Data Center Workshop

Rolle, Mars 2008

DataCenter par la face “optique”

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Agenda

- CWDM DC extensions
- EWDM DC extensions
- DWDM DC extensions

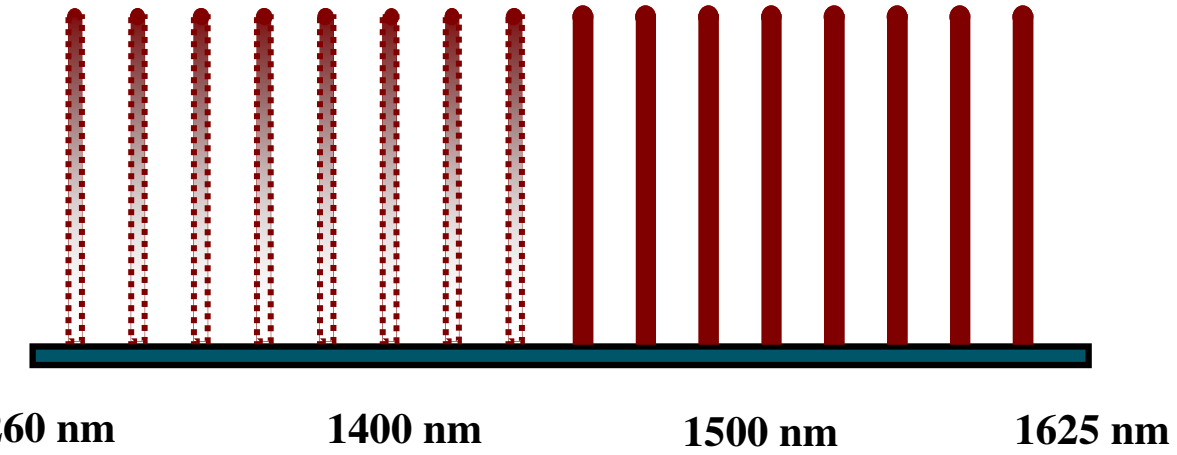
Wavelength Division Multiplexing Flavors:
Channel Spacing Sets The Difference

D-WDM

Optimized for bandwidth

C-WDM

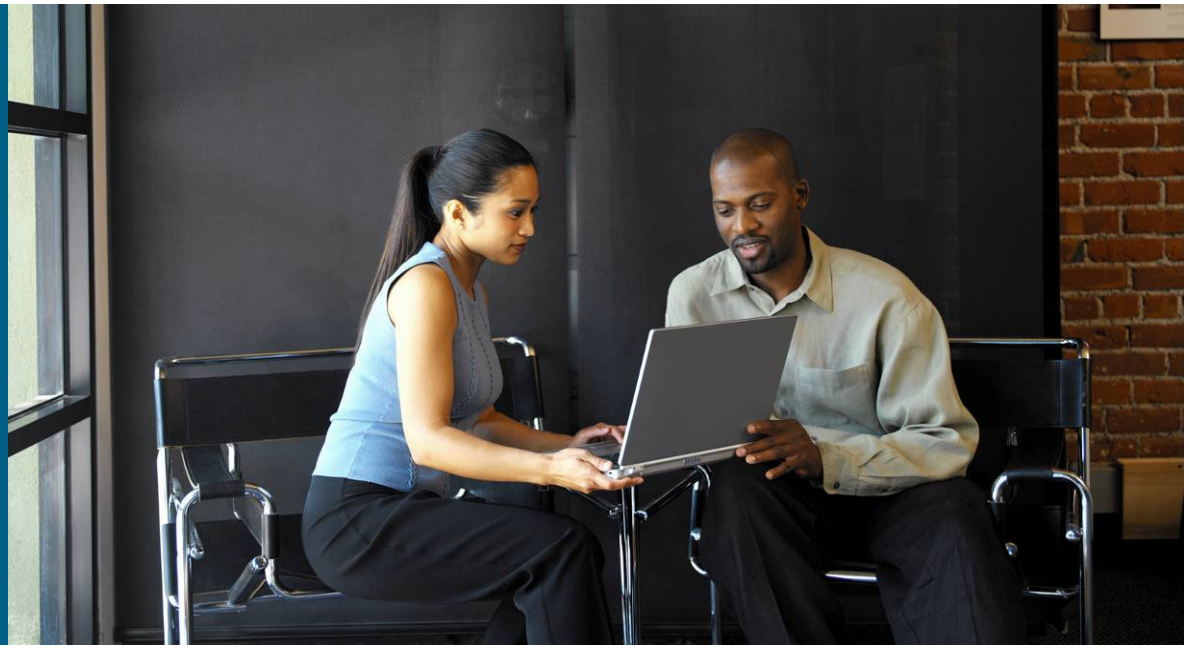
Optimized for low-cost



Cisco GBICs: Coarse vs. Dense WDM

Characteristic / Type	Coarse (CWDM)	Dense (DWDM)
Wavelengths	8	32/40/80/112
Spacing	20 nm / 2500 Ghz	0.8 nm / 100 Ghz
Amplifiable	Not w/ conventional EDFA	YES
Rerouting	NO	YES
Application	Enterprise/ SP metro access	Large Enterprise/Service Provider

CWDM DC extensions



Home

Cisco CWDM SFP & GBIC Solution Building Blocks

CWDM SFPs & GBICs:

- 8 different “colored” SFPs & GBICs, one per wavelength

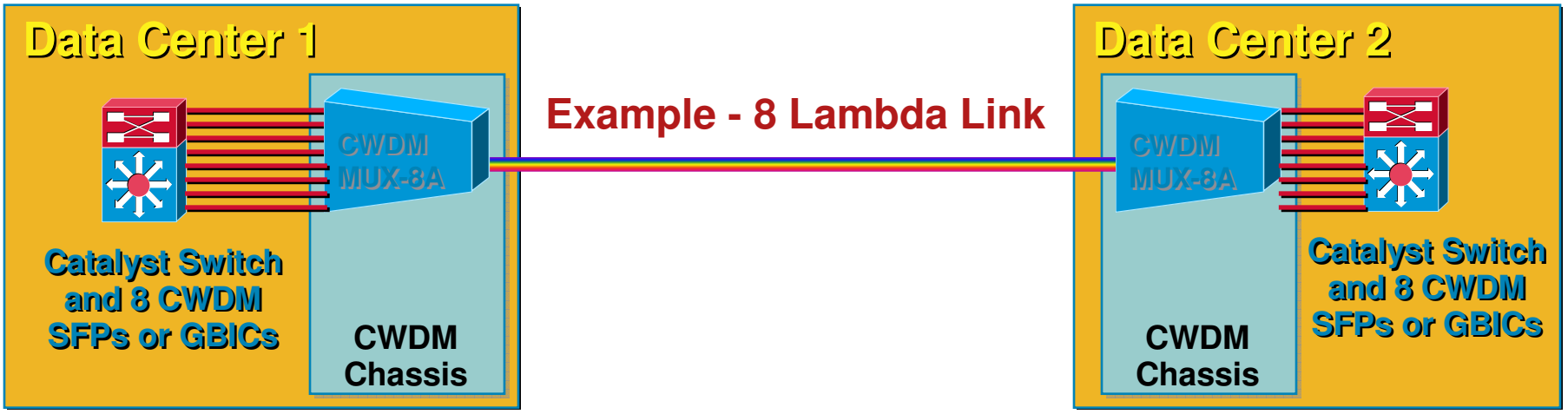
  1470 nm, 1490 nm,
  1510 nm, 1530 nm,
  1550 nm, 1570 nm,
  1590 nm, 1610 nm

- Works on any MDS 9000 FC Port (2 & 4 Gb/s) and Catalyst switches

CWDM OADM:

- **3 versions for 1, 4, and 8 wavelengths (color)**
- **Mounted in 1-RU chassis**
- **OADMs connected via optical ring**

