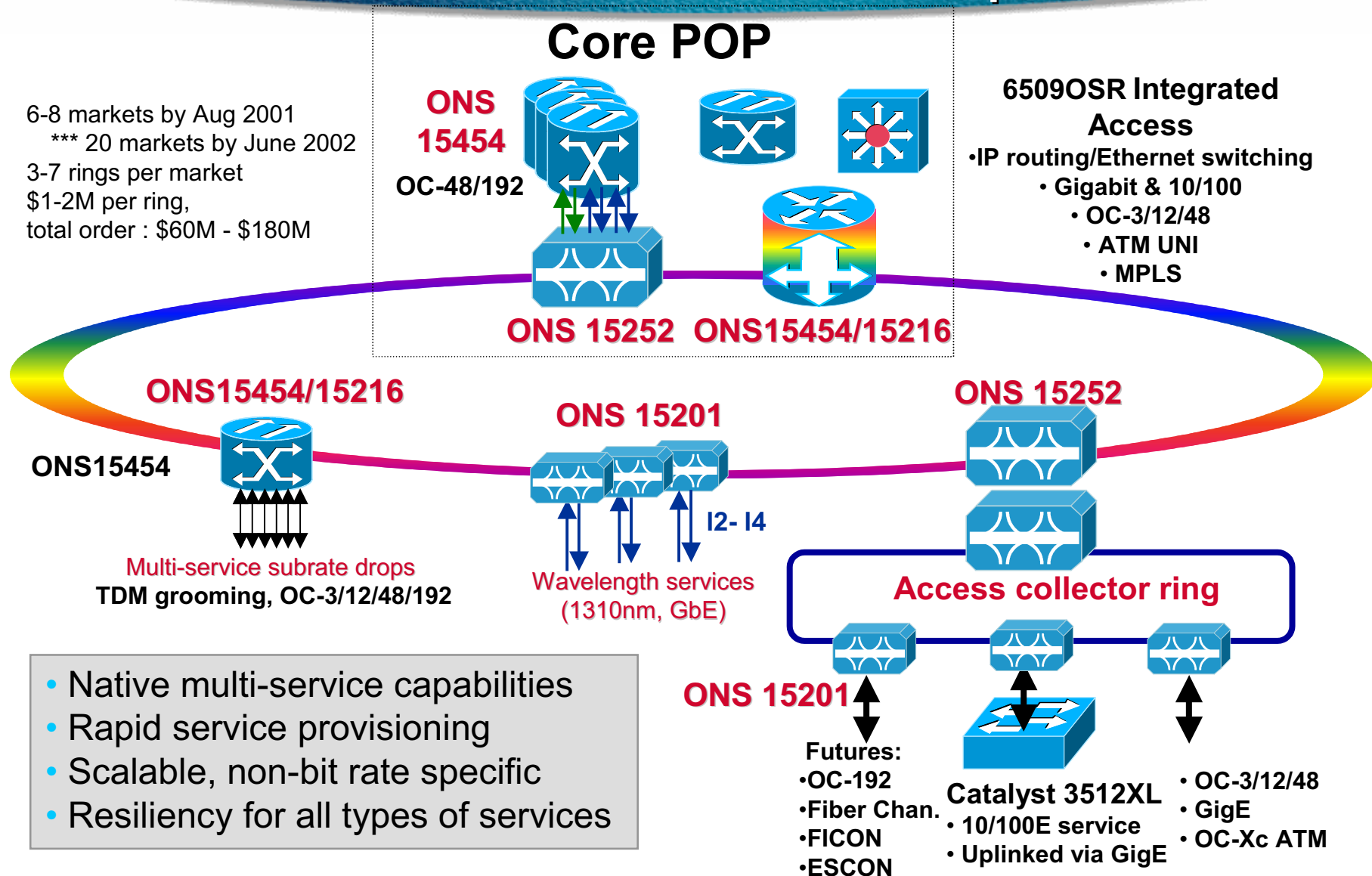
### Client Protected

48 customer with 100 Mbit/s each.  
A total of 72 Gbit/s in the building ring.

