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# PowerEdge MX Ethernet I/O Modules

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<th>MX9116n</th>
<th>MX5108n</th>
<th>MX7116n</th>
<th>25Gb Pass-Through</th>
<th>10GbT Pass-Through</th>
</tr>
</thead>
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<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;800Mpps</td>
<td>&lt;75ns</td>
<td>&lt;100ns</td>
<td>&lt;100ns</td>
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<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 (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>
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<tr>
<td>External QSFP28 Ports</td>
<td>4</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>0</td>
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<tr>
<td>External QSFP+ Ports</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
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<tr>
<td>External SFP28 Ports</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>16</td>
<td>0</td>
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<tr>
<td>External 10G-BaseT Ports</td>
<td>0</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>16</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>N/A</td>
<td>N/A</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>N/A</td>
<td>N/A</td>
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<tr>
<td>FC fabric services</td>
<td>Zoning, F_Port, NPIV</td>
<td>No</td>
<td>Yes (via MX9116n)</td>
<td>N/A</td>
<td>N/A</td>
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<tr>
<td>Converged iSCSI (LAN and SAN)</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes (via MX9116n)</td>
<td>N/A</td>
<td>N/A</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

<table>
<thead>
<tr>
<th>MXG610s</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>32Gb FC Switch</strong></td>
</tr>
<tr>
<td>Designed for mission-critical applications and optimized for flash storage and highly virtualized server environments</td>
</tr>
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</table>

## Performance

<table>
<thead>
<tr>
<th>Speeds</th>
<th>32Gbps (multi-speed 8, 16, or 32Gbps)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Switch capacity (Gbps)</td>
<td>1024 Gbps (32 * 32 Gbps) in Full Fabric Switch mode</td>
</tr>
<tr>
<td>Credit Buffers</td>
<td>2K, providing &gt;50 credits/port average</td>
</tr>
<tr>
<td>Latency (Microseconds)</td>
<td>&lt; 0.9 µs</td>
</tr>
<tr>
<td>Maximum frame size</td>
<td>2112-byte payload</td>
</tr>
</tbody>
</table>

## Ports

<table>
<thead>
<tr>
<th>Total ports</th>
<th>16 internal ports (16, or 32Gbps)</th>
</tr>
</thead>
<tbody>
<tr>
<td>8 external SFP+ ports (8, 16, or 32Gbps)</td>
<td></td>
</tr>
<tr>
<td>2 external QSFP ports - 4 ports each (16, or 32Gbps)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Port model options</th>
<th>8 ports w/2 SFP+ transceivers</th>
</tr>
</thead>
<tbody>
<tr>
<td>16 ports w/4 SFP+ transceivers</td>
<td></td>
</tr>
<tr>
<td>16 ports w/4 SFP+ transceivers, Enterprise Software License (port count can be increased with on-demand license)</td>
<td></td>
</tr>
</tbody>
</table>

| 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

- Class 16 and 32Gbps: SWL, LWL SFP+ |
- Class 16 and 32Gbps: SWL, QSFP+ (supports 4x1 Breakout)
# PowerEdge MX Ethernet Mezzanine Cards

<table>
<thead>
<tr>
<th></th>
<th>QL41262</th>
<th>QL41232</th>
<th>XXV710</th>
<th>ConnectX-4 LX</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Vendor</strong></td>
<td>Qlogic/Cavium</td>
<td>Qlogic/Cavium</td>
<td>Intel</td>
<td>Mellanox</td>
</tr>
<tr>
<td><strong>Max Speed</strong></td>
<td>25GbE</td>
<td>25GbE</td>
<td>25GbE</td>
<td>25GbE</td>
</tr>
<tr>
<td><strong>Ports</strong></td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td><strong>NIC Type</strong></td>
<td>CNA</td>
<td>NIC</td>
<td>NIC</td>
<td>NIC</td>
</tr>
<tr>
<td><strong>Dell PN</strong></td>
<td>51GOW</td>
<td>HJ3FX</td>
<td>H9NTY</td>
<td>WCHFY</td>
</tr>
<tr>
<td><strong>SKU</strong></td>
<td>543-BBDI</td>
<td>543-BBDJ</td>
<td>543-BBDH</td>
<td>543-BBDK</td>
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<tr>
<td><strong>General</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NPAR (# Partitions)</td>
<td>Yes /8(port)</td>
<td>Yes /8(port)</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Secure Firmware Updates</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>PTP: IEEE 1588</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>DPDK</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td><strong>Network Boot</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>UEFI iSCSI Offload Boot</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>Yes (boot, no offload)</td>
</tr>
<tr>
<td>UEFI FCoE Boot</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Legacy iSCSI iBFT Boot</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
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<tr>
<td><strong>RDMA</strong></td>
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<td></td>
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<td></td>
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<tr>
<td>RoCE v1</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>RoCE v2</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>iWarp</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
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<tr>
<td><strong>Offloads</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>iSCSI HW Offload</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>FCoE HW Offload</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Large Receive Offload (LRO)</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Giant Send Offload (GSO)</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>TCP Segmentation Offload (TSO)</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Transmit-Side Scaling (TSS)</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td><strong>Network Virtualization Overlay</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>GENEVE</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>VXLAN-GPE</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
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<tr>
<td>MPLS</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
</tbody>
</table>

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)
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

**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

**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

**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/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 socket is comprised of two separately addressed physical ports.

