# Table of Contents

- Quick Reference Guides
- PowerEdge MX7000 Overview
- MX Network I/O Modules
- MX Scalable Fabric Architecture
- Example Topologies
- Cable & Optic Information
- Corning Edge8 Structured Cabling
- Additional Resources
Quick Reference
# PowerEdge MX Ethernet I/O Modules

<table>
<thead>
<tr>
<th>Feature</th>
<th>MX9116n</th>
<th>MX5108n</th>
<th>MX7116n</th>
<th>25Gb Pass-Through</th>
<th>10GBT Pass-Through</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Fabric Switching Engine</strong>&lt;br&gt;High-performance, scalable L2/L3 25GbE fabric switch with multi-chassis fabric scaling capabilities</td>
<td>Basic Ethernet Switch&lt;br&gt;Entry level, high-performance 25G Ethernet blade switch for single chassis configurations</td>
<td>Fabric Expander Module&lt;br&gt;Low latency 25GbE fabric expander that helps scale fabric bandwidth across multiple chassis</td>
<td>Direct connection&lt;br&gt;Transparency connect 8 MX compute sleds to the LAN of your choice at 25G or 10Gb speeds.</td>
<td>Direct connection&lt;br&gt;Transparency connect 8 MX compute sleds to the LAN of your choice using 10G-BaseT</td>
<td></td>
</tr>
<tr>
<td><strong>Performance</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Uplink Speeds</td>
<td>10/25/40/50/100GbE</td>
<td>10/25/40/50/100GbE</td>
<td>25GbE</td>
<td>10/25GbE</td>
<td>10G-BaseT</td>
</tr>
<tr>
<td>Switch fabric capacity</td>
<td>6.4Tbps</td>
<td>960Gbps</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Forwarding capacity (Mpps)</td>
<td>2380Mpps</td>
<td>363Mpps</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Latency (Microseconds)</td>
<td>&lt;450ns</td>
<td>&lt;800ns</td>
<td>&lt;75ns</td>
<td>&lt;100ns</td>
<td>&lt;100ns</td>
</tr>
<tr>
<td><strong>Ports</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Internal server ports (Speed)</td>
<td>16 (25GbE)</td>
<td>8 (25GbE)</td>
<td>16 (10/25GbE)</td>
<td>16 (10/25GbE)</td>
<td>16 (10GbE)</td>
</tr>
<tr>
<td>External QSFP28-DD Ports</td>
<td>12</td>
<td>0</td>
<td>2</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>External QSFP28 Ports</td>
<td>4</td>
<td>0</td>
<td>2</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>External QSFP+ Ports</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>External SFP28 Ports</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>External 10G-BaseT Ports</td>
<td>0</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td><strong>Features</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Native Fibre Channel support</td>
<td>Yes</td>
<td>No</td>
<td>Yes (via MX9116n)</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>FCoE/FC</td>
<td>FCoE transit, 8/16/32G Native FC</td>
<td>FCoE Transit</td>
<td>Yes (via MX9116n)</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>FC Fabric services</td>
<td>Zoning, F_Port, NPIV</td>
<td>No</td>
<td>Yes (via MX9116n)</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Converged iSCSI (LAN and SAN)</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes (via MX9116n)</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Max VLANS (L2/L3)</td>
<td>4K/500</td>
<td>4K/500</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Link Aggregation (Groups/Members)</td>
<td>128/16</td>
<td>128/16</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Jumbo frames (Bytes)</td>
<td>9216</td>
<td>9216</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Max Routes (IPv4/IPv6)</td>
<td>16K/8K</td>
<td>16K/8K</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>MAC Table</td>
<td>136K</td>
<td>272K</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>PVST Total Instances</td>
<td>128</td>
<td>128</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Fresh Air Compliant</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
</tbody>
</table>
# PowerEdge MX Fibre Channel I/O Module

**MXG610s**

32Gb FC Switch

- **Performance**
  - **Speeds**: 32Gbps (multi-speed 8, 16, or 32Gbps)
  - **Switch capacity (Gbps)**: 1024 Gbps (32 * 32 Gbps) in Full Fabric Switch mode
  - **Credit Buffers**: 2K, providing >50 credits/port average
  - **Latency (Microseconds)**: < 0.9 µs
  - **Maximum frame size**: 2112-byte payload

- **Ports**
  - **Total ports**: 16 internal ports (16, or 32Gbps), 8 external SFP+ ports (8, 16, or 32Gbps), 2 external QSFP ports - 4 ports each (16, or 32Gbps)
  - **Port model options**:
    - 8 ports w/2 SFP+ transceivers
    - 16 ports w/4 SFP+ transceivers
    - 16 ports w/4 SFP+ transceivers, Enterprise Software License
    - Port count can be increased with on-demand license
  - **Port types**: D_Port (Diagnostic Port), E_Port, F_Port, M_Port (Mirror Port); optional port type control in Brocade Access Gateway mode: NPIV-enabled N_Port

- **Features**
  - **Security**: DH-CHAP (between switches and end devices), FCAP switch authentication; HTTPS, IPsec, IP filtering, LDAP with IPv6, OpenLDAP, Port Binding, RADIUS, TACACS+, User-defined Role-Based Access Control (RBAC), Secure Copy (SCP), Secure Syslog, SFTP, SSH v2, SSL, Switch Binding, Trusted Switch
  - **Management**: HTTP, SNMP v1/v2/v3 (FE MIB, FC Management MIB), SSH; Auditing, Syslog; Brocade Advanced Web Tools; Command Line Interface (CLI); SMI-S compliant; Administrative Domains; trial licenses for add-on capabilities; Integrated management through Dell EMC OpenManage Enterprise-Modular
  - **Enterprise Bundle**: ISL Trunking, Fabric Vision, and Extended Fabric
  - **Classes of service**: Class 2, Class 3, and Class F (inter-switch frames)
  - **Brocade optical transceivers**: 16 and 32Gbps: SWL, LWL SFP+
  - 16 and 32Gbps: SWL, QSFP+ (supports 4x1 Breakout)
## PowerEdge MX Ethernet Mezzanine Cards

<table>
<thead>
<tr>
<th>Vendor</th>
<th>QL41262</th>
<th>QL41232</th>
<th>XXV710</th>
<th>ConnectX-4 LX</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max Speed</td>
<td>25GbE</td>
<td>25GbE</td>
<td>25GbE</td>
<td>25GbE</td>
</tr>
<tr>
<td>Ports</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>NIC Type</td>
<td>CNA</td>
<td>NIC</td>
<td>NIC</td>
<td>NIC</td>
</tr>
<tr>
<td>Dell PN</td>
<td>51G0W</td>
<td>HJ3FX</td>
<td>H9NTY</td>
<td>WCHFY</td>
</tr>
<tr>
<td>SKU</td>
<td>543-BBDI</td>
<td>543-BBDJ</td>
<td>543-BBDH</td>
<td>543-BBDK</td>
</tr>
</tbody>
</table>

### General
- NPAR (# Partitions): Yes (8/port) / Yes (8/port) / No / No
- Secure Firmware Updates: Yes / Yes / Yes / Yes
- PTP: IEEE 1588: Yes / Yes / Yes / Yes
- DPDK: Yes / Yes / Yes / Yes

### Network Boot
- UEFI iSCSI Offload Boot: Yes / No / No / Yes (boot, no offload)
- UEFI FCoE Boot: Yes / No / No / No
- Legacy iSCSI iBFT Boot: No / No / Yes / Yes

### RDMA
- RDMA: RoCE v1: Yes / Yes / No / Yes
- RoCE v2: Yes / Yes / No / Yes
- iWarp: Yes / Yes / No / No

### Offloads
- iSCSI HW Offload: Yes / No / No / No
- FCoE HW Offload: Yes (1 FCoE partition/port) / No / No / No
- Large Receive Offload (LRO): Yes / Yes / No / Yes
- Giant Send Offload (GSO): Yes / Yes / Yes / Yes
- TCP Segmentation Offload (TSO): Yes / Yes / No / Yes
- Transmit-Side Scaling (TSS): Yes / Yes / No / Yes

