Intra-DC & DCI considerations for 100G+ migration

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EXFO

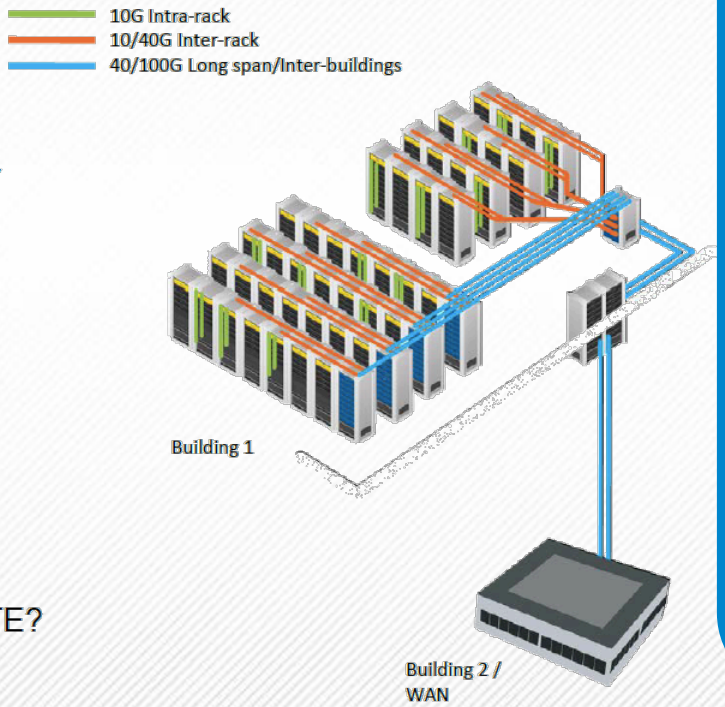
10G/40G to 100G/200G/400G Migration

- Due to the significant increase in bandwidth demand, Data Center connections are moving from 1G/10G, to 25G/40G/100G

- Within the Data Center Rack
  - **10GE** being deployed now
  - 25GE to be deployed soon
  - 50GE to the server will likely follow

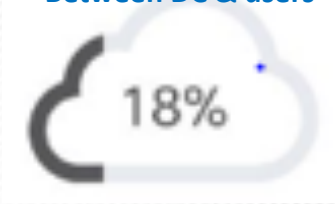
- Between Data Center Racks
  - **40GE** being deployed now
  - 100GE to be deployed soon
  - What follows? 200GE or 400GE?

- Long Spans/DCI & WAN
  - **100GE** being deployed now
  - 400GE being standardized now
  - What follows? 800GE, 1TE or 1.6TE?

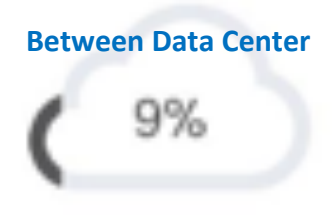


DC global traffic
5 ZB 2016/ 10.4 ZB 2019

Between DC & users



Between Data Center



Within the DC

10G/40G to 100G/200G/400G Migration

Transceiver industry has developed **2 categories:**

- **Parralel optics (MPO connector): 2-3**
- **WDM optics (LC connector): 1-4**

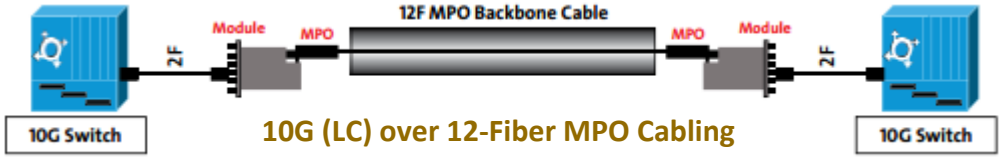
Migration to 100G+ interfaces means **line rate upgrade of 10Gbps to 25/50/100Gbps**

Standardized reach for transceivers:

- MMF: OM4/ WBMMF – 150 m
- SMF: OS1/ OS2 – 10 km (2km)

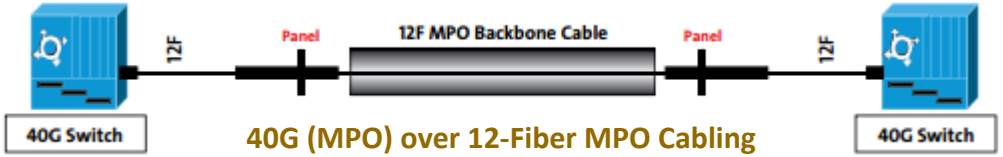
MTP/MPO connectors and 12 or 24 fibers ribbon are used in backbone cables due to installation efficiency

1



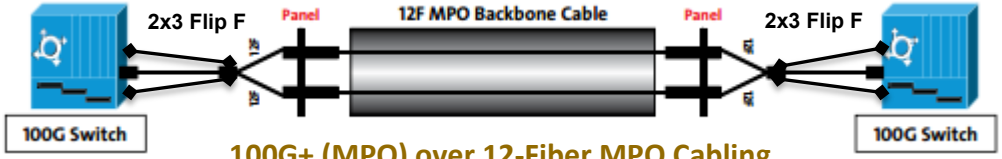
10G (LC) over 12-Fiber MPO Cabling

2



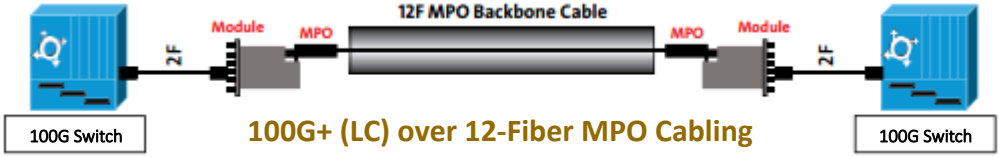
40G (MPO) over 12-Fiber MPO Cabling

3



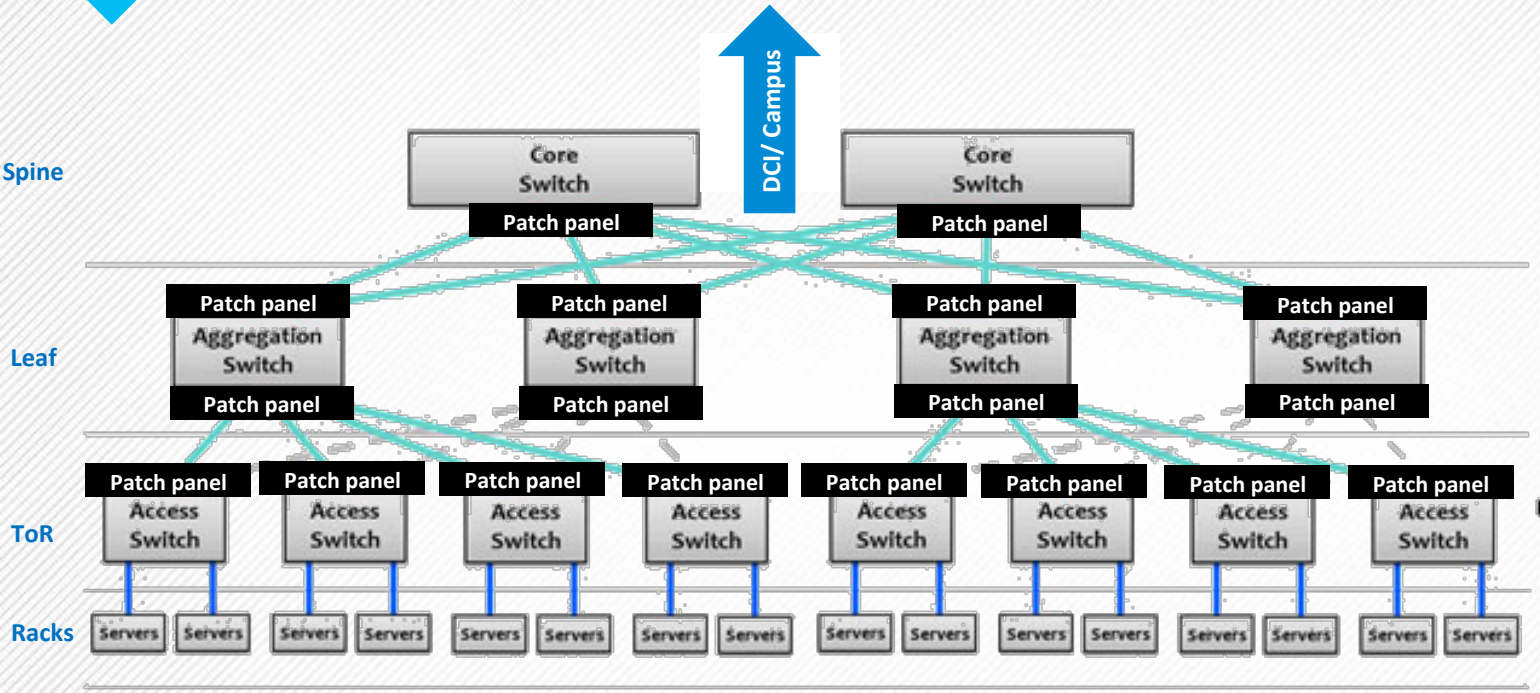
100G+ (MPO) over 12-Fiber MPO Cabling

4



100G+ (LC) over 12-Fiber MPO Cabling

Data center design rule trend (Leaf-Spine)