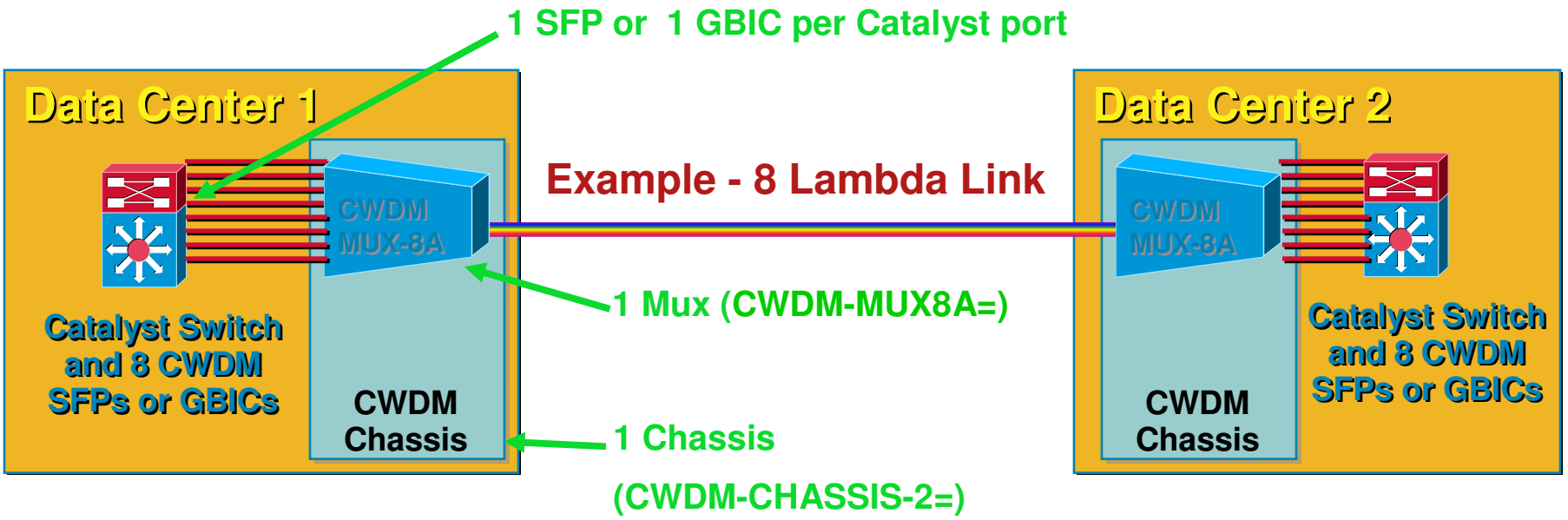
Data Centers connection: 1 to 8 Links
GE only



- Distance depends on fiber quality and number splices
- With CWDM-OADM4-1= and CWDM-OADM4-2=, 4 Lambda max
- With MUX-8, 8 Lambda max supported

Configuration example of CWDM PTP

Data Centers connection: 1 to 8 Links
GE only



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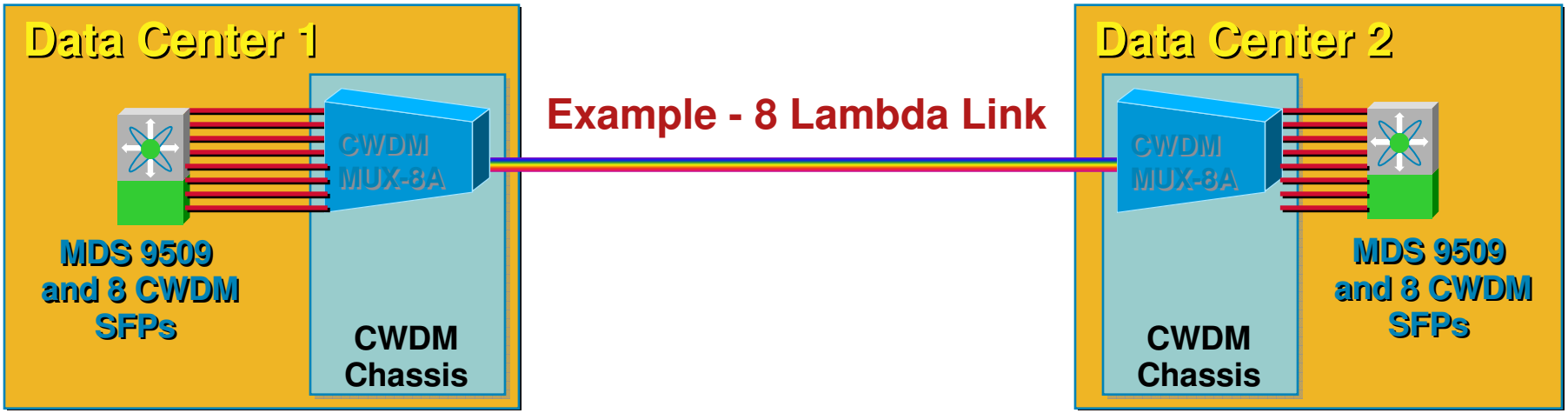
Configuration example of CWDM PTP

Data Centers connection: 1 to 8 Links
FC only



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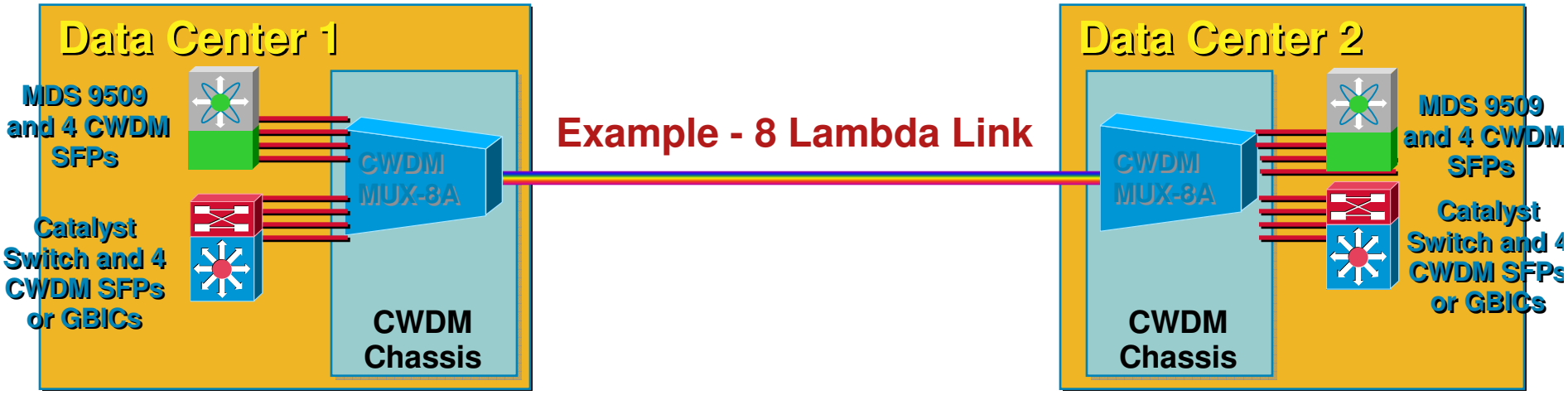
Configuration example of CWDM PTP