### Network Virtualization Overlay
- GENEVE: Yes / Yes / Yes / Yes
- VXLAN-GPE: No / No / Yes / Yes
- MPLS: Yes / Yes / Yes / Yes

---

All NICs support the following:
- iDRAC Connection View
- Wake On LAN
- SR-IOV
- UEFI iSCSI iBFT Boot
- UEFI PXE Boot
- Legacy PXE Boot
- NVGRE
- VXLAN
- IP, TCP, UDP checksum offloads
- Large Send Offload (LSO)
- Receive-Side Scaling (RSS)
## PowerEdge MX Fibre Channel Mezzanine Cards

<table>
<thead>
<tr>
<th></th>
<th>LPm31002-D</th>
<th>LPm32002-D</th>
<th>QME2692</th>
<th>QME2742</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vendor</td>
<td>Broadcom (Emulex)</td>
<td>Broadcom (Emulex)</td>
<td>Marvell (QLogic)</td>
<td>Marvell (QLogic)</td>
</tr>
<tr>
<td>Max Speed</td>
<td>16GFC</td>
<td>32GFC</td>
<td>16GFC</td>
<td>32GFC</td>
</tr>
<tr>
<td>Ports</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>NIC Type</td>
<td>HBA</td>
<td>HBA</td>
<td>HBA</td>
<td>HBA</td>
</tr>
<tr>
<td>Dell PN</td>
<td>17N63</td>
<td>31KFT</td>
<td>G620Y</td>
<td>PD8ND</td>
</tr>
<tr>
<td>SKU</td>
<td>544-BBCM</td>
<td>544-BBCN</td>
<td>544-BBCO</td>
<td>544-BBCP</td>
</tr>
<tr>
<td>General</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Configuration through F10 and F2 consoles</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Out-of-band Firmware Updates</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Inventory and Configuration through iDRAC</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Secure Firmware Updates</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
</tr>
</tbody>
</table>
MX7000 Overview
PowerEdge MX7000 chassis

Modular foundation to scale across multiple racks to suit a range of demanding use cases

Hosts flexible blocks of server and storage resources while providing outstanding efficiencies through shared power, cooling, networking, I/O and management within the chassis itself

Key Capabilities

- 7U modular enclosure has 8 front-accessible, single-width bays that accommodates variety of compute and storage sleds
- Support for 3 I/O fabrics, each with redundant modules
- QuickSync2 (wireless), Touchscreen LCD and traditional crash cart at-the-box management options

HIGHLIGHTS

- Support for at least three server processor microarchitecture generations and ready for 400Gb Ethernet and beyond
- Non-disruptive upgrades; unique no mid-plane design makes for easier future technology upgrades
PowerEdge MX7000 chassis (front view)

7U chassis designed to support at least three future generations of server technologies

A
Compute Sleds
• No compromise design with up to eight 2-socket or four 4-socket options
• Up to eight drives plus M.2 boot option for greater storage options than ever before in large chassis

B
Storage Sleds
• Flexible, granular drive-level assignment; drives can be mapped to a server or shared
• Up to 16 SAS HDDs/SSDs
• 12 Gb/s direct attached SAS

C
Power and Cooling
• High efficiency 3 KW power supplies
• Grid and N+N redundancy
• Evenly distribute chassis-wide cooling
PowerEdge MX7000 chassis (rear view)

Scalable Networking
- Two redundant general purpose fabrics
- MX Scalable Fabric Architecture for multi-chassis networking
- Future forward design

Storage Networking
- Redundant, highly available
- 32G Fibre Channel or 12G SAS storage fabric
# PowerEdge MX7000 generational comparison

<table>
<thead>
<tr>
<th>Feature</th>
<th>MX7000</th>
<th>M1000e</th>
</tr>
</thead>
<tbody>
<tr>
<td>RTS</td>
<td>September 2018</td>
<td>Shipping since PowerEdge 10G (~ CY2008)</td>
</tr>
<tr>
<td>Rack Height</td>
<td>7U</td>
<td>10U</td>
</tr>
<tr>
<td>Sled Orientation</td>
<td>Vertical</td>
<td>Vertical</td>
</tr>
<tr>
<td>Sled Support</td>
<td>MX740c 2S standard-height, single-wide</td>
<td>M600/M605/M805/M905</td>
</tr>
<tr>
<td></td>
<td>MX840c 4S standard-height, double-wide</td>
<td>M610/M610X/M710/M710HD/M910/M915</td>
</tr>
<tr>
<td></td>
<td>MX5016s SAS storage sled (16 drives)</td>
<td>M420/M520/M620/M820</td>
</tr>
<tr>
<td></td>
<td></td>
<td>M630/M830</td>
</tr>
<tr>
<td></td>
<td></td>
<td>M640</td>
</tr>
<tr>
<td>No. of Blades</td>
<td>Up to 8 standard height (2S or storage sleds)</td>
<td>Up to 32 quarter-height (M420)</td>
</tr>
<tr>
<td></td>
<td>Up to 4 double-wide (4S)</td>
<td>Up to 16 half-height</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Up to 8 full-height</td>
</tr>
<tr>
<td>I/O Module Bays</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>Fabric Types Supported</td>
<td>2 general purpose (Ethernet, future technologies)</td>
<td>3 general purpose (Ethernet, Fibre Channel, InfiniBand)</td>
</tr>
<tr>
<td></td>
<td>1 storage specific (Fibre Channel, SAS)</td>
<td></td>
</tr>
<tr>
<td>Power Supplies</td>
<td>Up to 6 3000W PSUs</td>
<td>Up to 6 2360W, 2700W, or 3000W PSUs</td>
</tr>
<tr>
<td>System Management</td>
<td>OpenManage Enterprise - Modular (Redfish API)</td>
<td>CMC (CLI-RACADM)</td>
</tr>
<tr>
<td>Quick Sync</td>
<td>Supported</td>
<td>Not supported</td>
</tr>
<tr>
<td>KVM</td>
<td>Integrated with Management Module</td>
<td>Discrete design</td>
</tr>
</tbody>
</table>
Network I/O Modules
PowerEdge MX9116n Fabric Switching Engine

**High-performance, scalable 25G fabric switch**
A comprehensive high-end L2/L3 switch with multi-chassis fabric scaling capabilities

**Key Capabilities**
- 16 x 25GbE server-facing ports, 2 x 100GbE Uplink ports, 2 x 100GbE/8 x 32G FC uplink ports, and 12 x Fabric Expansion/Uplink ports
- Each Fabric Expansion port can operate as 2 x 100GbE, 2 x 40GbE, 8 x 25GbE, 8 x 10GbE
- Supported in Fabrics A & B
- Supports all PowerEdge MX Ethernet Cards
- Supports Open Networking, Full Switch and SmartFabric operating modes
- < 450ns latency, 6.4 Tbps switching fabric
- NVMe over Fabric Ready

**HIGHLIGHTS**
- Optimum performance fabric switch providing high scalability at a low TCO
- Highly efficient embedded ToR functionality that reduces cost and improves performance & latency
- Industry’s first Open Networking fabric switch with ONIE and a choice of OS10 Enterprise Edition or select 3rd party OS
Each QSFP28-DD & QSFP28 socket is logically addressed as a port group.

A port group is a logical descriptor given to one or more physical ports that supports one or more logical configurations.

For example, port group 12 represents physical ports 39 and 40.