Active switch-to-switch connections (optical fiber) singlemode

Inactive backup switch-to-switch connections (optical fiber)

Server connections (typically copper)

MDA

MDA

MDA, IDA or HDA

HDA

HDA or EDA for Top of Rack

EDA

EDA

Typical fiber distances

40G-100G SMF

Up to 3,300 ft.
1,000 m

Up to 500-650 ft.
150-200 m

Up to 20 ft.
6 m

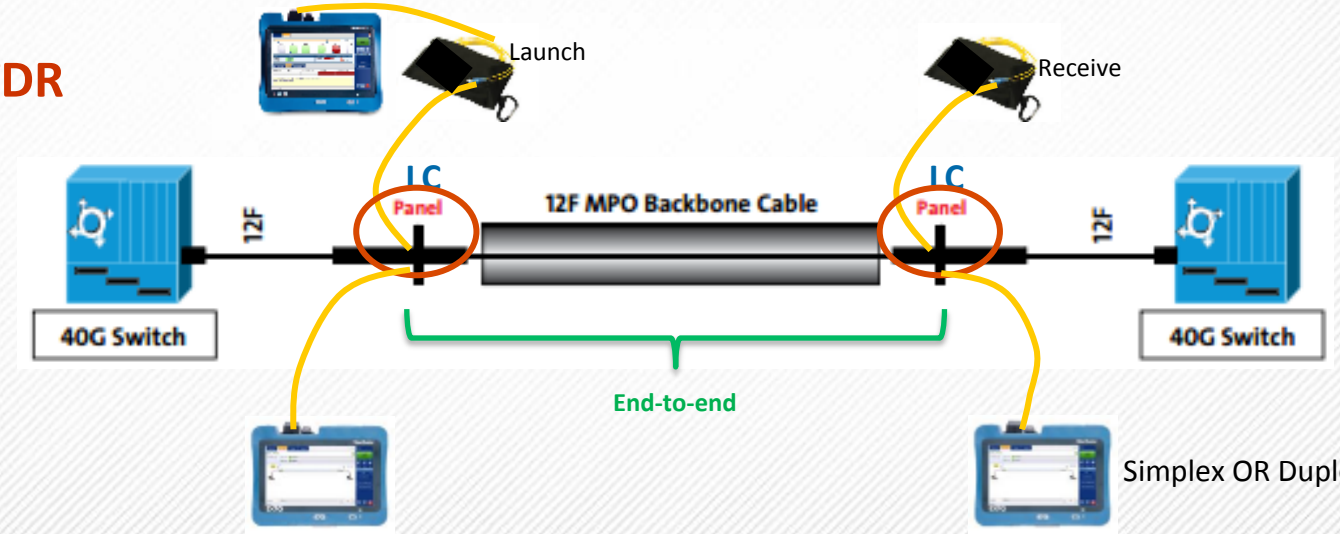
CAT-6A/7/8
Twinax copper

OLTS vs iOLM-OTDR / RL, BR, ORL… Tier-1 & 2

Return loss (RL) is the loss of power in the **signal returned/reflected by a discontinuity** in a transmission line or optical fiber **(also called Reflectance or back reflection).**

Optical Return Loss (ORL) is a measure taken from one end of the **total energy reflected back to the source by all the interfaces** (IOR, breaks, backscatter, etc.) created inside a component or along a link.

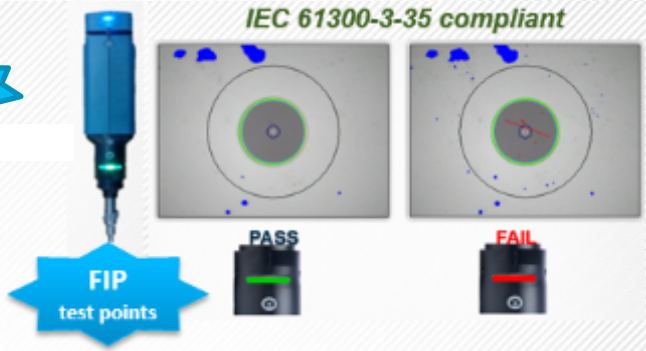
iOLM - OTDR

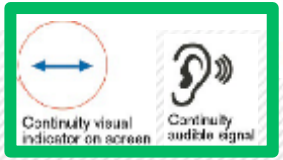


OLTS

What DC operation testing makes sense?

Server
Server EDA Patch Cord
Server EDA Patch
HDA
Leaf
Switch EDA Patch Cords
Edge SAN Switch
FIP
Cross Connect Jumper
FIP
MDA
OLTS
FIP
Switch EDA Patch Cord
FIP
EDA Patch
Core SAN Switch
FIP
Spine
OLTS



