DCAA-17-0010B

Optical fiber cabling infrastructure for Data Center

Fujikura Ltd,

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TRENDS AND ISSUES ON OPTICAL CABLING

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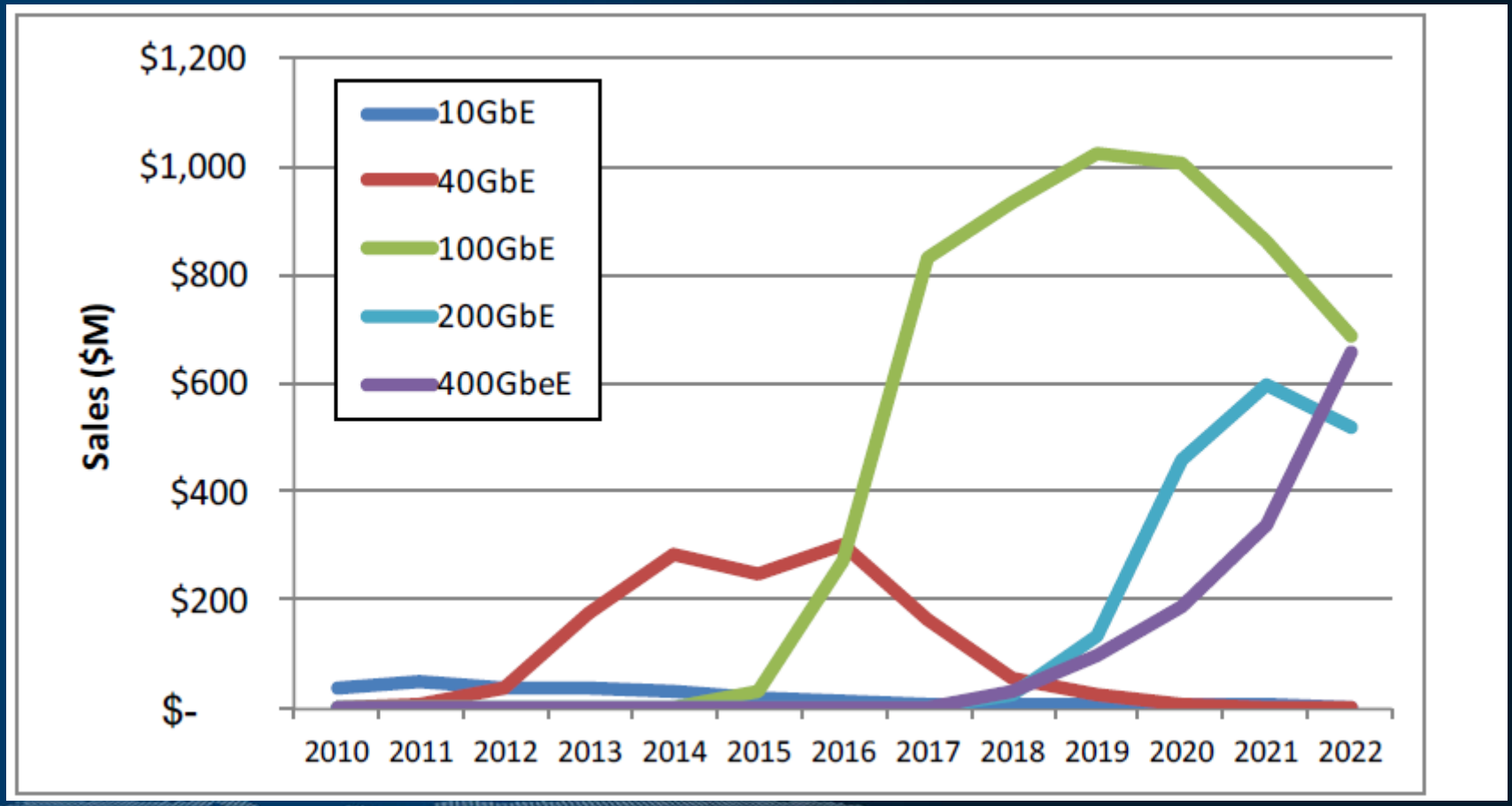
IP Traffic Growth, 2016-2021

1 ExaByte = 10^{18} Bytes

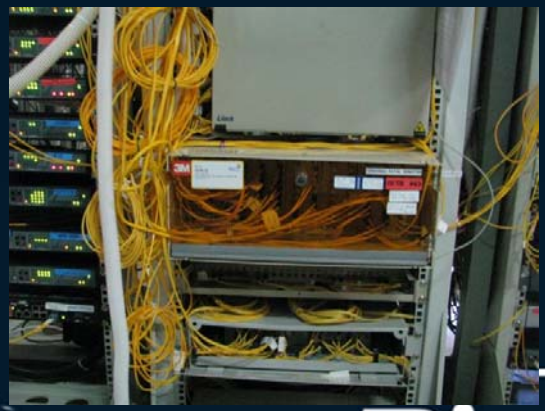
Source: Cisco Visual Networking Index, 2017

Transition From 100G To 200G/400G in OTT Cloud: Amazon, Google and Microsoft



Source : “Mega Datacenter Optics”, LightCounting, June 2017.