Each QSFP28-DD socket is comprised of two separately addressed physical ports.
PowerEdge MX9116n Fabric Switching Engine
Typical Cable & Optic Options

QSFP28-DD ports are backwards compatible and support QSFP28 and QSFP+ Optics and cables
QSFP28 ports are backwards compatible and support QSFP+ Optics and cables

NOTE: Not every option is presented on this page. Please contact your account team for additional options
Connecting to Non-Dell EMC 10GbE or 25GbE uplink ports
For example: Cisco, Arista, Juniper

The same optics & cables work on the QSFP+/QSFP28 ports on the MX5108n

Non-Dell EMC Switch

Non-Dell EMC 25G Optic

CBL-MPO12-4LC-OM4-xM

Non-Dell EMC Switch

Non-Dell EMC 25G Optic

CBL-MPO12-4LC-OM4-xM

25 GbE Uplink

10 GbE Uplink

QSFP-40G-SR4

QSFP28-100G-SR4
Connecting MX9116n to Fibre Channel Switch

- 8/16/32G FC Optic (Vendor Specific)
- CBL-MPO12-4LC-OM4-xM
- QSFP-64GFC-SW4 (8/16G)
  Or
- Q28-128GFC-SW4 (16/32G)
PowerEdge MX5108n Ethernet switch

Entry level, high performance, 25G Ethernet switch
Economical solution for single chassis configurations

Key Capabilities

- 8 x 25GbE server-facing ports, 2 x 100GbE uplink ports, 1 x 40GbE port and 4 x 10GBase-T ports
- Supported in Fabrics A & B
- Supports all PowerEdge MX Ethernet Cards
- Supports Open Networking, Full Switch and SmartFabric operating modes
- < 800ns latency, 960Gbps switching fabric
- NVMe over Fabric Ready

HIGHLIGHTS

- High-performance, low-latency Ethernet switch for single chassis deployments
- Option of Dell EMC Networking Linux-based OS10 Enterprise Edition OS
- Industry’s first Open Networking blade switch with ONIE and a choice of select 3rd party OS
PowerEdge MX5108n Ethernet switch
Typical Cable & Optic Options

NOTE: Not every option is presented on this page. Contact your account team for additional options
PowerEdge MX7116n Fabric Expander Module

Low latency 25G fabric expander
Scales fabric bandwidth across multiple chassis

Key Capabilities

• 16 x 25GbE server-facing ports, 2x Fabric Expansion ports back to FSE
• Supported in Fabrics A & B
• Supports all PowerEdge MX Ethernet Cards
• No switching ASIC and no OS
• Sub ~75ns latency
• All switching done at FSE
• No port to port oversubscription
• Also serves as a Pass-Through module to select Dell EMC Networking Ethernet switches (25GbE only)*

HIGHLIGHTS

• Low latency fabric expander module for efficiently scaling fabric bandwidth across a multi-chassis environment
• One cable supports 8 x 25GbE connections back to the FSE
• Nothing to manage, no firmware to update

*Requires OpenManage Enterprise – Modular v1.10.00
PowerEdge MX7116n Fabric Expander Module
Cable & Optic Options

To 2x QSFP28
- DAC-Q28DD-2Q28-100G-xM
  OR
- AOC-Q28DD-2Q28-100G-xM
  OR
- Q28DD-200G-2SR4 (Optic)
  AND
- CBL-MPO12DD-2MPO12-OM4-xM

To 8x SFP28
- DAC-Q28DD-8S28-25G-xM
  OR
- AOC-Q28DD-8S28-25G-xM
  OR
- Q28DD-200G-2SR4 (Optic)
  AND
- Corning Edge8 Cabling

Breakout 8x25GbE

NOTE: Breakout is only supported at 25GbE to Dell EMC Switches only.

To MX9116n

- DAC-Q28DD-200G-xM
  OR
- AOC-Q28DD-200G-xM
  OR
- Q28DD-200G-2SR4 (Optic)
  AND
- CBL-MPO12DD-OM4-xM

Breakout 8x25GbE

Future Use

DAC-Q28DD-8S28-100G-xM
OR
AOC-Q28DD-8S28-100G-xM
OR
Q28DD-200G-2SR4 (Optic)
AND
CBL-MPO12DD-OM4-xM
Popular Ethernet SKUs

Ethernet I/O Modules

<table>
<thead>
<tr>
<th>Factory SKU</th>
<th>After Sale SKU</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>210-AODD</td>
<td>210-AODC</td>
<td>Dell EMC MX9116n 25GbE Fabric Switching Engine, 12x QSFP28-DD, 2x QSFP28 100GbE, 2 x QSFP28 100GbE/32GFC</td>
</tr>
<tr>
<td>210-ANZJ</td>
<td>210-ANZI</td>
<td>Dell EMC MX5108n 25GbE Ethernet Switch, 4x10G-BaseT, 1x40GbE QSFP+, 2x100GbE QSFP28</td>
</tr>
<tr>
<td>210-ANUK</td>
<td>210-ANUJ</td>
<td>Dell EMC MX7116n 25GbE Fabric Expander Module</td>
</tr>
</tbody>
</table>

Fibre Channel Optics for MX9116n*

<table>
<thead>
<tr>
<th>Factory SKU</th>
<th>After Sale SKU</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>407-BBZF</td>
<td>407-BBZH</td>
<td>Dell Networking Transceiver, 16G QSFP+ SWL Fibre Channel QSFP (4x16GFC, Supports 8/16 GFC)</td>
</tr>
<tr>
<td>407-BBZE</td>
<td>407-BBZG</td>
<td>Dell Networking Transceiver, 32G QSFP28 SWL Fibre Channel QSFP (4x32GFC Supports 8/16/32 GFC)</td>
</tr>
</tbody>
</table>

*NOTE: These optics are NOT supported in the MXG610s FC switch

4x Breakout Cables for Ethernet & FC QSFP to 4x LC connectors

<table>
<thead>
<tr>
<th>Factory SKU</th>
<th>After Sale SKU</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>470-ABOF</td>
<td>470-ABPH</td>
<td>Dell Networking Cable, MPO to 4xLC, Fiber Breakout Cable, MMF, OM4, Optics Required, 1M</td>
</tr>
<tr>
<td>470-ABOG</td>
<td>470-ABPE</td>
<td>Dell Networking Cable, MPO to 4xLC, Fiber Breakout Cable, MMF, OM4, Optics Required, 3M</td>
</tr>
<tr>
<td>470-ABOH</td>
<td>470-ABPG</td>
<td>Dell Networking Cable, MPO to 4xLC, Fiber Breakout Cable, MMF, OM4, Optics Required, 5M</td>
</tr>
<tr>
<td>470-ABOI</td>
<td>470-ABPK</td>
<td>Dell Networking Cable, MPO to 4xLC, Fiber Breakout Cable, MMF, OM4, Optics Required, 7M</td>
</tr>
</tbody>
</table>
# QSFP28-DD Cables for FSE/FEM and FSE/FSE VLT Connections

## DAC & AOC Cables

<table>
<thead>
<tr>
<th>Factory SKU</th>
<th>After Sale SKU</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>470-ACTP</td>
<td>470-ACUI</td>
<td>Dell Networking 2x100GbE QSFP28-DD Passive Direct Attach Cable, No FEC, 0.5 Meter</td>
</tr>
<tr>
<td>470-ACTR</td>
<td>470-ACUL</td>
<td>Dell Networking 2x100GbE QSFP28-DD Passive Direct Attach Cable, No FEC, 1 Meter</td>
</tr>
<tr>
<td>470-ACTS</td>
<td>470-ACUN</td>
<td>Dell Networking 2x100GbE QSFP28-DD Passive Direct Attach Cable, No FEC, 2 Meter</td>
</tr>
<tr>
<td>470-ACYY</td>
<td>470-ACYV</td>
<td>Dell Networking 2x100GbE QSFP28-DD Passive Direct Attach Cable, No FEC, 3 Meter</td>
</tr>
<tr>
<td>470-ACTI</td>
<td>470-ACUB</td>
<td>Dell Networking 2x100GbE QSFP28-DD Active Optical Cable, No FEC, 5 Meter</td>
</tr>
<tr>
<td>470-ACTF</td>
<td>470-ACTX</td>
<td>Dell Networking 2x100GbE QSFP28-DD Active Optical Cable, No FEC, 10 Meter</td>
</tr>
<tr>
<td>470-ACTG</td>
<td>470-ACTY</td>
<td>Dell Networking 2x100GbE QSFP28-DD Active Optical Cable, No FEC, 20 Meter</td>
</tr>
</tbody>
</table>