**Integration Ethernet services on 15454 MSPP**  
**Combination of 15200 & 15454**



# Sprint The Network Concept





# Metro 1500 IBM References

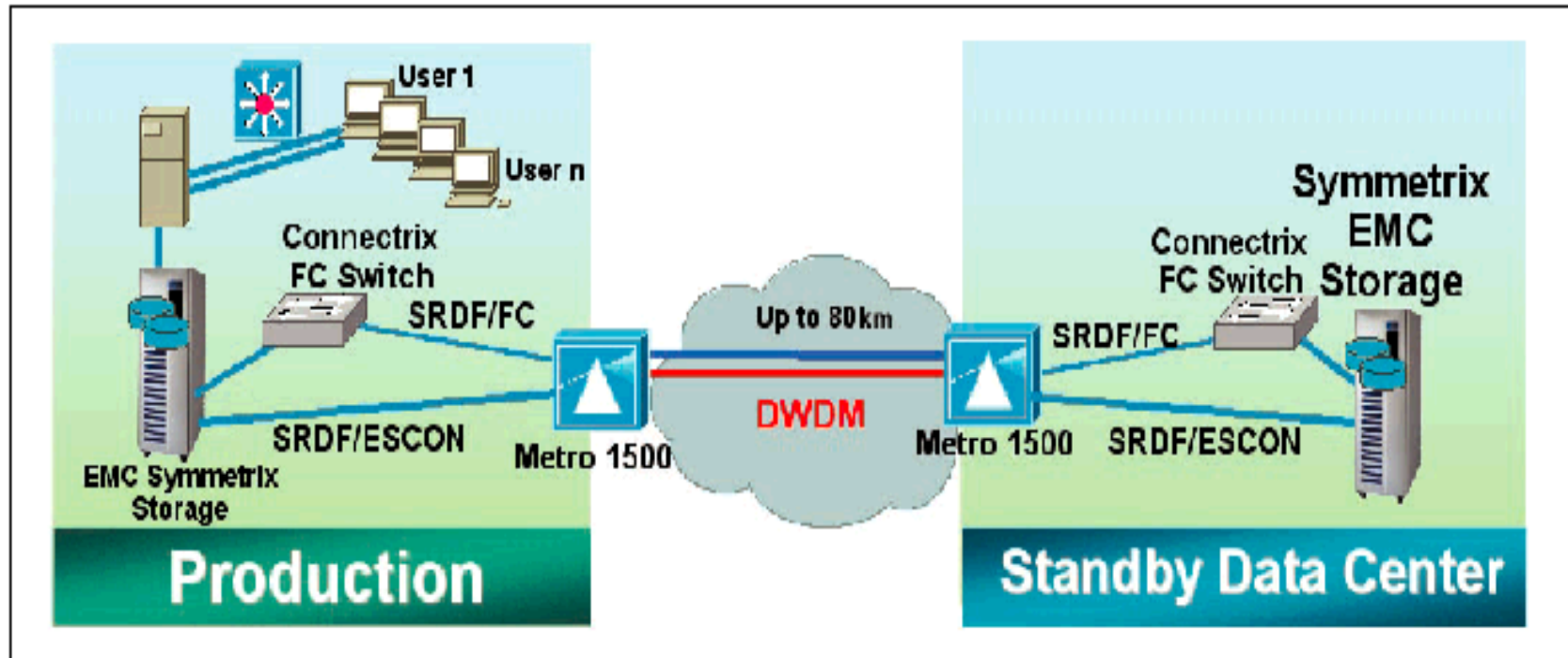
Location	Install Date	Link Distance (km)	Hyperlink?	Application Hardware
London	September, 1999	18	Yes	IBM
Berlin	July, 1999	12	No	IBM
New Zealand	November, 1999	30	Yes	IBM
Hong Kong	May, 2000	20	Yes	IBM / Hitachi
Vienna	April 1999	5	No	IBM / Hitachi

[ GDPS Reference sites ]