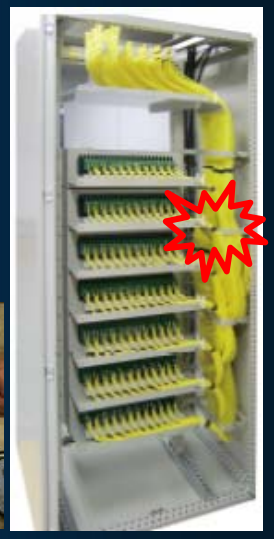
Cable/cord convergence in Data Center



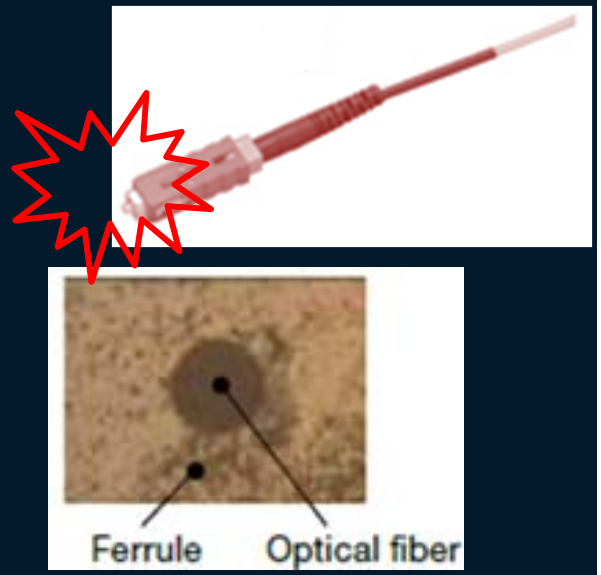
Trouble in Data Center

Man-made calamity

Fiber cable damage



Connector problems



Trends and Issues on Optical Cabling in DC

High speed

- 10G → 40/100G→200/400G

Cost reduction

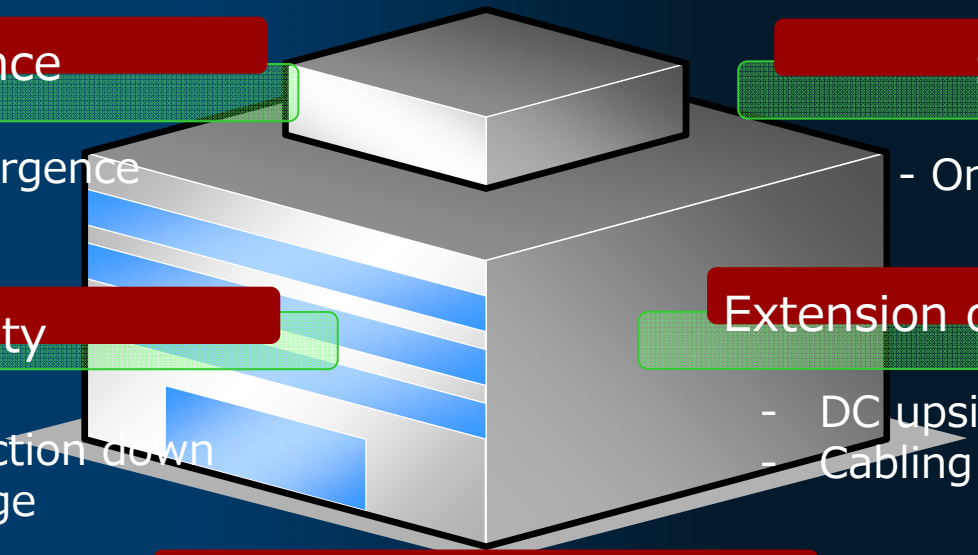
- Reduce Material＆Installation cost
- Save space
- Avoidance of double imvestment

Maintenance

- Cable/cord convergence

Scalability

- On demand expansion



Availability

- Avoiding connection down and fibre damage

Extension of link distance

- DC upsizing
- Cabling between buildings

Reduction of wiring volume

- Air conditioning efficiency

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SOLUTIONS

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Solution

1. High speed, multi-core & high density
   - MPO cabling system

2. Cable/Cord Convergence
   - Field installable connector
   - Low friction cable

3. Trouble Prevention
   - Fibre Identification
   - Connector Cleaning

Outline of MPO connector

- MPO (Multi-fiber Push On) is multiple fiber connector for 40/100GbE transmission

- Used trunk cable deployed in backbone Data Center

- Standardized IEC 61754-7 and TIA 604-5

12MPO connector

24MPO connector

Newtwork system & applicable optic fibre

Speed	Standard	Fiber	No. of fiber	Distance	Link budget of tranciever
1Gb/s	1000BASE-SX	OM2,OM3,OM4	2	550m	3.56dB
	1000BASE-LX	SM	2	5000m	4.56dB
10Gb/s	10GBASE-SR	OM3	2	300m	2.6dB
		OM4	2	400m	2.9dB
	10GBASE-LR	SM	2	10000m	6.2dB
	10GBASE-ER	SM	2	40000m	10.9dB
40Gb/s	40GBASE-SR4	OM3	8	100m	1.9dB
		OM4	8	150m	1.5dB
	40GBASE-LR4	SM	2	10000m	6.7dB
100Gb/s	100GBASE-SR4	OM3	8	70m	1.9dB
		OM4	8	100m	1.5dB
	100GBASE-SR10	OM3	20	100m	1.9dB
		OM4	20	150m	1.5dB
	100GBASE-LR4	SM	2	10000m	8.3dB
	100GBASE-ER4	SM	2	40000m	18dB
	100G-PSM4 (*)	SM	8	500m	3.3dB

Required MPO connector

MPO connector interfacec

QFSP tranciever (40G)

*Reference value

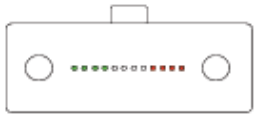
40GbE/100GbE interface (MMF)

40G & 100G Ethernet – MDI Recommendations

References MPO interface req's/specs of IEC 61754-7.