## Optical Transceiver + MMF Fiber*

<table>
<thead>
<tr>
<th>Factory SKU</th>
<th>After Sale SKU</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>407-BCBL</td>
<td>470-BCBM</td>
<td>Dell Networking Transceiver, 2x100GbE, QSFP28-DD, 2SR4, No FEC Capable, MPO, MMF</td>
</tr>
<tr>
<td>470-ADBF</td>
<td>470-ADCE</td>
<td>Dell Networking Cable, MPO12-DD to MPO12-DD, Fiber Cable, MMF, OM4, Optics Required, 1M</td>
</tr>
<tr>
<td>470-ADBK</td>
<td>470-ADBH</td>
<td>Dell Networking Cable, MPO12-DD to MPO12-DD, Fiber Cable, MMF, OM4, Optics Required, 3M</td>
</tr>
<tr>
<td>470-ADBI</td>
<td>470-ADCH</td>
<td>Dell Networking Cable, MPO12-DD to MPO12-DD, Fiber Cable, MMF, OM4, Optics Required, 5M</td>
</tr>
<tr>
<td>470-ADCI</td>
<td>470-ADBJ</td>
<td>Dell Networking Cable, MPO12-DD to MPO12-DD, Fiber Cable, MMF, OM4, Optics Required, 7M</td>
</tr>
<tr>
<td>N/A</td>
<td>N/A</td>
<td>Corning Edge8 Structured Cabling</td>
</tr>
</tbody>
</table>

*NOTE: These optics & cables are NOT supported in QSFP28 or QSFP+ ports

*OS10EE v10.5.0 is required to use optics & passive fiber for FSE/FEM connections
PowerEdge MX Ethernet Pass-through Modules

Key Capabilities
• 16 x 25GbE server-facing ports
• 16 x SFP28 or 10G-BaseT external ports
• Supported in Fabrics A & B
• Supports all PowerEdge MX Ethernet Cards

HIGHLIGHTS
• Simple Ethernet pass through from compute sled to external switch
• One cable per compute sled
• Nothing to manage, no firmware to update
PowerEdge 25GbE Pass-Through Module
Cable & Optic Options

25G Uplink
DAC-SFP28-25G-xM
OR
AOC-SFP28-25G-xM
OR
SFP28-25G-SR-NOF
AND
CBL-LC-OM4-xM

10G Uplink
DAC-SFP-10G-xM
OR
DAC-SFP28-25G-xM*
OR
AOC-SFP-10G-xM
OR
SFP-10G-SR
AND
CBL-LC-OM4-xM

*DAC-SFP28-25G-xM supports 10GbE and 25GbE
Pass-Through Module Port Mapping – Dual Port NIC
PowerEdge MXG610s Fibre Channel Switch

High-performance, Brocade Gen 6 32G FC switch
The latest Fibre Channel technology for large scale Storage Area Networks

Key Capabilities
• 16 x 32G FC server-facing ports, 8 x 32G SFP FC ports, and 2 QSFP FC uplink ports (4 x 32G per QSFP)
• Supported in Fabric C Only
• Supports all MX Fibre Channel HBAs
• Designed for maximum flexibility and value with “pay-as-you-grow” scalability and Ports on Demand (PoD) licensing
• Compatible with Brocade and Cisco fabric/director class switches
• NVMe over Fabric Ready

HIGHLIGHTS
• High performance, non-blocking FC switch in a modular chassis platform for demanding all flash storage environments
• Unique Ports on Demand licensing to “pay-as-you-grow”
• Simplified cable management using QSFP ports
PowerEdge MXG610s Fibre Channel Switch
Typical Cable & Optic Options

SFP+, LWL, 16Gb, BR (Optic)
OR
SFP+, LWL, 32Gb, BR (Optic)

AND

16/32GFC (SWL)

16/32GFC (LWL)

SFP+, SWL, 16Gb, BR (Optic)
OR
SFP+, SWL, 32Gb, BR (Optic)
AND
CBL-LC-OM4-xM

Breakout 4x 16/32 GFC

QSFP+, SWL, 32Gb, BR (4x 32GFC Optic)
AND
CBL-MPO12-4LC-OM4-xM

NOTE: Not every option is presented on this page.
Contact your account team for additional options
MXG610s Additional Information

- Must be ordered in pairs
- Supports all PowerEdge MX Fibre Channel HBAs
- 3 base models available:
  - 8 activated ports & 2x FC32 SFP+ optics
  - 16x activated ports & 4x FC32 SFP+ optics
  - 16x activated ports & 4x FC32 SFP+ optics, Enterprise Bundle
- Additional port licenses can be added
- Additional 16G FC and 32G FC optics can be purchased for activated ports
- **NOTE**: A port license is consumed when that port is activated, regardless if port is internal or external (QSFP ports count as 4 licenses)
- **NOTE**: While 32 licensed ports is technically possible, 24 ports is the maximum number of ports that are usable. Don’t purchase more than 24 port licenses

The Enterprise bundle includes ISL Trunking, Fabric Vision, and Extended Fabric licenses

- **ISL Trunking**: Provides the ability to aggregate multiple physical links into one logical link for enhanced network performance and fault tolerance. Also enables Brocade Access Gateway ISL Trunking (N_port Trunking)
- **Fabric Vision**: Enables MAPS (Monitoring and Alerting Policy Suite), Flow Vision, IO Insight, VM Insight, and ClearLink (a.k.a. D_Prot) to non-Brocade devices
  - MAPS enables rules based monitoring and alerting capabilities, provides comprehensive dashboards to quickly troubleshoot problems in Brocade SAN environments
  - Flow Vision enables host to LUN flow monitoring, application flow mirroring for offline capture and deeper analysis, and test traffic flow generation function for SAN infrastructure validation
  - IO Insight automatically detects degraded storage IO performance with integrated device latency and IOPS monitoring embedded in the hardware
  - ClearLink (D_Prot) to non-Brocade devices allows extensive diagnostic testing of links to devices other than Brocade switches and adapters. (Functionality requires support by attached device, availability to be checked by the user)
- **Extended Fabric**: Provides greater than 10km of switched fabric connectivity at full bandwidth over long distances
- **NOTE**: These features are only available in the Enterprise Bundle - individual feature licenses are not available
## MXG610s: Popular SKUs

<table>
<thead>
<tr>
<th>Factory SKU</th>
<th>After Sale SKU</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>210-AOCI</td>
<td>210-AOCL</td>
<td>Dell EMC MXG610S switch, includes 8 activated ports &amp; 2x FC32 SFP+ SWL optics</td>
</tr>
<tr>
<td>210-AOCK</td>
<td>210-AOCJ</td>
<td>Dell EMC MXG610S switch, includes 16 activated ports &amp; 4x FC32 SFP+ SWL optics</td>
</tr>
<tr>
<td>210-AOCM</td>
<td>210-AOCH</td>
<td>Dell EMC MXG610S switch, includes 16 activated ports &amp; 4x FC32 SFP+ SWL optics, Enterprise Bundle</td>
</tr>
<tr>
<td>528-BCBS</td>
<td>528-BCBU</td>
<td>Dell EMC MXG610S 8 Ports-On-Demand activation, no additional optics</td>
</tr>
<tr>
<td>528-BCBT</td>
<td>528-BCBV</td>
<td>Dell EMC MXG610S Enterprise Feature License Bundle (Trunking, Extended Fabric, and Fabric Vision)</td>
</tr>
</tbody>
</table>

8 ports licensed = 6 servers & 2 external uplinks or 7 servers & 1 external uplink
16 ports licensed = 8 servers & up to 8 external uplinks (any combination of SFP+ & QSFP ports)*
24 ports licensed = 8 servers & all 16 external uplinks