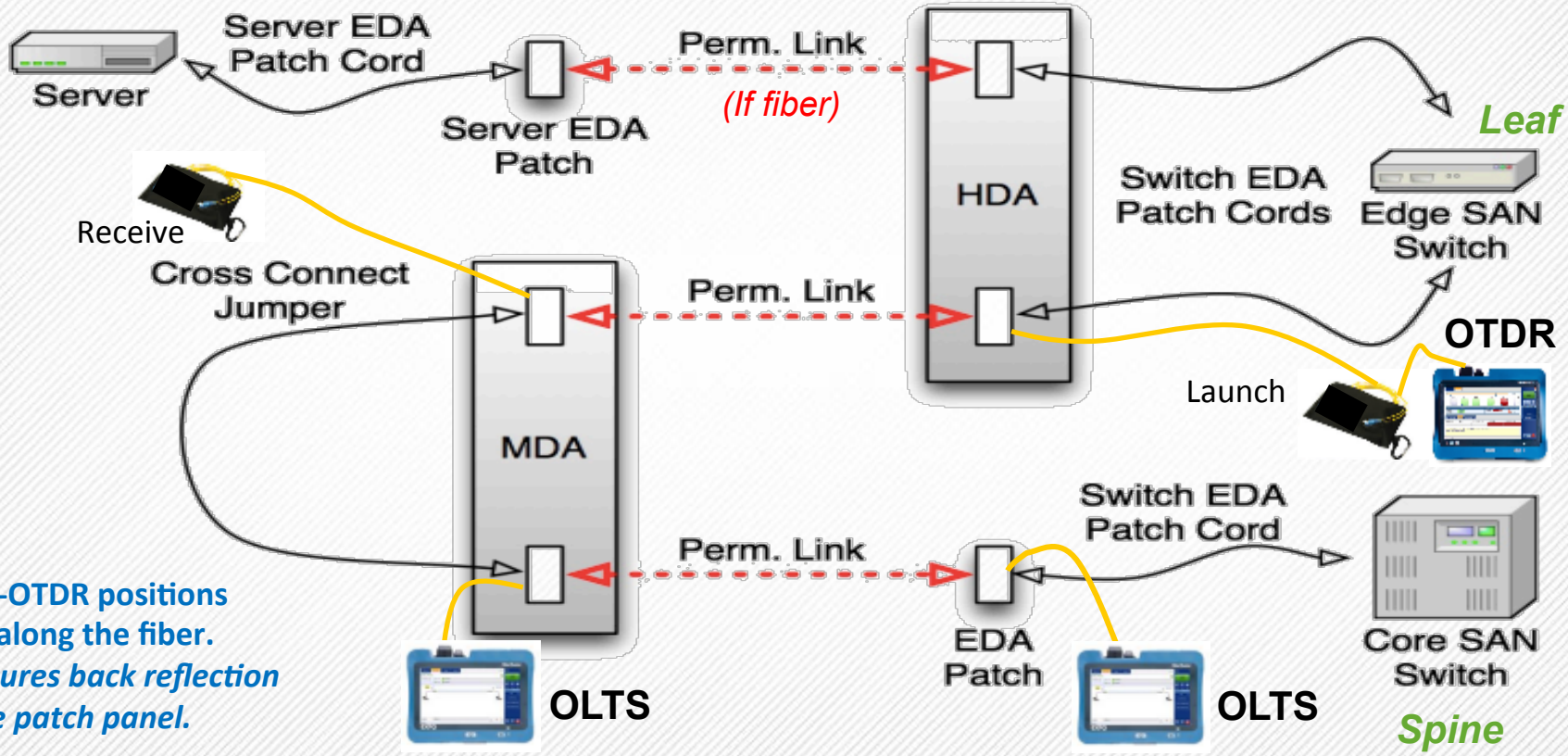


Copper channel

Fiber channel

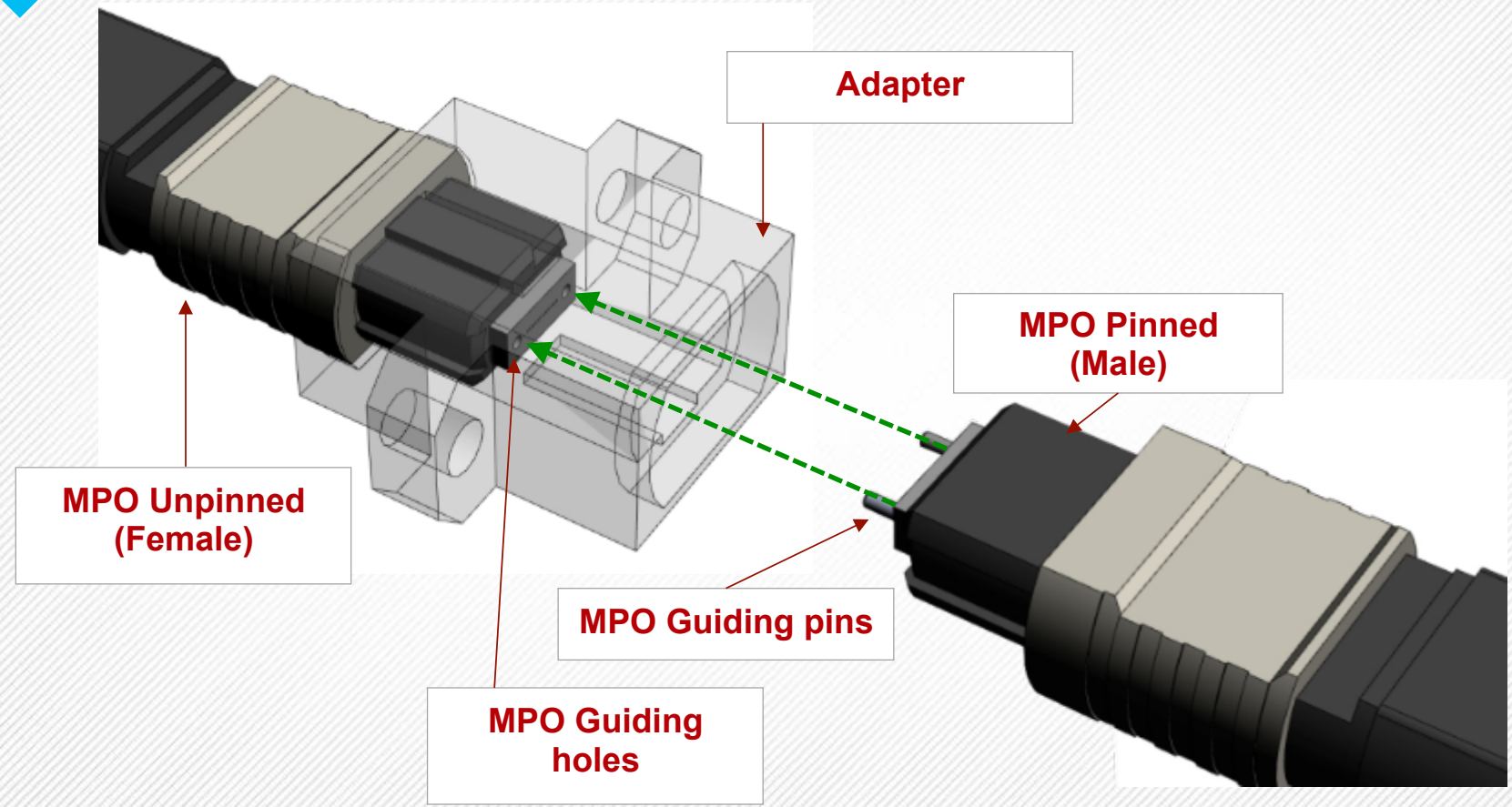
Move Add & Changes (MAC) of transceiver (OLTS)

100G+: Additional DC testing scenarios

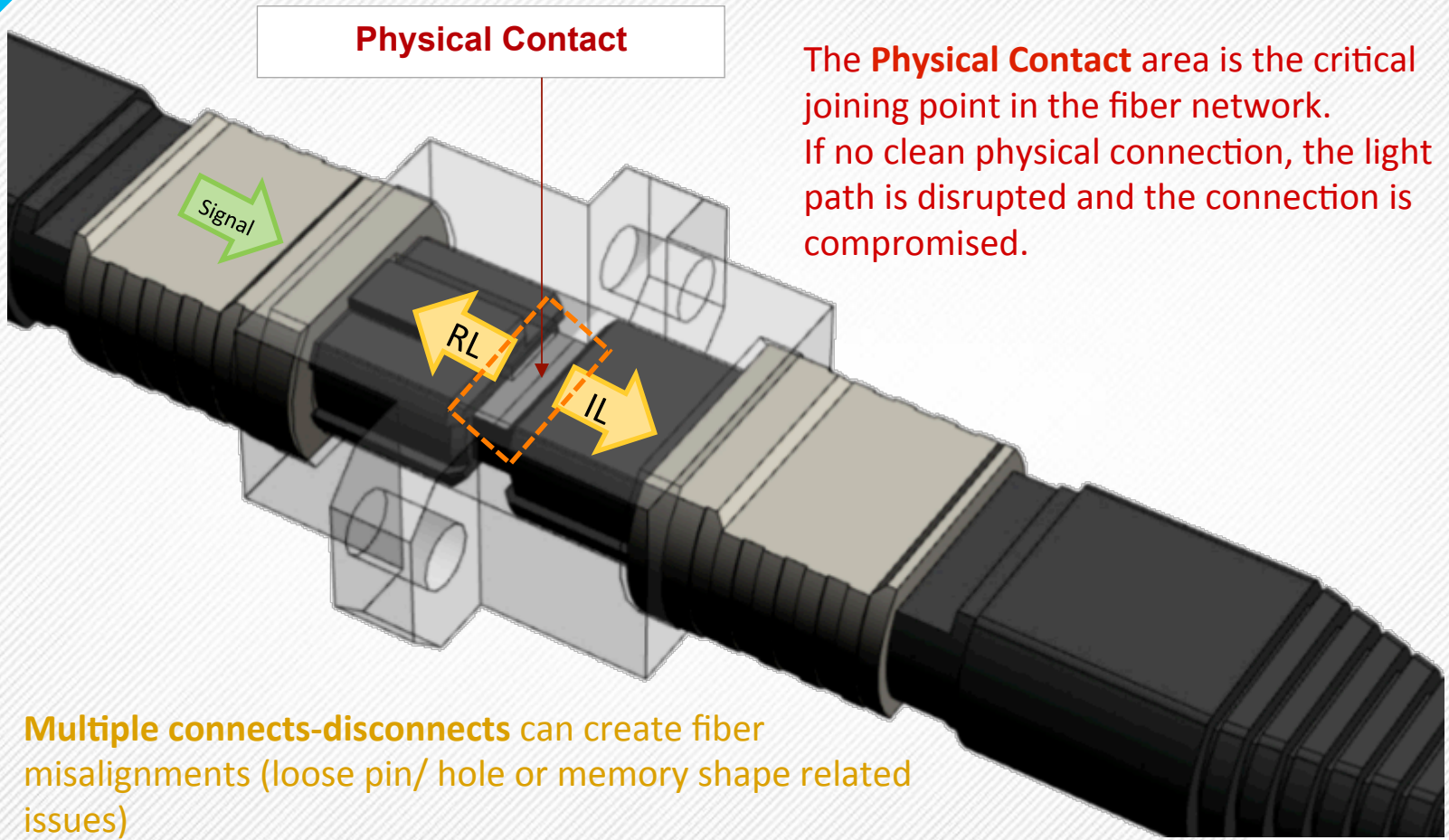


iOLM-OTDR positions fault along the fiber.
Measures back reflection at the patch panel.