- ☐ **Morgan Stanley Dean Witter**
- ☐ **Deuche Bank**
- ☐ **Chase Manhattan Bank in (Bournemouth, England) uses the M1500 in a DR (backup data center configuration).**
- ☐ **Pinnacle West**
- ☐ **Lehman Brothers**  
<http://comnews.com/stories/articles/c1000pays.htm>
- ☐ **Allied Irish Bank**
- ☐ **HongKong Telecom**

# DR 구성방안 (EMC SRDF Sample)

## Transaction Path for write to disk with synchronous SRDF over DWDM



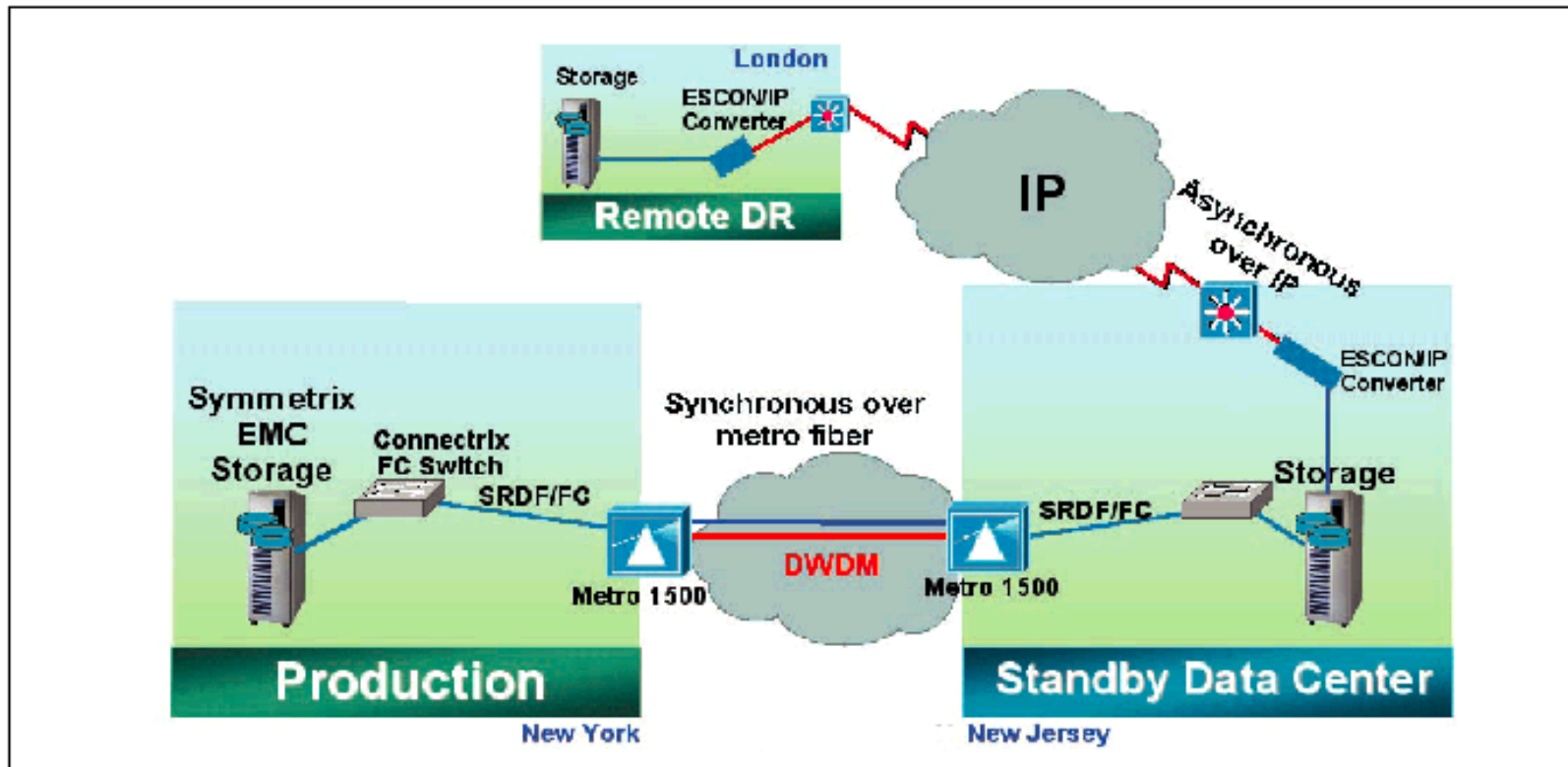
Fast replication.  
Symmetrix cache coherency.