**NOTE**: QSFP ports use 4 activation licenses
# Fibre Channel Optics & Cables for MXG610s

## Fibre Channel Optics

<table>
<thead>
<tr>
<th>Factory SKU</th>
<th>After Sale SKU</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>407-BBCF</td>
<td>407-BBBB</td>
<td>Brocade 16G SFP SWL Fibre Channel, 1 pack, requires port license</td>
</tr>
<tr>
<td>407-BBXJ</td>
<td>407-BBXM</td>
<td>Brocade 32G SFP SWL Fibre Channel, 1 pack, requires port license</td>
</tr>
<tr>
<td>407-BBXK</td>
<td>407-BBXL</td>
<td>Brocade 32G SFP SWL Fibre Channel, 8 pack, requires port license</td>
</tr>
<tr>
<td>407-BBXH</td>
<td>407-BBXO</td>
<td>Brocade 32G SFP LWL, 10Km SMF, 1 pack, requires port license</td>
</tr>
<tr>
<td>407-BBXI</td>
<td>407-BBXN</td>
<td>Brocade 32G SFP LWL, 10Km SMF, 8 pack, requires port license</td>
</tr>
<tr>
<td>407-BCBB</td>
<td>407-BCBC</td>
<td>Brocade 32G QSFP SWL Fibre Channel QSFP (4 x 32G), 1 pack, requires 4 port licenses</td>
</tr>
</tbody>
</table>

**NOTE:** These optics are NOT supported in the MX9116n Fabric Switching Engine

## MMF LC/LC cables for SFP+ SWL optics

<table>
<thead>
<tr>
<th>Factory SKU</th>
<th>After Sale SKU</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>470-ACMB</td>
<td>470-ACLV</td>
<td>OM4 LC/LC Fiber Patch Cable 1 Meter</td>
</tr>
<tr>
<td>470-ACLS</td>
<td>470-ACLT</td>
<td>OM4 LC/LC Fiber Patch Cable 2 Meter</td>
</tr>
<tr>
<td>470-ACMF</td>
<td>470-ACMO</td>
<td>OM4 LC/LC Fiber Patch Cable 3 Meter</td>
</tr>
<tr>
<td>470-ACLK</td>
<td>470-ACLX</td>
<td>OM4 LC/LC Fiber Patch Cable 5 Meter</td>
</tr>
<tr>
<td>470-ACMH</td>
<td>470-ACMN</td>
<td>OM4 LC/LC Fiber Patch Cable 10 Meter</td>
</tr>
</tbody>
</table>

## Breakout cables for 4x32GFC QSFP optic

<table>
<thead>
<tr>
<th>Factory SKU</th>
<th>After Sale SKU</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>470-ABOF</td>
<td>470-ABPH</td>
<td>Dell Networking Cable, MPO to 4xLC, Fiber Breakout Cable, MMF, OM4, Optics Required, 1M</td>
</tr>
<tr>
<td>470-ABOG</td>
<td>470-ABPE</td>
<td>Dell Networking Cable, MPO to 4xLC, Fiber Breakout Cable, MMF, OM4, Optics Required, 3M</td>
</tr>
<tr>
<td>470-ABOH</td>
<td>470-ABPG</td>
<td>Dell Networking Cable, MPO to 4xLC, Fiber Breakout Cable, MMF, OM4, Optics Required, 5M</td>
</tr>
<tr>
<td>470-ABOI</td>
<td>470-ABPK</td>
<td>Dell Networking Cable, MPO to 4xLC, Fiber Breakout Cable, MMF, OM4, Optics Required, 7M</td>
</tr>
</tbody>
</table>
IOM Placement Rules for Fabrics A & B

- Mixing MX9116n and MX7116n within the same fabric *IS* allowed
- No mixing of Ethernet switch and Pass Through Modules within the same fabric on MX7000
  - For example, MX9116n in A1 and 25G PTM in A2 is not allowed
- No mixing of Pass Through Module speeds within the same fabric on MX7000
  - For example, 10G-BaseT PTM in A1 and 25G PTM in A2 is not allowed
Scalable Fabric Architecture
PowerEdge MX Scalable Fabric Architecture

How can multiple chassis behave like a single network?

Legacy Modular Solutions
- Ethernet switches in each chassis = Latency
- Multiple hops for east-west traffic = Latency
- Excessive cabling = Cost
- Multiple switches to manage = Cost

Best-in-class Multi Chassis Ethernet
- Aggregate 50GbE to 200GbE bandwidth in each server
- <600ns “any-any” latency
- No server to server oversubscription
- Scales up to 10 chassis, 80 compute sleds
- 8x25Gbps over a single cable
- Cost effective, low TCO
Scalable Fabric Architecture Topology – One Fabric

- **Chassis 1:**
  - Slot A1: FSE
  - Slot A2: FEM

- **Chassis 2:**
  - Slot A1: FEM
  - Slot A2: FSE

- **Chassis 3:**
  - Slot A1: FEM
  - Slot A2: FEM

- **Chassis 10:**
  - Slot A1: FEM
  - Slot A2: FEM
Scalable Fabric Architecture Topology – Two Fabrics

Chassis 1:
- Slot A1: FSE
- Slot A2: FEM
- Slot B1: FSE
- Slot B2: FEM

Chassis 2:
- Slot A1: FEM
- Slot A2: FSE
- Slot B1: FEM
- Slot B2: FSE

Chassis 3:
- Slot A1: FEM
- Slot A2: FEM
- Slot B1: FEM
- Slot B2: FEM

Chassis 10:
- Slot A1: FEM
- Slot A2: FEM
- Slot B1: FEM
- Slot B2: FEM

NOTE: Fabric B is not required to be populated in every chassis.
Examples of **Unsupported** Scalable Fabric Topologies

The Scalable Fabric Architecture currently requires that a FEM in slot A1 be connected to an FSE in slot A1, a FEM in slot A2 be connected to an FSE in slot A2, and so on.

It is not supported to have a FEM in slot A2 be connected to an FSE in slot A1, for example:

- MX9116n A1 <-> MX7116n A2
- MX9116n B1 <-> MX7116n B2
- MX9116n A1 <-> MX7116n B1
- MX9116n B1 <-> MX7116n A2
- MX9116n A1 <-> MX7116n B1
- MX9116n A2 <-> MX7116n B2
In order to provide optimal performance through the MX9116n FSE, it is recommended to connect the FEMs to the FSE in the following order:

1. Connect FEMs from first two chassis to Port-Group 1
2. Connect FEM from Chassis 4 to Port-Group 2
3. Connect FEM from Chassis 6 to Port-Group 3
4. Connect FEM from Chassis 8 to Port-Group 4
5. Connect FEM from Chassis 10 to Port-Group 5
6. Connect FEM from Chassis 3 to Port-Group 7
7. Connect FEM from Chassis 5 to Port-Group 8
8. Connect FEM from Chassis 7 to Port-Group 9
9. Connect FEM from Chassis 9 to Port-Group 10
10. Unused QSFP28-DD ports can be utilized for additional uplinks, connections to rack servers, or VLT connections (VLT is required for SmartFabric Services)

QSFP28-DD ports are backwards compatible and support QSFP28 and QSFP+ Optics and cables.

QSFP28 ports are backwards compatible and support QSFP+ Optics and cables.
PowerEdge MX networking with Embedded Top of Rack switching

Rack servers and other Ethernet devices can be connected directly to the MX9116n FSE via the appropriate breakout cable

• Rack servers do not need to be connected to separate Top of Rack switches
• Communication between all devices is kept within the FSE
• Provides a single point of management and network security
• Reduces cost and improves performance and latency
• Supported in Full Switch and SmartFabric modes
Example Topologies
### Cable & Optic Option Key

The sample topologies in the following slides will use different cable types depending on the use-case.

Additionally, the cable/optic type used will vary depending on the length required.