40GBASE-SR4

100GBASE-SR4



Left 4 pins are Tx
Right 4 pins are Rx
(inner 4 pins unused)

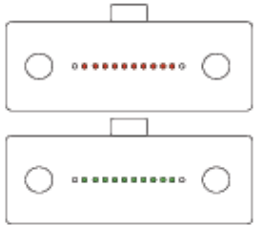
100GBASE-SR10

Inner 10 pins, Top Row are Rx
Inner 10 pins, Bot Row are Tx
(outermost pins both rows unused)

Option A
(recommended)

Inner 10 pins, Left Side are Tx
Inner 10 pins, Right Side are Rx
(outermost pins each side unused)

Option B



Inner 10 pins, Top are Rx
Inner 10 pins, Bot are Tx
(outermost pins Top & Bot unused)

Option C

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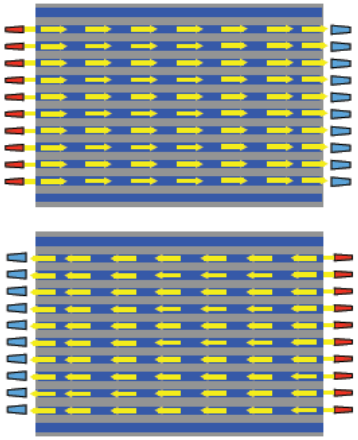
40GbE/100GbE transmission (MMF)

High Speed Short Reach Technologies: Multiple Fiber Parallel Systems on MMF

40GBASE-SR4

100GBASE-SR4

- Two 12 Fiber Cables, or 24 fiber Cable
  - 20 Active
  - Duplex link
- 10 x 10 Gb/s
- MPO connector
  - 2 x 12 fiber
  - 1 x 24 fiber
- One wavelength per fiber



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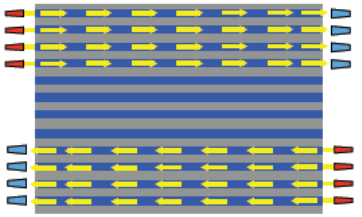
High Speed Short Reach Technologies: Multiple Fiber Parallel Systems on MMF

100GBASE-SR10

- One 12-fiber cable
  - duplex link
  - 8 active fibers
- 4 x 10 Gb/s
- 12 Fiber MPO connector
- One wavelength per fiber



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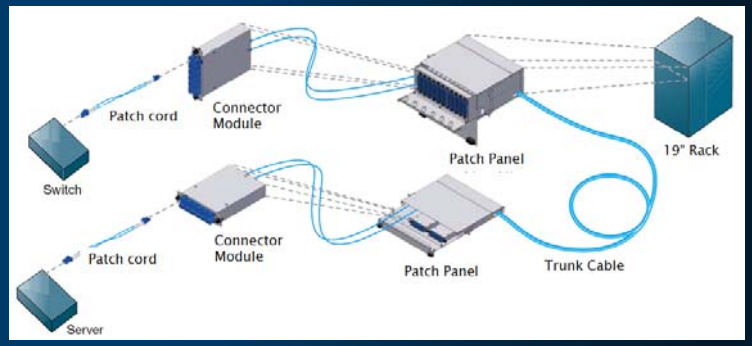
Upgrade 10G→40G/100

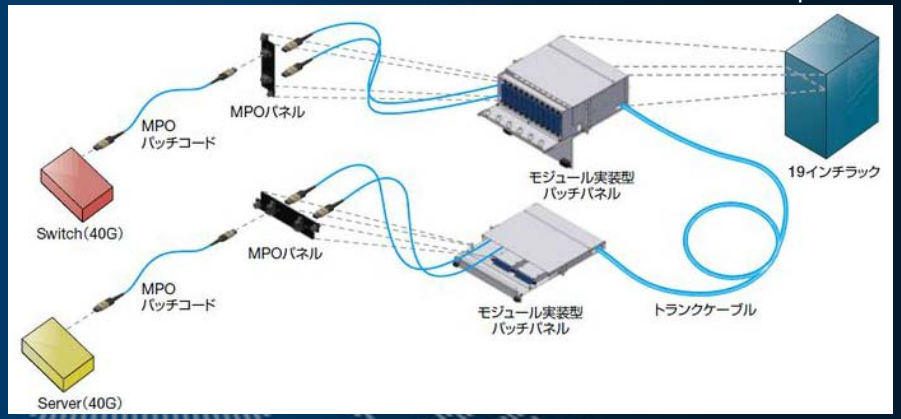
10GBASE-SR cabling structure



40GBASE-SR4,
100GBASE-SR4 cabling structure

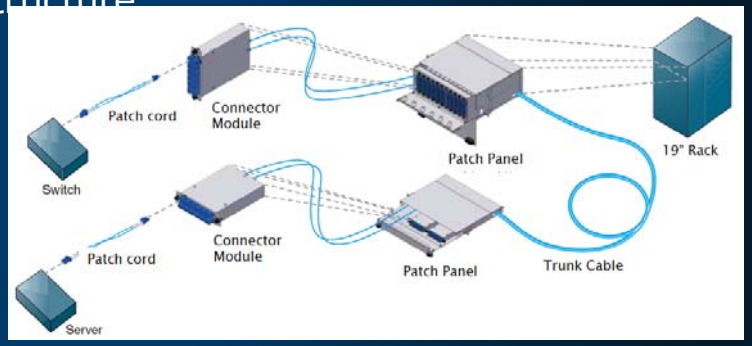
LC patch cord + connecormodule
→ MPO panel +MPO patch cord(12MPO/12MPO)