Storage system availability,  
Ordered transmission of data

# DR 구성방안

## (EMC Hybrid Sync/Async SRDF)

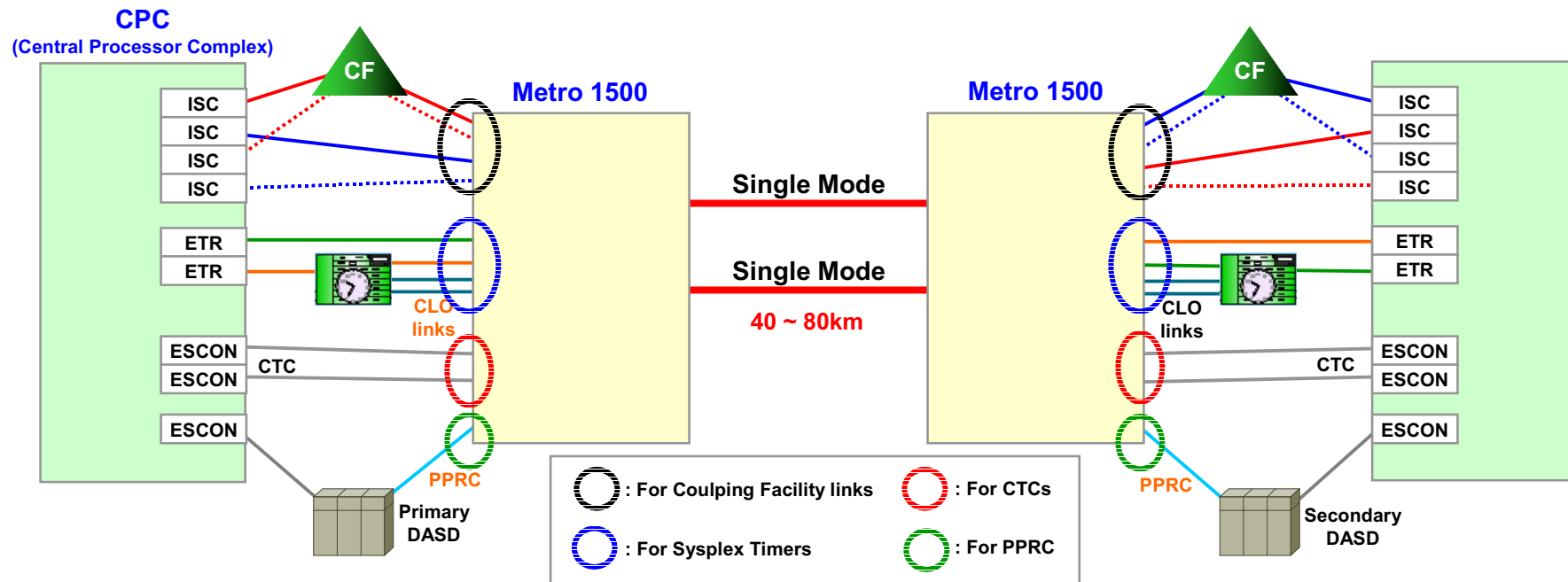
Hybrid Sync/Async data replication over extended distance



Overcome distance restriction on Synchronous SRDF replication.  
Metro area sync replication and then async replication over WAN/IP.  
The async replication is separated from the initial transaction  
so no affection to Production system.