MTP/MPO - Guiding pins, guiding holes



MTP/MPO - Physical contact is key…

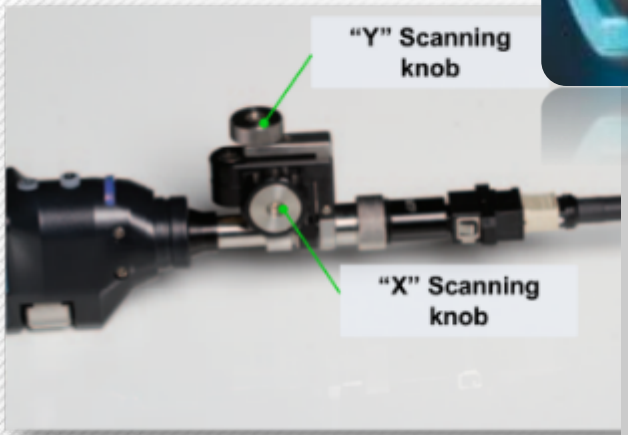


The **Physical Contact** area is the critical joining point in the fiber network.
If no clean physical connection, the light path is disrupted and the connection is compromised.

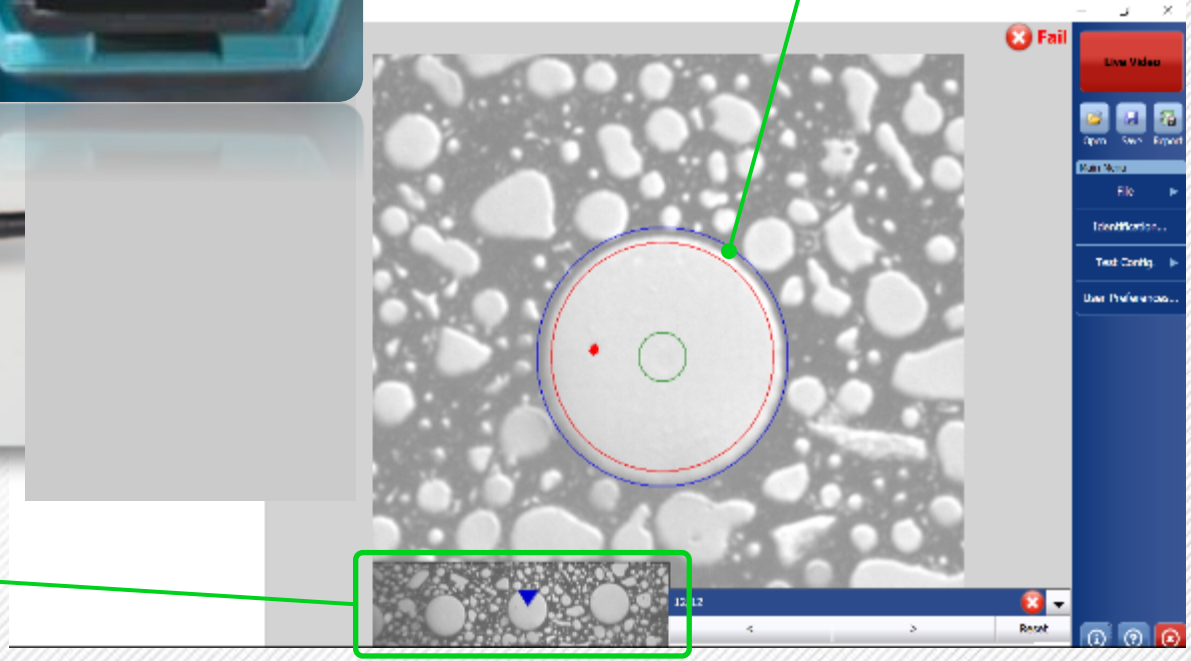
Multiple connects-disconnects can create fiber misalignments (loose pin/ hole or memory shape related issues)

FIP MTP/ MPO12/24 inspection probe

MTP12 – MTP24 (MM/SM)

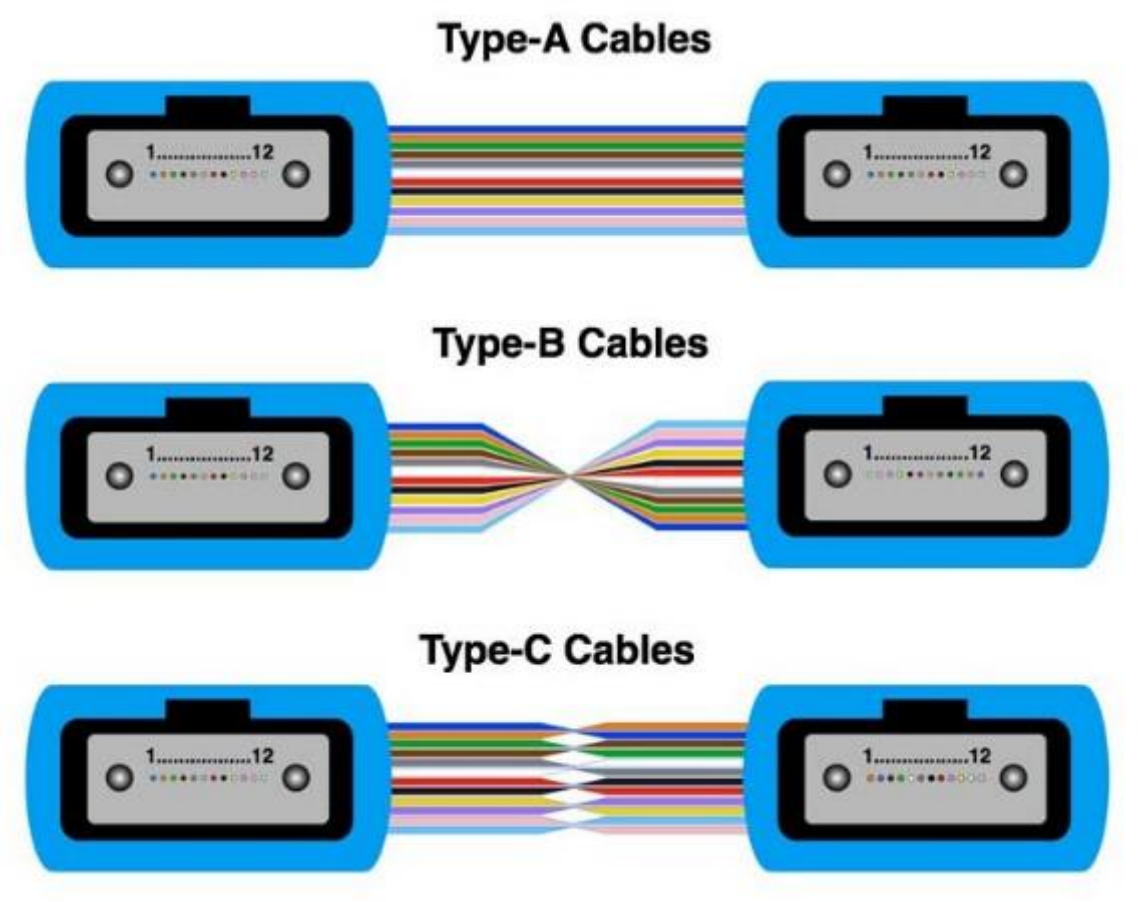


High mag view (400X):
Highest Magnification on the market
Auto-center + Auto Focus