Method A : Required both straight & cross type MPO patch
Method B : Required only cross type MPO patch cord



Upgrade 10G→100G

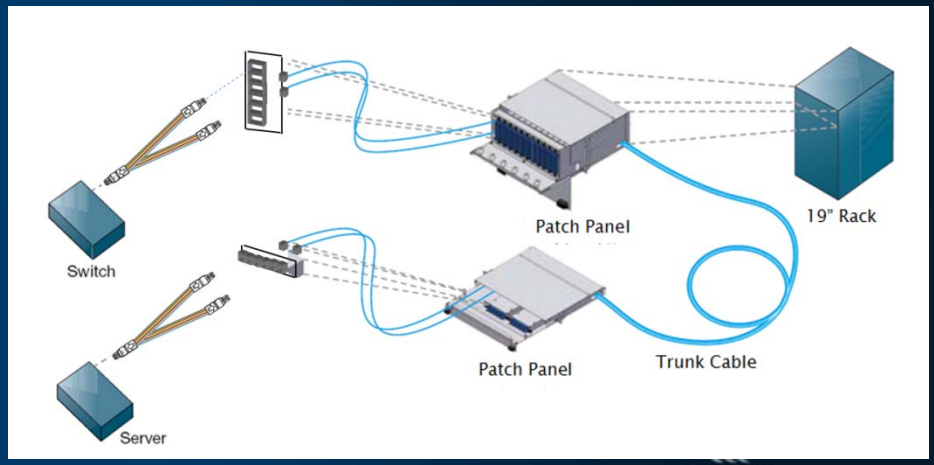
10GBASE-SR cabling structure



LC patch cord + connector module
→ MPO panel＋MPO patch cord (24MPO/2x12MPO)

Method A : Required only one type of MPO patch cord
Method B : Required two types of MPO patch cord

100GBASE-SR10 cabling structure

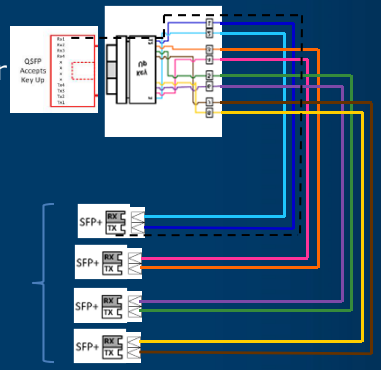


40GbE-10GbE x 4 solution

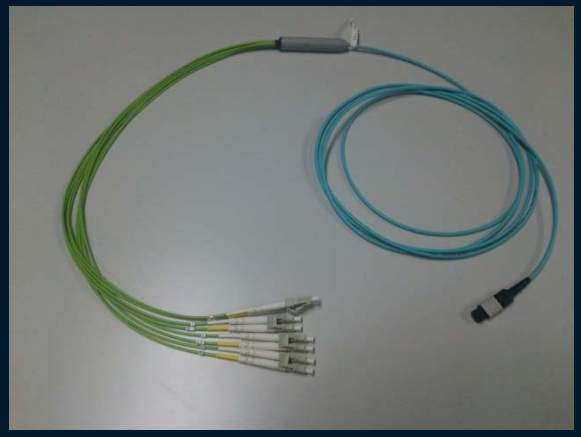
○Direct connection

QSFP transceiver

12MPO(8core use)/DxLC cord



SFP+
Transceiver



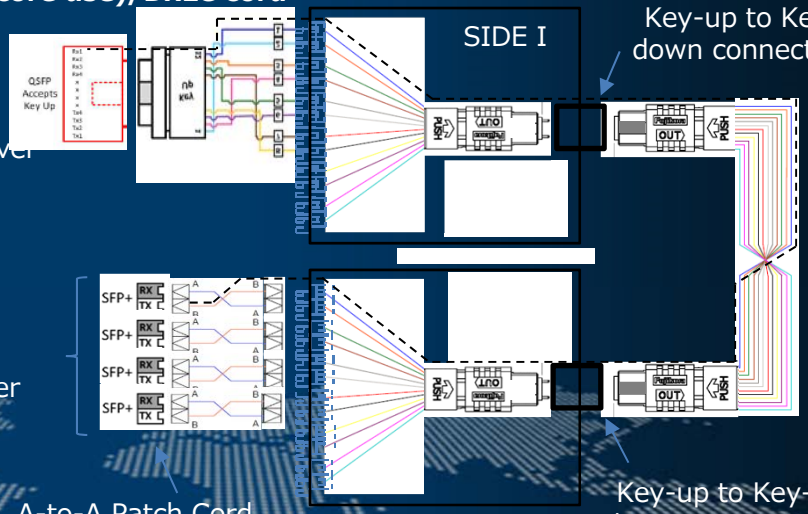
12MPO(8core use)/DxLC cord

○Connection via trunk cable (example)