<table>
<thead>
<tr>
<th>Cable Option</th>
<th>Description</th>
<th>Connector</th>
<th>DAC (very short)</th>
<th>AOC (short-medium)</th>
<th>Optic (medium-long)</th>
<th>Fiber (Requires Optic)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>FSE/FEM Connection</td>
<td>QSFP28-DD</td>
<td>DAC-Q28DD-200G-xM</td>
<td>AOC-Q28DD-200G-xM</td>
<td>Q28DD-200G-2SR4</td>
<td>CBL-MPO12DD-OM4-xM or Corning Edge8 Structured Cabling</td>
</tr>
<tr>
<td>2</td>
<td>100GbE Uplink</td>
<td>QSFP28</td>
<td>DAC-Q28-100G-xM</td>
<td>AOC-Q28-100G-xM</td>
<td>Q28-100G-SR4-NOF</td>
<td>CBL-MPO12-OM4-xM</td>
</tr>
<tr>
<td>3</td>
<td>40GbE Uplink</td>
<td>QSFP28/QSFP+</td>
<td>DAC-QSFP-40G-xM</td>
<td>AOC-QSFP-40G-xM</td>
<td>QSFP-40G-SR4</td>
<td>CBL-MPO12-OM4-xM</td>
</tr>
<tr>
<td>4</td>
<td>Breakout 2x100GbE</td>
<td>QSFP28-DD</td>
<td>DAC-Q28DD-2Q28-100G-xM</td>
<td>AOC-Q28DD-2Q28-100G-xM</td>
<td>Q28DD-200G-2SR4</td>
<td>CBL-MPO12DD-2MPO12-OM4-xM</td>
</tr>
<tr>
<td>5</td>
<td>Breakout 8x25GbE</td>
<td>QSFP28-DD</td>
<td>DAC-Q28DD-8S28-25G-xM</td>
<td>AOC-Q28DD-8S28-25G-xM</td>
<td>Q28DD-200G-2SR4</td>
<td>Corning Edge8 Structured Cabling</td>
</tr>
<tr>
<td>6</td>
<td>Breakout 8x10GbE</td>
<td>QSFP28-DD</td>
<td>DAC-Q28DD-8S28-25G-xM</td>
<td>AOC-QDD-8SFP-10G-xM</td>
<td>QDD-80G-2SR4</td>
<td>Corning Edge8 Structured Cabling</td>
</tr>
<tr>
<td>7</td>
<td>Breakout 4x25GbE</td>
<td>QSFP28</td>
<td>DAC-Q28-4S28-25G-xM</td>
<td>AOC-Q28-4S28-25G-xM</td>
<td>Q28-100G-SR4-NOF</td>
<td>CBL-MPO12-4LC-OM4-xM</td>
</tr>
<tr>
<td>8</td>
<td>Breakout 4x10GbE</td>
<td>QSFP28/QSFP+</td>
<td>DAC-QSFP-4SFP-10G-xM</td>
<td>AOC-QSFP-4SFP-10G-xM</td>
<td>QSFP-40G-SR4</td>
<td>CBL-MPO12-4LC-OM4-xM</td>
</tr>
<tr>
<td>9</td>
<td>Breakout 4x16G FC</td>
<td>QSFP28/QSFP+</td>
<td>Not Supported</td>
<td>Not Supported</td>
<td>QSFP-64GFC-SW4</td>
<td>CBL-MPO12-4LC-OM4-xM</td>
</tr>
<tr>
<td>10</td>
<td>Breakout 4x32G FC</td>
<td>QSFP28</td>
<td>Not Supported</td>
<td>Not Supported</td>
<td>Q28-128GFC-SW4</td>
<td>CBL-MPO12-4LC-OM4-xM</td>
</tr>
<tr>
<td>11</td>
<td>Breakout 2x40GbE</td>
<td>QSFP28-DD</td>
<td>DAC-Q28DD-2Q28-100G-xM</td>
<td>AOC-Q28DD-2Q-40G-7M</td>
<td>QDD-80G-2SR4</td>
<td>CBL-MPO12DD-2MPO12-OM4-xM</td>
</tr>
</tbody>
</table>
Example Topologies
Scalable Fabric Wiring Diagram – 2 Chassis

Fabric A Populated

Fabric A & B Populated

Cable Option 1

Cable Option 1
Example Topologies
Scalable Fabric Wiring Diagram – 3+ Chassis

Chassis 1 & 2

Cable Option 1

Chassis 3-10

Cable Option 1
Example Topologies
Scalable Fabric Wiring Diagram – Rack Server Connectivity

Cable Option 1

Cable Option 5 (25GbE) or Cable Option 6 (10GbE)
Example Topologies
MX9116n Standard Ethernet w/VLT + Fibre Channel NPG

Cable Option 1

Spine Switches

Cable Option 2

FC Switches

Cable Option 9 (16G)
or
Cable Option 10 (32G)
Example Topologies
MX5108n Standard Ethernet w/VLT: SFP28 Uplinks

ToR Switches

Cable Option 3

Cable Option 7 (25GbE)
or
Cable Option 8 (10GbE)
Example Topologies
MX5108n Standard Ethernet w/VLT: 10G-BaseT Uplinks
Example Topologies
MX5108n Standard Ethernet w/VLT: 10G-BaseT Uplinks; FCoE FSB
Example Topologies
MX5108n Standard Ethernet w/VLT: SFP28 Uplinks; FCoE FSB

Cable Option 3

ToR Switches

NPG Gateway

Cable Option 7 (25GbE)
or
Cable Option 8 (10GbE)
Example Topologies
MX7116n Fabric Expander Module as Pass-Through*

Set 100G ports to 4x25G

Cable Option 4 (25GbE)

ToR Switches

Cable Option 5 (25GbE)

*Pass-Through to Dell EMC networking switches only
Unsupported Topologies in SmartFabric mode

While these topologies are supported in Full Switch Mode, SmartFabric Services currently requires both Ethernet switches to reside in slots A1/A2 or B1/B2.

It is not supported having one switch in Fabric A and the second in Fabric B.
Cable & Optic Information
## Cables & Connectors

There are four primary cable types used with optical connectors in PowerEdge MX Ethernet networking: DAC, AOC, MMF, SMF

<table>
<thead>
<tr>
<th>Cable Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>DAC (Copper)</td>
<td>Direct Attach Copper “TwinAx” Copper wires &amp; shielding 2-wires/Channel</td>
</tr>
<tr>
<td>AOC (Optical)</td>
<td>Active Optical Cable</td>
</tr>
<tr>
<td>MMF (Optical)</td>
<td>Multi-Mode Fiber 50-um Large core fiber 100m (300m) reach Easy to attach components Transceiver are low cost Fiber 3x cost of SMF</td>
</tr>
<tr>
<td>SMF (Optical)</td>
<td>Single-Mode fiber 9-um Tiny core fiber 2/10Km reach Hard to attach components Transceivers are expensive SMF cost less than dental floss!</td>
</tr>
</tbody>
</table>

There are three optical connectors used in PowerEdge MX Ethernet networking: SFP, QSFP, QSFP-DD

<table>
<thead>
<tr>
<th>Connector</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>“SFP”</td>
<td>Small FormFactor Pluggable 1 Channel 2 Fibers or wires 1-1.5W Duplex LC optical connector MMF or SMF</td>
</tr>
<tr>
<td>“QSFP”</td>
<td>Quad Small FormFactor Pluggable 4 Channels 8 Fibers or wires 3.5W-5W MPO12 8 fiber parallel optical connector</td>
</tr>
<tr>
<td>“QSFP-DD”</td>
<td>Quad Small FormFactor Pluggable – Double Density 8 Channels 16 Fibers or wires 10W MPO12DD 16 fiber parallel optical connector</td>
</tr>
</tbody>
</table>
## Cables & Connectors

<table>
<thead>
<tr>
<th>Consideration</th>
<th>Copper</th>
<th>Fiber</th>
</tr>
</thead>
<tbody>
<tr>
<td>Deployment</td>
<td>Already installed in many locations and its use is less expensive to connect devices to a network. Copper solutions can get bulky when bunched together as they are thicker than fiber</td>
<td>Less bulky than copper solutions and easy to utilize breakout units (structured cabling) to deconstruct multi-lane runs into lower capacity end points (i.e. 100G -&gt; 4x25G)</td>
</tr>
<tr>
<td>Signal Loss</td>
<td>Copper cables can only transmit information over relatively short distances</td>
<td>Fiber optic cables experience less signal loss than copper cabling and can support long distances</td>
</tr>
<tr>
<td>Electro-Magnetic Interference (EMI)</td>
<td>Susceptible</td>
<td>Impervious</td>
</tr>
<tr>
<td>Security</td>
<td>Copper solutions are easier to tap</td>
<td>Fiber is more difficult to tap. Some Federal and large enterprises mandate Fiber as a result</td>
</tr>
<tr>
<td>Cost</td>
<td>RJ45 ($) → DAC ($$)</td>
<td>AOC ($$$) → Transceiver + Fiber ($$$)</td>
</tr>
</tbody>
</table>
Introduction to QSFP28-DD
Quad Small Form Factor Pluggable Double Density

• Current QSFP28 optical modules support 40 and 100 Gigabit Ethernet applications. They feature four electrical lane pairs that can operate at 10 or 25 Gbps.