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.
PowerEdge MX9116n Fabric Switching Engine
Typical Cable & Optic Options

When implementing a SmartFabric, two DAC-Q28DD-200G-xM OR AOC-Q28DD-200G-xM cables are **REQUIRED** for the VLTi connection

- **Breakout 4x16/32 GFC**
  - DAC-Q28-100G-xM OR AOC-Q28-100G-xM OR Q28-100G-SR4-NOF (Optic) AND CBL-MPO12-4LC-OM4-xM
- **QSFP28-64GFC-SW4 (4x 16GFC Optic)** OR **Q28-128GFC-SW4 (4x 32GFC Optic)** AND CBL-MPO12-4LC-OM4-xM

- **Breakout 4x 16/32 GFC**
  - DAC-Q28DD-2Q28-100G-xM OR AOC-Q28DD-2Q28-100G-xM OR QSFP-40G-SR4 (Optic) AND CBL-MPO12-2MPO12-OM4-xM

- **QSFP28-64GFC-SW4 (4x 16GFC Optic)** OR **Q28-128GFC-SW4 (4x 32GFC Optic)** AND CBL-MPO12-4LC-OM4-xM

- **Breakout 8x25GbE**
  - DAC-Q28DD-8S28-25G-xM OR AOC-Q28DD-8S28-25G-xM OR Q28DD-200G-2SR4 (Optic) AND 8xLC Breakout Cartridge

- **100GbE Uplink**
  - DAC-Q28-100G-xM OR AOC-Q28-100G-xM OR Q28-100G-SR4-NOF (Optic) AND CBL-MPO12-OM4-xM

- **Breakout 4x 10GbE**
  - DAC-Q28DD-4S28-10G-xM OR AOC-Q28DD-4S28-10G-xM OR QSFP-40G-SR4 (Optic) AND CBL-MPO12-4LC-OM4-xM

- **Breakout 8x10GbE**
  - DAC-Q28DD-2Q28-100G-xM OR AOC-Q28DD-2Q28-100G-xM OR QSFP-40G-SR4 (Optic) AND CBL-MPO12-4LC-OM4-xM

- **Breakout 2x100GbE**
  - DAC-Q28DD-2Q28-100G-xM OR AOC-Q28DD-2Q28-100G-xM OR QSFP-40G-SR4 (Optic) AND CBL-MPO12-4LC-OM4-xM

- **Breakout 2x40GbE**
  - DAC-Q28DD-2Q28-100G-xM OR AOC-Q28DD-2Q28-100G-xM OR QSFP-40G-SR4 (Optic) AND CBL-MPO12-4LC-OM4-xM

- **Breakout 4x25GbE**
  - DAC-Q28DD-16S28-25G-xM OR AOC-Q28DD-16S28-25G-xM OR QSFP-40G-SR4 (Optic) AND CBL-MPO12-4LC-OM4-xM

- **Breakout 8x25GbE**
  - DAC-Q28DD-8S28-25G-xM OR AOC-Q28DD-8S28-25G-xM OR QSFP-40G-SR4 (Optic) AND CBL-MPO12-4LC-OM4-xM

- **Breakout 8x10GbE**
  - DAC-Q28DD-8S28-25G-xM OR AOC-Q28DD-8S28-25G-xM OR QSFP-40G-SR4 (Optic) AND CBL-MPO12-4LC-OM4-xM

- **Breakout 2x40GbE**
  - DAC-Q28DD-2Q28-100G-xM OR AOC-Q28DD-2Q28-100G-xM OR QSFP-40G-SR4 (Optic) AND CBL-MPO12-4LC-OM4-xM

NOTE: Not every option is presented on this page
Contact your account team for additional options
Connecting to Cisco 10GbE or 25GbE uplink ports

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

- ** QSFP-40G-SR4 (10 GbE Uplink)**
- ** QSFP28-100G-SR4 (25 GbE Uplink)**
- ** CBL-MPO12-4LC-OM4-xM (Cisco 10G Optic)**
- ** CBL-MPO12-4LC-OM4-xM (Cisco 25G Optic)**
Connecting MX9116n to Fibre Channel Switch

- 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

When implementing a SmartFabric, a VLTi connection using ports 9 & 10 is required with both ports running at 40GE.