12MPO(8core use)/DxLC cord

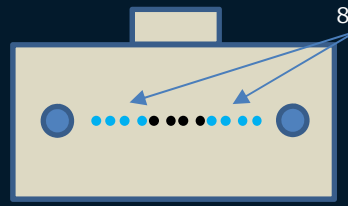
Connector module

QSFP transceiver



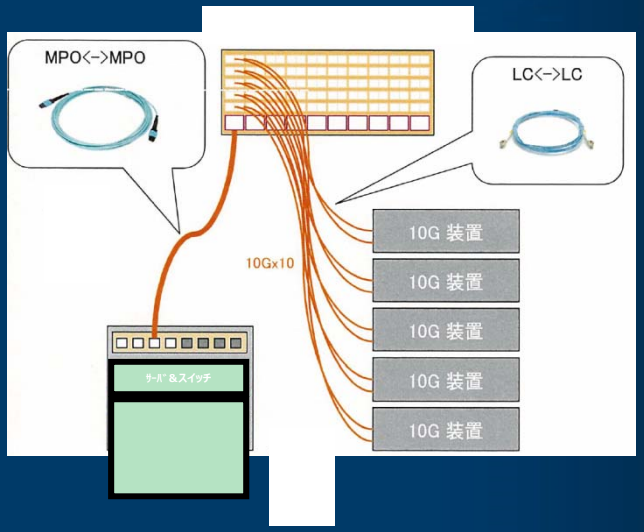
SFP+
Transceiver

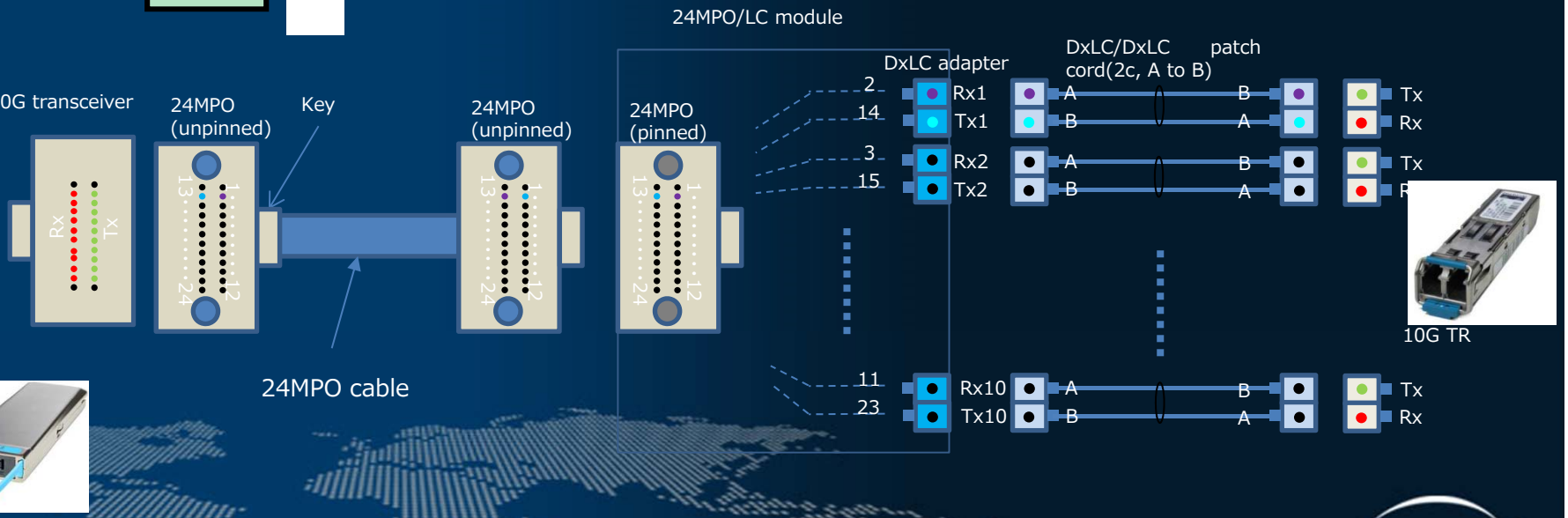
A-to-A Patch Cord



Example of Optical Transmission Path

100GbE-10GbE x 10 solution





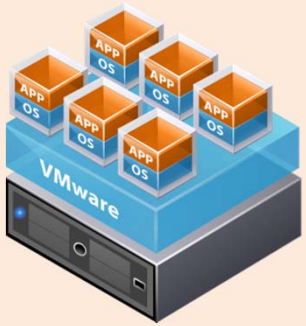
Useful on server virtualization

＜Traditional Architecture＞

Virtualization

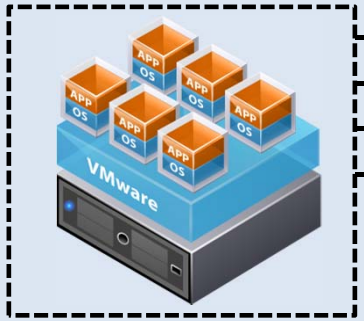
＜Virtual Architecture＞

Virtualization software applied in DC



Solution:
MPO connectorized cable

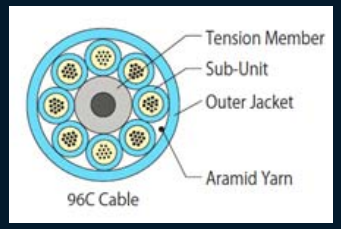
Multiple high speed interfaces are required to one physical server