Data Centers connection: 1 to 8 Links
Mix of FC and GE



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- With CWDM-OADM4-1= and CWDM-OADM4-2=, 4 Lambda max
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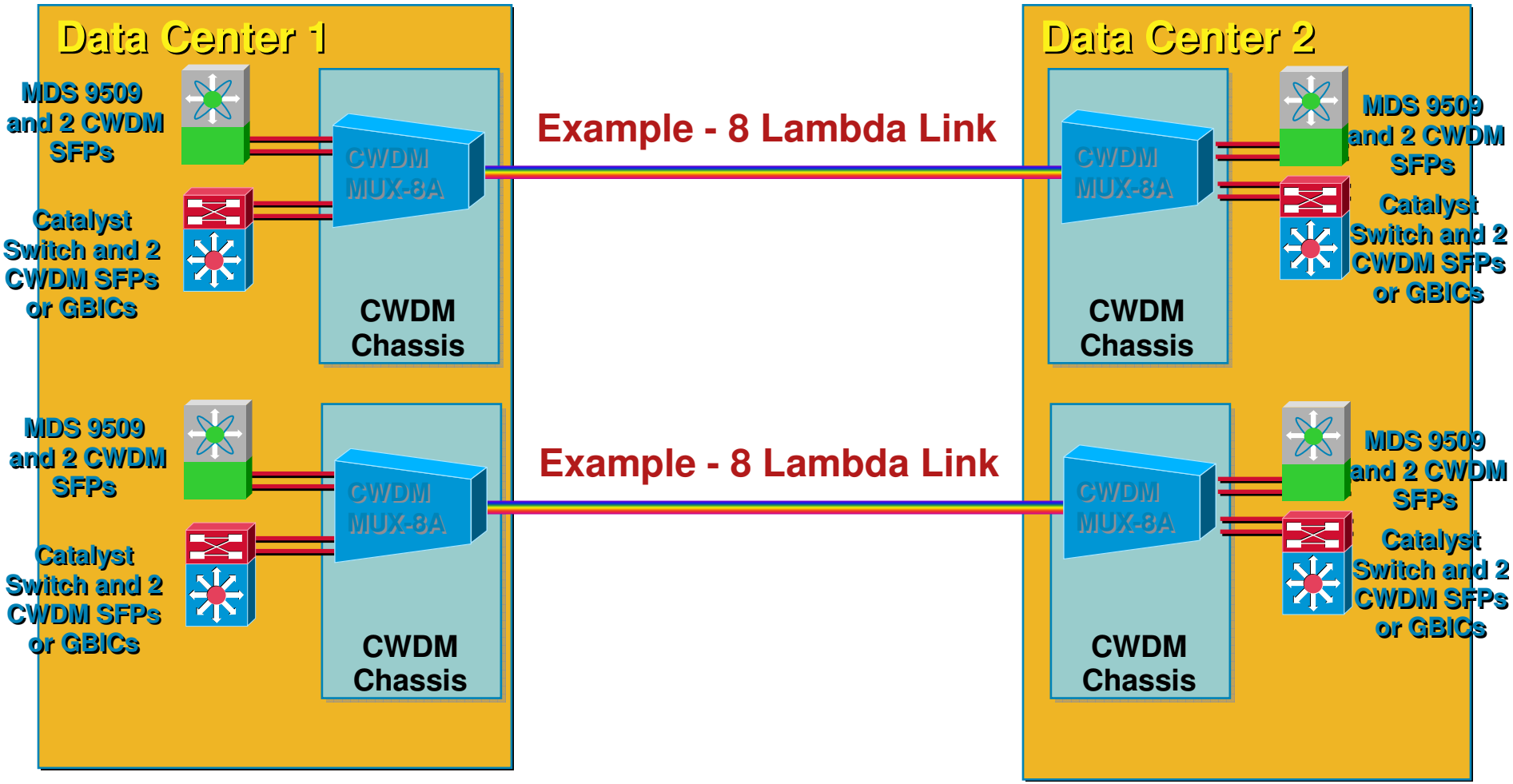
Configuration example of CWDM PTP

Data Centers connection: 1 to 8 Links
Mix of FC and GE, redundant



Configuration example of CWDM PTP

Passive CWDM System:

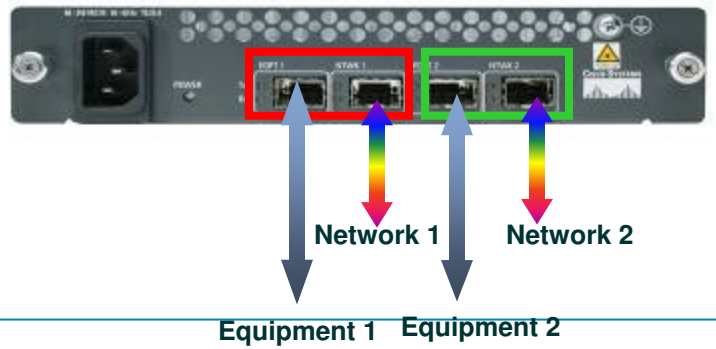
2 channel Transponder

WDM SFP-based transponder at-a-glance

WDM-SFP-2CH-CONV=

Any-rate any-protocol between 100 Mbps and 2,488 Mbps

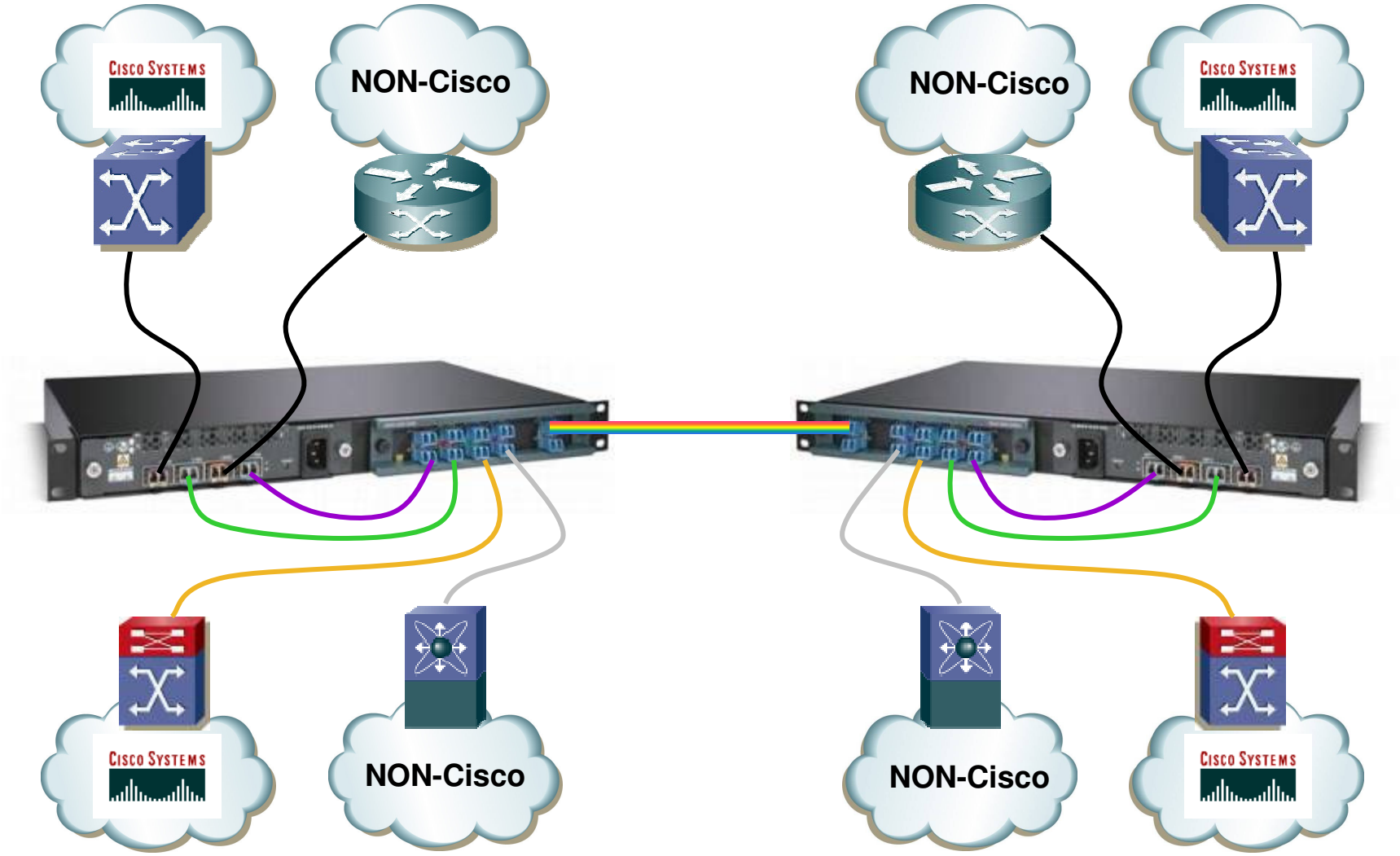
Any-client any-trunk WDM SFP



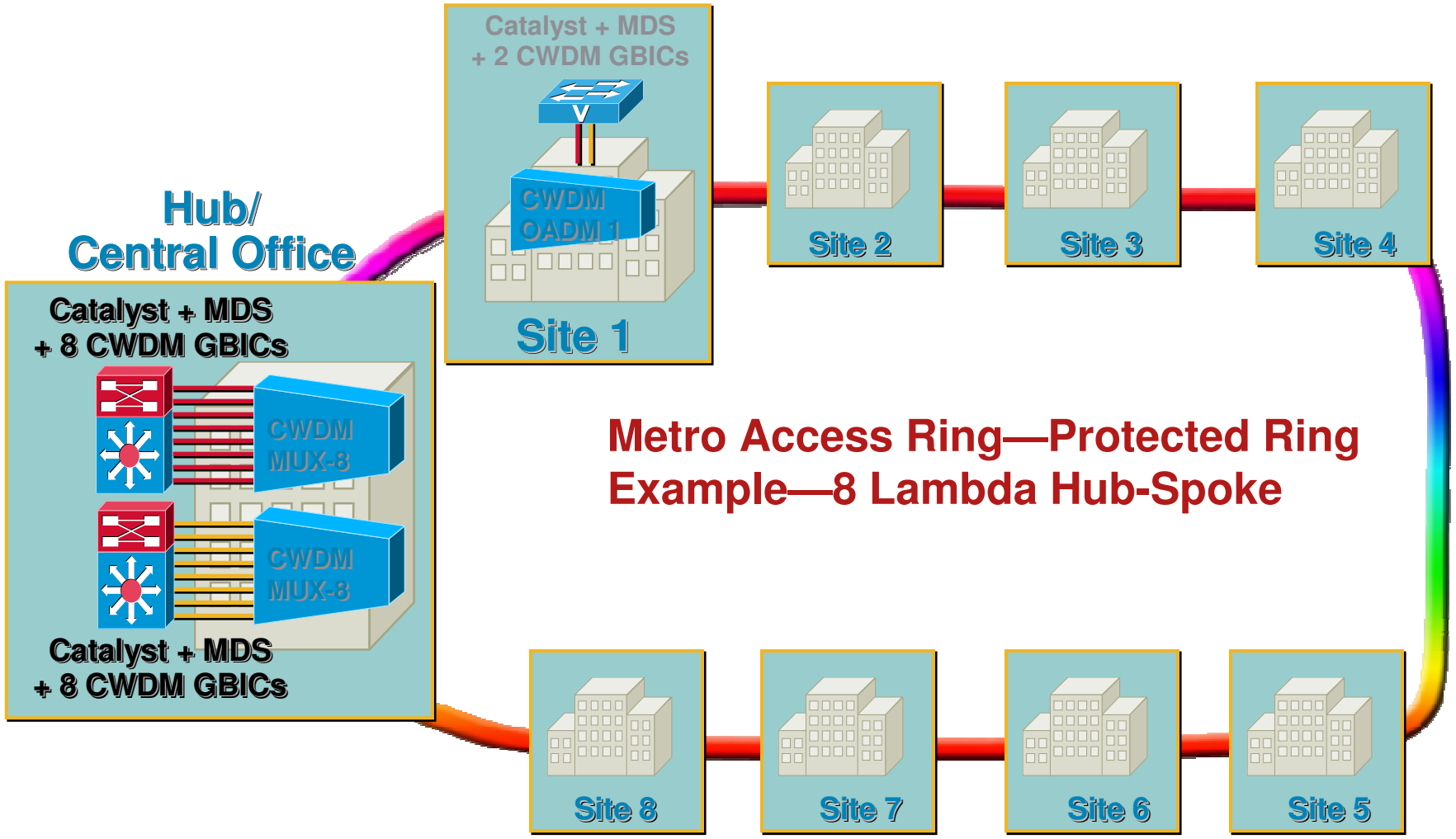
Plugs in the CWDM chassis for passives Unmanaged unit

- **Alimenté électriquement**
- **Unmanaged unit that runs no software**
- **2-channels**
- **4 connecteurs SFPs (à fournir)**
- **3500 $ GPL**
- **Usefull to connect non Cisco switches that disable Cisco SFP & CWDM ;-)**

Passive CWDM System: 2 channel Transponder Sample CWDM network



Metro Access Ring:
GE Service for up to 8 sites



Exemples de configuration CWDM Protected PTMP

Single Fiber 4-Channel CWDM Mux/ Demux

Objective

- Enable single fiber Gigabit Ethernet links (max 4Gig links per fiber)

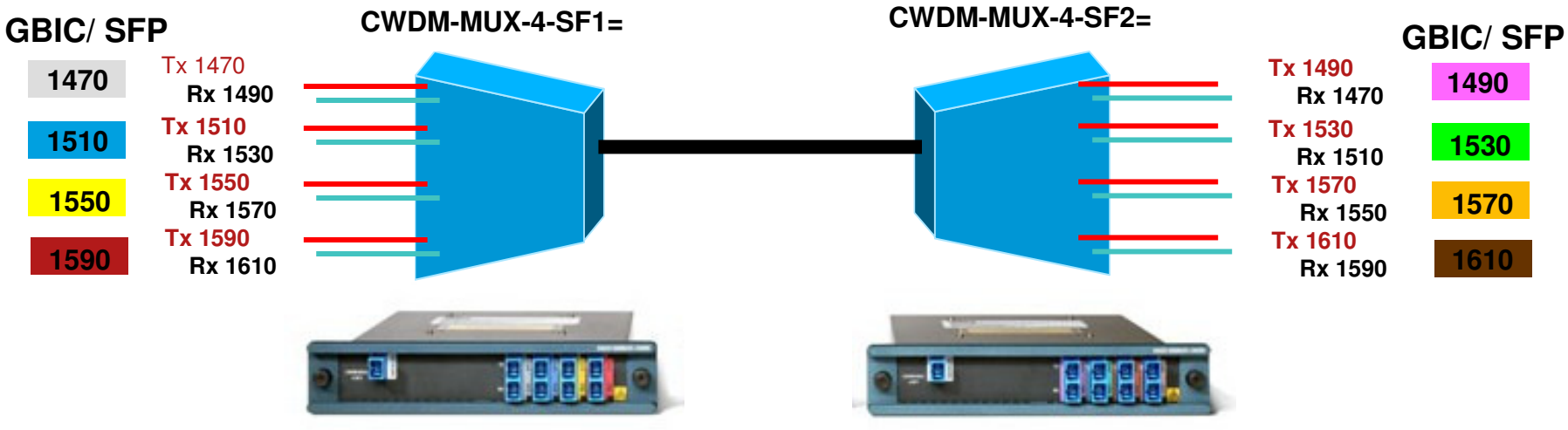
Product

- 2 passive CWDM filter modules; same form factor like existing CWDM filter modules
- Part numbers: CWDM-MUX4-SF1= and CWDM-MUX4-SF2=
- Use different wavelengths for transmit and receive on the same fiber

How it works

- Pair 1410/1490nm, 1510/1530nm, 1550/1570nm, and 1590/1610nm for 4 links

Single Fiber Modules will be used with existing CWDM GBICs/ SFPs



CWDM
Various

- Back to back: CWDM SFP & GBIC can be used back-back for non-WDM applications (attenuator needed for short distance)
- Extended Reach on Single Mode Fiber (SMF)

  Un-amplified, back-back

- CWDM is not amplifiable (except 1530nm and 1550nm)

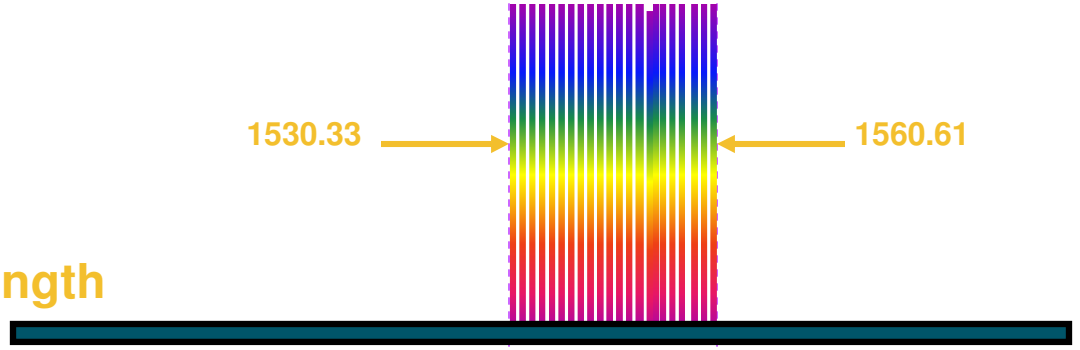
EWDM DC extensions

Home

Cisco EWDM Concept: mixing CWDM and DWDM wavelengths on the same fiber

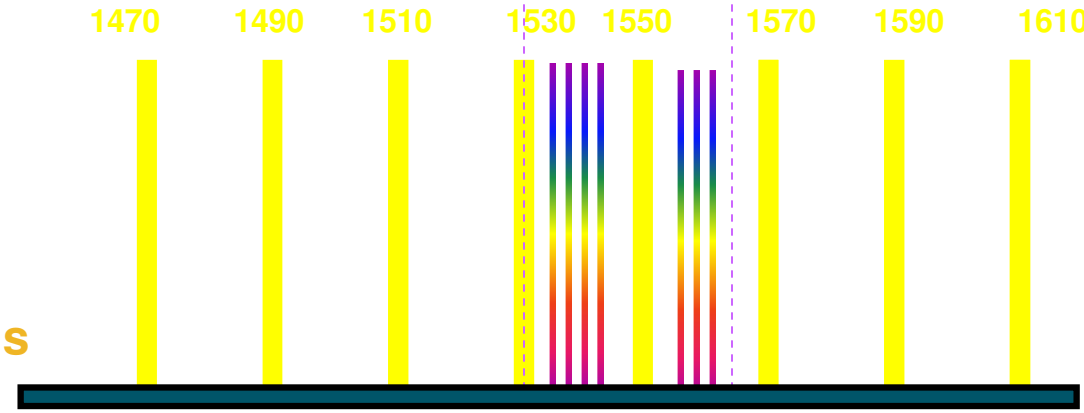
D-WDM

Cisco Metro DWDM wavelength (nm)