• QSFP28-DD is designed with eight lanes that operate at up to 25 Gbps via NRZ modulation (up to 200 Gbps aggregate)

• QSFP56-DD is designed with eight lanes that operate at up to 50 Gbps via PAM4 modulation (up to 400 Gbps aggregate)

• QSFP-DD is backward compatible with QSFP+ and QSFP28 connectors

• Slightly deeper than QSFP28 with a second row of contacts

• Breakouts
  – QSFP-DD ↔ 2 × QSFP28 (100G)
  – QSFP-DD ↔ 4 × QSFP28 (50G as 2 × 25G, half-populated)
  – QSFP-DD ↔ 8 × SFP28 (25G)
QSFP28-DD Breakout Cables

DAC-Q28DD-8S28-25G
DAC-Q28DD-2Q28-100G
CBL-MPO12DD-2MPO12-OM4
Corning Edge8®
Structured Cabling
EDGE8® Fiber Solutions from Corning

- Dell EMC Networking has a wide variety of Ethernet switches with ports that can be broken out into multiple lower speed ports. For example:
  - QSFP+ 40GbE can be decomposed to 4x10GbE or 4x1GbE
  - QSFP28 100GbE can be decomposed to 4x25GbE
  - QSFP28-DD 2x100GbE ports can be decomposed to 2x100GbE, 2x40GbE, 4x50GbE, 8x25GbE or 8x10GbE

- Why Structured Cabling?
  - Control cable sprawl
  - Organize, label and orchestrate a clean footprint so IT staff can quickly and predictably discern the purpose of each fiber run

- Dell EMC has partnered with Corning Structured Cabling Solutions to provide an easy to customize structured cabling solution

- This solution provides rack housings from 1U to 4U allowing for multiple cassette types in each enclosure. The system has cassettes to do the following:
  - QSFP breakout to 4xLC (MPO12 to 4xLC)
  - QSFP to QSFP extension (MPO12 to MPO12)
  - QSFP-DD to 2xQSFP28 (MPO12-DD to 2xMPO12)
  - QSFP-DD to 8xLC (MPO12-DD to two 4xLC cartridges)
  - QSFP-DD to QSFP-DD extension (MPO12-DD to MPO12-DD)
EDGE8® HD Housings

- EDGE8® HD housings include
  - Mountings for standard 19” racks and cabinets
  - Sliding drawers, enabling module or panel installation from the front or rear of the housing.
  - Integrated cable routing elements to make real structured patch cord management possible while providing finger access without the need for tools or any other accessories.
  - Side-routing guides for patch cord integration to the cabinet which provide flexible installation options for back-to-back or flush-mounting requirements
  - Quick-mount capability making it quick and easy for one person to install the housing with little effort.
  - Easy labeling with a full-size mounting area on the inside of the front door
  - An easily installable trunk mounting plate providing flexibility depending on your design (e.g., back-to-back) or application (e.g., reduced depth) concept.
  - 1U, 2U, and 4U housing options
EDGE8® Modules & Adapter Panels

• EDGE8® Modules
  – The EDGE8® modules have an MPO interface on one side and four LC interfaces on the other
  – All EDGE8® modules can be installed without tools from the front or the rear of any EDGE8® housing.
  – LC duplex adapters feature hinged shutters that move up and out of the way when the connector is inserted. Specially designed indents in the shutters ensure that the end faces of the connectors are never touched.
  – In addition, the shutters are visual fault locator (VFL) compatible to allow easy port identification while diffusing the VFL light to ensure adequate eye safety.

• EDGE8® MPO Adapter Panels
  – EDGE8® MPO adapter panels are pass-through panels that provide a simple interface to mate MPO connectors.
  – EDGE8® MPO adapter panels are available with one, two, and four 8-fiber adapters for multimode and single-mode applications. All panels feature unique shuttered reversible adapters at the front of the panel for on-site changes to manage field polarity, and visual port identification while defusing the VFL light to ensure adequate eye safety.
EDGE8® Patch, Trunk, and Jumper Cables

• **EDGE8® Trunks**
  - EDGE8® MPO trunks are used between patch panel housings and are pre-terminated cables with 8-fiber MPO connectors on both ends. All trunks have strain-relief clips and allow for tool-less installation in EDGE8® housings. These trunks conform to TIA-568 Type-B or Type-A polarity, depending on product selection. In addition, the trunks are standard with a pulling grip for easy handling during installation in cable tray or through fire wall pass throughs.

• **EDGE8® MPO Patch Cords**
  - EDGE8® 8-fiber MPO patch cords are typically used within racks between the device and an EDGE8® Module or Adapter panel. The EDGE8® MPO patch cord uses MTP® PRO connectors, which allows for a simple one-step, color-coded polarity change feature without removing the connector housing. The connector also provides the capability for field-friendly pinning configuration changes with safe handling of pins and easy color identification while maintaining product integrity.

• **Reverse Polarity Uniboot Duplex Jumpers**
  - EDGE™ reverse polarity uniboot duplex jumpers allow for the quick and easy conversion from a TIA-568 A-B polarity to a TIA-568 A-A polarity without exposing the fibers or needing any tools. The jumper comes with A-B polarity that can be leveraged for all described applications. This uniboot design allows one cable to carry both fibers, reducing jumper bulk when routing.
## Example 1: MX7116n FEM to MX9116n FSE
### MPO12-DD to MPO12-DD across DC

### Item | OM4 Part Number (NAFTA) | OM4 Part Number (EMEA and APJ) | Description |
--- | --- | --- | --- |
1 | HA6E616QPH-L4xxxM | HA6E616QLZ-L4xxxM | EDGE 16 F Y-Jumper, MPO-12DD (unpinned) to two MPO-12 (unpinned) MTPs, 36-in breakout leg length, Type-B polarity, 3.1 mm cable, xxxM |
2 | GE5E516QPNDUxxxM | GE5E516QLZDDUxxxM | EDGE8® MTP Trunk, 16 F, MPO-12 (pinned) to MPO-12 (pinned), TIA-568 standard Type-B polarity, pulling grip on first end only, 7.0 mm cable, xxxM |
3 | EDGE8-CP32-V3 | EDGE8-CP32-V3 | EDGE8 4-Port MPO Connector Panel |

Note: NAFTA uses plenum cable and EMEA/APJ uses LSZH cable.
### Example 2: QSFP28-DD Uplink to 2x 80GbE/100GbE MPO12-DD to MPO12 across DC

