Intra-DC & DCI considerations for 100G+ migration

Nicholas Gagnon, BDM Data Center
NANOG 68 Dallas - October 18th, 2016
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?
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
Data center design rule trend (Leaf-Spine)

Typical fiber distances

- **MDA**: 40G-100G SMF
  - Up to 3,300 ft. (1,000 m)

- **HDA**: up to 500-650 ft. (150-200 m)

- **EDA**: up to 20 ft. (6 m)
  - CAT-6A/7/8 Twinax copper

---

**Spine**

- **Core Switch**
- **Patch panel**

**Leaf**

- **Aggregation Switch**
- **Patch panel**

**ToR**

- **Access Switch**
- **Patch panel**

**Racks**

- **Servers**
- **Patch panel**

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

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

**Server connections (typically copper)**
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.
What DC operation testing makes sense?

- **Leaf**
  - Server EDA Patch Cord
  - Cross Connect Jumper
  - MDA
  - EDA Patch
  - Switch EDA Patch Cord
  - Edge SAN Switch
  - Core SAN Switch
  - FIP

- **Spine**
  - Server EDA Patch
  - HDA
  - Switch EDA Patch Cords

- **OLTS**
  - Move Add & Changes (MAC) of transceiver (OLTS)
iOLM-OTDR positions fault along the fiber. Measures back reflection at the patch panel.
MTP/MPO - Guiding pins, guiding holes

- MPO Unpinned (Female)
- MPO Guiding pins
- MPO Guiding holes
- Adapter
- MPO Pinned (Male)
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)
MTP12 – MTP24 (MM/SM)

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

High mag view (400X):
Highest Magnification on the market
Auto-center + Auto Focus
MTP/MPO cable configurations (polarity, types)
100G+ migration (base 8) MTP/ MPO parallel
1. Link Length
2. Total link loss
3. Link ORL
4. Connection Insertion Loss
5. Connection Return Loss
6. Pass/Fail diagnostic

OTDR
Any back reflection issues at the patch panel?

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.
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

Data Center 1
QoS

Data Center 2
QoS

Data Center 3
QoS

OSA+100G test
CD/PMD In-band OSNR

DWDM Optical Network
MPLS / CORE
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
DCI- Service Performance Evaluation

Packet Delay Variation (jitter)

Network Latency

Packet loss

Data Center A
- Email, Web, Backup
- Ethernet Switch
- Tape Library
- NAS

Bandwidth

Data Center B
- Files, Financial, Database
- Ethernet Switch
- NAS
- iSCSI

Branch Office

QoS

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

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

- Best practice: Test from 10M to 100G
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
DATA CENTER FIBER

It’s a vendor agnostic forum

linkedin.com/grp/home?gid=8424957