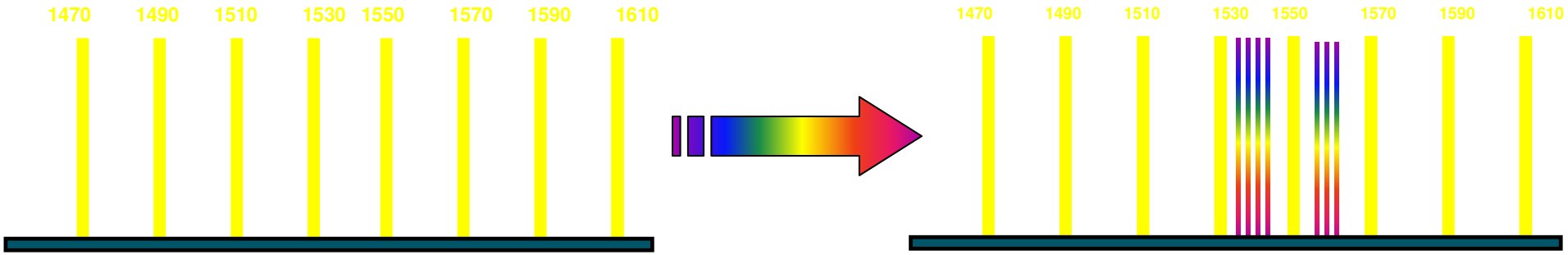
C-WDM

Cisco CWDM wavelengths (nm)

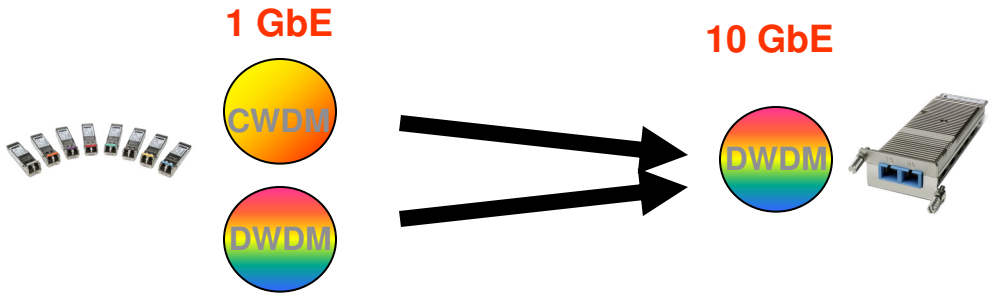


EWDM MUX/DEMUX devices allow to overlay up to 8 DWDM wavelengths with Cisco's 8 CWDM channels

Cisco EWDM value proposition

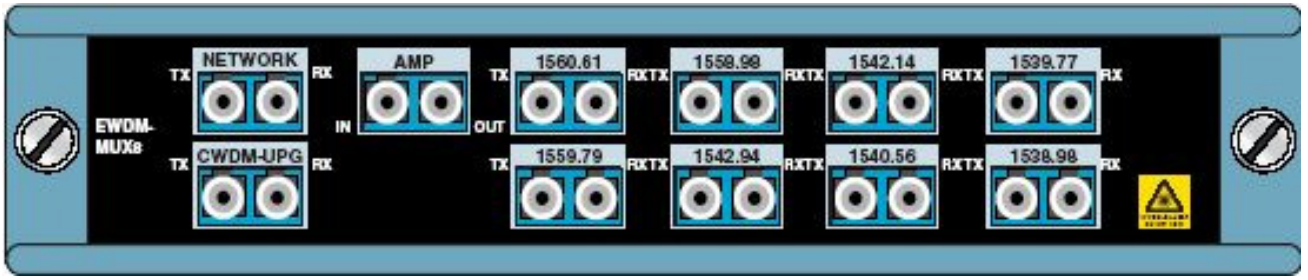


- Scale CWDM networks to 10G wavelengths by using 10G DWDM transceivers.
- Scale CWDM networks to 16 wavelengths with up to 8 DWDM wavelengths.
- Maximize reach by amplifying 10G DWDM wavelengths independently from the CWDM channels: overall reach not limited by 10G DWDM power budget lower than 1G CWDM.



Cisco EWDM Product Family

EWDM-MUX8A=
(8-channels MUX/DEMUX)



EWDM-OADM4=
(4-channels OADM)

EWDM-OADM2=
(2-channels OADM)

EWDM-OA=
(Optical Amplifier)

Anatomy of an EWDM Passive Unit

EWDM-OADM4=
(4-channels OADM)

The NETWORK port sends and receives the CWDM+DWDM signals to and from the network..

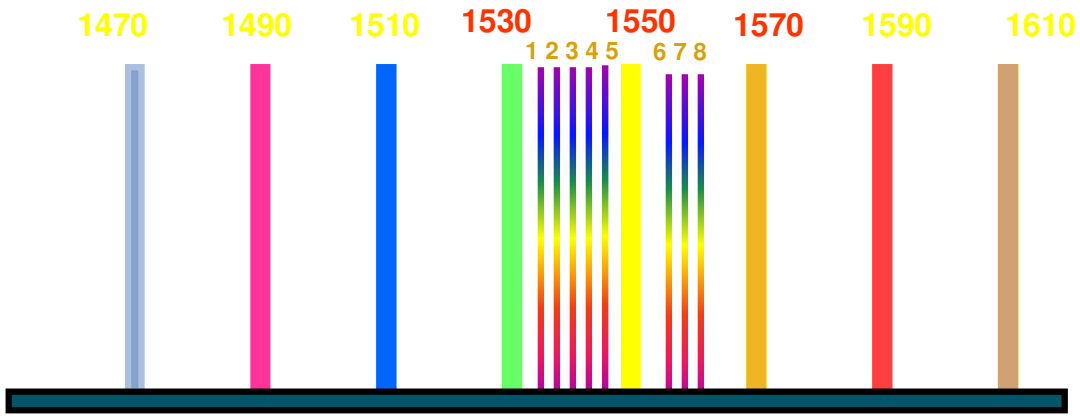
The AMP port send the composite DWDM signal to the amplifier and receives it back amplified.