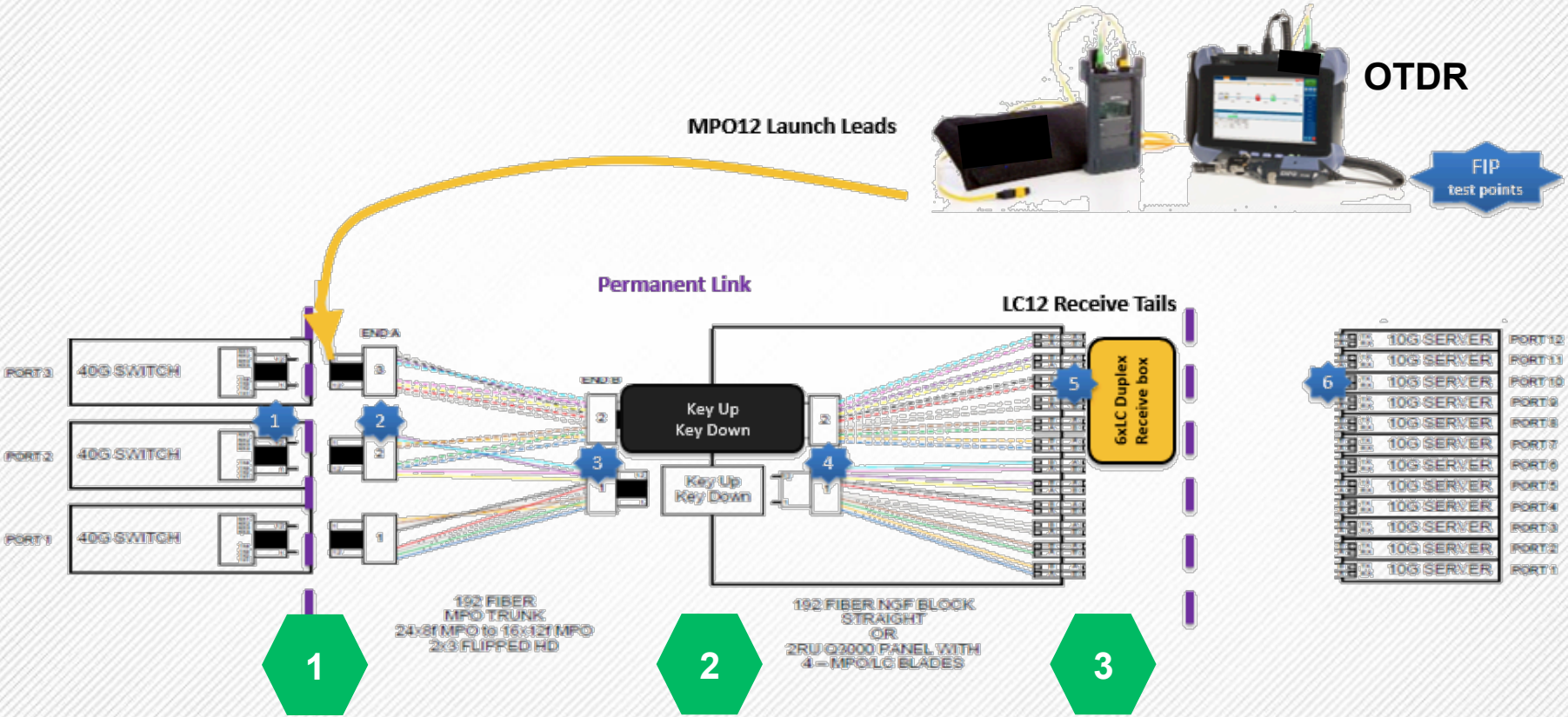


Low mag view PIP (100X):
Allows to see which fiber is being inspected in High magnification

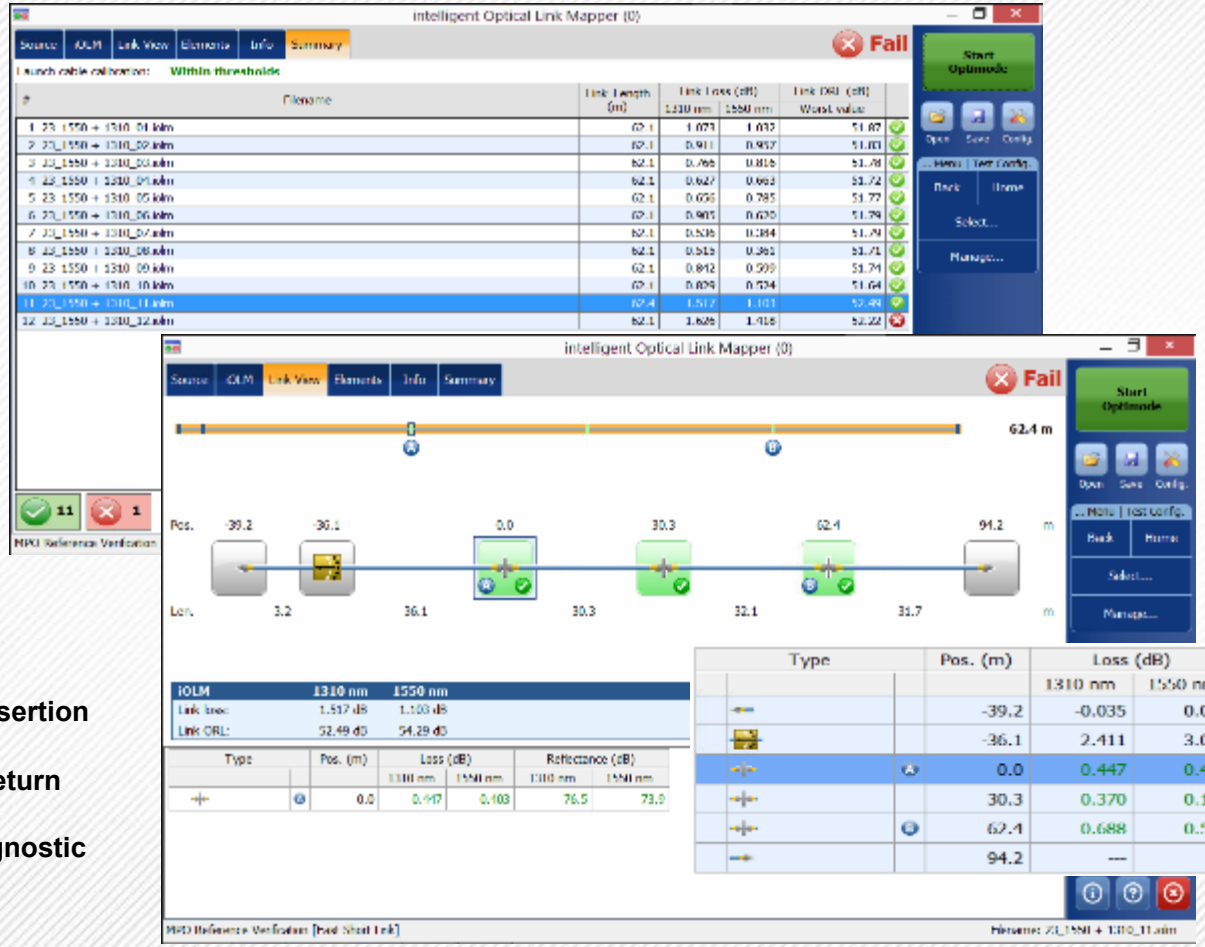
MTP/MPO cable configurations (polarity, types)



100G+ migration (base 8) MTP/ MPO parallel



iOLM – MTP switch kit: software interface



OTDR

1. Link Length
2. Total link loss
3. Link ORL
4. Connection Insertion Loss
5. Connection Return Loss
6. Pass/ Fail diagnostic

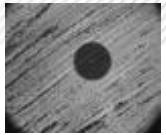
Any back reflection issues at the patch panel?