- VM FT
- VMotion
- VM communication
- VM strage

Reduction of wiring volume

Approx. 50mm



13.3mm

96fiber MPO trunl cable

CAT6A cable x 48

Reduce instalation cost & Save space

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Solution

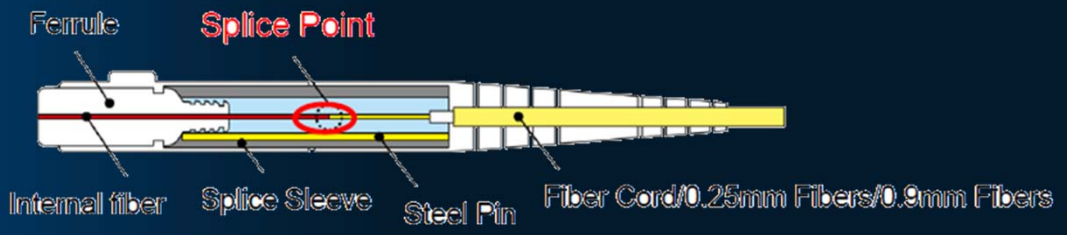
1. High speed, multi-core & high density
   - MPO cabling system

2. Cable/Cord Management
   - Field installable connector
   - Low friction cable

3. Trouble Prevention
   - Fibre Identification
   - Connector Cleaning

Field installable connector

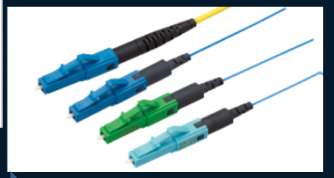
- Able to inspect integrity of bare fibers before splicing
- Only requires basic training
- Eliminates excess cable issue



Sleeve

Connector Stub and Holder Assembly

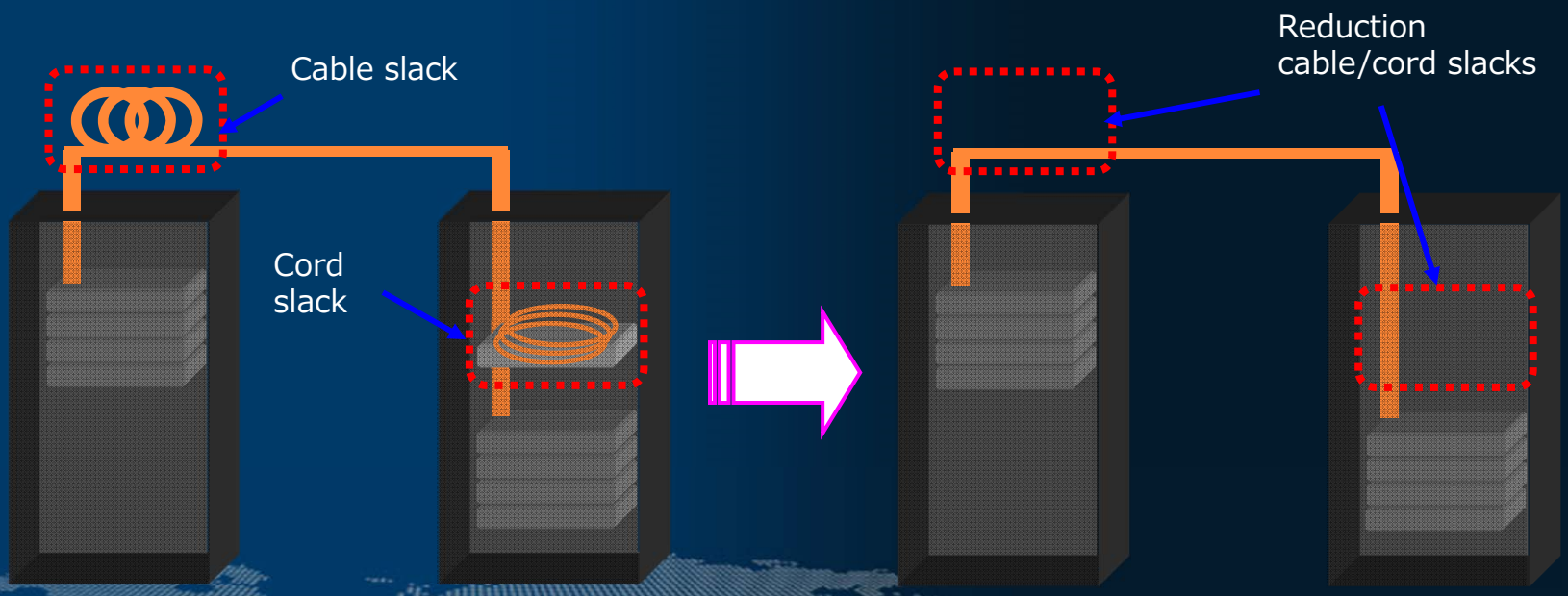
Before Assembly



After Assembly

Field installable connector

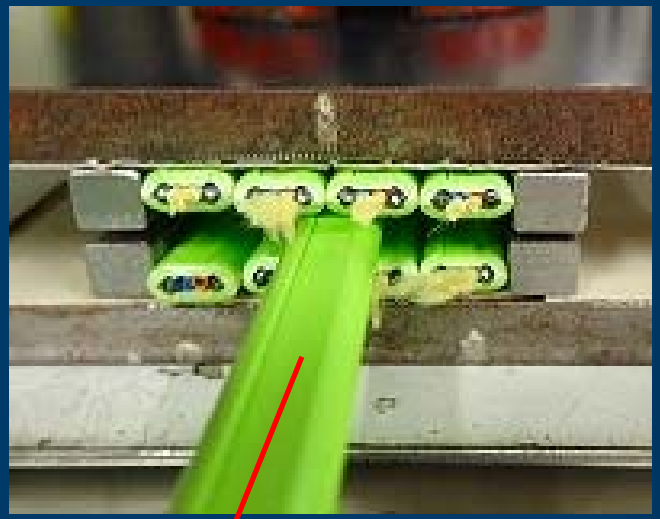
- Enable to improve cable/cord convergence
  - Reduction of cable/cord slacks
  - No need to check cable/cord length in advance Installation cost down
  - Cable/cord cost down