Client DWDM signal ports. LC connectors

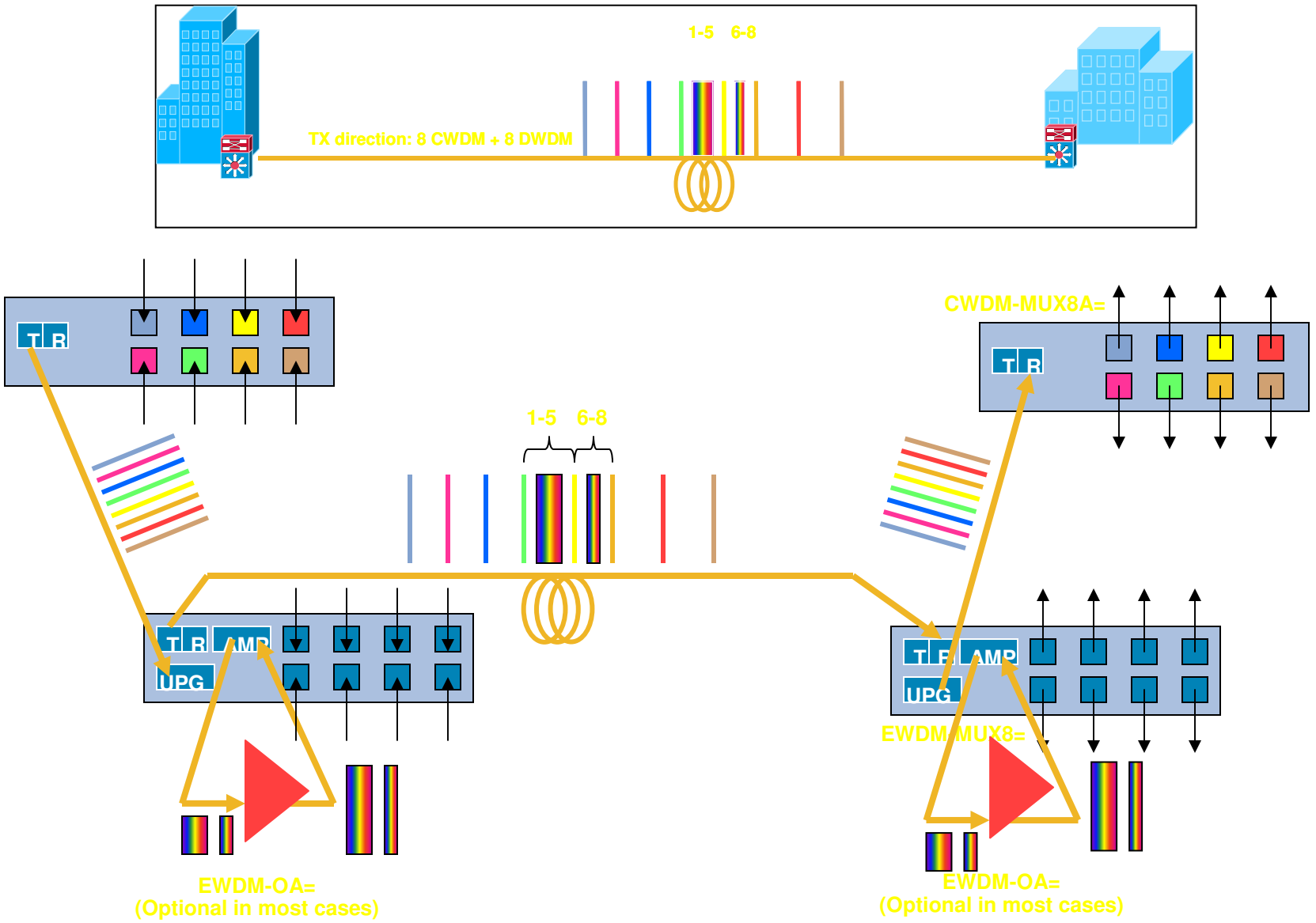
The CWDM-UPG port sends and receives the CWDM wavelengths to the CWDM units (sitting upstream)

Cisco EWDM Channel Plan

Channel ID	Wavelength (nm)	EWDM-MUX8=	EWDM-OADM4=	EWDM-OADM2=
1	1538.98	*		
2	1539.77	*	*	
3	1540.56	*	*	
4	1542.14	*	*	
5	1542.94	*	*	
6	1558.98	*		
7	1559.79	*		*
8	1560.61	*		*



EWDM with CWDM



Traffic disruption when installing EDWM

- When installing EWDM solution, running CWDM traffic needs to be disconnected in order to connect the traffic to the EDWM filters
- Traffic will be down on the fiber path until EWDM is properly installed and running
- The only way to avoid disruption is to already have a bidirectional fiber protected CWDM ring. In this case, upgrade can be implemented on one path first. When the upgrade is complete on the first path, upgrade of the protected path can be implemented.

Cisco DWDM GBICs

Highlights:

- 32 GBICs - one for each color
- Match 100GHZ ITU grid
- Match Cisco 4-skip-1 grid for ONS 15xxx products
- Can be amplified with EDFAs
- Use with ONS15216 Filter set
- Cisco Quality ID in GBIC EEPROM

Platform Support:

- Catalyst 2950
- Catalyst 3550
- Catalyst 4500
- Catalyst 6500
- More details in Cisco Wavelength Division Multiplexing Transceivers Compatibility Matrix (http://www.cisco.com/en/US/partner/docs/interfaces_modules/transceiver_modules/compatibility/matrix/OL_6982.html)

Product Numbers:

DWDM-GBIC-XX.XX

(5 995 $ GPL)

Equipment: Standard GBIC interface
Network: Dual SC connector

Cisco DWDM SFPs

Highlights:

- 32 SFPs - one for each color
- Match 100GHZ ITU grid
- Match Cisco 4-skip-1 grid for ONS 15xxx products
- Can be amplified with EDFAs
- Use with ONS15216 Filter set
- Supported protocols: Gigabit Ethernet, Fibre Channel 1 Gbps and 2 Gbps
- Optical link budget of 28 db

Platform Support:

- Catalyst 6500 (Sup720, Sup32-8GE, WS-6724-SFP, WS-6748-SFP, ME-C6524GS-8S ME-C6524GT-8S, MDS 9000)
- Catalyst 3560, 3560-E, 3750, 3750-E (since 12.2.40)
- MDS 9000 family
- More details in Cisco Wavelength Division Multiplexing Transceivers Compatibility Matrix (http://www.cisco.com/en/US/partner/docs/interfaces_modules/transceiver_modules/compatibility/matrix/OL_6982.html)
- … and in Cisco MDS 9000 Family Pluggable Transceivers (http://www/en/US/products/hw/ps4159/ps4358/products_data_sheet09186a00801bc698.html)

Product Numbers:

DWDM-SFP-XXXX

(5 995 $ GPL)

Cisco DWDM Xenpaks

Highlights:

- Up to 32 channels for 320 Gb/s on a single fiber strand
- DWDM Xenpaks match the 100 GHz channel plan of Cisco ONS metro products (compatible with ITU-T G.692 grid)
- 23 dB of power budget and -500/+1600 ps/nm of dispersion tolerance
- 150/200 km reaches with amplification

Platform Support:

- Catalyst 6500 (& OSR7600):
  - WS-X6704-10GE
  - WS-SUP32-10GE-3B
- CRS-1
- More details in Cisco Wavelength Division Multiplexing Transceivers Compatibility Matrix (http://www.cisco.com/en/US/partner/docs/interfaces_modules/transceiver_modules/compatibility/matrix/OL_6982.html)

Product Numbers:

DWDM-XENPAK-XX.XX

(20 000 $ GPL)

X2 DWDM is on the radar

Pricing

Product ID	Pricing
EWDM-MUX8=	$12,000
EWDM-OADM4=	$6,000
EWDM-OADM2=	$3,000
EWDM-OA=	$12,000

Configuration example of EWDM PTP

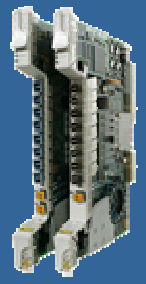
DWDM DC extensions

Optical + MDS SAN Extension

Optical Service Interfaces

2.5G DataMuxponder

- 2 x GbE
- 2 x 1G FC/FICON
- 1 x 2G FC/FICON
- 8 x ESCON



10 DataMuxponder

- 8 x GbE
- 8 x 1G FC/FICON/ISC-1
- 4 x 2G FC/FICON/ISC-3
- 2 x 4G FC

2.5G MR Transponder

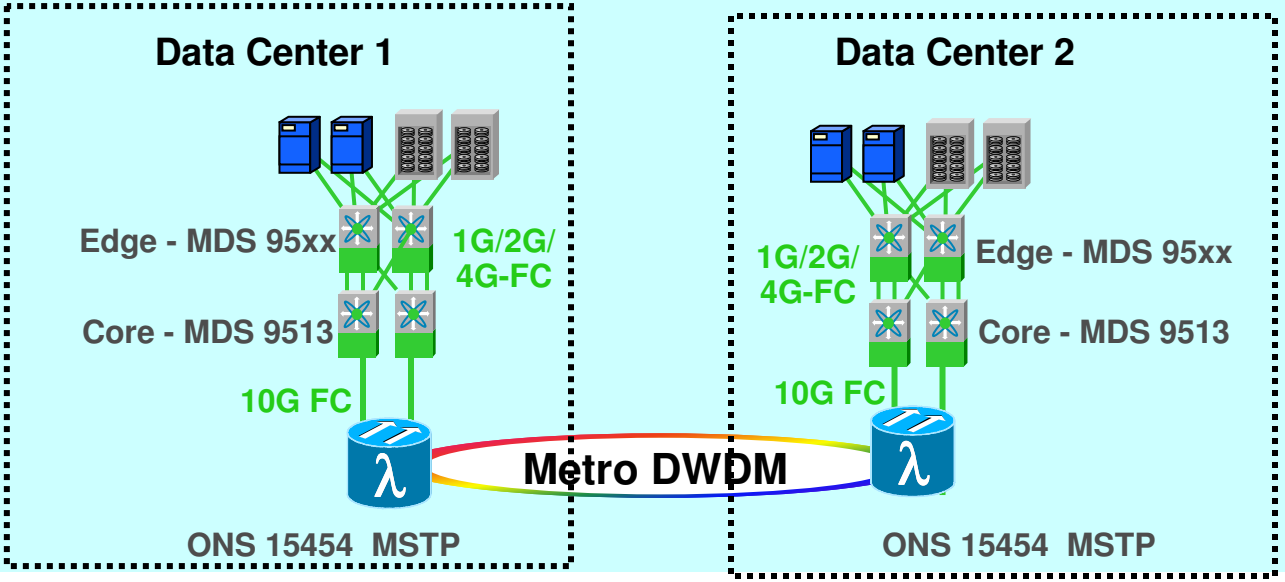
- 1 x GbE/FC/2GFC
- ETR / CLO / ISC3 STP