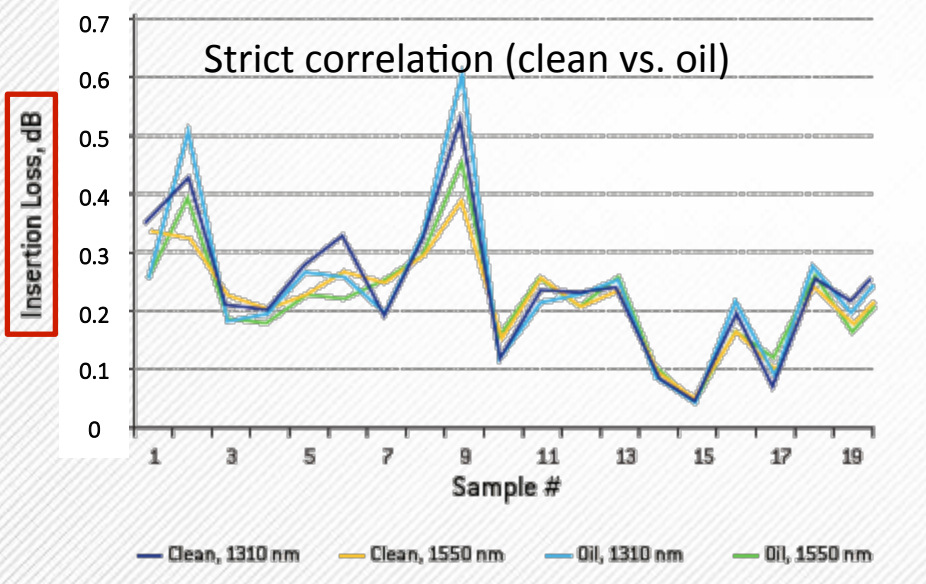
Reflectance	ISO/IEC 11801 (2010)	TIA-568.3-D (2013)	ISO-IEC 14763-3 (2014)*
MMF	20 dB	20 dB	35 dB
SMF	35 dB UPC	35dB UPC 55 dB analog video	45 dB UPC 60 dB APC

* Reference test cords; should have the same or better performance specification as the hardware terminating the cabling under test;

Coherent-based: -30dB = EDFA APR mode issue
Direct modulation: -40 to -45dB CRC issues

Finger oil



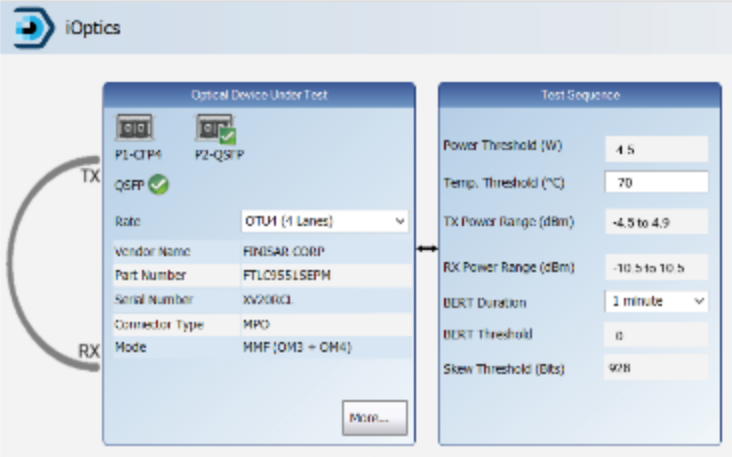


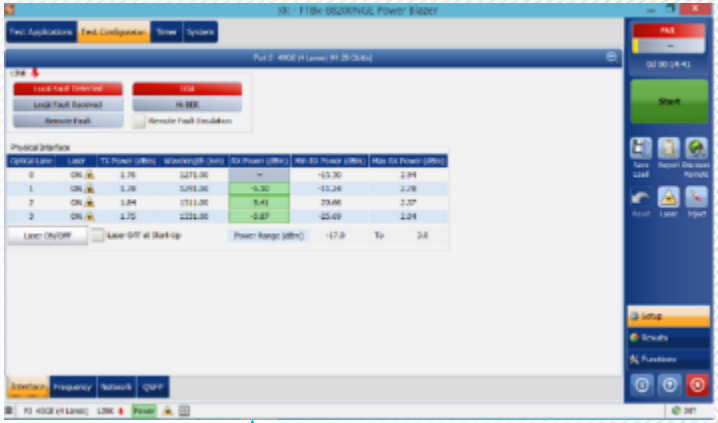
What about back reflection?

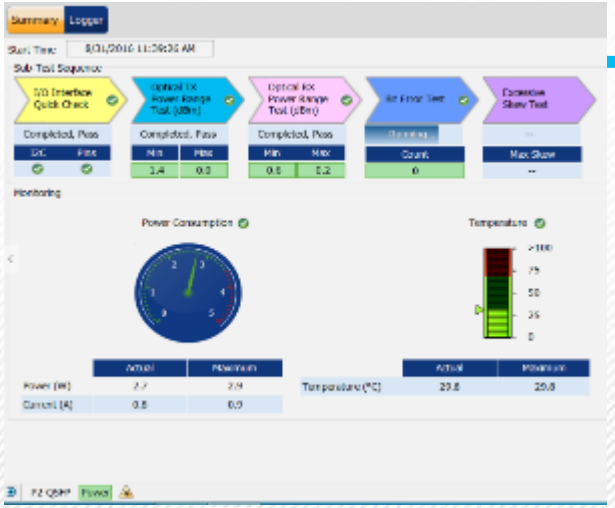
Source: EXFO Application Note 327 – Touching on Failure: Sources of Singlemode Fiber Issues in the Data Center, *December 2015*

Do you face pluggables quality issues?

Quick quality check for next-gen High Speed pluggables with quick **pass**/ **fail** verdict