Because port 10 defaults to 100GE, use a 40GE QSFP+ optic/cable, not a 100GE QSFP28 optic/cable

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 module
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

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
PowerEdge MX7116n Fabric Expander Module
Cable & Optic Options

To MX9116n
DAC-Q28DD-200G-xM
OR
AOC-Q28DD-200G-xM

Future Use
# 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

<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>

**NOTE:** These cables are NOT supported in QSFP28 or QSFP+ ports
PowerEdge MX Ethernet Pass-through Modules

25GbE Pass-through Module
- 16 x 25GbE internal ports
- 16 x SFP28 Ports

10G-BaseT Pass-through Module
- 16 x 25GbE internal ports
- 16 x 10G-BaseT Ports

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)**

- **16/32GFC (LWL)**

- **16/32GFC (SWL)**

- **Breakout 4x 16/32 GFC**

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

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

<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-ACLY</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

<table>
<thead>
<tr>
<th></th>
<th>A2</th>
<th>B1</th>
<th>B2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Any Ethernet IOM</td>
<td>Empty</td>
<td>Empty</td>
<td>Empty</td>
</tr>
<tr>
<td>Any Ethernet IOM</td>
<td>Same IOM as A1</td>
<td>Empty</td>
<td>Empty</td>
</tr>
<tr>
<td>Any Ethernet IOM</td>
<td>Empty</td>
<td>Same IOM as A1</td>
<td>Empty</td>
</tr>
<tr>
<td>Any Ethernet IOM</td>
<td>Same IOM as A1</td>
<td>Same IOM as A1</td>
<td>Empty</td>
</tr>
<tr>
<td>Any Ethernet IOM</td>
<td>Same IOM as A1</td>
<td>Any Ethernet IOM</td>
<td>Same IOM as A1</td>
</tr>
<tr>
<td>Any Ethernet IOM</td>
<td>Same IOM as A1</td>
<td>MX9116n or MX7116n</td>
<td>MX9116n or MX7116n</td>
</tr>
<tr>
<td>MX9116n or MX7116n</td>
<td>MX9116n or MX7116n</td>
<td>Any PTM or MX5108n</td>
<td>Same IOM as B1</td>
</tr>
<tr>
<td>Any PTM or MX5108n</td>
<td>Same IOM as A1</td>
<td>MX9116n or MX7116n</td>
<td>MX9116n or MX7116n</td>
</tr>
</tbody>
</table>

- 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 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
Chassis Connection Order

In order to provide optimal performance through the MX9116n FSE, it is recommended to connect the FEMs to the FSE in the following order:

- Connect FEMs from first two chassis to Port-Group 1
- Connect FEM from Chassis 4 to Port-Group 2
- Connect FEM from Chassis 6 to Port-Group 3
- Connect FEM from Chassis 8 to Port-Group 4
- Connect FEM from Chassis 10 to Port-Group 5
- Connect FEM from Chassis 3 to Port-Group 7
- Connect FEM from Chassis 5 to Port-Group 8
- Connect FEM from Chassis 7 to Port-Group 9
- Connect FEM from Chassis 9 to Port-Group 10

Unused QSFP28-DD ports can be utilized for additional uplinks, connections to rack servers, or VLT connections (VLT is required for SmartFabric Services).
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

**Embedded ToR supported in Full Switch Mode today, SmartFabric Mode in a future release
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>Not Supported</td>
<td>Not Supported</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>QSF-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>6</td>
<td>Breakout 8x10GbE</td>
<td>QSFP28-DD</td>
<td>DAC-Q28DD-8S28-25G-xM</td>
<td>AOC-QDD-8SFP-10G-xM (Future)</td>
<td>QDD-80G-SR4 (Future)</td>
<td>Future</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>
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<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>QSF-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>QSF-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>NONE</td>
<td>QDD-80G-SR4 (Future)</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
Example Topologies
Scalable Fabric Wiring Diagram – 3+ Chassis

Chassis 1 & 2

Cable Option 1

Chassis 3-10
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

Cable Option 1

Cable Option 2

Spine Switches
Example Topologies
MX9116n Standard Ethernet w/VLT + Fibre Channel NPG

Cable Option 1
Cable Option 2

Spine Switches
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

VLTi

VLTi

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

ToR Switches
Cat 6A Copper
NPG Gateway
Cable Option 2
Cable Option 3
Example Topologies
MX5108n Standard Ethernet w/VLT: SFP28 Uplinks; FCoE FSB

ToR Switches

Cable Option 3

VLTi

Cable Option 7 (25GbE) or Cable Option 8 (10GbE)

NPG Gateway
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.

MX9116n A1/B1

MX5108n A1/B1

MX9116n Chassis 1:A1/Chassis2:B1
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 &quot;TwinAx&quot; 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><strong>Deployment</strong></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><strong>Signal Loss</strong></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><strong>Electro-Magnetic Interference (EMI)</strong></td>
<td>Susceptible</td>
<td>Impervious</td>
</tr>
<tr>
<td><strong>Security</strong></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><strong>Cost</strong></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 400Gbps 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
Additional Resources
## White Papers

<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>
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</table>
## Other Resources

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
<th>URL</th>
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</thead>
<tbody>
<tr>
<td>Dell EMC Networking MX9116n Spec Sheet</td>
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<td><a href="https://www.dell.com/learn/product_docs/dellemcnetworkingmx9116nspecsheet.pdf">https://www.dell.com/learn/product_docs/dellemcnetworkingmx9116nspecsheet.pdf</a></td>
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</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>
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</table>
## Revision History

<table>
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<tr>
<th>Date</th>
<th>Version</th>
<th>Changes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sept 13, 2018</td>
<td>1.0.1</td>
<td>Initial Internal Release</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>
</tbody>
</table>