10G MR Transponder

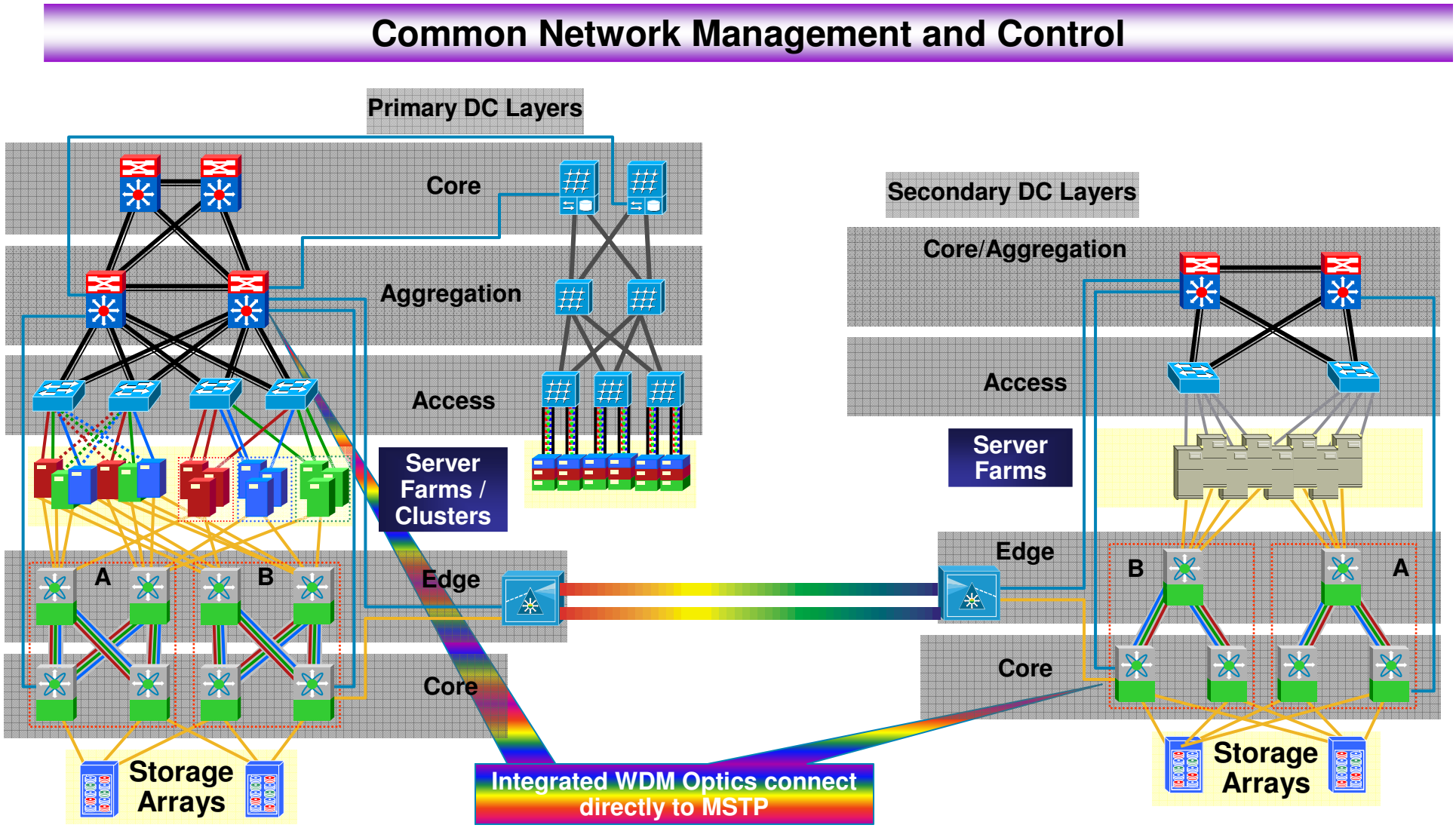
- 1 x 10GbE LAN PHY
- 1 x 10G FC

- ✓ **Integrated Management:** CapEX and OpEX reductions through simplification and allows complete network diagnostics support at a glance
- ✓ **Virtual SANs (VSAN):** enables consolidation of services onto **fewer wavelengths**. Strict isolation still maintained to isolate connections
- ✓ A **PortChannel** is a logical bundling of identical links, and treated as one logical ISL. Overcomes circuit bandwidth limitations and enables connection assurance in case of link failure – **Enables 10Gbps portchanneling across MSTP**
- ✓ **Distance Extension** allows Data Replication across greater distances, thus, providing greater geographical flexibility and compliance with regulations – supports 1/2/4 and 10Gbps FC over MSTP / Buffer Credit to support large distance

Data Center scalability through the most flexible, efficient, secure networks.