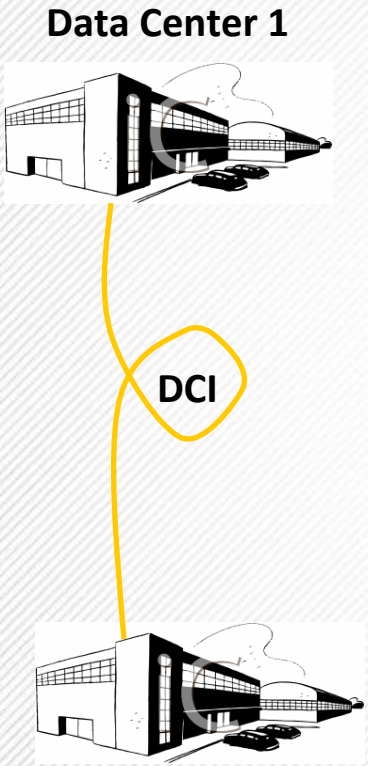


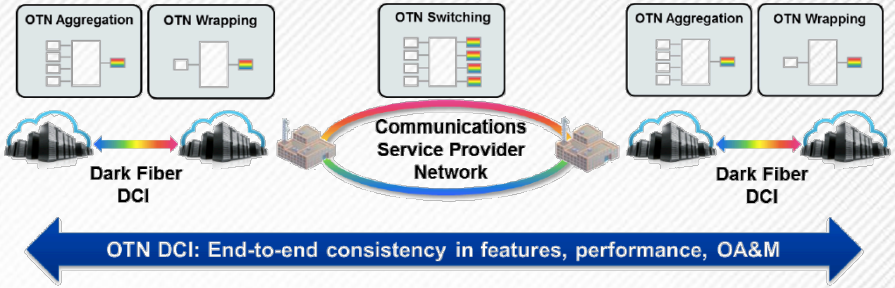


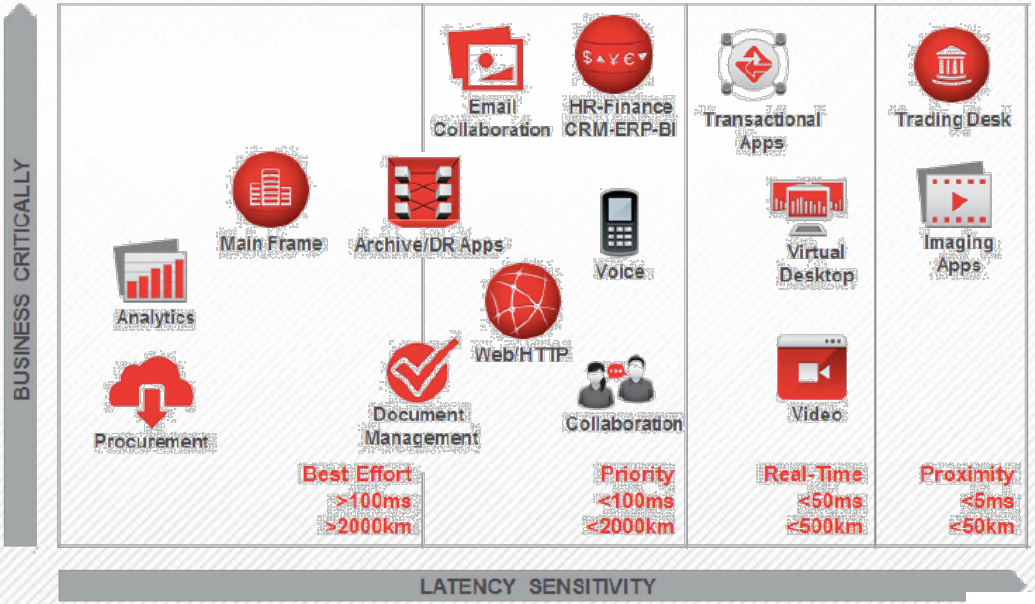


Supports all popular high-speed pluggables

Network Latency is not always created equal…





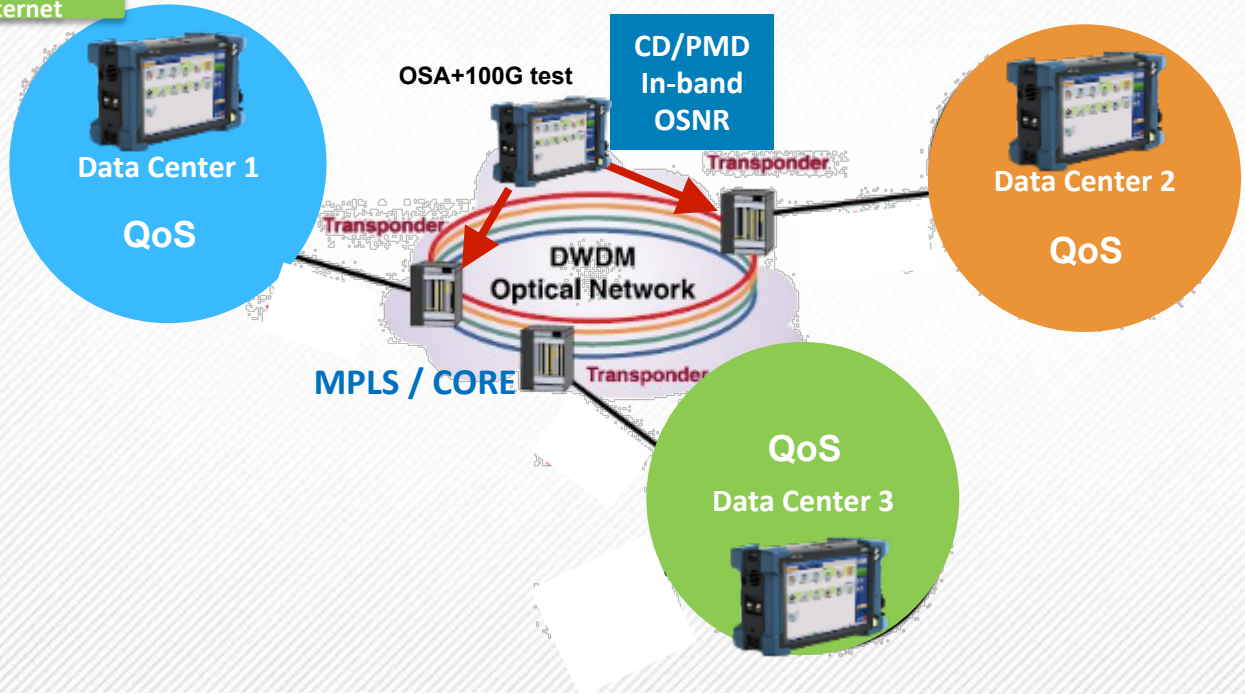


What DCI testing considerations make sense?

Key Performance Indicator (KPIs), per Class of Services (CoS)

Network latency / Packet loss / Bandwidth / QoS / BER estimation

- VoIP
- IPTV Video / OTT
- Premium IP / VPN Service
- High Speed Internet

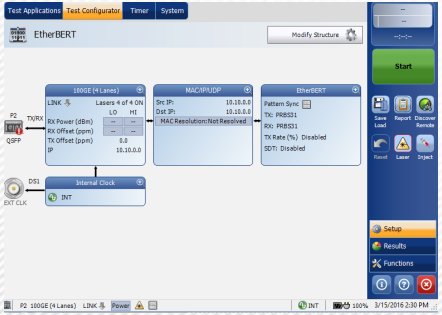


DCI- Bit Error Rate (BER) evaluation

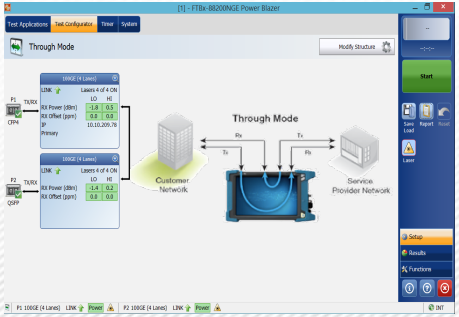
- Ethernet Layer 2: traffic validation
- During the construction phase, it is essential to test the traffic shaping using different profiles
- Validate the traffic protection with service disruption measurement