Low Friction Cord

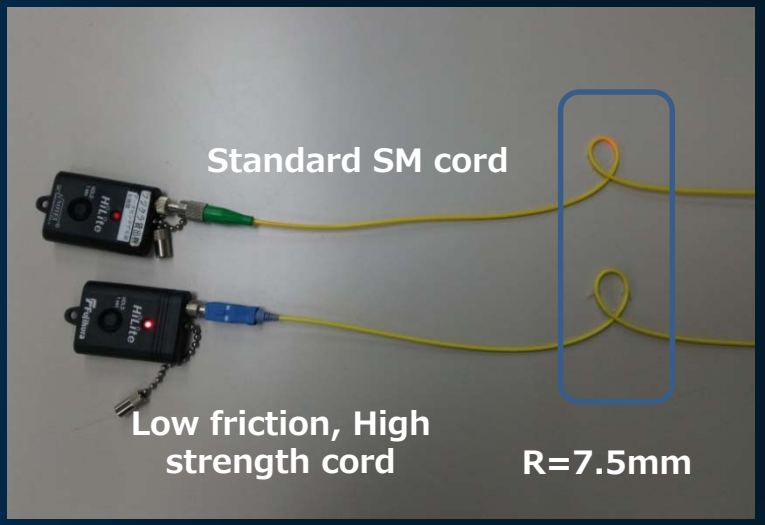
<Benefits>
- Providing reliability, availability and serviceability
- Higher mechanical performance

Low friction



Impprove low friction ratio
more than 50%

Comparison of bending loss



Solution

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   - MPO cabling system

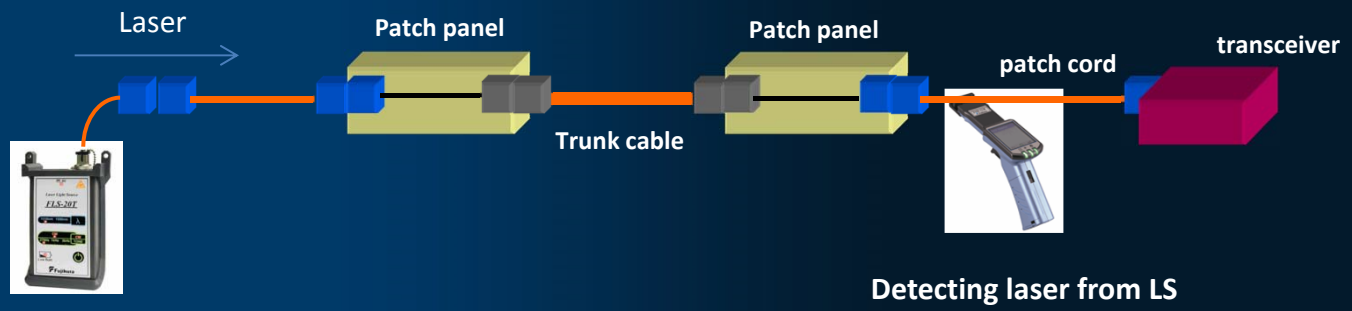
2. Cable/Cord Management
   - Field installable connector
   - Low friction cable