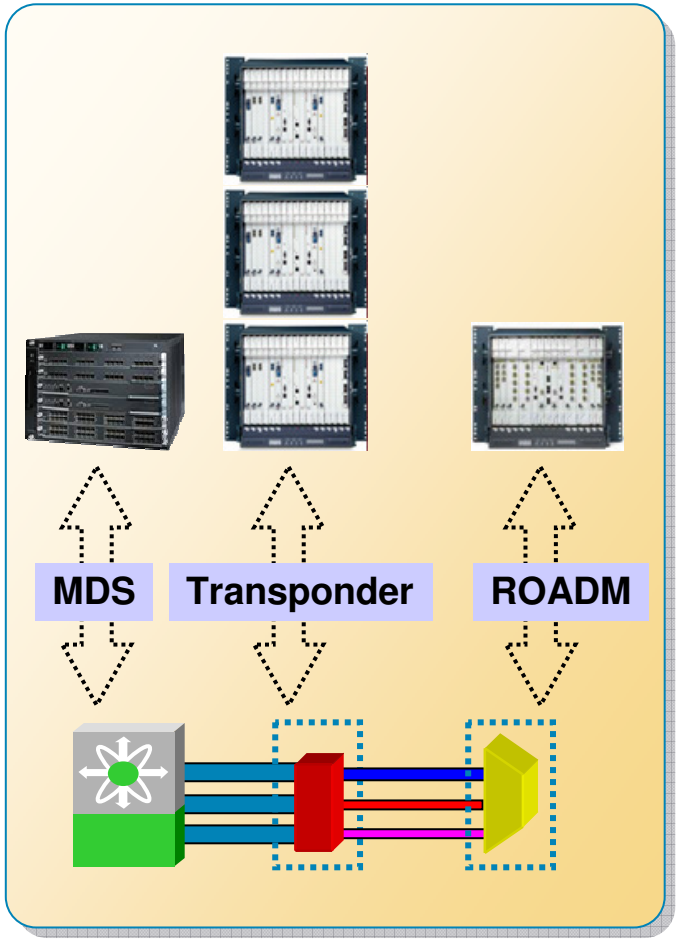


New Cisco DCoDWDM Architecture



DWDM Optics Integrated in MDS 9000

FC and DWDM - Today



Lower CapEx

Up to 50% less lasers

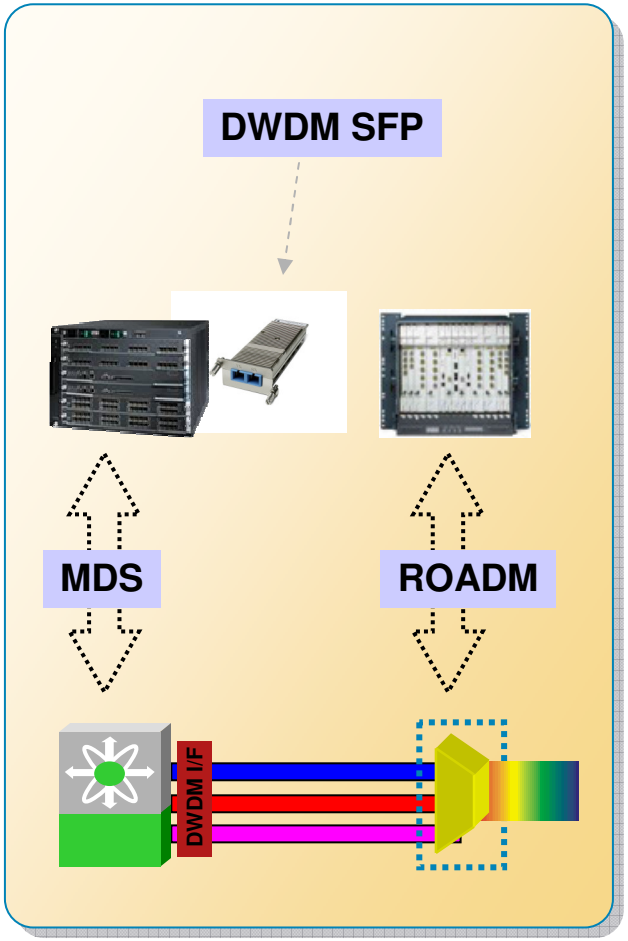
Lower OpEx - improved efficiency

Fewer shelves, less rack space, less power, simplified management

Enhanced resiliency

Fewer active components, fewer points of failure

FC and DWDM - MDS w/ Integrated DWDM Optics



DCoDWDM: What have we Implemented so far?

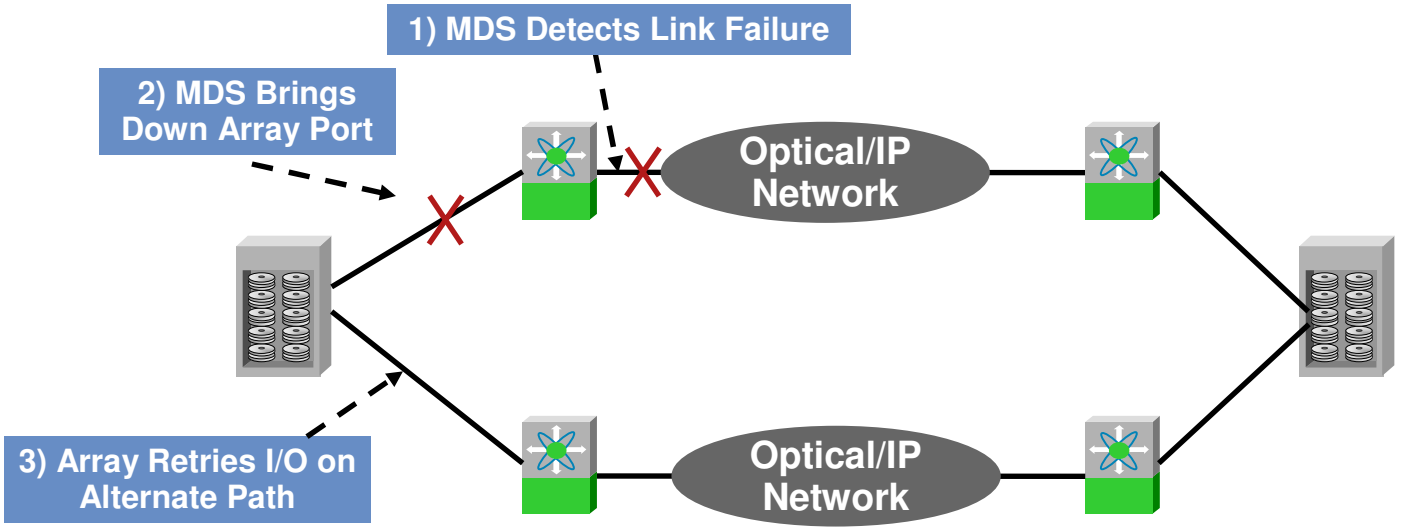
- **Element Integration: MDS + MSTP**
  - Scale up to 32 4G λs
  - Future 10G λs support
  - Optical OAMP
  - Fully interoperable with Cisco 15454 MSTP
  - Designed to interoperate with third-party DWDM
- **Management Integration**
  - Integrated DC over DWDM design tools

Industry First

Pluggable 1G/2G/4GFC compatible with 100GHz DWDM systems

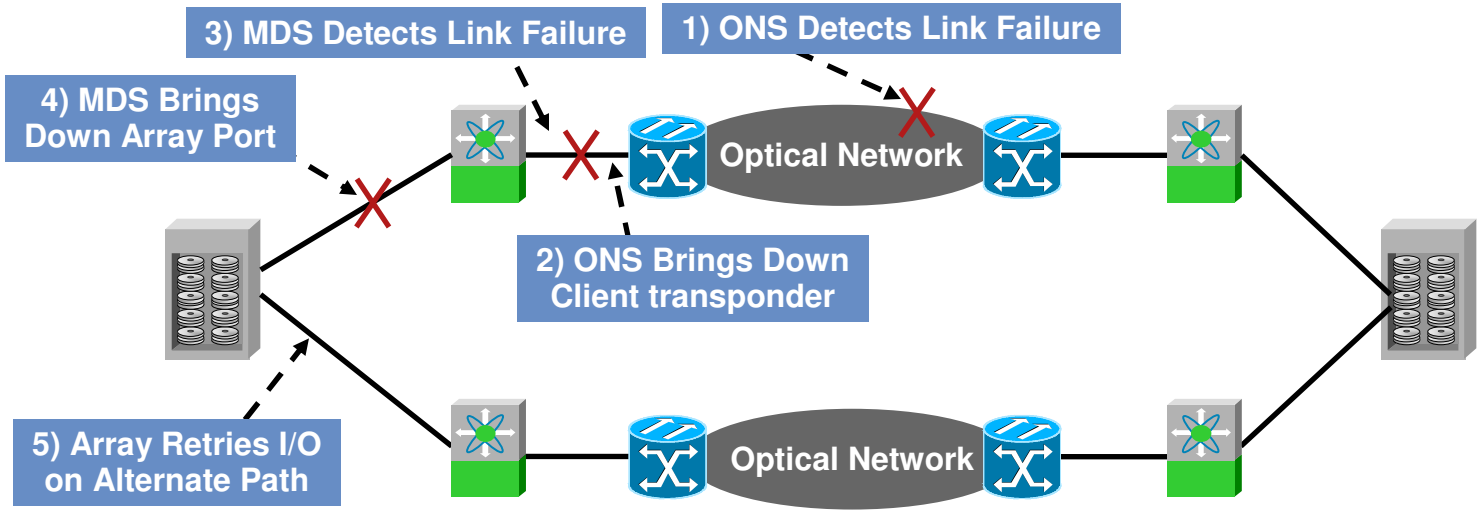
Improving Optical Recovery

Port Track for Resilient SAN Extension Solutions



- Arrays recover from a link failure via I/O timeouts; however, this can take several seconds or longer
- MDS PortTrack addresses this by monitoring the WAN/MAN link and if it detects a failure, it will bring down the corresponding link connected to the array
- The array after detecting a link failure will redirect the I/O to another link without waiting for the I/O to timeout

Improving Optical Recovery
Port Tracking and ONS FLC or Squelching



- The MDS port tracking feature can be used with the ONS 15530 Forward Laser Control (FLC) or ONS 15454 squelching feature to further track failures in the network, improving the ability to detect failed paths
- Forward Laser Control, squelching and port-tracking offer end to end path failure detection

DWDM
Channel

- Les ONS sont dans la GPL est peuvent être revendus par tous les partenaires
- Les ONS peuvent être installés et maintenus par tous les partenaires (y compris dans l'absolu par ceux qui n'ont pas la compétence)
- Les ONS peuvent être installés et maintenus par autre un partnenaire (qui en a la compétence) que celui qui l'aura vendu.
- Un partenaire qui vend les ONS peut acheter à un autre la prestation d'installation et de maintenance pour revendre le tout au client dans une offre complète
- Smartnet possible aussi pour la maintenance
- Cisco CA possible aussi pour l'installation

Links

- CWDM: http://www.cisco.com/go/cwdm
- DWDM: http://www.cisco.com/go/optical
- Prerequisites to support CWDM & DWDM optics:

http://www.cisco.com/en/US/products/hw/modules/ps5455/products_device_support_table09186a0080385874.htm

- DataCenter: http://www.cisco.com/go/datacenter


CISCO