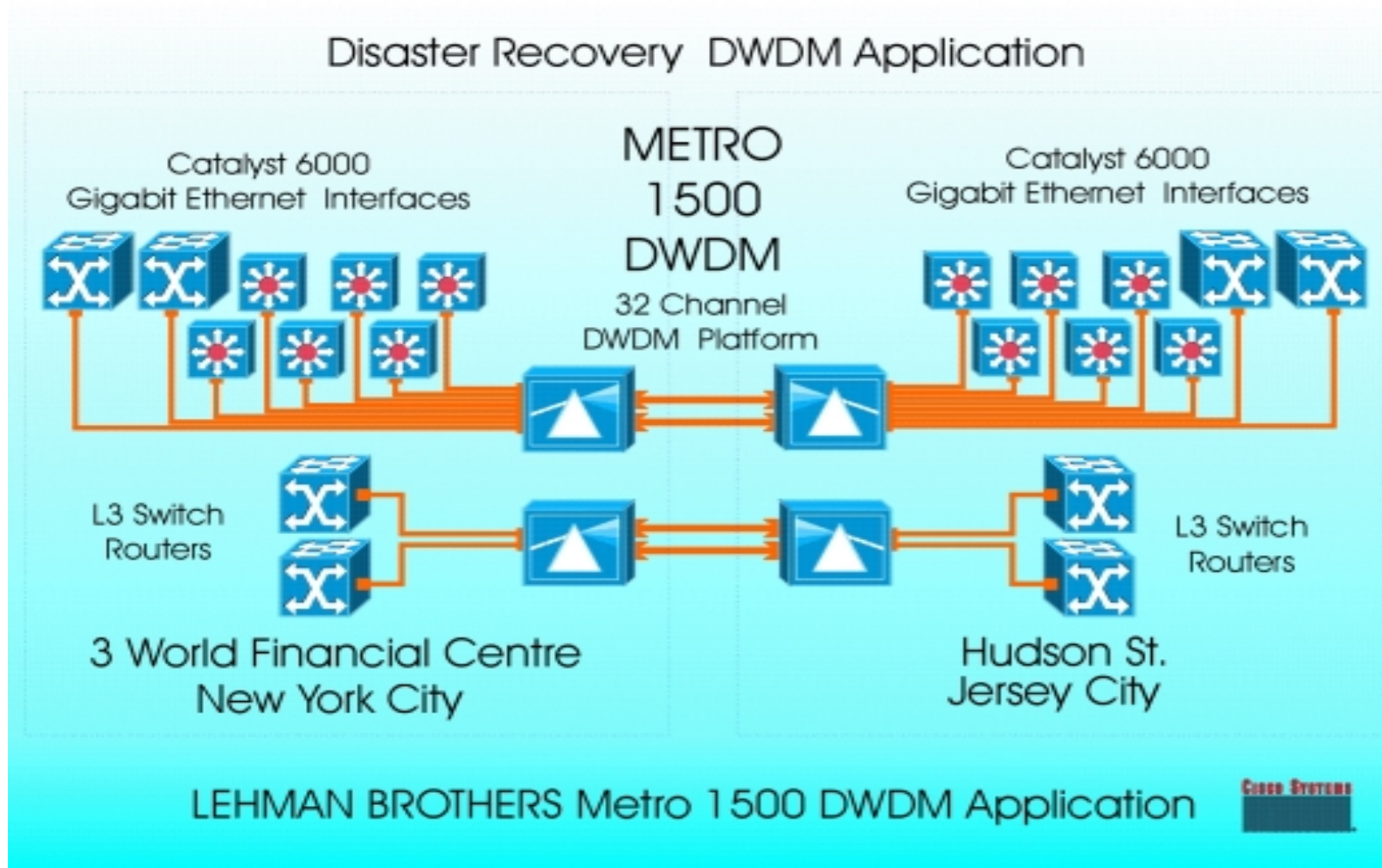
# DR 구성방안 (IBM GDPS)