- Establish:
  - Testing period
  - Threshold values

Simplified BER test setup view

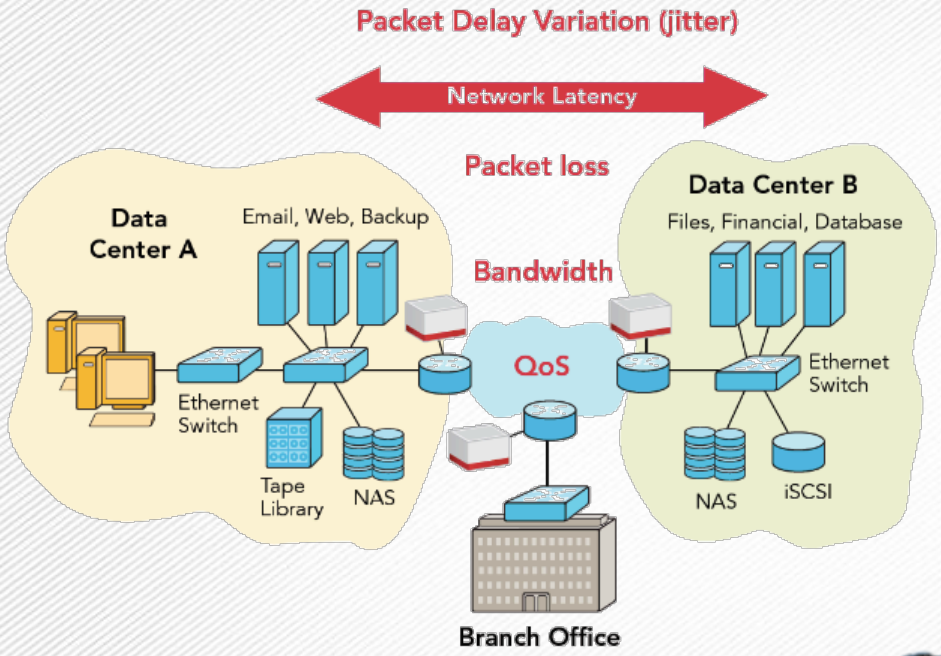


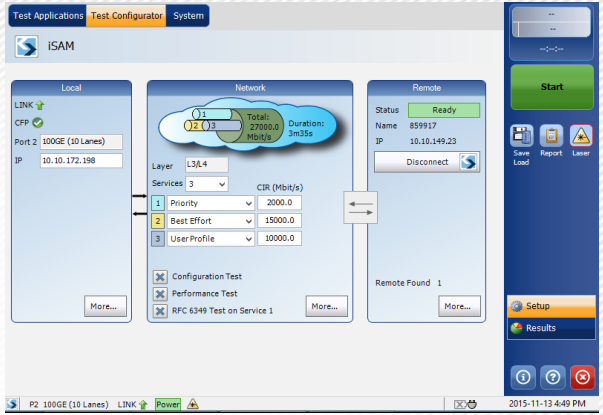
100G Through mode testing



Summary and detailed views of alarms and errors

DCI- Service Performance Evaluation

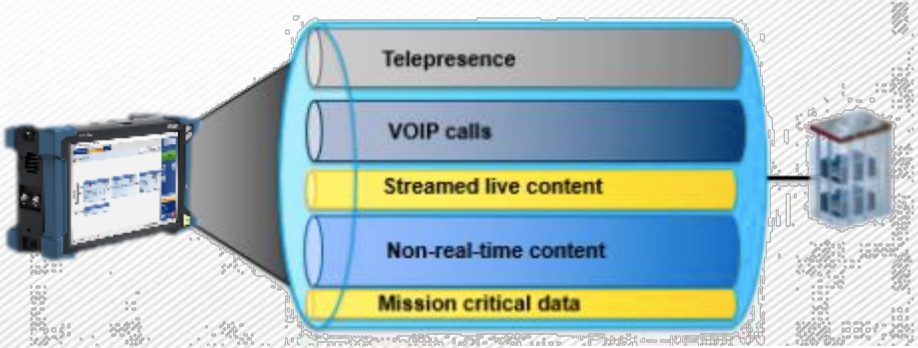




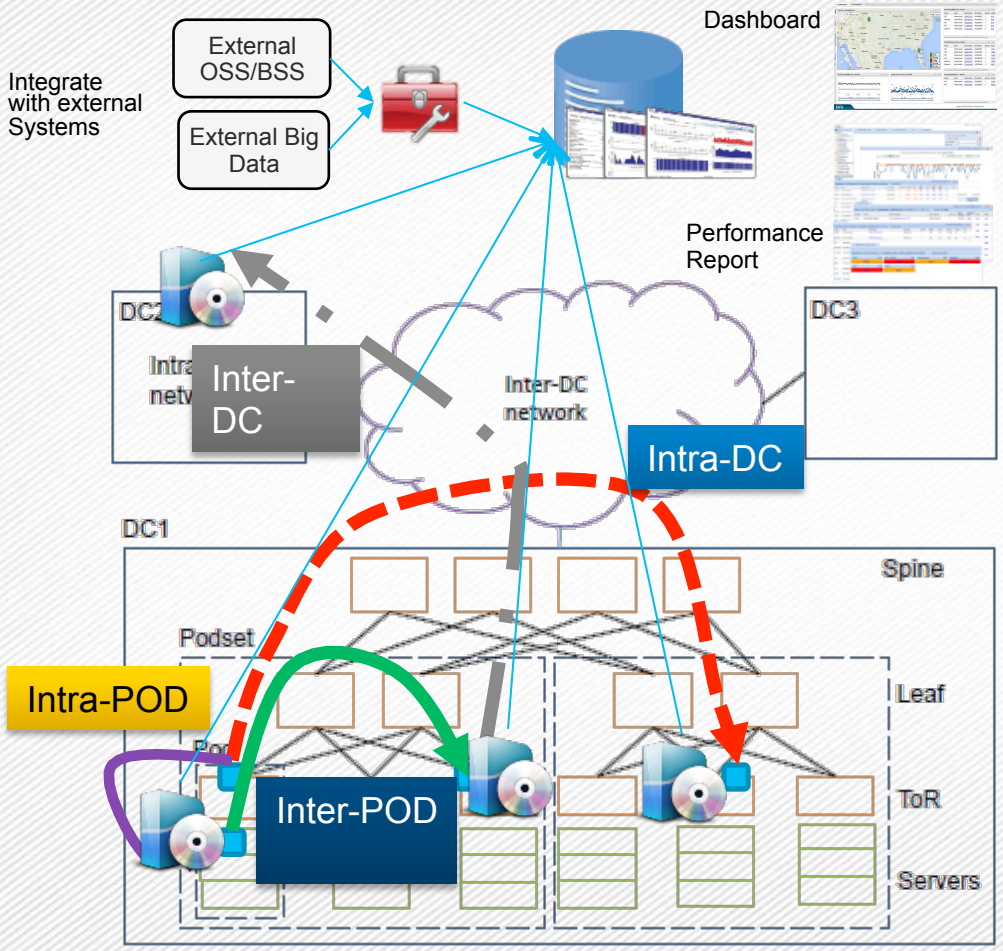
✓ ***Option:*** **Test against latest cutting-edge MEF standards and thresholds, and configurable performance criteria (stringent requirements)**

✓ ***Best practice:*** **Test from 10M to 100G**

Multi-Service SAM (Y.1564) test
TCP Throughput Test (RFC 6349)
Packet synchronization (SyncE and 1588 PTP)



Data Center – Intra + DCI assurance



Data Center Deployment:

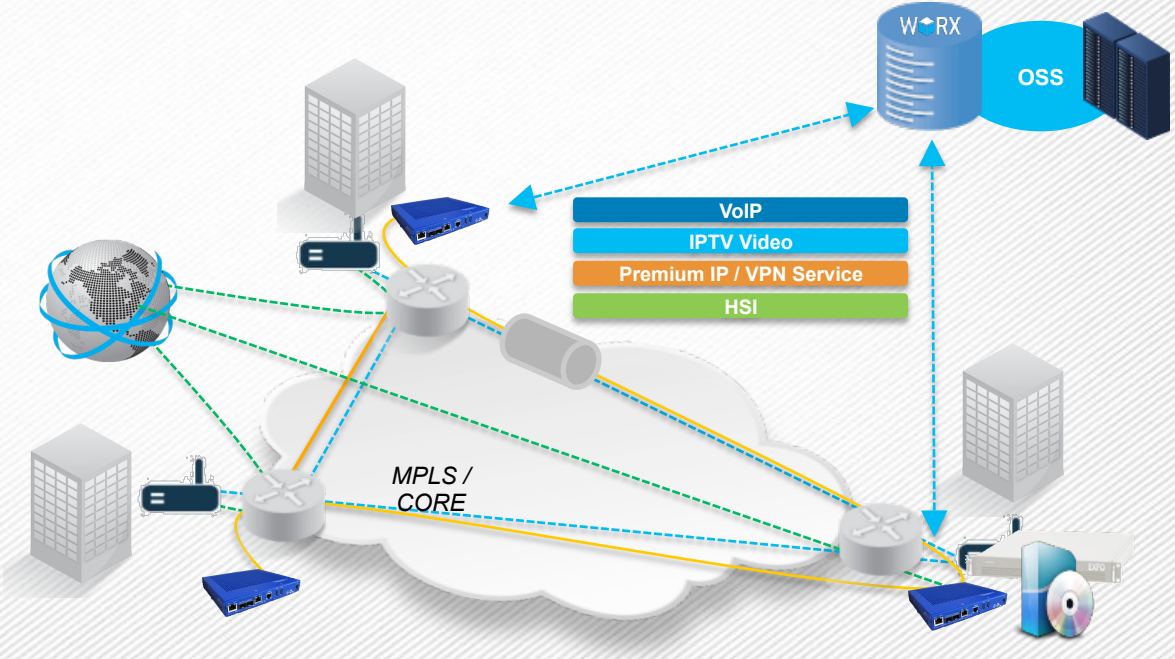
- Measure mesh performance across all probes using L2 or L3 techniques
- Complete transport layer performance analysis with unidirectional and round trip results
- Using protocols with low utilization to avoid impacting services (OAM or TWAMP)

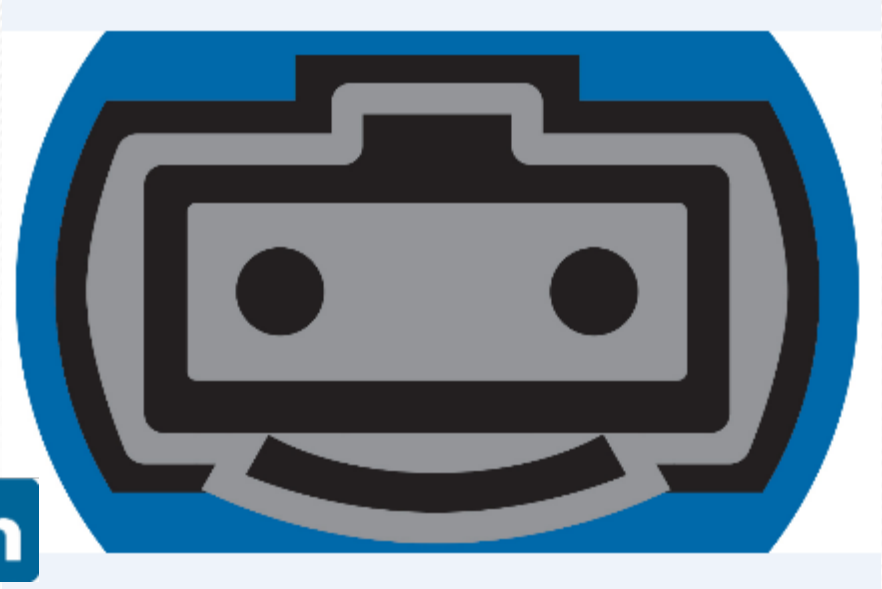
E2E IP Transport – DCI assurance

Monitor performance between data centers

- Continuous core SLA and availability across multiple CoS simultaneously
- Combination of L3 Standards based approach
- Emulate Voice/Video/Web transaction and capture QoE performance
- Integration with OSS through Toolkit API

Monitor Service / Network and Customer QoE Real-Time with Reporting and Dashboard





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