**Note:** NAFTA uses plenum cable and EMEA/APJ uses LSZH cable.

<table>
<thead>
<tr>
<th>Item</th>
<th>OM4 Part Number (NAFTA)</th>
<th>OM4 Part Number (EMEA and APJ)</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>HA6E616QPH-L4xxxM</td>
<td>HA6E616QLZ-L4xxxM</td>
<td>EDGE 16 F Y-Jumper, MPO-12DD (unpinned) to two MPO-12 (unpinned) MTPs, 36-in breakout leg length, Type-B polarity, 3.1 mm cable, xxxM</td>
</tr>
<tr>
<td>2</td>
<td>GE5E516QPNDUxxxxM</td>
<td>GE5E516QLZDDUxxxxM</td>
<td>EDGE8® MTP Trunk, 16 F, MPO-12 (pinned) to MPO-12 (pinned), TIA-568 standard Type-B polarity, pulling grip on first end only, 7.0 mm cable, xxxM</td>
</tr>
<tr>
<td>3</td>
<td>EDGE8-CP32-V3</td>
<td>EDGE8-CP32-V3</td>
<td>EDGE8 4-Port MPO Connector Panel</td>
</tr>
<tr>
<td>4</td>
<td>JE6E608QE8-NBxxxM</td>
<td>JE6E608QEZ-NBxxxM</td>
<td>8-Fiber MTP Jumper, MPO-12 (unpinned) to MPO-12 (unpinned), Type-B polarity, 2.0 mm cable, xxxM</td>
</tr>
</tbody>
</table>

**Diagram:**
- **Rack 1:** HA6E616QPH-L4xxxM to HA6E616QLZ-L4xxxM
- **Rack 2:** GE5E516QPNDUxxxxM to GE5E516QLZDDUxxxxM
- **Connections:**
  - Q28DD-200G-2SR4 (100G)
  - Q28DD-80G-2SR4 (40G)
  - Q28-100G-SR4 (100G)
  - QSFP-40G-SR4 (40G)

© Copyright 2019 Dell Inc. Note: NAFTA uses plenum cable and EMEA/APJ uses LSZH cable.
### Example 3: QSFP28-DD to 8x Rack Servers

**MPO12-DD to 8xLC Duplex Across DC**

Note: NAFTA uses plenum cable and EMEA/APJ uses LSZH cable.

<table>
<thead>
<tr>
<th>Item</th>
<th>OM4 Part Number (NAFTA)</th>
<th>OM4 Part Number (EMEA and APJ)</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>HA6E616QPH-L4xxxM</td>
<td>HA6E616QLZ-L4xxxM</td>
<td>EDGE 16 F Y-Jumper, MPO-12DD (unpinned) to two MPO-12 (unpinned) MTPs, 36-in breakout leg length, Type-B polarity, 3.1 mm cable, xxxM</td>
</tr>
<tr>
<td>2</td>
<td>EDGE8-CP32-V3</td>
<td>EDGE8-CP32-V3</td>
<td>EDGE8 4-Port MPO Connector Panel</td>
</tr>
<tr>
<td>3</td>
<td>GE5E616QPNDDPxxxM</td>
<td>GE5E616QLZDDPxxxM</td>
<td>EDGE8 MPO Trunk, 16 F, MPO-12 (pinned) to MPO-12 (unpinned), TIA-568 Standard Type-A polarity, pulling grip on first end only, 7.0 mm cable, xxxM</td>
</tr>
<tr>
<td>4</td>
<td>ECM8-UM08-05-E5Q-ULL</td>
<td>ECM8-UM08-05-E5Q-ULL</td>
<td>EDGE8 Module, LC duplex to MPO-12 (pinned), 8 F, universal polarity</td>
</tr>
<tr>
<td>5</td>
<td>797902QD120xxxM</td>
<td>E797902QNZ20xxxM</td>
<td>EDGE Uniboot Duplex LC Jumper, LC UPC uniboot to LC UPC uniboot, 2.0 mm cable, xxxM</td>
</tr>
</tbody>
</table>

Q28DD-200G-2SR4 (100G)  
Q28DD-80G-2SR4 (40G)

SFP28-25G-SR (25G)  
SFP-10G-SR (10G)
Corning EDGE8® Resources

• Corning EDGE8® General Information: www.corning.com/dellemc
• Corning EDGE8 Solutions brief (LAN-2480-AEN): Link
• Corning Choosing the correct Bill-of-Material (LAN-2495 AEN): Link
• Corning: EDGE8-01U-SP Housing Quick Guide
• Corning: EDGE8-02U- Housing Quick Guide
• Corning: EDGE8-04U Housing Quick Guide
• Corning: EDGE8 Standard Recommended Procedure
• Corning: Solutions Intro video
Additional Resources
<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
<th>URL</th>
</tr>
</thead>
<tbody>
<tr>
<td>PowerEdge MX7000 Chassis Management Cabling</td>
<td>How to cable the MX9002m management modules together</td>
<td><a href="https://downloads.dell.com/manuals/all-products/esuprt_ser_stor_net/esuprt_poweredge/poweredge-mx7000_white-papers5_en-us.pdf">https://downloads.dell.com/manuals/all-products/esuprt_ser_stor_net/esuprt_poweredge/poweredge-mx7000_white-papers5_en-us.pdf</a></td>
</tr>
</tbody>
</table>
## Other Resources

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
<th>URL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dell EMC Networking MX9116n Spec Sheet</td>
<td>Dell EMC Networking MX9116n Spec Sheet</td>
<td><a href="https://www.dell.com/learn/product_docs/dellemcnetworkingmx9116nspecsheet.pdf">https://www.dell.com/learn/product_docs/dellemcnetworkingmx9116nspecsheet.pdf</a></td>
</tr>
<tr>
<td>Dell EMC Networking MX7116n Spec Sheet</td>
<td>Dell EMC Networking MX7116n Spec Sheet</td>
<td><a href="https://www.dell.com/learn/product_docs/dellemcnetworkingmx7116nspecsheet.pdf">https://www.dell.com/learn/product_docs/dellemcnetworkingmx7116nspecsheet.pdf</a></td>
</tr>
<tr>
<td>Dell EMC Networking MX5108n Spec Sheet</td>
<td>Dell EMC Networking MX5108n Spec Sheet</td>
<td><a href="https://www.dell.com/learn/product_docs/dellemcnetworkingmx5108nspecsheet.pdf">https://www.dell.com/learn/product_docs/dellemcnetworkingmx5108nspecsheet.pdf</a></td>
</tr>
<tr>
<td>MXG610s Support Page</td>
<td></td>
<td><a href="https://www.dell.com/support/home/product-support/product/networking-mxg610s">https://www.dell.com/support/home/product-support/product/networking-mxg610s</a></td>
</tr>
<tr>
<td>Date</td>
<td>Version</td>
<td>Changes</td>
</tr>
<tr>
<td>-------------------</td>
<td>---------</td>
<td>-----------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Sept 25, 2018</td>
<td>1.1</td>
<td>Initial Public Release</td>
</tr>
<tr>
<td>Sept 26, 2018</td>
<td>1.1.2</td>
<td>Corrected FC Gateway Topology, Fixed headers, updated cable images, corrected NPAR support for Intel NICs</td>
</tr>
<tr>
<td>October 25, 2018</td>
<td>1.2</td>
<td>Updated PTM image, Added additional cables &amp; optics to 25G PTM, Scalable Fabric design for Dual Fabrics, Clarified supported 40G optics, updated Mellanox NIC information, added Additional Resources section, information on connecting to Cisco switches, unsupported topologies for Scalable Fabric and SmartFabric services</td>
</tr>
<tr>
<td>January, 2019</td>
<td>1.3</td>
<td>Clarified items on the switch Quick Reference page, added IOM slot matrix, corrected SKU numbers, updated Dell EMC 4x32G FC optic to reflect support for 4x 8G FC, corrected description of MXG610s on QRG page, updated list of white papers</td>
</tr>
<tr>
<td>May, 2019</td>
<td>1.4</td>
<td>Clarified cables/optics for VLTi on MX5108, updated NPAR support on NIC QRG, corrected SKU numbers, updated resources and whitepaper links, updated MX7116n QRG, Updated Layout/Template</td>
</tr>
<tr>
<td>September, 2019</td>
<td>1.5</td>
<td>Updated multiple slides to add new cables/optics supported with OS10.5.0, Added Slide for MX7116n FEM as Pass-Through Module, Updated &amp; Added whitepaper links, Added information about Corning Edge8 Structured Cabling</td>
</tr>
</tbody>
</table>