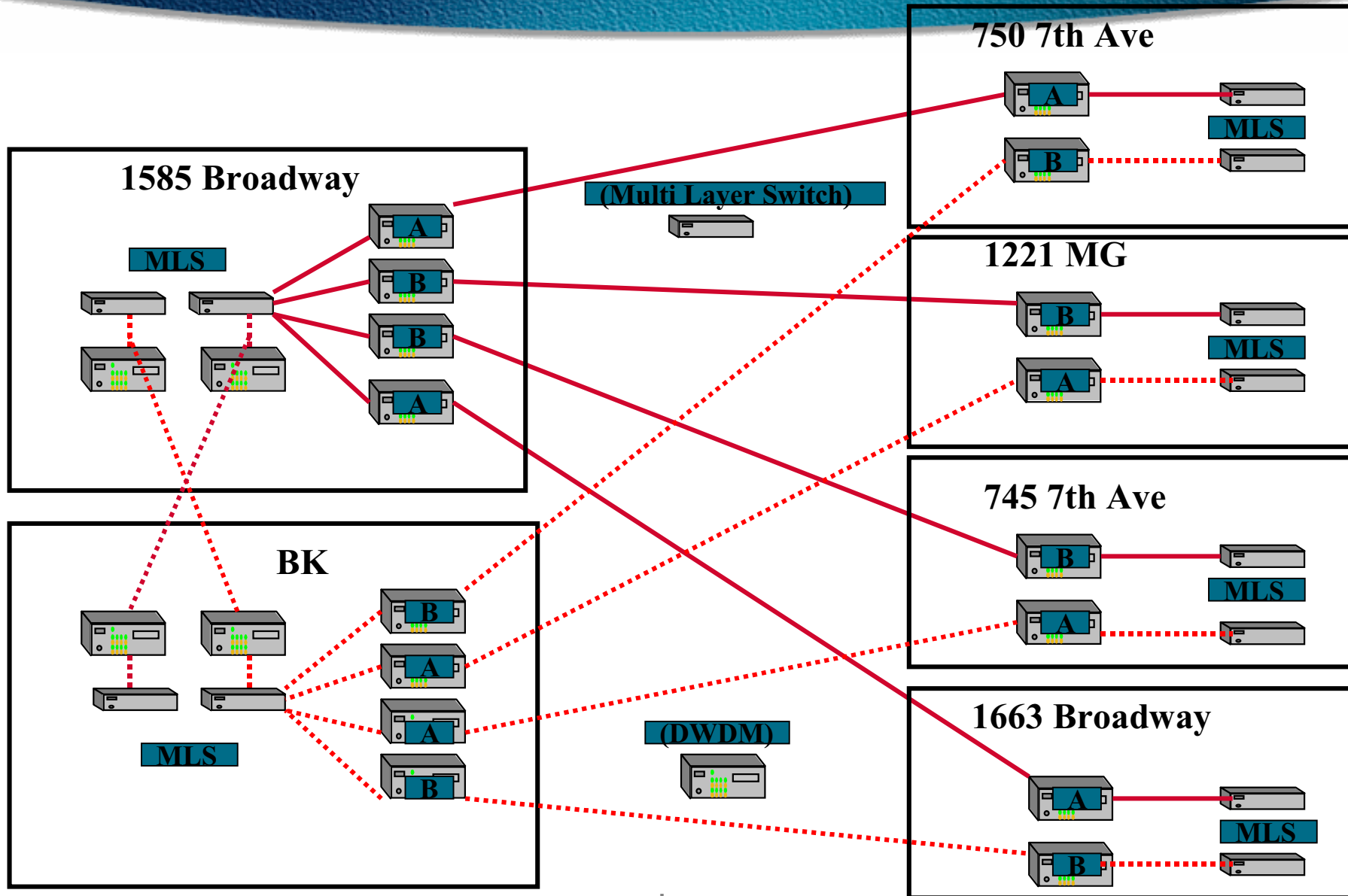
Channel type	Fiber	Connector	Bit Rate	Channel Module
CF links(HiPerLink)	SM	SC Duplex	1.06Gbps	1.062Gbps for IBM Coupling Link WCM
Sysplex Timers	MM(62.5/50um)	ESCON Duplex	8Mbps	Low speed transparent WCM
CTCs(ESCON)	MM(62.5/50um)	ESCON Duplex	200Mbps	TDM channel module 4*ESCON
PPRC(ESCON)	MM(62.5/50um)	ESCON Duplex	200Mbps	TDM channel module 4*ESCON

- ISC : InterSystem Channel
- ETR : External Time Reference
- CLO : Control Link Oscillator
- ESCON : Enterprise Systems CONNECTION
- PPRC : Peer to Peer Remote Copy
- CTC : Channel To Channel
- DASD : Direct Access Storage Device