3. Trouble Prevention
   - Fibre Identification
   - Connector Cleaning

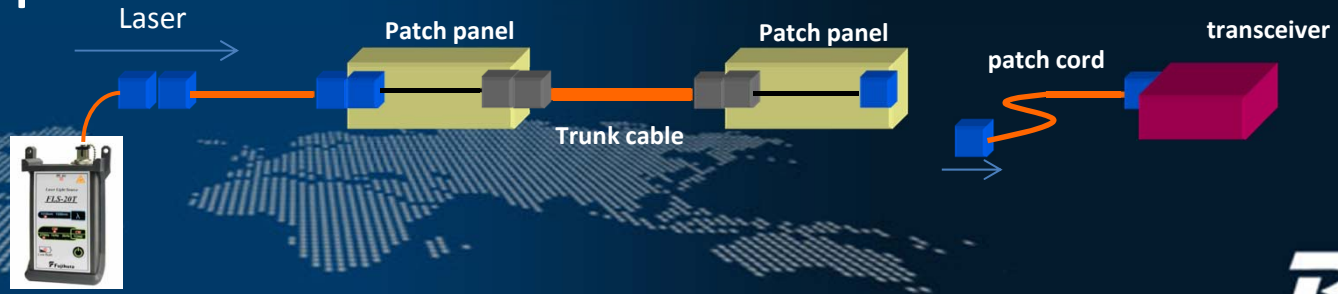
Fibre Identifier

Prevent connector unplug by mistake

Step1 : Check the target port which is removed



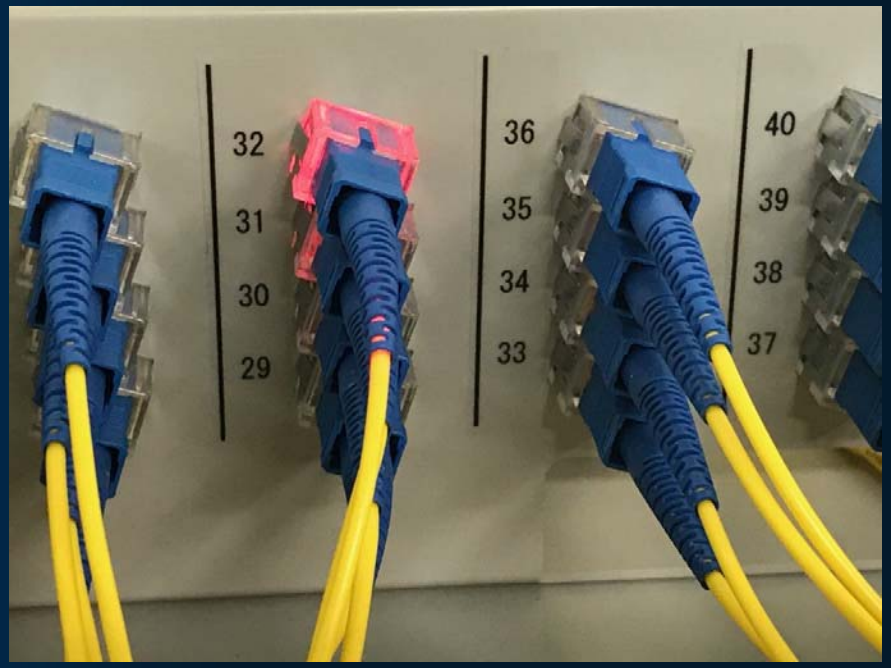
Step2: Pull out the connector

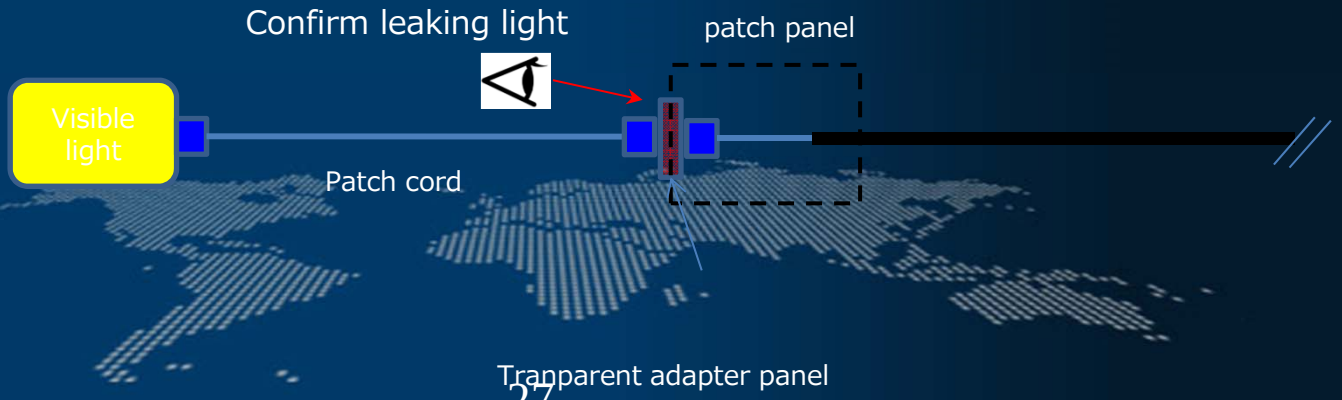


Transparent adapter

- Easy to identify target port using visible light

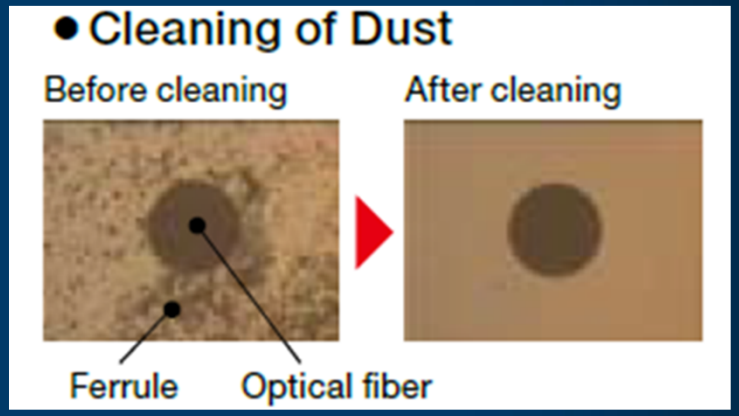
- Enable to prevent miss-remove of patch cord

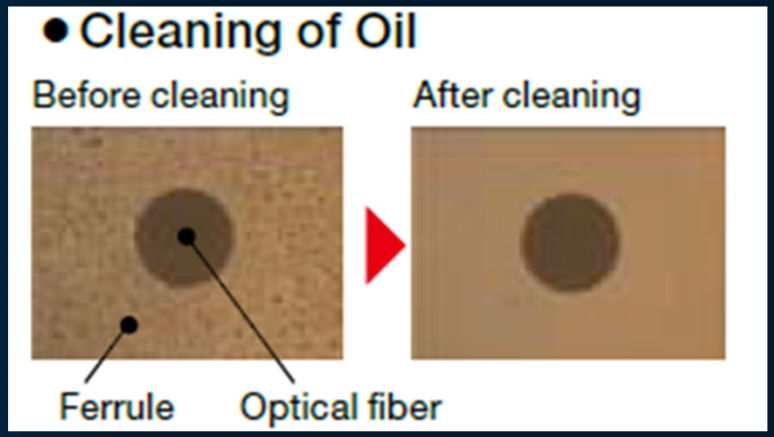




Connector Cleaner

CONTAMINATION is the root cause of network failure.
Connector cleaning before mating is one of the best practices.





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Conclusion

- MPO Connector will become a norm in the Data Center
- Cable/Cord management will be a key concern in the Data Center

Thank You

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