# 'L' Banking

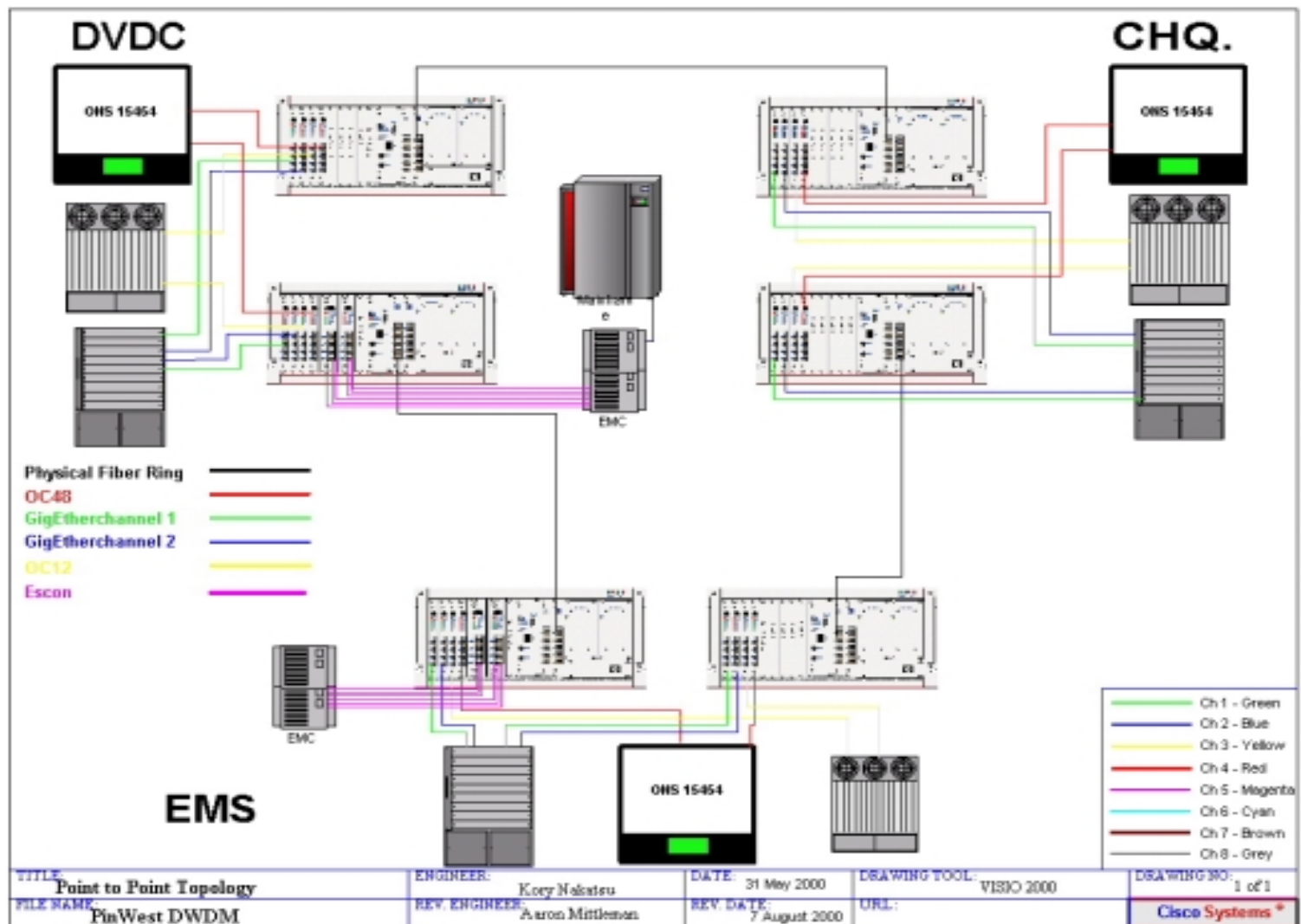


# 'M' Company

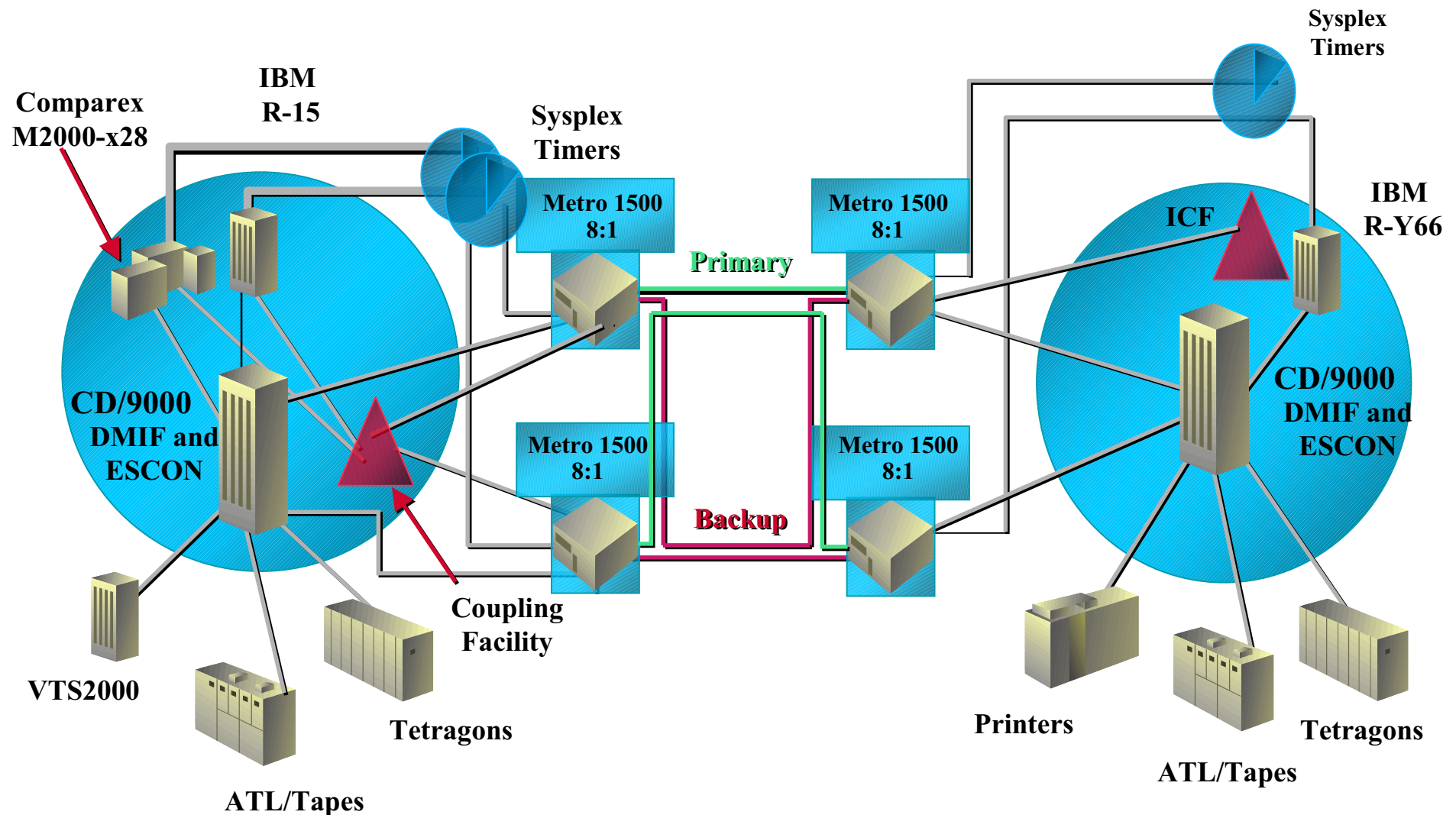




# 'P' Banking



# Major Insurance Firm, Austria GDPS



# CISCO SYSTEMS



## EMPOWERING THE INTERNET GENERATION<sup>SM</sup>